ICNB
Instituto da Conservação da Natureza e da Biodiversidade, I.P.

Ministério do Ambiente e do Ordenamento do Território

AGREEMENT ON THE CONSERVATION OF POPULATIONS OF EUROPEAN BATS

Report on implementation of the Agreement in Portugal

- 2010 / 6 MoP -

INDEX

A. General Information

- *Name of Party*: Portugal
- *Date of Report*: 31 May 2010 (Revision: 30 August 2010)
- *Period Covered*: March 2006 to May 2010
- *Competent Authority*: Instituto da Conservação da Natureza e da Biodiversidade (ICNB)
- *Compiler of report*: Luísa Rodrigues

B. Status of Bats within the Territory of the Party

1. Summary details of Resident Species

25 species are currently known in Continental Portugal (Table 1).

The revision of the Portuguese Red Data Book, using the new criteria of IUCN, was recently published (Cabral MJ (coord.), Almeida J, Almeida PR, Dellinger T, Ferrand de Almeida N, Oliveira ME, Palmeirim JM, Queiroz AI, Rogado L & Santos-Reis M (eds). 2005. *Livro Vermelho dos Vertebrados de Portugal*. Instituto da Conservação da Natureza. Lisboa). *Pipistrellus nathusii* was not evaluated in the continent because its presence was reported in 1910 but there are no recent observations for this species.

After the publication of the Portuguese Red Data Book, the presence of *Eptesicus isabellinus* and *Myotis escalerai* (replacing *M. nattereri*) was confirmed in the continent; it is still uncertain if *M. nattereri* is also present. Genetic data suggest that *Plecotus auritus* may be replaced by *P. begognae*, but this species is not yet accepted by the scientific community.

2. Status and Trends

Table 1 shows the status and the apparent population trends of the species known in Continental Portugal.

*Table 1 - Status and apparent population trends of the species known in Continental Portugal (data published in the Portuguese Red Data Book (Cabral et al, 2005)); trends were calculated only for species with status other than Least Concern. *: Portuguese Red Data Book refers to M. nattereri, the presence of M. escalerai was confirmed after 2005. **: not evaluated because its presence was confirmed after 2005.*

Species	Status	Apparent Trend
Rhinolophus ferrumequinum	Vulnerable	Indeterminate
Rhinolophus hipposideros	Vulnerable	Indeterminate
Rhinolophus euryale	Critically Endangered	Declining
Rhinolophus mehelyi	Critically Endangered	Severe declining
Myotis mystacinus	Data Deficient	Unknown

Myotis emarginatus	Data Deficient	Indeterminate
*Myotis escalerai**	Vulnerable	Seems to be increasing
Myotis bechsteinii	Endangered	Unknown
Myotis myotis	Vulnerable	Declining
Myotis blythii	Critically Endangered	Severe declining
Myotis daubentonii	Least Concern	
Pipistrellus pipistrellus	Least Concern	
Pipistrellus kuhli	Least Concern	
Pipistrellus pygmaeus	Least Concern	
Hypsugo savii	Data Deficient	Unknown
Nyctalus leisleri	Data Deficient	Unknown
Nyctalus noctula	Data Deficient	Unknown
Nyctalus lasiopterus	Data Deficient	Unknown
Eptesicus serotinus	Least Concern	
*Eptesicus isabellinus***		
Barbastella barbastella	Data Deficient	Unknown
Plecotus auritus	Data Deficient	Unknown
Plecotus austriacus	Least Concern	
Miniopterus schreibersii	Vulnerable	Stable
Tadarida teniotis	Data Deficient	Unknown

3. Habitats and Roost Sites

In Portugal there are many habitats that can be used by bats. We have extensive limestone zones, with many caves, that are used by cave-dwelling species both in the winter and during the maternity season. In the last decades, with the declining of the mining activities, new potential roosts became available and are now occupied.

There are also many known roosts in buildings, cliffs, bridges and a few trees used by bats are identified.

4. Threats

The major threats that occur in Portugal are:

Disturbance

In the last years there has been an increase in the number of people involved in outdoor activities, including caving, and we often find signs of the recent presence of visitors inside the caves. The disturbance is particularly bad during the hibernation and maternity seasons. In some caves we even found signs of fires and shotgun cartridges.

Roost destruction

In the past there were several records of vertical caves blocked by shepherds to keep their animals from falling in them, but currently this practice seems to be rare.

Loss of feeding areas

Due to anthropogenic pressures, the habitat composition has greatly changed in many regions of Portugal in the last decades. Most of these changes are due to negatively affect bat species, particularly the threatened ones. The impacts are not yet quantified for most the situations, but it is already known the negative impact resulting from the destruction of many kilometres of riparian vegetation, cut and flooded during the construction of numerous large dams all over the country. Similarly, agro-forestry intensification is due to affect many species, namely through the use of dense swards that impede access to food, the degradation of water quality, the destruction of riparian vegetation or the use of alien species for forestry production. Although not yet quantified in Portugal, the overall use of agricultural chemicals, namely of broad-spectrum pesticides, is known to reduce food abundance to bats, which are also subject to poisoning by these chemicals, through the ingestion of contaminated food and water. The lack of knowledge and the lack of specific bat friendly landscape management measures make feeding habitat loss even a greater threat to bats in Portugal.

Pesticides

Pesticides probably affect bats, but there is no data on the subject.

Traffic injuries

There are several records regarding several species (*R. ferrumequinum*, *R. hipposideros, P. kuhli*, *P. pipistrellus, P. pygmaeus, P. austriacus, E. serotinus, M. daubentonii, M. escalerai, M. schreibersii, N. leisleri, B. barbastellus*) found dead in roads, but there is few quantitative data on this subject.

Wind-turbines

Since 2001, 363 cadavers of 11 species (*P. pipistrellus, P. pygmaeus, P. kuhli, H. savii, N. leisleri, N. noctula, N. lasiopterus, T. tenotis, M. daubentonii, E. serotinus*, *M. schreibersii*) were found, but it is not possible to evaluate its impact on populations.

5. Data Collection, analysis, interpretation and dissemination

Data collection, analysis, interpretation and dissemination are done by “ICNB”, Universities (“Universidade de Lisboa”, “Universidade do Porto”, “Universidade de Trás-os-Montes e Alto Douro” and “Universidade de Évora”), speleologists (from several Speleologists Associations belonging to “Federação Portuguesa de Espeleologia”, namely “Associação dos Espeleólogos de Sintra”, “Núcleo de Espeleologia da Costa Azul”, “Grupo Protecção Sicó”,”Grupo de Espeleologia e Montanhismo”, “Centro de Estudos e Actividades Especiais”, “Alto Relevo – Clube de Montanhismo”, “Núcleo de Espeleologia de Leiria”, “Espelo Clube de Torres Vedras”, “Núcleo de Espeleologia de Alcobaça”, “Núcleo de Espeleologia da Associação Académica da Universidade de Aveiro” and “Geonauta”) who are doing roost monitoring, and technicians who are developing roost and habitat local monitoring in the frame of minimization measures of projects subjected to Impact Studies (particularly wind farms).

