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ACTION PLAN FOR THE CONSERVATION OF THE POND BAT (*Myotis dasycneme*) IN EUROPE

(Mammalia:chiroptera)

– Final version –

report to the Council of Europe

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FOREWORD

At its 17th meeting, the Standing Committee of the Bern Convention decided to ask for the drawing-up of action plans for two bat species as a contribution to the EURO-SPECIES Programme (Action Theme 11 of the Pan-European Biological and Landscape Diversity Strategy).

The draft action plan for the conservation of the Pond Bat (*Myotis dasycneme)* in Europe has been presented at the 4th Advisory Committee to the Eurobats Agreement (Stockholm, 19-21 April 1999).

The final version takes into account the comments from the consultation process, the discussions of the Eurobats Advisory Committee and of the 19th Standing Committee of the Bern Convention.

The Standing Committee of the Bern Convention adopted a Recommendation No. 73 on 3 December 1999 on the implementation of the action plan for conservation of the Pond Bat *(Myotis dasycneme)* in the territories covered by the Convention.

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REVISED ACTION PLAN FOR CONSERVATION OF THE POND BAT (*Myotis dasycneme*) IN EUROPE

SUMMARY

The pond bat (*Myotis dasycneme*) is recorded from the eastern seaboard of the North Sea to the River Yenisey in Russia and from about 60°N to a southern limit varying between c.50°N and c.44°N. It has been considered one of Europe‘s rarer and more threatened species and is included in *The 1996 IUCN Red List of Threatened Animals*. It is one of about 90 species of the genus *Myotis*, which is almost worldwide in distribution.

The species is included in Appendix II of the Bern Convention on the Conservation of European Wildlife and Natural Habitats, Appendix II of the Bonn Convention on the Conservation of Migratory Species of Wild Animals (and its Agreement on the Conservation of Bats in Europe) and Annex II and Annex IV of the EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora. It has protection through national legislation in most range states, although the nature of the legislation and its implementation varies.

Principal roost sites are in buildings and trees in summer and in underground habitats for winter hibernation. Summer maternity colonies range from a few tens to several hundred individuals. Most of the insect food is taken from close to open, smooth water surfaces. Foraging range may be up to 15 km from the daytime roost. Movements of up to 300 km occur between summer and winter sites and males may aggregate at sites along migration routes. Foraging routes (and probably migratory routes) generally follow sheltering linear landscape features.

Both roosts and foraging habitats are threatened. Roosts in buildings are threatened by disturbance, change of use, renovation or demolition – activities which may be essential for the maintenance of the building or desired for improvement. Further, bats may not always be welcome in buildings. Roosts in trees may be affected by unfavourable management of individual trees or of woodland. Similarly, roosts for hibernation in underground habitats are threatened by closure, changes in use or increased disturbance. In all such sites a major problem is the concentration of bats from a wide area into particular, often traditionally used, sites; bats are particularly sensitive to disturbance at maternity colonies or in hibernation. The pond bat principally feeds over water and changes to water quality and associated habitat will affect the insect prey and the bat‘s ability to feed on these insects. Changes in landscape, pesticide use, habitat fragmentation and the removal of linear landscape features (used as sheltered flyways between roosts and foraging areas) may all pose significant threats to bat populations.

The pond bat is not well studied since relatively few roosts were known and many have been lost through a range of causes. Recent field survey work using bat detectors, which enable identification of the bat in its foraging habitats, suggest that the species may not be as rare as formerly thought and has resulted in the discovery of many more roosts. Increased interest and knowledge in many range states has facilitated the identification and monitoring of more sites used for hibernation. Nevertheless, the species remains poorly known, is relatively rare and its populations may be concentrated into particular lowland and wetland areas. The application, at a Europe-wide level, of recently developed techniques for survey, monitoring and the assessment of more precise conservation requirements, offer opportunities to contribute to the conservation of this vulnerable species. Its medium-range migratory behaviour implies the need for international collaboration to identify the factors influencing its conservation during transboundary movements.

This Action Plan gives detailed background to the current knowledge of the status and ecology of the pond bat and how this relates to identified or perceived threats to the species, including information at the national level through a series of tables. It recognises that the migratory behaviour of this species makes international collaboration an essential element of its conservation management. The plan proposes as overall objectives:

- to maintain and enhance pond bat populations;
- to establish more precise knowledge of status, distribution and abundance, in relation to environmental factors, to enable objective response to changes in status and threats;
- to co-ordinate land use and other policy that can influence the conservation of pond bat habitat;
- to promote awareness in the general public, professions and special interest groups whose activities may affect the pond bat's status and protection;
- to co-ordinate the conservation of the pond bat as far as possible with other bat species (and other species and habitat plans) and with wider interests of landscape diversity conservation and restoration, especially of waterbodies.

The Standing Committee of the Bern Convention is encouraged to adopt this plan with the following actions required to meet its goals at the European level. Numbers at the end of action points refer to further discussion and possible mechanisms for implementation given in the body of the text.

Plan development and management

1. Pond bat conservation status within each country should be identified according to the IUCN criteria and based, as far as possible, on comparable systematic surveys and comparable estimation methods. (4.1.)

2. A system for the development and implementation of this action plan should be established, at national and Europe-wide levels, with power to modify its objectives and targets as implementation and the availability of research results progresses. Countries sharing populations should develop an effective mechanism for co-operation to secure transboundary conservation and management, including with reference to the migratory behaviour of the species. The action plan should be reviewed and revised as appropriate every five years. (4.1.).

Species protection

3. Laws should provide for the protection of pond bats, their roosts and foraging areas. Enforcement should be promoted and provide for appropriate penalties in regions where populations are known to be threatened by disturbance, pesticides, roost destruction or loss of foraging areas. (4.1.)

4. National criteria for sites needing protection for their pond bat populations should be agreed internationally. These criteria should be reviewed periodically to ensure that they are set at an appropriate level. Protected areas should be established for sites meeting the criteria. (4.1.)

Species recovery

5. Identify any populations in immediate threat of extinction and take appropriate action. (4.2.)

Habitat protection

6. Information and education should be developed to raise awareness amongst official bodies and interest groups involved in the management of the different parts of the pond bat habitat complex, for their specific role in an integrated approach to pond bat conservation. (4.3.)

7. Develop an active policy for the protection, maintenance and - as appropriate - enhancement or creation of roosts for pond bats, with particular reference to buildings, trees and underground habitats; educate responsible personnel and organise and finance survey work. (4.3.)

8. Identify foraging habitats, key flight paths and migration routes, and protect and manage a network of core habitats for pond bats, including summer roosts and hibernacula. (4.3.)

9. Ensure that the conservation of the landscape in which bats forage and commute is a material consideration in environmental impact assessment studies, performed to a suitable standard by bat specialists. These studies should particularly consider protection of roosts, foraging habitat, flight paths and the overall continuity of the landscape. (4.3.)

10. Target management of water systems on a more natural character, in which vegetation on the banks is developed, but the open character of the landscape is not changed. In appropriate nature development projects, open water surface should be incorporated. (4.3.)

11. Control nutrification and other pollution of water ecosystems, and where necessary clean polluted substrate. Maintain water levels in pond bat habitat. (4.3.)

Education

12. Ensure that adequate and objective information on bats and rabies is available for general communication to the public, public media and responsible authorities, who should maintain close co-operation with bat specialists in the response to any (potential) bat rabies incident. Such information should be prepared in co-operation with representatives of all relevant interest groups. (4.4.)

13. Develop information and education campaigns on bat and pond bat needs and opportunities for conservation for the general public and for specialist target groups, and ensure adequate resources to provide advice are readily available. (4.5.)

Monitoring and research

14. Co-ordinate and prioritise scientific research on the pond bat throughout its European range. (4.6.)

15. Co-ordinate the regular gathering of all necessary data and material to monitor the status of pond bats in Europe and identify the causes of any status change. (4.6.)

Cross-referencing

16. Ensure that in the development and implemenatation of this plan there is full cross-referencing to appropriate habitat and other species conservation and management plans and wider initiatives for the development of relevant policy, programmes and legislation. (4.7.)

1. INTRODUCTION

The secretive life of bats, raising young hidden away in dark and, for humans, often inaccessible roosts, foraging with silent sounds in the night and hibernating in cold and dark underground ‘caves‘ and ‘cellars‘, plus their association with ‘dark powers‘, makes bats, including the pond bat, little known creatures and the object of suspicion.

Development of active conservation measures for the pond bat (*Myotis dasycneme)* in Europe is a challenging goal. This bat species is characteristic primarily of north western European lowland and wetland landscapes and an indicator of a healthy network of wetlands and human settlements. Its conservation is a feasible proposition which can be achieved without high costs and significant human conflicts. Preservation of its habitats is beneficial to a range of other threatened wetland wildlife.

Many details on its distribution and life history are yet to be discovered, but the trend data available suggest that it is likely to react positively to implementation of conservation measures on site and landscape scales.

The information presented in this action plan for the conservation of the pond bat in Europe is based on the experience of the authors with ecology and conservation of bats in general (and the pond bat in particular), an intensive survey of available literature, and last but not least on the overwhelming amount of information presented to us by our colleages througout the range of the pond bat in reaction to a questionnaire that was circulated to them.

2. BACKGROUND INFORMATION

2.1. Description of the species

The genus *Myotis* (family Vespertilionidae) includes about 90 species and is almost worldwide. The pond bat, *Myotis dasycneme* (Boie, 1825), belongs to the subgenus *Leuconoe* with about 40 species. It is a medium-sized member of the genus, with a wingspan of 20 – 32 centimetres, a forearm of 41 - 49 mm, and a mass of (11)14 - 20 (23) g.

Its distribution ranges from north western Europe to the Yenisey River in north eastern Russia (from c.2oE to c.90oE), and from northern France, through Hungary, central Siberia and Kazakhstan in the south to southern Sweden, Baltic States and esatwards in the north, roughly between 48º – 60º N lattitudes (Map 1).

It is included in *The 1996 IUCN Red List of Threatened Animals* as VU A2c.

The pond bat is an insectivorous bat mainly foraging in open landscape rich with water. With its relatively long and broad wings it is adapted to hunting in straight and fast flight (35 km/h) close to water surfaces. Here it catches prey from the water surface with its large feet, or close to the surface with its wings. Its ecolocation calls vary from steep, short frequency modulated (FM) calls for short range high resolution, to shallower and longer near constant frequency (fm-QCF-fm) calls for long range detection.

The home range is relatively large. It hunts to at least 15 kilometres away from the roost and may cover large distances in the course of the night. It commutes between roost and hunting area along flight paths, which over land follow linear vegetation structures to suitable water routes in the vicinity. Commuting to favoured hunting areas at greater distance is thus predominantly over water.

Maternity and other summer roosts are known from buildings, and are mostly found in attics, in hollow walls or behind roof edges. Mating roosts are known from bird and bat boxes and tree hollows, but mating also occurs in hibernacula. Groups of males (10 to 30 individuals) are observed in buildings along routes towards the hibernation sites.

Maternity colonies range from a few tens to several hundreds of animals. The groups often show distinct site fidelity, but can be found occupying several different sites at the same time, and frequently move between nearby sites. Also complete movement of the colony over larger distances (several kilometres) may occur.Young, normally one per female, are born around the middle or late June and will start flying and hunting after 4 to 5 weeks. Maximum known age is 19.5 years.

In winter, the pond bat is typically known from underground sites, such as caves, quarries, bunkers, fortifications and cellars, where it hibernates between the middle of October and the beginning or late April. The species is considered to be a facultative migrant covering middle to long range distances, with known movements between 10 to up to 300 kilometres.

Three aspects of the biology of temperate European bats make them particularly vulnerable to population pressures. Firstly, bats (mainly females) gather in maternity colonies in summer: more or less the whole of a breeding female population for a considerable area may be concentrated into one roost, which may be liable to destruction, disturbance or change of use. A colony can be very faithful to a particular roost, which may be occupied for long historical periods. Secondly, in winter bats hibernate and the greater part of the population may be concentrated into a few sites. These are also vulnerable to destruction, disturbance or change of use. The arousal of a bat from hibernation torpor is a very slow process, and as each arousal costs a great deal of energy, unscheduled arousals are potentially life-threatening. Thirdly they require a good supply and range of insects throughout their reproductive season, but especially in mid summer when females suckle their young. Insect food supplies available to foraging bats are not only influenced by the population densities of flying insects. They are also affected by habitat structure, including sheltered flyways linking up important foraging areas. Changes of land use, pesticide treatments, removal of linear landscape features and habitat fragmentation may all pose significant threats to bat populations.

2.2. Distribution and population estimation methodologies

2.2.1. Definitions and population estimation

Pond bats form their largest and most concentrated aggregations in June and July when breeding females and their immature offspring congregate in a traditional **maternity roost**. Such a collection of bats is termed a **colony**. Its size and composition by sex, age and reproductive group varies continuously throughout the summer.

A pond bat colony may occupy one, or a number, of traditional sites in a small area. At least a proportion of the female young return to breed in their natal roost and there is no evidence for permanent emigration. It therefore may be asumed that the mothers in the roost will be related.

In winter, bats from summer colonies usually move towards nearby or more distant underground sites termed **hibernacula.** Data from banding studies, between the 1940s and 1968, in the Netherlands, show a tendency towards traditional regions for hibernation, but for most **summer populations** in Europe the exact hibernation sites are not known and information on the composition of the **winter populations** is lacking.

Mating is observed in the hibernacula during winter, but also in the autumn small mating groups of one male with three or four female bats can be found in special **mating sites** (bird and bat boxes, tree hollows). It may be assumed that genetic interchange will be greater within local or regional summer populations. However, individuals which travel long distances provide genetic links bewteen populations to form a **metapopulation** in a country or region.

Pond bats are not distributed evenly at any time of the year, their dispersion patterns vary seasonally. They are relatively easy to count in the field when foraging, especially pond bats that are commuting on a flight path, when they tend to be flying all in one direction and will be using loud long fm-QCF-fm pulses. Such calls are detectable over a relatively large distance and will provide opportunity for reliable counts.

Older trend information is primarily based on counts of hibernating pond bats. From this some problems may arise. What proportion of the real population is actually observed in hibernacula is not known, but probably relatively small. It is not know if trends in the hibernacula may be considered representative, but general trends of bats in hibernacula througout Europe show remarkable similarity. Survey intensity in hibernacula in Europe in general varies over the years, and survey intensity is constantly increasing in some of the sites with the longest count records.

Currently experiments on a regional scale to supplement this information with roost exit counts and counts of bats passing on flight paths are being started. Such estimates should be regarded as minima, since they only tell us about known colonies or populations, and so are vulnerable to the discovery of further maternity roosts or hibernacula.

In regions where searching efforts for both maternity roosts and hibernacula have been intensive and prolonged over many decade, estimates may be quite reliable. In regions where neither is true, estimates should be regarded as tentative minima, and a basis to build upon through further surveys.

Whatever the weakness of population estimates for a region, trends for specific colonies over years can be reliably followed by standardised annual summer counts.

2.2.2. Status and trends of the European populations

Information on status and trends in bats in general, and in the pond bat in particular, is not readily available and difficult to interpret. Pond bat habitats are patchily distributed. Summer and winter habitats, hence distribution in summer and winter, may be far apart in one area, hibernation sites may well be within summer haunts in another, leading to a facultative migrant behaviour. As a result, distribution is highly dynamic in space and time even within one season. Efficient survey and monitoring techniques are different for different types of habitat use (roosting, foraging, commuting, migration), some are only recently developed (bat detector survey) or being developed (detector monitoring), and the level of experience and training in different techniques is unevenly spread across Europe. As a result only sparce and scattered information on occurrence, distribution and trends is available and status and trends in general are poorly known for many areas.

There is a large discrepancy between observed numbers in summer and winter. There are a number of possible explanations, which probably all explain part of this phenomenon. Pond bats may hibernate in the typical hibernation sites, but somehow hidden from the surveyors; a large number of these typical hibernation sites may be unknown to us; or different types of hibernation site which are overlooked may be used.