There are some databases prepared by "ICNB" and "Faculdade de Ciências de Lisboa": (a) Bat observations (based on bibliography and fieldwork), (b) Underground roosts monitoring programme, and (c) Banding (captures and recaptures).

The web site of “ICNB” contains a database called SIPNAT (“Sistema de Informação do Património Natural”; http://portal.icnb.pt/ICNPortal/vPT2007/Valores+Naturais/SIPNAT/) which includes information on occurrence and characterization of all species included in the Portuguese Red Data Book.

The web site of “ICNB” contains a plan (“Plano Sectorial da Rede Natura 2000”; http://portal.icnb.pt/ICNPortal/vPT2007/O+ICNB/Ordenamento+e+Gestão/Plano+Sectorial+da+Rede+Natura+2000/) which comprehends cartography and conservation and management measures of Portuguese SCI´s. The plan includes information on natural values included in the annex II of Habitats Directive and data on the species present in the Portuguese SCI´s (covering species included in annexes II and IV).

The web site of “ICNB” contains two maps of the location of bat roosts (one regarding roosts of national importance, and another regarding other roosts) (http://portal.icnb.pt/NR/rdonlyres/3A1E6911-67D7-41C1-B451-B30D17F46277/0/morcegos.zip).

C. Measures Taken to Implement Article III of the Agreement

6. Legal measures taken to protect bats, including enforcement actions

Portuguese law protects all bat species since 1967. They are also covered by international legislation that was transferred to national legislation, such as Bern Convention, Bonn Convention, and Habitats Directive.

A few incidents involving bats were reported to the police.

Several calls concerning bats in houses were received and support on exclusion was provided in a few cases.

7. Sites identified and protected which are important to the conservation of bats

The survey of the underground roosts is already quite complete. The actual list of Portuguese SCI´s includes the majority of underground important roosts.
The roosts of the remaining species are still poorly known.

8. Consideration given to habitats which are important to bats

In Portugal the landscape is not managed specifically to protect bat-feeding habitats. However, since most of the main important known roosts are inside SCI´s, some planning/management and regulatory rules protect directly or indirectly feeding habitats (as well as roosts). Under the implementation of environmental impact assessment regulation there is also compensation and minimization measures, as well as monitoring, specifically for bats feeding habitats (and also roosts).
In spring 2008 a conflict regarding one maternity colony and a Historical Building appeared. The colony had around 150 *R. hipposideros* and use to breed in some rooms that need to be restored during the maternity season. To avoid the colony disturbance a temporary heated roost was created by a Speleologist Association ("Associação dos Espeleólogos de Sintra") in collaboration with "Cultursintra", in a building where some bats seldom appeared. The temporary roost was colonized by the colony and the bats breed there already in 2008 as well as in 2009 and 2010. However, since the temporary roost also needs to be restored, the two entities decided to adapt a bigger room to try to attract bats all over year and a new roost was created in spring 2009 ("Morcegário da Regaleira"). Until now the new roost was not colonized by the colony, and only isolated bats have been found so far. The project was funded by "Associação dos Espeleólogos de Sintra" and "Cultursintra".

9. Activities carried out to promote the awareness of the importance of the conservation of bats

10th Bat Night was organised by "Grupo Protecção Sicó", on 26 August 2006. A few dozens of participants (including speleologists) participated in a session with several presentations on bat ecology and conservation. After dusk there was a walk with bat detectors.
11th Bat Night was organized by "Fundo para a Protecção dos Animais Selvagens" and "Museu de História Natural da Faculdade de Ciências da Universidade do Porto" on 22 June 2007. Around 400 students participated in several activities. After dusk there was a walk with bat detectors, preceded by a talk.
12th Bat Night (first phase) was organized by "Fundo para a Protecção dos Animais

Selvagens" and "Museu de História Natural da Faculdade de Ciências da Universidade do Porto" on 20 June 2008. Around 350 students participated in several activities. After dusk there was a walk with bat detectors, preceded by a talk.

12th Bat Night (second phase) was organized by "ICNB" and "Carsoscópio" on 30 August 2008. An online programme was held, with interviews to bat specialists and EUROBATS Secretariat (Andreas Streit). After dusk there was a walk near the entrance of a maternity roost with bat detectors.

13th Bat Night (first phase) was organized by "Associação dos Espeleólogos de Sintra", "Cultursintra" and "Federação Portuguesa de Espeleologia" on 20 June 2009. Around 120 participants were present. A new bat roost ("Morcegário da Regaleira", described under point 8) was inaugurated. After dusk there was a walk with bat detectors, preceded by a talk.

13th Bat Night (second phase) was organized by "Grupo Protecção Sicó" on 29 August 2009. A few dozens of participants participated in a walk with bat detectors, preceded by a talk.

"ICNB" organized two field trips with students from universities, presented six environmental education lectures to general public, gave nine talks about bat conservation in schools and universities and organized four workshops in schools.

"Museu de História Natural da Faculdade de Ciências da Universidade do Porto" organized 19 family sessions comprising talks and walks with bat detectors, for a few hundreds. Some sessions were organized with other entities ("Fundo para a Protecção dos Animais Selvagens", "Câmara Municipal do Porto" and "Biblioteca Municipal Almeida Garrett").

"Museu de História Natural da Faculdade de Ciências da Universidade do Porto" organized a session for teachers.

"Museu de História Natural da Faculdade de Ciências da Universidade do Porto" organized nine activities for schools, for a few hundreds of students.

A private company, Natuga, led by biologists created touristic walks with bat detectors in a partnership with São Jorge Castle in Lisboa. In 2009, around fifteen walks were done throughout the summer with a total of 300 participants. In 2010 Natuga started the walks in May and had 20 participants in the first walk. In 2010 another partnership with an old Monastery in the district of Braga led to a guided walk with 50 people in May.

The science pavillion "Pavilhão do Conhecimento" in partnership with "ICNB" and the speleologist association "Associação dos Espeleólogos de Sintra" organized in May 2010 a family walk in the Quinta da Regaleira for 45 persons.

The science pavillion "Pavilhão do Conhecimento" in partnership with "ICNB" and the speleologist association "Núcleo de Espeleologia da Costa Azul" organized a family talk in June 2010 about animal adaptations to the dark. The talk was assisted by 140 persons.

Science Centre of Alviela ("Carsoscópio") was built near a cave which harbours maternity colonies of several species (http://www.alviela.cienciaviva.pt/home/). The Centre has an interactive exhibition and during summer weekends organizes walks after dusk near the entrance of the maternity roost with bat detectors.

A website about bats was created (http://static.publico.clix.pt/morcegosnaweb). It includes online images collected in a maternity roost by 4 infrared cameras and videos. Visitors may ask questions, which are answered by specialists.

A blog about bats was created (http://morceguismos.blogspot.com/). It intends to be a way of dissemination and raising awareness about these mammals and it includes the divulgation of past and ongoing projects, news, activities and technical reviews. The blog hopes to give an important contribution to the conservation of Portuguese bats species.