Distribution

The Palaearctic distribution of the pond bat ranges from north western Europe (the Netherlands, Denmark and southern Sweden) to the Yenisey River in eastern Russia, and south to northern France, Hungary, Slovakia, central Siberia and northern Kazakhstan, roughly between 2o - 90oE and 48º – 60º N (Map 1). There is one record from Manchuria.

Within its European range, the species is recently recorded from Belarus, Belgium (Flanders and Wallonia), Croatia, the Moravian karst area in the Czech Republic, the middle Jutland and Bornholm area in Denmark, Estonia, northernmost France, Germany (federal states of Baden-Württemberg, Berlin/Brandenburg, Bremen, Hamburg, Lower Saxony, Mecklenburg Pomerania, Northrhein Westfalia, Saxony and Thüringen) lowlands in the eastern and southern parts of Hungary, north and east Kazakhstan, the eastern part of Latvia, the eastern part of Lithuania, Moldova, throughout the Netherlands with concentrations in the northwestern lowlands, Poland, Romania, Slovakia, southern Sweden, Russia, Ukraine and eastern Serbia (see Map 1 and Table 1).

The available information could lead to the interpretation that within the known distribution, the summer occurrence is limited to relatively small centres of populations separated by areas of very sparse populations in the western part of its range. Such data as are available for the eastern part of its range suggest a similar pattern, and that the species is often rare in apparently suitable habitat.

Designated centres of population include The Netherlands, Jutland, to a lesser extend the Federal state of Mecklenburg-Vorpommern in north eastern Germany, the Baltic States and lowlands in parts of the former USSR.

In most of its range, however, no systematic survey has been carried out. Recently, bat detector surveys have been or are being performed in different parts of Europe, but due to different standards in training, organisation and available observers, with very different survey intensities. At the same time in southeastern Europe attention has been or is being given to the survey of bats on attics and lofts. In some of the areas between known centres of population these surveys have lead to the discovery of formerly unsuspected nursury populations, whereas in others so far only foraging individuals have been observed.

Co-ordinated assessment of distributional data using appropriate methods, and training and spreading of information is needed to improve our knowledge on the distribution and status of the pond bat.

Table 1 gives data on the occurrence of pond bat in the various range states.

Population estimate

In 1988 there was a suggested population of 3,000 individuals in western Europe and a world population of 7,000, but this can be regarded as an underestimate, for populations within and outside western Europe.

For most countries only very incomplete or no summer data are available and only low numbers are observed in hibernacula, leaving us with few hard figures upon which to base a population estimate.

Nonetheless experts from those countries where survey work has been intensified recently and where maybe samples of the suitable pond bat landscapes were surveyed, tried to produce estimates for their countries (see table 2.2). A recent estimate for Hungary for instance is 10,000 individuals, their largest known maternity roost is about 1,000 individuals.

In the Netherlands, a nation wide systematic and goal-directed survey carried out between 1986 and 1993, lead to a recent population estimate based on its summer occurrence, of 8,000-10,000 individuals; a population 4 to 5 times higher than was previously estimated to be present. In contrast, in hibernacula in the Netherlands only 400-500 pond bats are recorded yearly. While most of the hibernating population is not observed in the winter such figures cannot be used directly as a population estimate. Summer samples seem to be 20 times higher than winter samples.

From its eastern range information showing a similar discrepancy between observed or estimated summer and winter populations is available. Russian data on marking and recapture show that hibernating pond bats are underestimated about 10 times and that summer samples are about 5 times higher than winter samples, leading to an estimate of at least 100,000 individuals for Russia.

Based on the assumptions that the ratio between old and new population estimates for the Netherlands (1:4 – 1:5) can be considered representative for the whole of its range, that summer populations are 20 to 50 times higher than the observed numbers in winter, that there will be unknown/unsuspected populations in a least 50% of the suitable area between the currently known centres of population, and given the recent estimates for coutries like Hungary, Latvia, the Netherlands and Russia we could estimate the population or the pond bat as 100,000 – 200,000 individuals.

It is clearly necessary, however, to survey the occurrence and distribution, and numbers of the pond bat throughout its range in much more detail to get to beter basis for population estimates, and to be able to reliably judge its status according to IUNC criteria.

Estimates for populations and population trends are given in Table 2.

Trends

In the Netherlands, one of the traditionally known population centres, long-term trend information is primarily based on counts of pond bats in underground hibernacula. In general these counts show slowly fluctuating numbers of the pond bat since 1943, without much rise or fall in population numbers, despite loss (or movement) of many summer roosts between the 1950s and the 1970s. Recently the total observed hibernating population seems to be increasing slowly, with decreasing numbers in some traditional hibernacula and increasing numbers in some new found (and protected) hibernacula.

Bat specialists throughout its range are almost unanimous in their opinion that they do not really have reliable data on trends. Reported indications, vary from weak negative or equal to weak positive. Here it should be recognized that these indications are mostly based on numbers in hibernacula, and that within these hibernacula only very low numbers are observed as compared to the (expected) population in the field.

2.3. Life history

2.3.1. Food

The diet of the pond bat is poorly known. In one study in the Netherlands a small sample of feacal pellets chosen at random at one site was analysed. Here 68 % (by volume) of the diet comprised small dipterans, almost all Chironomidae (Diptera). About 11% consisted of Coleoptera, 8% chironomid pupae, 1,5% caddis flies (Trichoptera) and one lacewing wing (Neuroptera) was found. The occurrence of pupal cases in the faeces suggests that the bats take chironomids at the moment of adult emergence at the water surface. In another in Mecklenburg- Westpomerania in northern Germany, 70% consisted of chironomids, 27 % Trichoptera, 3 % Lepidoptera and 0,15 % Culicidae (Diptera).

With respect to the high proportion of Chironomidae, the diet resembles that of Daubenton’s bat, so overlap in diet of the two species may occur where they are sympatric.

2.3.2. Foraging techniques, timing and ranges

The American term foraging is used since it incorporates all activities involved in hunting or searching for prey items using flight and echolocation, as well as capturing, dismembering and finally swallowing them after chewing. A distinct foraging area is an area within which a bat may spend some time on these activities (maybe about 30 minutes or longer). However, with species that hunt and commute over large distances, like the pond bat, commuting and foraging may be one functional behaviour, while moving through a larger system of canals and lakes. A foraging bout is a period of time during which foraging occurs. It is separated from other bouts by a period of resting during which rapid digestion and egestion of faeces occurs, permitting further consumption of food. Interforaging periods may be spend in daytime roosts, or in temporary night roosts.

The pond bat is typically known to hunt in a fast (up to 35 km/h) and straight flight in long curves, patrolling at about 30 centimetres (10 to 60 centimetres) above the surface of larger open waterbodies. Nevertheless, they can be quite manoeuvrable. They take insects with their large feet directly from the water surface (trawling), or with the wing or tail membrane close to the water surface, or will even pursue the prey some metres up in the air or above the vegetation on the bank (aerial hawking).

Sometimes this strategy of hunting in a ‘two-dimensional plane‘ above the water surface is abandoned and they will hunt in a more ‘three-dimensional space‘ above and around the waterbody and adjacent structures, such as around trees and houses.

To date no radiotelemetry studies on the pond bat have been carried out, hence information on foraging behaviour, foraging range and distribution of foraging activity in the landscape is mainly based on survey work with bat detectors and flash lights. Detailed data from the Netherlands are being supplemented with surveys in other lowland areas in north western Europe. There is no information available on foraging times or differences in foraging ranges and time between individuals, seasons and regions etc. Emergence starts at approximately 45 to 50 minutes after sunset, and will take between 30 to 60 minutes depending on the size of the colony. Returning for the day again will take between 30 and 60 minutes and all bats will have returned at approximately 45 to 60 minutes before dawn when it is still relatively dark. In spring and autumn, when no young have to be fed, most will stay out all night.

Based on the distance between bats foraging in the field and potential or known roost sites, and on systematically following flight paths in landscapes where such is possible, the foraging range is estimated to up to 15 kilometres from the roost, where commuting distances or distances covered while hunting may add many tens of kilometres and may encompass a total area of up to 700 km^2. There is no direct knowledge of the occurrence and size of core foraging areas withing the foraging range, but differences in densities of hunting animals and/or foraging activity can be observed in the field.

Living in a relatively cool and humid temperate climate, and being dependent on insect prey, it is necessary for them to also feed during, cool rainy and windy nights, and they may be observed hunting at temperatures near 0 ºC or in quite heavy rain.

2.3.3. Social organisation, reproduction and growth

A pond bat nursery colony may occupy one, or a number of traditional sites in a small area. At least part of the female young return to breed in their natal roost and there is no evidence for permanent emigration. It therefore may be assumed that the mothers in the roost will be related.

Female pond bats do not reach sexual maturity before August of their second year. Hence females take part in mating and reproduction from their second year on. In general they produce a single young, but, recently the birth of twins has been documented.

Females start occupying the maternity roost from the end of March onward. The young are born in June and start flying after about 4 to 5 weeks. After weaning both adults and juveniles start leaving the maternity roost and using other roost sites. Subadult males are rarely found in nursery colonies. Male pond bats become sexual active in September. Development of testes begins to be apparent in late August but the epididymides are not filled until September.

2.3.4. Survival and longevity

The survival rate of pond bats in the Netherlands was estimated at about 70 % (70% in summer populations and 67% in winter populations). It proved to be independent of age and sex. From this values of life span of 13 years and of life expectancy of 2.8 years can be calculated. The oldest banded pond bat recapture is aged 19,5 years.

2.3.5. Hibernation and hibernacula

Hibernation is a complex adaptation to long periods of food deprivation, which should not be confused with summer torpor. Summer torpor can only last for up to 24 hours, and leads to daily arousal at dusk.

Pond bats are traditionally known to hibernate in typical ‘underground‘ sites, which are stable with respect to temperature (4 to 9 ºC), humidity, darkness and quietness: natural caves, (limestone) quarries, mine-corridors, but also in bunkers, fortifications and cellars, where they hibernate roughly from mid October to the middle of March or end of April. They are found hibernating either singly or in small groups from 2 to 10 bats, with numbers that range from 1 to nearly 700 in one site. They may hang or lie almost everywhere from the ceiling to the floor, in exposed positions or more or less protected in holes and crevices.

In these stable sites the pond bat awakens on average once every 26 days, but more often towards the end of the hibernation period. There is no evidence of foraging during mild winter days. When climatoligical conditions in the hibernacula change during winter, they will shift to other positions.

Recently, while survey intensity and knowledge of its distribution are growing, individuals and small groups are being found hibernating in sites which are more exposed to the ambient weather conditions, for instance the space under the roof tiles or under the roof edge, in the areas where the summer populations are resident.

2.3.6. Migration

The species is considered to be a facultative migrant, covering middle to long range distances, with known displacements from 10 to 300 kilometres.

Recaptures of pond bats banded in summer roosts and hibernacula in the Netherlands, Belgium and Germany show a tendency for migration generally between the lowland landscape in the north west of the Netherlands and caves and underground sites in the hilly and mountainous regions in the south (S.Limburg, Ardennes, Namur-Liege), south east (Eifel, Sauerland) and nearly east (Teutoburger Wald, Weserbergland), following canals and the natural course of the rivers. Migration directions and routes of other European populations are not known.

In the Netherlands in spring, the pond bats leave the hibernacula in the south from the middle of March to end of April, and arrive at nursery roosts in the north from the end of March to the end of April (migration distance approximately 300 km, spring migration period approximately 2 weeks).

In autumn the bats on average leave the summer roost around the middle of August and arrive at the hibernaculum between second half of August to early November (autumn ‘migration period‘ approximately 10 weeks). The first part of this period, however, coincides with the mating season and the real migration to the winter quarters will probably start from the end of September. In the Osnabrück Hill area in summer aggregations of males (10 to 30 individuals) observed in buildings along routes towards the hibernation sites, disperse from the end of August / beginning of September, when the mating season starts.

2.3.7. Habitat requirements

In the course of the night, as well as seasonally, pond bats use a range of functionally different habitats. To be able to support a bat population a landscape should, on a larger scale, provide a complex of habitat elements allowing succesful roosting, foraging, and dispersal/migration between roosts and hunting habitats, and between summer haunts and hibernation sites.

Effective conservation measures have to be directed at the conservation and restoration of this complex of functional habitat elements within the natural range of the species. Based on this complex of functional habitat elements the following attempts to describe the eco-profile of the pond bat. It describes elements of the complex that we know, and those that we do not know or do not know sufficiently; we also identify where more study is needed and where and how, for the pond bat, conservation and restoration of the different habitat elements is possible.

2.3.7.1. Roosts

In the course of the season, and sometimes even during the course of one night, bats may use a whole range of more or less clearly definable and functionally different roosts: **nursery** or **maternity roosts**, where the female bats aggregate and give birth to and raise their young; **male roosts** used by the males in the summer period, but outside the mating season; **night roosts** in the foraging areas, where resting and food processing, digestion etc. take place; **'temporary or transitional roosts'** used by females, males subadults and/or juveniles in areas where summer populations are present, in the phase before and after aggregation of the females in the maternity roosts; **mating roosts** where males attract a number of adult females for mating; **temporary 'migration roosts'** used during migration, which may be found in areas where no or no large summer population seem to be present; **winter roosts** or **hibernacula** where hibernation occurs in the winter period. A particular roost structure can serve different functions at different times.

Nursery roosts are predominantly known from buildings, often in sites which are warmed by the sun (e.g.with slate or iron covered roofs), or heated by the human occupants. More east in its range trees and, in warmer regions, also bridges and cavities in stone or rock faces are recorded. Within the roost bats choose the warmest sites. Structures used are: older to relatively new (10-20 years) houses, where the bats occupy the space in the hollow double brick walls, under the roof tiles, under the lead covering around chimneys, or under the roof edge and under a flat roof; the boiler room on top of an apartment building, wall covering and roof structures of larger storage buildings; church lofts (see Tables 3, 4 and 5).

Roosts of males are known from hollow walls and roof edge of, for example, storage buildings.

There is no information available on night roosts used by pond bats, but since, for instance, the females in spring and autumn leave the maternity roost for the whole of the night, it may be assumed that they do use night roosts.

Mating roosts are known from hollow walls, the space under the roof tiles, bird and bat boxes and tree hollows, but mating is also observed in hibernacula in the autumn and during the mid-winter census of hibernating bats (see Tables 3 and 6).

There is no information available on roost types used during migration.

Pond bat hibernacula may be any structure with an underground character and of almost any size, such as natural caves, (limestone) quarries, mine-corridors, but also bunkers, fortifications and cellars (see Tables 3 and 5).

Hibernating pond bats are also observed in sites without the underground character, such as the space under roof tiles or under the roof edge of buildings. Since an active survey of this type of hibernation sites is not possible, records are only made incidentally and its occurrence may be underestimated.

We have to be aware that many underground ‘hibernation sites‘, may serve other functions for bats, such as for mating and swarming outside the actual hibernation period, and that such roosts may be visited by bats during the whole year (see Tables 3 and 7).

2.3.7.2. Foraging habitat

The **foraging habitat** comprises the habitats that produce prey items as well as the habitats in which these prey items can be caught, which may or may not be the same habitat.

From its western range the pond bat is typically known to forage close to the surface of larger open water bodies with still or slow flowing water, such as canals (> 2,5 m wide), lakes, the open water bodies in swamp areas, rivers, and ponds, in relatively open landscapes; mostly water with well-developed fringing vegetation with reed, but not densely wooded with trees or bushes. They may leave the water surface of, e.g., canals and hunt higher up in the air (5 to 10 metres) and above and around the vegetation on the bank and adjacent structures.