A time-table regarding the seasons when caves should not be visited due the presence of important bat colonies is presented in the website of "Federação Portuguesa de Espeleologia" (http://www.fpe-espeleo.org/index.php?option=com_content&view=article&id=30:abrigos-de-importancia-nacional-epocas-de-hibernacao-e-de-criacao&catid=36:quiropteros-cavernicolas&Itemid=65).

Several articles about bats were published in magazines and newspapers.

Several talks were presented in National Conferences.

10. Responsible bodies, in accordance with Article III.5 of the Agreement, nominated for the provision of advice on bat conservation and management

This point has not been implemented yet.

11. Additional action undertaken to safeguard populations of bats

In accordance with Portuguese law the entrances of inactive mine galleries should be closed for security reasons. There has been an effort that methods compatible with the continuation of their use by bats (recommended by EUROBATS Publication Series nº 2) are adopted. Galleries colonized by important bat colonies are being closed by fences, galleries used by some bats are being closed by bat friendly gates with doors (to allow monitoring) and galleries not used by bats are being closed by walls with large respiration holes (this will allow a future colonization but not their monitoring). Vertical shafts are being protected with grilles. Several mines were already closed with bat friendly methods.

Several pits of an abandoned mine used by several species for hibernating were fenced, paid by "Environmental Planning Programme" and "ICNB".

A highway close to a maternity roost was constructed. A fence paid by the promoter was placed around the roost to avoid its disturbance.

A gallery that harboured some dozens of bats was destructed by a dam. A new gallery was constructed, paid by the promoter.

12. Recent and ongoing programmes (including research and policy initiatives) relating to the conservation and management of bats

Monitoring programme of cave-dwelling species. A monitoring programme of the cave-dwelling species is in progress since 1987, coordinated by “ICNB”. This programme involves the estimation of bat numbers present in the most important wintering and maternity roosts. The surveys are carried out annually in most of the roosts. Co-funded by "ICNB", “Faculdade de Ciências de Lisboa”, “Universidade do Porto” and “Federação Portuguesa de Espeleologia” (namely, “Associação dos Espeleólogos de Sintra”, “Núcleo de Espeleologia da Costa Azul”, “Grupo Protecção Sicó”,”Grupo de Espeleologia e Montanhismo”, “Centro de Estudos e Actividades Especiais”, “Alto Relevo – Clube de Montanhismo”, “Núcleo de Espeleologia de Leiria”, “Espelo Clube de Torres Vedras”, “Núcleo de Espeleologia de Alcobaça”, “Núcleo de Espeleologia da Associação Académica da Universidade de Aveiro” and “Geonauta”).

Control of the vegetation in the entrances of some roosts. There has been an effort to cut the vegetation in the entrances of some roosts, which sometimes become blocked. Funded by "ICNB".

Creation of the Science Centre of Alviela (“Carsoscópio”). The Centre was built in the “Natural Park of Serras de Aire and Candeeiros” (also referred under point 9) near a cave that harbours maternity colonies of several species. The Centre was first opened to the public on 15 December 2007, and has received 45797 visitors until 31 May 2010. It includes an interactive exhibition with several modules on bats and an observatory, where visitors can observe the bats inside the cave using infrared cameras. Centre’s purposes include promotion and preservation of the natural heritage that surrounds the Alviela River Spring, environmental education and support to scientific research. Co-funded by "Structural Funds for Environment” and “Câmara Municipal de Alcanena”.

Creation of the Science Centre of Lousal. The Centre was built near an abandoned mine which includes a gallery colonized by a maternity colony. The exhibition includes an interactive module on bats, containing short documentaries, 2D games and quizzes. Its main objective is to introduce several aspects of bat biology and ecology to the general public, and particularly to school communities, and to encourage an understanding of these animals, and their important role in nature. The module is almost finished. Funded by “Agência Ciência Viva” and “Fundação Frédéric Velge”.

SIMBioN – Biodiversity monitoring and information system of North Portugal. This program is a joint venture between “ICNB” and “CIBIO - Universidade do Porto” to implement a long term biodiversity monitoring at the North Portugal. Along with habitats, plant species, and other fauna, nine target bat species were selected as species richness and biodiversity

indicators. Based on the distribution models of those species the predicted areas with the highest species richness were selected and the occurrence of the target bat species is going to be being confirmed via acoustic transects. By the end 15 sampling stations will be defined, each with a maximum of three 30 minutes transects to be walked yearly with a bat detector. In the long term the collected information will allow to infer local changes in populations and to take action whenever needed. "ICNB" workers will be actively involved on this program, as such a workshop was already held to explain the protocols and to give a basic introduction on how to use bat detectors. Funded by "FEDER/Programa Operacional do Norte" (ON2), "Comissão de Coordenação e Desenvolvimento Regional do Norte", "Quadro de Referência Estratégico Nacional" and "Fundo de Desenvolvimento Regional da União Europeia".

Document "Manual de apoio à análise de projectos relativos à implementação de infra-estruturas lineares". The manual (http://portal.icnb.pt/NR/rdonlyres/999BBAF3-41CE-40DD-9697-DBAC22AB3F38/0/manual_apoio_infra_linear.pdf) aims to be a guideline for the analysis of new infrastructures (roads, railway lines and canals) projects. The manual gathers referenced information on impacts, minimization measures, compensation and monitoring of natural values.

Document "Tenho morcegos em casa, o que devo fazer? - Guia de apoio a situações de coabitação e exclusão de morcegos em edifícios". The document (http://portal.icnb.pt/NR/rdonlyres/AE340217-C2C3-4F30-9FB2-D0C0EBFB5FC3/0/Guia_coabit_exclus_morceg.pdf) aims to be an informative guide for the general public regarding cohabitation with bats and giving advice on bat exclusion.

Bat exclusion. These activities are being done by rangers, after training. A document on bat exclusion devices was prepared.

Ultra-sound workshops. Two theoretical and practical courses on acoustic identification of bats were organized (May 2008 and July 2009).

Monitoring and analysis of the diversity of bats in the ridge of Marão due to natural and anthropogenic factors relevant. The ridge of Marão is one SCI where 15 species of bats are already confirmed. This graduation thesis, prepared by Carmen Silva, consisted of acoustic inventory of bat species that use areas like wind farms, vicinity of underground roosts, waterways and forested places, and assessment of environmental variables that influence bat activity and richness specific. In the sampled places of study area, the activity's level of bats in the four habitat types decreased in following order: close to underground roosts > waterways> forested areas > wind farms. Statistical analysis showed that altitude and distance to the nearest underground roost are negatively correlated with activity and number of species. In contrast, the distance to the nearest wind turbine showed a positive correlation for both ecological indicators. The comparison of habitat types showed that

activity and richness were smaller in wind farms. This study contributed to a better understanding of the list of species that occur in the ridge of Marão, because it was the first study based on the technique of registration of ultrasound.