Although they forage in relatively open landscapes and above open water surfaces, and may be found hundres of metres from the shore of larger lakes or rivers, they are mostly found hunting in the shelter of the bank. Wind speed and direction is an important factor determining which part of the water habitats are used for hunting.

More rarely they are observed to hunt above smaller more enclosed water surfaces or above wet peatbog or marsh landscapes or even meadows or natural pastures. In the vicinity of the roosts they can be observed hunting along wooded banks, tree lines, forest edges or gardens in built-up areas.

Canals and larger ponds in the built-up area of some cities are hardly ever used, whereas in other cities such habitat is regularly used. ‘Industrial habitat‘ like harbours and waterways, which can be strongly illuminated and have intensive traffic of boats, may well be used as a hunting habitat by pond bats.

A few rare observations are available on pond bats hunting above brackish water in estuaries near the North and Baltic Seas.

Within larger areas with suitable habitats they may concentrate on some restricted areas. Such restrictions may be opportunistic rather than enforced.

Although information on habitat use from its eastern range is rare, in general it occurs in less open and more forested landscapes. It is assumed that the combination of forest and water is important for the pond bat.

The preferred foraging habitats are summarised in Table 8.

2.3.7.3. Flight paths

Many bat species use distinct flight paths to commute between their day roost and hunting areas. For the pond bat, known flight paths over land follow ‘linear‘ vegetation structures, like hedges, tree lines or gardens to reach a suitable waterway in the vicinity of the roost. From there, commuting towards or through the foraging area is along canals, rivers and the banks of lakes.

2.3.7.4. Migratory routes

Current data on pond bat migration routes are based on recaptures of banded individuals in the period between leaving the nursery roosts and entering hibernacula. From these data migration along the canals and river systems in the landscape – very similar to the daily flight paths – can clearly be deduced.

2.4. Pond bats and humans

Human activity throughout Europe in historic times has presented both positive as well as negative effects on the availability of pond bat habitat.

It is assumed that at the time that humans started populating the north western lowlands in Europe, pond bats were using tree roosts in the summer season and migrating along the river systems to natural caves for hibernation.

In the course of humans settlement roosting and foraging habitat was lost where forest areas were cut down and peat and swamp areas were changed into agricultural areas.

On the other hand human activity lead to creation of new foraging habitat by digging an extensive system of canals and ditches and the creation of freshwater lakes bordered by marsh vegetation and by impoldering marine areas. This system of waterways also provided new possible migration routes. Substitute roosts were built in the form of church lofts and double brick-walls. Excavation, mining and building subterranean fortifications, bunkers etc. provided new possibilities for hibernation, the latter even within the lowland summer area.

2.4.1. Public attitudes

Until recent decades public attitudes to all bat species was negative in many European countries, largely due to historical prejudices, partly fostered by the literature. Bats were regarded as pests, and were treated as such by many house owners. With persistent publicity and education, a reversal in attitudes has been achieved in certain countries, so that only a minority of people are now averse to them. Some of these are genuinely bat-phobic, and panic-stricken at the thought of sharing their homes with bats. Most have their fears allayed by visits from bat workers who demonstrate a bat’s amazing ultrasonic powers with a bat detector, show them how small they are, and explain about the many fascinating aspects of their long lives.

Such work aimed at public awareness has indeed made general attitude a lot more positive. This process however may at a very different stage in different part of Europe.

The occurrence of rabies-related virus, predominantly recorded in the serotine bat, but in a few cases also in the pond bat, has made people in general more cautious. A serious problem in this matter is presented by the tendency of some public media to exaggerate ‘rabies events‘.

People and communities responsible for management of the building the pond bats choose to use may be very open minded and happy with this little part of ‘nature‘ which they may host in their house, church etc, but may also be prejudice or narrow-minded regarding the function of e.g. church buildings and the nuisance that these uninvited guests may provide.

In general the attitude is positive, but professional bodies are too often unaware of where and in what way their activities could either positively or negatively effect bat populations.

2.4.2. Conflicts with humans

Serious conflicts with humans rarely occur, but in interactions with humans, the fact that bat are unknown, that there is prejudice, general fear, and fear of rabies, colours the feelings and observations of people involved.

Bats in churches, larger buildings or in homes may cause some problems by depositing in or against the building. In most cases droppings will be concentrated on one particular site. While these are very dry droppings – undigested insect parts – which are easily cleaned away, this is mostly no real practical problem. The problem often is a psychological or attitude problem: people don't like droppings, they like it to be clean, or people may be afraid. The attitude may be very different in different parts of Europe.

In some – rare – cases, bat droppings and urine on a ceiling will produce stains and smell, e.g., when coming into contact with dampness or leakage of water. Bat roosts may in some situations cause 'noise' problems: bats squeaking or crawling around in a ceiling or wall. This is dependent on the construction of the building, the exact location of the roost within the building, and some species seem to be louder than others. House owners are often not aware of their pond bats, which seem to be a relatively quiet species.

There is some prejudice that bat droppings or bats themselves may encourage problems in conservation of wooden constructions.

Rabies in bats again is probably more of a psychological problem than a real problem. Responsible bodies, as well as the public, with little or no knowledge of bat ecology tend to overreact. Rabies infection is found in only a few species, and in only a small percentage of the individuals analysed. These, mostly being animals found by the general public hanging in unnatural circumstances, are far from a random sample. The disease, however, is simply too serious not to be regarded with great caution. Clear information on bats and clear procedures for handling of cases of (potential) infection should be present in all countries with responsible bodies able to react adequately without overreactions which may be counter productive to bat conservation efforts.

In some caves the interests of hibernating bats conflict with the desire of cavers (spelaeologists) to carry out their sport without restrictions. Alternatively, an owner may wish to open up the cave for commercial visits which involve disturbance due either to lighting regimes or noise.

2.5. Threats, limiting factors, and obstacles to conservation

2.5.1. Demographic viability

Recent information on composition of populations with respect to age and sex is not available. In areas which are at the moment known as population centres, reproduction levels and distribution of the population do not indicate weakened demographic viability. However, current knowledge of the general occurrence and distribution, and local productivity throughout the range of the pond bat is too poor to judge fully the level of this risk, especially on a regional scale.

2.5.2. Genetic viability

To date no studies on pond bat genetics are available. Hence, levels of genetic variability between populations or colonies in smaller areas or between populations on a larger international scale are not known, and risks of weakened genetic viability cannot be judged.

2.5.3. Threats to pond bat habitat

Threats to the pond bat may be differentiated with respect to summer roosts, winter roosts and the landscape providing the general summer habitat. Due to the poor level of information on its occurrence and distribution for many states in its range the threats are not known precisely.

2.5.3.1. Threats to roosts in the summer habitat

Many pond bat roosts have been lost due to remedial timber treatment and renovation of buildings.

Toxic treatment of timber in (church) attics and lofts, meant to safeguard the roof structures from wood rot and beetle infestation, has been and still can be a major disaster for many bat species living in attics. Advice on the timing of treatment and the use of safer chemicals or even non-chemical methods (such as hot air) are available, but need more development and more awareness with the people responsible for the maintenance of buildings and those applying the timber treatment.

Renovation and rebuilding of (church) attics and lofts and other buildings is often badly timed for the nursing period of bats and closing entrances to keep out pigeons and other birds may lead to inaccessibility for bats also. In the course of renovation, materials used, including certain wood preservatives may render the roost unsuitable for bats. Changes in architecture and the need for extra space by the human occupants may result in churches or other large buildings having no loft space that is suitable for bats. Professional information and supervision is needed to safeguard the roosts where for instance bats under a flat roof may be the cause of need for renovation. Roosts in double brick-walls or under roof tiles are lost by insulation through the introduction of rock wool, polystyrene, etc.

Threat through renovation of buildings and timber treatment may be increasing in eastern European countries through recent economical development.

Shortage of tree hollows, and forest management not consistent with maintaining sufficient availability of tree hollows, is considered to be a problem in its eastern range in areas where roosts rely on the availability of cavities, hollows and fissures in trees. But even in its western range this could create a problem in areas where bats rely on the availability of tree hollows for mating roosts.