Patterns of genetic diversity in Portuguese populations of *Myotis daubentonii daubentonii* and *Myotis d. nathalinae*. This MSc, prepared by Bruno Simões, examined the genetic variation within populations of *M. d. daubentonii* and *M. d. nathalinae* in a known glacial refugia, the Iberian Peninsula, using cytochrome *b* DNA sequence data. Additional samples and DNA sequences across Europe and Japan were included to assess how the species spread from this refugium. Additionally it was also the aim of this thesis to distinguish these two cryptic taxa based on morphometric data. Morphological data suggest that it is possible to distinguish the two groups in the field. However some individuals possess intermediate morphological characteristics. The data show a pattern that corresponds to a model "refugia-within-refugia" were *M. d. daubentonii* spread north and *M. d. nathalinae* was trapped in Iberia, becoming an Iberian endemism. This study should be useful in determining the distinction between *M. daubentonii* and *M. d. nathalinae*, and thus make a contribution towards a better understanding of European bat diversity. Funded by "CIBIO – Universidade do Porto".

Genetic structure and gene flow of fragmented bat populations. In this PhD thesis, prepared by Patrícia Salgueiro, mtDNA sequences and nuclear microsatellite loci were used to increase the knowledge about the fragmented populations of the two threatened bat species: the Azorean bat (*Nyctalus azoreum*) and the continental Schreiber's bent winged bat (*M. schreibersii*). This study included an examination of the phylogenetic relationships among several species within the genus *Nyctalus*, and the estimate of the genetic divergence between *N. azoreum* and its mainland ancestor, *N. leisleri*. It also involved the analysis of the genetic diversity within populations, and genetic differentiation among the studied fragmented populations, thus revealing new insights about their population structure, history and behavioural dispersal. This thesis provided important information to define biologically meaningful conservation units for the studied species. For *N. azoreum*, two management units were suggested (S. Miguel island and the Central Group), while for *M. schreibersii* four units were defined (North, West Centre, Marvão and South). These units should be taken into account when planning conservation and management actions. Funded by "Fundação para a Ciência e a Tecnologia".

Population ecology of M. schreibersii and M. myotis. All bats presently considered as threatened in Portugal are cave-dwellers, which show that the conservation of this group of species requires an active management programme. However, the planning of management measures requires a good knowledge of some aspects of the biology of species, including their population ecology. Much of this critical knowledge is still missing,

as bats are among the least studied of vertebrates. To contribute to overcome this limitation, four general objectives were planned for this PhD, prepared by Luísa Rodrigues: (1) understand bat migration patterns and their causes, (2) determine how spatial behaviour influences population structure and potential gene flow among maternity colonies, (3) determine if there are critical times during the yearly cycle of bats, and (4) understand how roosting behaviour and phenology relate to ambient and roost climate. The two first objectives were studied with *M. schreibersii* and the latter with *M. myotis*. Results are discussed in the perspective of planning of management measures, particularly in the Portuguese context.

Ecology of a host-parasite system: a study in temperate cave-dwelling bats. Parasitism is one of the most successful modes of life displayed by living organisms. The transition to a parasitic lifestyle brought many advantages to parasites, namely a stable environment, mobility and a lesser investment in nutritional functions. However, it also entailed a set of adaptative challenges that had to be met by parasites. These had to find a way of dispersing between hosts often discontinuously distributed in space and time. Moreover, they had to adapt to the frequent presence of other potential competing parasites within the host's body. Lastly, due to their dependence on hosts for successfully reproducing and dispersing, parasites had to balance the exploitation of resources of a host with the need to keep it alive. The main aim of this PhD, prepared by Sofia Lourenço, was to determine how bat ectoparasites have overcome some of these challenges and successfully adapted to their hosts, using two temperate-zone cave dwelling bats (*M. schreibersii* and *M. myotis*) and its ectoparasites as model systems. Results showed that a group of specific bat ectoparasites, the nycteribiids, was able to overcome the spatial unpredictability of its hosts within caves by evolving efficient sensorial mechanisms to locate them from a distance. In addition, some parasitic mites, ticks and nycteribiids were found to deal with the temporal unpredictability of their bat hosts, by maximising their reproduction during the reproductive period of bats, when more hosts were more available and particularly vulnerable. Results also showed that competition is likely to occur among bat parasite species, even if for short-term periods, influencing the structure of their communities. Finally, a suggestion was found of potential costs induced by a parasitic mite on the body condition of its bat host. It was discussed how these potential costs may play a role in the social structure of the bat. Overall, this study provided evidences that bat parasites have tightly coevolved with their hosts. Some of conclusions are likely to apply to other host-parasite systems involving bats in temperate-zones. Funded by "Fundação para a Ciência e a Tecnologia".

Bat winter activity: the influence of prey abundance. In the temperate zones bats spend most of the winter in hibernation, but they are known to interrupt it for reasons that are not always understood. The objective of this MSc, prepared by Ana Margarida Augusto, was to

determine if foraging was a relevant activity during these interruptions in a part of the temperate zone with particularly mild winters - the Mediterranean. To do this, using a colony of *M. myotis* located in southern Portugal as a model, we (i) compared the abundance of prey during the winter with that of other seasons, (ii) checked if bats frequently made potential foraging trips, and (iii) verified if the faecal pellets produced in the winter contained prey. Bats often made potential foraging flights throughout the winter, and preliminary analyses of the content of faecal pellets confirmed that they are often foraging. The quantification of the abundance of prey in the major types of the land cover demonstrated that there is much less prey during the winter than in autumn and spring. However, in winter prey were somewhat more abundant than in the summer, a season that is probably a food bottleneck for Mediterranean *M. myotis*. Consequently, our preliminary analysis suggests that, thanks to mild winters, there is sufficient prey to make winter foraging by Mediterranean *M. myotis* possible, but that food is not abundant at this time of the year. As winter feeding may be important for the survival of Mediterranean bats, management around key colonies should take into consideration the winter foraging needs of bats.

Bird and bat mortality estimates in wind farms. The aim of this MSc, prepared by Joana Bernardino, was to evaluate how commonly used methodologies influence the estimates of mortality and at the same time suggest changes that will enable their improvement. Thus, five of the parameters that most condition the estimates were analysed: i) predation rate, ii) searcher detection, iii) frequency of carcass searches, iv) annual time pattern of fatalities and v) the mortality formula. The results of the present study confirm the importance of carcass removal trials to estimate the predation rate. In the study area, trials should be conducted 4 times a year, with daily checks of the carcasses for, at least, 15 days. As for carcass search schedules, the results suggest that more frequent searches are not necessarily more advantageous, meaning that schedules with a longer length of time between samples collecting can also be adopted. Whatever the variables, the mortality formula presented in Kerns J, Erickson WP & Arnett EB (2005) *Bat and bird fatality at wind energy facilities in Pennsylvania and West Virginia. Pages 24–95 in EB Arnett (editor) Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of bat fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines.* A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International, Austin, USA. is responsible for better estimates of number of bird or bats killed than other formulas. Nevertheless, the standard error is still large, showing the need to continuously improve the formula in order to correctly assess the mortality. Funded by Bio3, Lda.