2.5.3.2. Threats to hibernation sites

General threats to hibernation sites also effect the pond bat. Hibernating bats and ‘underground‘ hibernacula are under constant threat of disturbance through a whole range of human activities during winter. Spelaeologists, geologists or archeologists, and guided tourists, tours, in themselvest are interested in and appreciative of both natural caves and artifical sites in their ‘natural‘ state, but may create serious disturbance to hibernating bats.

Other activities such as parties, underground events ranging from Christmas markets to survival sports, use of sites as storage rooms or as places to grow mushrooms, Brussel sprouts or worms, the development of the sites into restaurants, theatres etc. cause excess disturbance or render the sites totally unsuitable for hibernating bats. In many eastern European countries disturbance through caving and survival sports may be increasing through development of tourism.

Additionally many old cellars, bunkers etc. are lost through demolition and development of the area. And potentially dangerous sites like quarries and old mine-corridors are closed for safety reasons, without ensuring accessibility for bats through, e.g., grilling or fencing.

New styles of architecture and building leave little or no unused space in buildings, such that new underground sites are unlikely to be developed without active policy. Problems listed above in 2.5.3.1., regarding timber treatment, renovation, rebuilding and insulation will also effect pond bats hibernating in buildings.

2.5.3.3. Threats to foraging habitat, flight paths, and migration routes

In the case of the pond bat, in its western range changes in land use in the last century might not have had a large effect on the overall availability of hunting habitats. On the one hand wetland areas have been converted to agricultural land, on the other hand canals and artificial lakes have been dug. More recent agricultural methods may have a negative effect on this balance. Drainage and high water consumption for cities and industries leads to drying out of areas with heavy effects on insect production, and to less water in canals and ditches. In formerly overall wet landscapes, where foraging above wet meadows, canals, ditches etc. was possible, foraging area has been reduced to the open water bodies. Nutrification leads to massive growth of vegetation, including algae in canals effecting the availability of the open water surfaces as a hunting habitat and affects the insect fauna. Development of artificial lakes into more natural marshes has to be done in such a way that open water surfaces stay available for the pond bat.

Pond bats in the summer prefer dwelling in relatively open areas in many parts of the range (more vegetated in some regions, such as Denmark). These are not the landscapes which have suffered the greatest loss of landscape structure through developments in agricultural land use. Loss of landscape structures linking (potential) roost sites and (potential) foraging area, might therefore not have been a major limiting factor for this species. Nonetheless, loss of flight paths through alterations in the landscape around roosts may present a problem at the site level.

The development of modern large-scale infrastructural works for motorways, roads, and railroads etc, may interrupt the bat flight paths on land or over water, and may hinder their passage. This process gradually leads to reduced continuity of the landscape. It is important to keep or develop an adequate network of protected flight paths between roost and foraging habitats, and between summer and winter areas. Requirements during migration are not really known and may be a constraint.

Threats related to the area and quality of the foraging habitat and landscape structure, among which, deforestation, decrease of age and species diversity in forests, and economical development (agriculture, industry and urbanisation) within river valleys, may be increasingly important in the eastern range of the species.

While a low level of nutrification of the water may increase the availability of chironomid prey items, toxic residues in the water environment (through water quality and polluted soils), such as heavy metals, pesticides, PCBs, PAKs, etc, will accumulate in bats feeding on insects which develop in these polluted environments. To date the effects of this risk with respect to reproduction and mortality of the pond bat are not studied. There is some evidence, however, that highly polluted river sections are being avoided as a hunting habitat. Pollution of European rivers with salts reduces insect production and thus the quality of foraging habitats.

A summary of threats (actual and potential) is given in Table 9

2.6. Conservation status and current conservation measures

2.6.1. International

The pond bat is included in Appendix II (strictly protected fauna species) of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 1979) and in Resolution No.6 (1998) of the Standing Committee listing the species requiring specific habitat conservation measures (Emerald Network). Conservation of this bat species would also be influenced by Recommendation No. 36 (1992) of the Standing Committee on the conservation of underground habitats.

The species is included in Annex II of the Convention on the Conservation of Migratory Species of Wild Animals (Bonn, 1979) and its Agreement on the Conservation of Bats in Europe. This action plan takes account of the Agreement's Conservation and Management Plan and other Resolutions adopted by parties to the Agreement. Within these Resolutions, the species is selected for examination of its migratory behaviour and its conservation will be influenced by transboundary programmes being prepared on underground habitats and forestry practice.

The species is included in Annex II and Annex IV of the EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC). Special Areas for Conservation are required to be established for Annex II species, and these are being developed as Natura 2000 sites in appropriate range states.

The Convention on Biological Diversity was an important product of the Earth Summit held in Rio de Janeiro (1992). Signed in Rio by 153 nation states and with others that have acceded since, it requires each contracting party to 'develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity, or adapt for this purpose existing strategies, plans or programmes which shall reflect, inter alia, the measures set out in the convention relevant to the contracting party concerned'. It seeks sustainable development, with one of the key tests of sustainability being the conservation of biodiversity; development cannot be regarded as sustainable unless biodiversity is conserved. A range of actions are identified to meet this aim. The pond bat is not specified in this convention.

2.6.2. National

The pond bat is protected in all range states except some countries of the former Yugoslavia and former USSR, although the level of protection provided by the legislation and its implementation varies and may be in need of better enforcement (Table 10).

2.6.3. Recent measures for conservation

The species is included in *The 1996 IUCN Red List of Threatened Animals* as Vulnerable: A2c. Its conservation is discussed in a *Global Action Plan for Microchiropteran Bats* in preparation by IUCN/SSC's Chiroptera Specialist Group, where it is highlighted in a sample summary Species Action Plan.

The Co-ordinating Panel for the Conservation of Bats in Europe (a regional subgroup of the Chiroptera Specialist Group) comprises a Europe-wide network of bat conservation specialists, established to develop and implement collaboration on bat conservation activities in Europe under relevant intergovernmental treaties and non-governmental concerns.

A first meeting of bat specialists to discuss the possibilities of European co-operation in the study of its migratory behaviour was held in December 1998 in Germany.

Apart from the measures identified above, conservation has generally been directed to site protection. This particularly relates to the protection of underground sites used by maternity colonies and/or for hibernation, and of buildings used by maternity colonies. Throughout its range, however, such measures are implemented only on a relatively regional or even local scale and limited to the conservation of only those maternity roosts and hibernacula that are known.

Co-operation in building renovation and the maintenance of interest and concern by government and non-government organizations and individuals has retained or improved many maternity colonies in buildings. Considerable effort has been applied to the conservation of known maternity roosts, but not always with success in view of requirements for renovation and maintenance of buildings used as roosts.

The conservation of underground sites has been complicated by concerns for the legitimate leisure use of caves, and the safety aspects of access to underground disused mines. These have been resolved in many cases by the installation of grilles at the entrances of many sites, and the operation of close seasons at certain times. The grilles are designed to allow free access to bats, but limit unauthorized human access. Numbers of bats in underground sites have increased following site protection. Protection of underground sites by grilles is not without its problems. Grilles may be difficult to install and maintain from vandalism and deterioration. More importantly, grilles that are suitable for the protection of a site used for hibernation may deter some species, including horseshoe bats, from using it in summer. This not only includes occupation of the site by maternity colonies, but also its use for autumn swarming behaviour, when bats congregate at night and mating may occur. Alternatives to grilles, such as fences, are being developed. The European Bats Agreement project on underground habitats includes the identification of key sites in Europe that need protection and the devising of guidelines for measures to protect important underground habitats. Availability of data on distribution and habitat use in the Netherlands has provided the opportunity to use the pond bat in assignment of Natura 2000 sites.

In the province of Noord-Holland, in the north western of the Netherlands, an active policy for conservation of the_wet meadow landscape, which also happens to be a core landscape for the pond bat in the Netherlands, is implemented to safeguard this landscape type and its ecological qualities.

Efforts to stop pollution of the aquatic environment and to clean river beds have lead to positive results in general. How this is affecting pond bats is however not know and not being studied, and in some countries the effort with which polluted river soils are being cleaned is far behind the efforts put into planning this.