Construction of a discriminant model for identification of three species of bat: Pipistrellus pipistrellus, Pipistrellus pygmaeus and Miniopterus schreibersii. Bats always proved difficult

to study in their natural habitat. Nocturnal habits, dark colours and fast flight difficult their identification during flight. Although ultrasonic devices and specialized software programs allow the identification of many species, sometimes that is not possible due to the overlap of the frequencies emitted by some species (e.g., *P. pipistrellus*, *P. pygmaeus* and *M. schreibersii*). This graduation thesis, prepared by Rui Gonçalves, aimed to build a discriminant model to allow the identification of these three species. The three selected best variables were Frequency of Maximum Energy (FmaxE), Band Width (BW) and repetition rate (TR). They showed significant differences, which allow differentiation and discrimination of species-level identification. The model showed a successful outcome achieved by cross-validation of 85.9%, a situation in which the program correctly classified 87.0% of the original cases (an effective value since discriminant analysis for cases of gender has values generally below 80 ± 90%).

Development of a stochastic-dynamic model (StDM) for predicting impacts arising from the installation of wind farms in the activity of bats. Wind power is today regarded as one of the most promising sources of renewable energy, representing economic and ecological benefits, given the clean way it generates electricity. However, the mortality of species of birds and bats has been documented, revealing the existence of direct and indirect impacts, local and cumulative, resulting from the presence of wind turbines. In this context the development of predictive tools which shows the risks associated with the installation of new wind farms, rehearsing measures to minimize impacts on communities in each region is of great conservation importance. The main objective of this graduation thesis, prepared by Joana Bernardino, focuses on the study of the relationship between the activity of bats and, the meteorological, physiographic and environmental characteristics of the areas where wind farms are installed or where it is planned that will be installed. The data obtained in monitoring the activity of bats in several wind farms, located in Serra do Alvão, Serra do Marão, Serra de Padrela and Serra de Montemuro in 2007 and 2008, allowed the development of appropriate statistical models to identify variables with significant influence on the activity of bats. Based on these variables and the interrelationships detected, was designed a stochastic-dynamic model (StDM) to preview the impacts in the activity of bats, arising from the installation of new wind farms in Northern Portugal. Subsequently, the model was validated, using data external to the building of it, and the activity of bats was estimated for two different scenarios: absence vs. presence of wind farm.

Using species distribution modelling and genetic analysis for the conservation of rare species: case studies on European bats. This PhD, prepared by Hugo Rebelo, examined the applicability of species distribution modelling combined with genetic analysis to fill knowledge gaps for poorly documented species, thus giving support to more adequate conservation policies. In this thesis, *B. barbastellus* was the chosen studied species due to

its rarity and wide knowledge gap. By comparing the accuracy of two different presence-only modelling techniques (Maximum Entropy (Maxent) and Ecological Niche Factor Analysis (ENFA)), it was shown that Maxent outperformed ENFA by successfully predicting *B. barbastellus* distribution in Portugal, with the discovery of several populations and extending known distribution ca. 100 km further south. In a second phase of this work, Maxent models were updated with new presence records of *B. barbastellus* and also projected to conditions during the Last Glacial Maximum (LGM) to determine the species' palaeo-distribution in Portugal. These results were integrated with mtDNA analysis to show that Portuguese populations constituted a homogeneous conservation unit, despite a predicted isolation between northern and southern populations during the LGM. By widening the geographical scope of this study in order to cover species' range, glacial refugia were identified in the southern European peninsulas of which only Iberia had no contribution for the postglacial colonisation of Europe. Finally, the research focused on the potential impact of future climate change on 28 European bat species, grouped according to their biogeographic patterns. Species associated with colder climates will suffer severe challenges for their survival and major regional extinctions are predicted whichever future climate change scenario is modelled. The future distribution of species associated with warmer climates varied according to the scenario modelled, and more severe climatic predictions resulted in a general contraction of each species' range. The research covered in this thesis shows that by integrating predictive modelling with genetic analysis it is possible to fill knowledge gaps in rare species, with implications for conservation. Funded by "Fundação para a Ciência e a Tecnologia".

Relationship between bat activity and fatalities, methodologies evaluation and influence of environmental and ecological factors on mortality. This MSc, prepared by Francisco Amorim, aimed to evaluate the effectiveness of widely spread methods in predicting the impacts of wind farms on bats and to understand how different types of variables influence fatalities. It also aimed to evaluate how mortality is related to species ecology and behaviour. A relationship between bat activity and fatalities was identified, in both cases *N. leisleri* and *Pipistrellus* species were the most representative. The highest values of activity and mortality were register from August to October. Activity and mortality showed a significant correlation with wind speed, temperature and relative humidity; mortality seems also to be related with Southeast winds. These results allow us to identify the weather conditions favouring higher fatalities. Results highlight the need for further studies that help us to better understand which other factors contribute for higher collision risk. The results shown by this study are extremely important for the implementation of effective minimization measures and therefore for bat conservation in wind farm dominated landscapes.

Implementation of a "microreserve" for bats in abandoned mines in Portugal. The generality of the communities of bats is in marked regression in Portugal. We are witnessing now the loss of important colonies, a situation that is accentuated among the cave-dwelling species by its dependence on a limited number of shelters. In this context it is imperative to draw up plans for the conservation of this fauna group which represents almost half of the Portuguese indigenous species of terrestrial mammals. This MSc, prepared by Mafalda Silva, arised from the recognition of the need for conservation of this group of mammals, setting out general guidelines for the protection of mining roosts for bats through the creation of a "microreserve". The "microreserves" areas are reduced in size, however, sufficient to implement effective management measures for certain groups of fauna or flora with punctual distribution along the territory, characterized by hosting species or habitats of high value or interest. There are several examples on this matter, which achieved good results and were able to intervene successfully at the level of effective conservation of species, namely the Valencian network of "microreserves" of flora and, in Portugal, the "microreserves" created by Quercus - National Association for Nature Conservation (major driver of this initiative in Portugal). There was no intention to perform a detailed study of the biology of bats, but instead, to gather information of their past situation in terms of conservation, and current trends in this area to be used pragmatically in the launching of new "microreserves". The aim was to collect data from institutions that have responsibilities in the matter, in order to develop the procedures and concepts that lead to the choice of important mines for intervention; to execute the planning of such operations to be performed, and finally move on effective implementation of these reserves. It was hoped to achieve a certain standardization of key procedures to be adopted by building a plan, as a facilitator, which clarifies how to act and what institutions to involve, helping to increase the conservation status of bats in Portugal. It was possible to trace this desired conservation plan, starting to implement and testing it on a shelter of national importance (case study of *Gourim* mines).

*Influence of vegetation clutter on the capacity of a ground foraging bat to detect and capture prey***.** This PhD, in preparation by Ana Rainho, aims to investigate how grass density affects the foraging ability of *M. myotis*. Spatial and temporal patterns in the availability of food are key elements in the foraging ecology of bats, but the mechanisms of food limitation in insectivorous bats are poorly understood. In general prey abundance is used as a surrogate for prey availability, but there may be an important difference between the two if there are habitat factors that make the access to prey difficult. The results of short captivity experiments, in which bats were given crickets in different types of ground cover – sparse, intermediate, and dense, demonstrated that vegetation clutter greatly affected their capacity to forage. They captured crickets in the three treatments, but they often ignored

them in the densest grass. They were equality efficient locating prey in the intermediate and sparse treatments, but were far more efficient capturing them in the sparse grass. Grasslands, natural and managed, are important foraging habitat for *M. myotis* in much of its range, but in the absence of natural grazers the vegetation may become too dense to allow effective access to its prey. Consequently, the management of foraging habitats of *M. myotis* is some regions should involve the use of grazing by domestic ungulates. Funded by "Fundação para a Ciência e a Tecnologia".