In some countries, recognizing the lack of distributional data, currently survey work directed at bats in their hunting habitats is being organised. Within this work the pond bat is one of the species receiving special attention.

3. GOALS AND OBJECTIVES

The overall goal for Europe is to maintain viable populations of the pond bat in coexistence with people throughout its European range. To achieve this goal it is of vital importance to identify and remove threats to the pond bat population and its habitat.

Objective 1

To maintain populations of the pond bat at a favourable conservation status through effective conservation of roosts and associated foraging habitats, including the maintenance of appropriate habitats in any identified centres of population and the enhancement of appropriate habitats in areas of depleted or threatened populations.

Objective 2

To establish more precise knowledge of status, distribution and abundance in relation to natural landscape, land use, climate and other environmental factors, to be able to respond objectively to changes of status and threats.

Objective 3

Co-ordinate policies of all official bodies that can influence the conservations of pond bat habitat: including agriculture, forestry, landscape, waterways and wetlands, old buildings, underground sites.

Objective 4

To promote awareness of pond bats and their conservation needs, in the general public, professional and special interest groups whose activities may affect their status and protection.

Objective 5

Co-ordinate pond bat conservation plans with those for other bat species, for landscape diversity and for restoration of the network of European rivers and other waterways.

4. ACTIONS REQUIRED TO MEET GOALS AT A EUROPEAN LEVEL

4.1. Species protection

Conservation action for the pond bat should be targeted on populations. Because populations may be shared across international borders, conservation and management should be carried out co-operatively between involved countries, and formal agreements between countries sharing populations are required.

National conservation status should objectively follow the most recent International Red List Categories (IUCN), where the conservation status is set by population numbers obtained using comparable methods. Co-operation between countries to develop and implement standardised methods for assessment of distribution, status and trends is of vital importance.

All countries should identify their legal and political responsibility for pond bat conservation. For most of its range protective legislation in general is adequate, but needs to be enforced or law enforcement needs to be improved. This includes improvement of the legislation, as necessary, with respect to assigning protected status – e.g. site of special interest to nature – to important maternity roost sites or hibernation sites and to take account of wider habitat requirements in some part of the range. In states where there is no legislation for the protection of bats (see Table 10), legislation should be developed and enforced.

National criteria for sites needing protection for their pond bat populations should be agreed internationally. These criteria should be reviewed periodically to ensure that they are set at an appropriate level.

The Standing Committee of the Bern Convention should adopt this Action Plan and thereby make pond bat conservation a political goal for all Contracting Parties.

To implement European policy on the national level, it is essential to work out a national pond bat action plan, designed and approved within the guidelines of the present Action Plan. National authorities should, in so doing, co-ordinate strategies with neighbouring countries sharing pond bat populations.

From the beginning of the process of elaborating such a national strategy, which may form part of a general bat action plan, it will be most important to include all those authorities and organisations with an interest in or whose activities may affect pond bats, such as those involved in policy and management of bats and other mammals, nature, landscape, agriculture, environment, waterways, underground sites, churches or other large buildings, heritage buildings etc.

A national plan should include detailed guidance on matters concerning political and legal responsibility for pond bat conservation, including damage prevention, education and training of specialised staff, public awareness, implementations of a monitoring program, and promoting scientific research. The plan should also identify and suggest any changes to the national and or sub national legislation that will be necessary to implement the plan. To initiate, co-ordinate, enhance and supervise all this work the national authorities in each country should form a ‘pond bat working group‘. Each national conservation plan should be based on scientific data relating to pond bat ecology and population status.

In order to set up a realistic, feasible, and effective pond bat conservation plan, the government should first identify priorities. A working group, including several interested groups, may help the government to identify priorities for pond bat conservation. All countries should facilitate the development of NGOs working on bat protection.

A system for monitoring the development and implementation of this action plan should be established with power to modify its objectives and targets as implementation and the availability of research results progresses.

Actions:

4.1.1. The Standing Committee of the Bern Convention adopt this plan.

4.1.2. Pond bat conservation status within each country should be listed according to the IUCN criteria and based, as far as possible, on comparable systematic surveys and comparable estimation methods.

4.1.3. A system for the development and implementation of this action plan should be established, at national and Europe-wide levels, with power to modify its objectives and targets as implementation and the availability of research results progresses. Countries sharing populations should develop an effective mechanism for co-operation to secure transboundary conservation and management, including with reference to the migratory behaviour of the species. The action plan should be reviewed and revised as appropriate every five years.

4.1.4. Laws should provide for the protection of pond bats, their roosts and if appropriate foraging areas. Enforcement should be promoted and provide for appropriate penalties in regions where populations are known to be threatened by disturbance, pesticides, roost destruction or loss of foraging areas.

4.1.5. National criteria for sites needing protection for their pond bat populations should be agreed internationally. These criteria should be reviewed periodically to ensure that they are set at an appropriate level. Protected areas should be established for sites meeting the criteria.

4.1.6. All countries identify and establish national pond bat management groups and empower them to design and produce a national pond bat action plan as a part of a national bat action plan. Countries sharing pond bat populations should produce these national action plans co-operatively to secure a transboundary action approach.

4.2. Recovery of endangered populations

At this stage areas of extinction or immediate threat of extinction have not been identified. Should such areas be identified a Recovery Programme to ensure adequate roost and foraging habitats should be initiated to encourage recolonisation or population increase.

Translocation is unlikely to be a viable option.

Actions:

4.2.1. Identify any populations in immediate threat of extinction and take appropriate action.

4.3. Habitat protection

Effective conservation action for the pond bat, on an international, national as well as a regional scale, should be targeted on conservation of the habitat complex allowing successful foraging, roosting, commuting and dispersal/migration. Because pond bat populations use such a range of functionally different habitats, conservation and management should be carried out co-operatively among official bodies and interest groups involved in the management of the different parts of its habitat complex.

Actions:

4.3.1. Information and education should be developed to raise awareness amongst official bodies and interest groups involved in the management of the different parts of the pond bat habitat complex, for their specific role in an integrated approach to pond bat conservation.

4.3.1. Protection of roosts

summer roosts

Intensive survey work to identify (potential) roosts, and training of bat workers to perform this survey should be organised; educate responsible personnel and organise and finance survey work. Ensure that pond bat summer roost conservation is a material consideration in appropriate environmental impact assessment studies, performed by bat specialists, using standardized procedures. Important roosts should be identified and given protection.

Sufficient availability and accessibility of summer roost sites should be safeguarded through ensuring that timber treatment, renovation and rebuilding of (potential) roost sites incorporates the needs of the bats.

– Ensure that (potential) pond bat sites are surveyed by bat specialists where timber treatment and/or renovation is planned, educate responsible personnel for this survey work and for advisory work with respect to the timber treatment and renovation.

– Prohibit the use of hazardous chemicals for remedial timber treatment in bat roosts and encourage the development and application of safer chemicals or non-chemical alternatives for timber treatment.

– Produce material on bats and their conservation to inform groups involved in timber treatment, insulation and renovation, such as owners of buildings or those responsible for the maintenance of the buildings, including timber treatment firms, insulation firms, renovation firms, architects, surveyors.

– Provide a system for advice and, where appropriate, financing for additional costs that may arise from taking account of bat needs in renovation and insulation for private persons owning a bat roost.

– Information and education for people involved in these problems, to raise awareness of these problems and to improve their professional approach, should be developed and distributed widely.

– Survey and if necessary improve the accessibility of potential roost sites (e.g. church lofts). Information and education with respect to the possibilities for bats to use new building should be developed and distributed widely.

Where bats may be a cause of the need for renovation, professional advice, and sometimes financial support should be provided to help resolve the problem and safeguard the roost.

(Potential) mating roost areas should be identified.