The importance of riparian vegetation for bat populations. In central Europe the riparian galleries, constituted by vegetation along the water courses, are important for some species of bats. This relation has not been studied in the Mediterranean region, but it is probable that due to the dryness of the climate they are here a habitat particularly critical for bats. Furthermore, this vegetation is frequently cutted down along the water courses. The overall objective of this PhD, in preparation by Tiago Marques, is to determine the importance of the riparian galleries for the populations of bats in Mediterranean ecosystems, contributing to the improvement of the management of the landscape and of the habitat for bats. Simultaneously, different aspects of this topic were studied, such as influence on bat activity of presence of vegetation along the water courses, structure of the vegetation, and availability of trophic resources (insects) for bats in water courses with different kinds vegetation structure. Funded by "Fundação para a Ciência e a Tecnologia".

Assessing road effects on bats in a Mediterranean landscape. Recent studies suggest that the impact caused by roads on bats may significantly affect bat communities. However, information is still lacking to determine the main driving factors causing this impact and to effectively mitigate it. The objectives of this MSc, in preparation by Denis Medinas, were to assess the effects of roads with different intensities of traffic on bat activity in a Mediterranean landscape and to determine the relative importance of landscape, road features and bat activity on road kills. Both daily road mortality sampling and seasonal bat activity monitoring took place between March and October of 2009. Results showed that *P. kuhlii* and *P. pygmaeus* represented majority of total specimens road killed (n=154), nevertheless we also found threatened and poorly known species like *R. hipposideros, R. ferrumequinum and B. barbastellus*. A peak of mortality occurred mostly in late summer and early autumn. Overall, landscape features were the most important variable set in explaining bat mortality. The greatest incidence of casualties was recorded at places where roads crossed high quality habitats (e.g. *montados* and water courses with developed vegetation gallery). However, distance to known roosts, intensity of bat activity and traffic volume also had a significant influence on mortality. Concerning activity data, we found no clear evidence of road avoidance by bats.

Environmental Education: Influence perception and attitudes toward bats. This MSc, in

preparation by Veronica Paiva, regards the problematic poor image of bats, associated to myths and legends, which obstacles their conservation. Environmental education is one possible way to provide information about bats and warn the population about the dangers that they cross, improving environmental awareness. This thesis aims to assess the impact that the actions of the Science Centre of Alviela ("Carsoscópio") and "Clube Bio-Ecológico Amigos da Vida Selvagem" have on the target-public and what is their contribution on the improvement of the public perception of bats.

Molecular Evolution of Bat Visual Sensory Perception. Contrary to folklore, bats are not blind; some have large eyes and excellent eyesight (Megabats), whereas others rely mainly on echolocation and have questionable visual capabilities (Microbats). Phylogenetic data suggest that the ancestor of all bats was capable of flight and echolocation and that Megabats most likely "traded" hearing for vision. Is it possible that in Megachiroptera, visual pathways have been selected at the expense of the echolocation/auditory pathways? To fully address this question, and with the aim of establishing evolutionary patterns and functionality of the photoreceptors visual pigments, a PhD is being prepared by Bruno Simões. The short-wavelength opsin gene (SWS) and the median to long-wavelength opsin gene (MWS/LWS) were amplified, cloned and sequenced in all bat families. This genomic data set covered more then 10% of all bat species present on Earth, including species that exist in different ecological niches (with different feeding and roosting) and that possess divergent sensory capabilities. Particular detail was given to the family Pteropodidae were opsins will be sequenced in all megabats genus. Our data show that the short-wavelength opsin has undergone gene defects leading to loss-of-function in several yinpterochiropteran and yangochiropteran lineages. This data will be integrated with spectral sensitivity molecular studies in current and ancestral opsin in bats. Funded by "Fundação para a Ciência e a Tecnologia" and Science Foundation of Ireland.

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13. Consideration being given to the potential effects of pesticides on bats, and their food sources, and efforts to replace timber treatment chemicals which are highly toxic to bats

Pest control agencies were contacted in order to explain that bats can not be harmed during their operations.

D. Functioning of the Agreement

14. Co-operation with other Range States

Cooperation with Spain concerning the recapture of banded bats is being carried out.

Luísa Rodrigues cooperated with Spain and Germany on the project "Tracing bat migrations through the isotopic fingerprint in hair".

Hugo Rebelo cooperates with the United Kingdom (University of Bristol), Turkey (Boğaziçi University), Italy (Università degli Studi di Napoli Federico II) and Greece (University of Crete, Museum of Natural History) regarding the training of students and subsequent development of species distribution models for bat conservation

Luísa Rodrigues participated in a workshop held in London in 2006, on Monitoring and Surveillance Guidelines and Setting up a Pan-European Monitoring Scheme for Underground Sites.

Ana Rainho participated in a workshop held in Berlin in 2008, on Pan European Bat Monitoring partnership.

Luísa Rodrigues participated in several EUROBATS Intersessional Working Groups (IWG on Transboundary Programme – Habitats: Data Compilation, IWG on Geographical Scope of the Agreement, IWG on Review of Guidelines for the Issue of Permits for the Capture and Study of Captured Wild Bats, IWG on Producing Guidelines on Bat Monitoring Methods to Assess Population Trends at Different Levels, IWG on Autecological Studies for Priority Species, IWG on Impact of Roads and Other Traffic Infrastructures on Bats, and IWG on Wind Turbines and Bat Populations, convening the last one.

Several Portuguese bat workers attended international conferences: *11th European Bat Research Symposium* (Romania, 2008: Ana Rainho, Luísa Rodrigues, Jorge Palmeirim, Ana Margarida Augusto, Hugo Rebelo, Sofia Lourenço, Francisco Amorim, Pedro Alves, Bruno Simões, Maria João Pereira, Tiago Marques, Bruno Silva, Sílvia Barreiro), *Annual Meeting of the Society of Molecular Biology and Evolution* (Spain, 2008: Bruno Simões), *Jornadas para la conservación y gestión de los quirópteros* (Spain, 2008: Ana Rainho, Luísa Rodrigues, Jorge Palmeirim, Hugo Rebelo, Paulo Barros, Pedro Silva-Santos), *1st International Berlin Bat Meeting: Bat Migration* (Germany, 2009: Maria João Pereira, Bruno Simões, Paulo Barros, Pedro Silva-Santos), *8th International Seminar on Detection Dogs Registration – Canine Detection: 2012 and Beyond* (UK, 2009: Miguel Mascarenhas, João Paula), *IX Jornadas SECEM* (Spain, 2009: João Paula) and *2nd International Berlin Bat Meeting:* Bat Biology and Infectious Diseases (Germany, 2010: Sofia Lourenço, Jorge Palmeirim).

Hugo Rebelo participated in the UK National Bat Conference in 2008, giving an invited lecture.

15. Measures taken to implement Resolutions adopted by Meetings of Parties

Resolution 2.2 - Consistent Monitoring Methodologies and Resolution 5.4 – Monitoring bats across Europe

In Portugal, since 1987 there has been a programme to monitor cave-dwelling species, coordinated by ICNB and developed in collaboration with “Faculdade de Ciências de Lisboa”, “Universidade do Porto” and “Federação Portuguesa de Espeleologia”. Maternity and hibernation underground roosts considered being of National importance and some buildings that harbour important colonies of "cave-dwelling species" such as *R. ferrumequinum* and *R. hipposideros* are monitored, in a total of around 30 places each season. Observations inside the roosts are done, counting the individuals or estimating the area of the colonies (visually and with photographs), using the methods described for *M.myotis/blythii* and *M. schreibersii* in the resolution approved in 2MoP and recommended by EUROBATS Publication Series nº 5. These methods can be successfully applied to *R. euryale, R. mehelyi, M. myotis, M. blythii* and *M. schreibersii*, which are very faithful to their roosts and hang from the ceiling, making the observations very reliable. In the case of *R. ferrumequinum* and *R. hipposideros*, there are more problems since they use many roosts to breed, in small numbers. Even during the winter, when they are expected to use only underground sites, they are not as philopatric as other species. In the case of *M. escalerai* and *M. emarginatus*, although most maternity colonies are known in underground roosts, since normally they use hidden places (especially *M. escalerai*), very often they are not observable inside. Often, only the capture of flying juveniles enables the identification of maternity sites. Details of monitoring programme have been forwarded to the relevant IWG.

Roosts inventoried during local monitoring programmes established as minimization measures of projects subjected to Impact Studies (particularly wind farms) are monitored by promoters. If any underground roost of National importance is found, it is included in the programme coordinated by “ICNB”.

A database including all observations done during the Monitoring Programme was prepared and is currently being updated.

Resolution 2.4 – Transboundary Programme: Habitat Proposals

Since underground habitats are particularly important in Portugal, a special attention has been given to them. In the National Conservation Plan of Cave-dwelling Bats (1992), information about the most important roosts is available.

Details of the most important underground roosts have been forwarded to the relevant IWG and were recently updated.

Resolution 2.5 – Geographical Scope of the Agreement

A study of migratory patterns of some cave-dwelling species (*M. schreibersii*, *M. myotis* and *M. blythii*) is being conducted in a few roosts.

Resolutions 2.7 and 3.3 – Format of National Reports

The reports have been prepared accordingly to the new formats.

Resolutions 2.8, 3.8, 4.9 and 5.10 – On the implementation of the conservation and management plan

An effort to implement the Article III of the Agreement has being taken, as presented in this Report.

Resolution 3.7 – Amendment of the Agreement

This point has not been implemented yet.

Resolution 4.3 – Guidelines for the Protection and Management of Important Underground Habitats

Portugal already sent information to the IWG. Several roosts were already protected with fences; other roosts should be protected. Abandoned mines are being protected with bat friendly methods. Recommendations included in EUROBATS Publication Series nº 2 are being followed.

Resolution 4.4 – Bat Conservation and Sustainable Forest Management

In Portugal forests are not managed specifically to protect bat-feeding habitats. However, some planning/management and regulatory rules protect directly or indirectly feeding habitats and roosts.

Two schemes of sustainable forest management certification (PEFC – Programme for the Endorsement of Forest Certification and FSC – Forest Stewardship Council) started to be applied in 2005 and certified area has been growing. These schemes include the identification of protected/threatened natural values and its protection, as well as the monitoring of the actions.

"ICNB" prepared recently internal guidelines for the analysis of new forestry projects. The document includes proposals to minimize impacts on fauna, flora, habitats, soil and landscape. Guidelines will be soon adapted to prepare a manual for public awareness, in particular land owners, project designers, machine operators and official entities.

Other points have not been implemented yet.

Resolution 4.5 – Guidelines for the Use of Remedial Timber Treatment

Remedial Timber Treatment is not commonly used in Portugal.

Resolutions 4.6 and 5.5 – Guidelines for the Issue of Permits for the Capture and Study of captured wild Bats

All issued permits (n=86) took these guidelines into consideration.

Resolutions 4.7 and 5.6 – Wind Turbines and Bat Populations

Portuguese recommendations for Environmental Assessment of wind turbines projects were prepared in 2004 and updated in 2009, being completed with the guidelines referred in EUROBATS Publication Series nº 3. Recommendations include 3 components: habitat survey (ground bat detectors surveys), roost inventory/monitoring and mortality (including Carcass Removal and Searcher Efficiency rates). The two first components should be studied 1 year before and 3 years after the construction of the wind farm (as well the third one), to allow comparisons.

Four MsS and Graduations Thesis on the effect of wind farms and on methodologies used to assess its effect were prepared (referred under point 12).

In December 2009 a report on the effect of wind farms on bats in continental Portugal was prepared. The document comprised the analysis of 171 reports regarding 49 wind farms, data referring from 2001 to 2008. Major conclusions include:

(a) general

(a.1) no finished or almost finished wind farm was correctly monitored accordingly to Portuguese recommendations

(b) mortality

(b.1) regarding power lines, no fatalities were found in 11 field seasons (considering field season the work done during the same year) (searches monthly; 5 wind farms)

(b.2) regarding turbines, 294 fatalities were found in 56 field seasons (searches variable: 19 monthly, 12 be weekly and 23 weekly; 33 wind farms)

(b.3) Data is still too recent to allow a long-term interpretation (15 wind farms were monitored 1 season, 10 were monitored 2 seasons and only 5 farms were monitored 3 seasons)

(b.4) observed fatalities belong to 11 species (Table 2)

Table 2 – Fatalities observed in Portuguese wind farms, per species.

Species	Fatalities number	% mortality
P. pipistrellus	88	29,9
N. leisleri	64	21,8
Not identified	31	10,5
Pipistrellus sp	28	9,5
P. pipistrellus/pygmaeus	22	7,5
H. savii	21	7,1
P. kuhli	13	4,4
P. pygmaeus	10	3,4
T. teniotis	5	1,7
E. serotinus	3	1,0
N. noctula	2	0,7
M. daubentonii	2	0,7
Nyctalus sp	2	0,7
P. pipistrellus/kuhli	1	0,3
N. lasiopterus	1	0,3
M. schreibersii	1	0,3

(b.5) analyzed data show that most fatalities belong to more abundant species, with "Least concern" status, indicating a reduced impact in species known to be threatened; however, the relative high percentage belonging to "Insufficient information" species (32,3%) may indicate worrier negative impacts on species that may have a unfavourable status

(b.6) observed fatalities occurred between March and November, but two peaks were observed (May-June and August-September) (Table 3)

Table 3 – Fatalities observed in Portuguese wind farms, per month.

Month	Number of searches /month	Fatalities number	% mortality
August	47	63	21,4
September	49	54	18,4
May	38	50	17,0
June	41	41	13,9
July	43	32	10,9
October	42	27	9,2
April	34	24	8,2
November	11	2	0,7
March	28	1	0,3
December	8	0	0,0
February	11	0	0,0
January	8	0	0,0

(b.7) two particularly worrying situations of specific turbines were detected (1 registered 8 out of 15 fatalities (53,3%); 1 registered 4 out of 5 fatalities (80%))

(b.8) fatalities were found at an average distance of 13,5m

(b.9) 44 carcasses (77,3%) were intact

(b.10) it was not possible to analyse sex and age

(b.11) it was not possible to relate mortality to temperature, wind speed, wind direction nor moon phases

(b.12) it was not detected any significant pattern in mortality variation along the years

(b.13) it was not detected any significant relation between mortality and turbine's height

(b.14) 9 wind farms analyzed activity vs. mortality, but it wasn't detected any significant relation in 6 cases. In the other 3 cases, there is evidence for some turbines regarding *P. pipistrellus* and *Pipistrellus* sp

(b.15) analyzed data showed increased mortality in turbines located near forests in 2 wind farms

(b.16) there are no data regarding searches done with dogs

(b.17) 16 wind farms present mortality estimates, 4 using bibliographic values of Carcass Removal and Searcher Efficiency rates and 12 extrapolating calculated rates (but the majority do not have yet rates calculated for different seasons)

(c.) habitat survey

(c.1) 44 wind farms present habitat survey data, but most data are shortly analyzed and are presented in a disorganized way

(c.2) 23 wind farms (52.3%) were badly surveyed during pre-construction phase (no data or collected less than 6 months) and 34 wind farms (77.3%) present no control area

(c.3) *P. pipistrellus* was the most detected species

(c.4) maximum activity was detected in August (Table 4)

Table 4 – Detected activity.

Month	**Number of field seasons with higher activity detected/month**
August	18
September	16
May	9
July	9
April	4
June	3
October	2
March	1

(c.5) analyzed data showed a coincidence between higher mortality and higher activity per month (Figure 1).

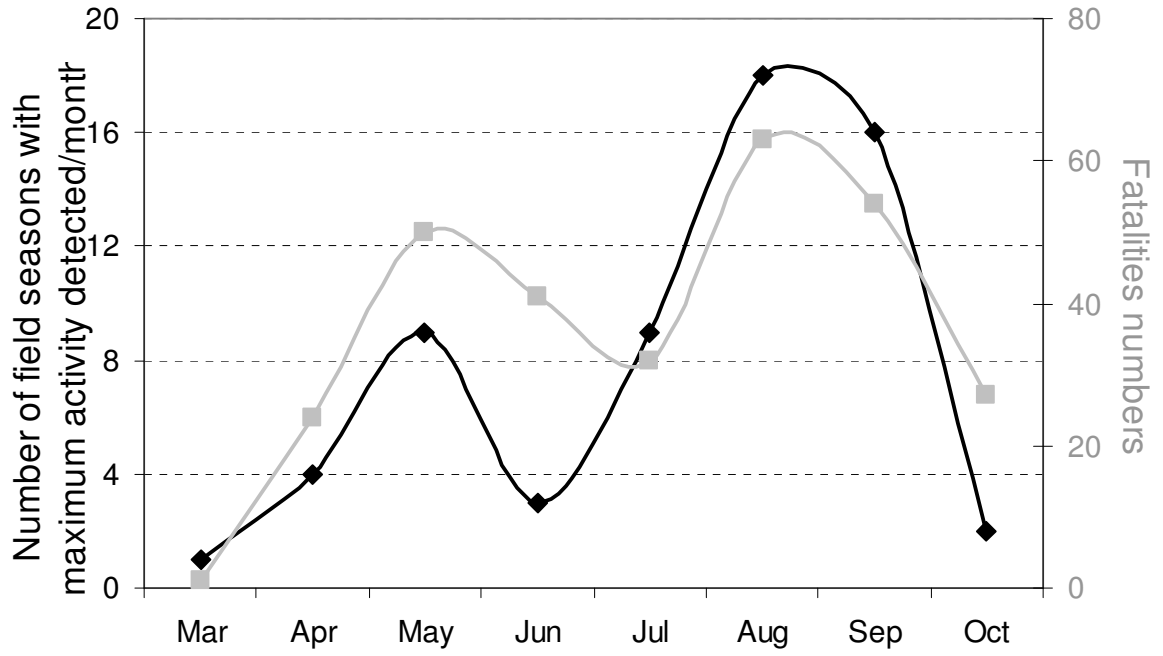

Figure 1 – Variation of observed mortality and detected activity along the year.

(c.6) 18 wind farms analyzed the influence of several variables on activity (32 field seasons showed a significant negative relation between activity and wind speed (activity clearly decreased > 1m/s in 9 seasons and wasn't detected > 2m/s in 6 seasons), and 24 field seasons showed a significant positive relation between activity and temperature (activity clearly decreased < 10ºC in 6 seasons and clearly increased > 20ºC in 5 seasons)

(c.7) no wind farm present a good comparison between activity surveyed during pre- and post-construction phases

(c.8) majority wind farms do not compare activity between farm and control areas

(c.9) no wind farm present height surveys

(c.10) analyzed data suggest a differential use of wind farms areas by different species (during functioning of 1 wind farm *E. serotinus* and *P. kuhli* were detected mostly near the turbines while *T. teniotis* and *Pipistrellus* sp seemed to avoid them; during construction of 1 wind farm there was an increase of the contacts with *E. serotinus* and *Pipistrellus* sp in the farm area; during functioning of 1 wind farm *P. pipistrellus´*s activity was clearly higher near turbines and corridors between turbines were sometimes used as feeding areas)

(d.) roost inventory/monitoring

(d.1) 25 wind farms present a good roost inventory, although 14 refers only to

underground roosts

(d.2) 268 potential roosts were inventoried (including 120 new occupied roosts and 4 new roosts considered as of national importance (2 maternities and 2 hibernation roosts)

(d.3) seasonal occupation was well studied in 15 wind farms

(d.4) variation along more than 1 year was studied in 10 wind farms; no significant variation in roost occupation was detected

Resolution 5.2 – Bats and Rabies in Europe

Passive surveillance is being carried out. Vaccination of people regularly handling bats is being recommended.

Other points have not been implemented yet.

Resolution 5.7 – Guidelines for the protection of overground roosts, with particular reference to roosts in buildings of cultural heritage importance

The known roosts are included in the database on bat observations. The roosts occupied by important colonies of species with cave-dwelling habits (*R. ferrumequinum* and *R. hipposideros*) are being monitored, and an agreement about its maintenance has been achieved with the owners.

One alternative overground roost was built in the past, to compensate the destruction of one building that harboured *T.teniotis*.

An informative guide for the general public regarding cohabitation with bats and giving advice on bat exclusion was prepared and is available on-line (referred under point 12).

Bat exclusion is being carried out by rangers, after training.

Suggestions contained in EUROBATS Publication Series nº 4 are being followed.

Other points have not been implemented yet.