Forest management, especially in mating roost areas, should be targeted to provide sufficient availability of tree hollows. Produce information on the vital function of tree hollows for bats for educational purposes. Implement and/or develop methods to provide sufficient availability of tree hollows through forest management policy.

hibernation roosts

Intensive survey work using suitably trained observers should be organised to identify (potential) hibernation sites; governments should provide for education, training and co-ordination of (voluntary) surveyors. In order to safeguard (potential) hibernation sites for the pond bat it is necessary to reduce the risks of disturbance or loss of the hibernacula through human activities. Ensure that the conservation of bat hibernacula is a material consideration in environmental impact assessment studies, performed by bat specialists using standardized procedures, taking account of risks to hibernation and to other roost functions.

Activities in these sites within the hibernation period should be prohibited or seasonally restricted. Special attention should be given to the function which sites, recognized as hibernation sites, may serve to bats outside the hibernation period (mating, swarming) and the impact activities might have on these functions.

The possibilities to integrate underground hibernation sites in new development of an area should be considered before their demolition. Closing of (potentially) dangerous sites should be done in a way ensuring accessibility for bats through e.g. grilling. In new building activities or development of areas the possibilities to create underground sites for bats should be investigated; case studies to gather experience are needed; existing experience should be gathered and analysed.

Those visiting or using potential hibernation sites, be it for recreational or professional purposes, should be informed of their responsibility towards hibernating (pond) bats. A 'Conservation Code' between interested parties can be agreed, as in the UK.

Action:

Develop an active policy for the protection, maintenance and - as appropriate - enhancement or creation of roosts for pond bats, with particular reference to buildings, trees and underground habitats; educate responsible personnel and organise and finance survey work.

4.3.2. Protection of foraging habitat, flight paths and migration routes

Intensive survey work to identify pond bat foraging habitat, flight paths and migration routes should be organised. Training and education regarding the use of batdetectors should be organised, based on the experience of bat workers familiar with pond bat survey work, and using the possibility to bring together their experience and reference material, e.g. on a multi-media CD-ROM. A European network of people trained by experienced detector operators to become instructors for bat workers in their countries (multiplication principle) can be developed. Programmes for bat detector training may need to be in individual European languages, based upon existing material which has already been used throughout Europe.

Identified core foraging areas, including summer roosts and hibernacula, should be protected. Where necessary foraging habitats of the pond bat should be assigned a conservation status in regional area development plans.

An active policy regarding the management of the (banks of) canals, rivers, lakes, etc, towards a more natural character is required, in which vegetation on the banks is developed, but at the same time the open character of the landscape is not changed. In development of artificial lakes into more natural marshes, part of the water surface should be kept open. Overnutrification of water ecosystems should be prevented to keep open water surfaces available.

Measures against drying out of areas should be taken, to safeguard insect production, and the availability of wet meadows and open water surfaces in canals and ditches as hunting areas.

An adequate network of protected flight paths between roost and foraging habitats has to be maintained or developed. Bridges and culverts on waterways used by the pond bats should be large enough to maintain the continuity of the landscape.

The effect of nutrification of the water on the pond bat should be assessed. The risk of accumulation and the effects of microcontaminants like heavy metals, pesticides, PCBs, PAKs, on the reproduction and mortality of the pond bat have to be studied and evaluated. In many places the water quality should be improved and where necessary polluted substrate should be cleaned. Where necessary, monitoring of food availability may be acrried out.

In general the impact of changes in the landscape on (pond) bat populations should be assessed, and problems and negative effects should be addressed. The conservation of the landscape in which bats forage and commute should be a material consideration in environmental impact assessment studies, performed by bat specialists. Standardized procedures for such impact assessments should be developed. These studies should particularly consider protection of roosts, foraging habitat, flight paths and the overall continuity of the landscape.

The use of the European water system as migration routes for the pond bat should be studied and possible threats identified. Key migration routes have to be identified. Linkage zones between isolated populations have to identified and maintained

Actions:

4.3.3. Identify foraging habitats, key flight paths and migration routes, and protect and manage a network of core habitats for pond bats, including summer roosts and hibernacula.

4.3.4. Ensure that the conservation of the landscape in which bats forage and commute is a material consideration in environmental impact assessment studies, performed to a suitable standard by bat specialists. These studies should particularly consider protection of roosts, foraging habitat, flight paths and the overall continuity of the landscape.

4.3.5. Target management of water systems on a more natural character, in which vegetation on the banks is developed, but the open character of the landscape is not changed. In appropriate nature development projects, open water surface should be incorporated.

4.3.6. Control nutrification and other pollution of water ecosystems, and where necessary clean polluted substrate. Maintain water levels in pond bat habitat.

4.4. Conflicts with humans and public attitudes

The risk for both humans (infection) and bats (persecution) resulting from the ‘rabies problem‘ should be minimized through adequate information addressed to public media and the general public and through adequate information and procedures for those having the professional responsibility to handle cases of (potential) infection.

General topics are treated under 4.3. protection of habitats, and 4.5. public awareness.

There is a need to ensure that adequate and objective information on bats and rabies is available for general communication to the public and public media. It should also be available for the responsible authorities, and should be prepared in co-operation with representatives from the different groups involved. Responsible authorities should maintain close co-operation with bat specialists in the response to any (potential) bat rabies incident

Actions:

4.4.1. Ensure that adequate and objective information on bats and rabies is available for general communication to the public, public media and responsible authorities, who should maintain close co-operation with bat specialists in the response to any (potential) bat rabies incident. Such information should be prepared in co-operation with representatives of all relevant interest groups.

4.5. Public awareness, education and information

Although general public awareness of bats has improved over the last two decades in some parts of Europe there is still a lot that can and has to be done. Most people have a positive attitude, and are interested to see bats and learn about them. More has to be done to gain their general support of positive policy and management toward bats by their government. The general public in certain landscapes can be made aware and proud of their special bat: the pond bat.

Agencies promoting bat conservation needs and awareness should be initiated and supported by governments, so that the measures they take to implement this Action Plan receive sympathetic responses from the public. Public funding may best be spent by promoting the image of pond bats, and bats generally.

However, bats are both nocturnal and highly secretive; features which make them largely unknown to most people. CCTV using infra-red cameras and time-lapse recorders can show the public interesting bat activities at selected maternity roosts, without disturbance. The more the public knows about bats, the more likely it is to accept the conservation measures taken to safeguard them. At present the media are keen to promote all kinds of bat events, since they provide original material.

In general, however, public awareness about bats most of all needs to be improved in those whose professional of private activities can affect bats or pond bats in particular.These groups and persons can be targeted generally, but where appropriate direct targeting related to particular pond bat roosts, foraging habitats or flight paths may be needed.

A suitable educational campaign should be prepared and conducted by following these stages:

a. find a lead agency that raises funds for all stages;

b. identify target groups, their present knowledge levels and attitudes, and assess the current educational information available;

c. design efforts and messages appropriate to each group;

d. identify individuals within each target group to deliver the messages, to increase the chances of successful implementation;

e. implement the educational campaign;

f. conduct an evaluation of each educational effort made;- what success/failures resulted; what modifications are needed for further improvements; which aspects were most effective?

g. Monitor achievements to gauge progress being made.

Attitudes and beliefs of the target groups, as well as the campaign goals, have to be reassessed in a continual process by returning to stage ‘b’).

A campaign to inform the public is an integral part of any conservation programme. Its action must be both continuous and far-reaching. It can be promoted by the same lead agency, which would follow a plan previously agreed upon in terms of content, instruments and personnel with the concerned ministries and regional administrators. The information provided should be tailored to its target audience to be effective.

Target groups may include:

- national, regional and local governments, especially those departments which are responsible for areas other than nature conservation, such as agriculture, waterways, landscape, traffic infrastructure, environment, forestry, building, veterinary medicine, mining, caves, defence, but also those responsible for nature conservation;

- non-governmental organisations involved in heritage and maintenance of buildings, maintenance of churches, heritage and management of mines and quarries, and nature conservation and management;

- commercial organisations involved in remedial timber treatment, renovation and maintenance of buildings and churches, agriculture, landscape development and planning, and management of quarries and mines;

- non-governmental organisations using roost sites (especially hibernacula) for leisure purposes;

- private persons who own pond bat roosts or other pond bat habitats.

An information campaign will cover several aspects including:

Pond bat ecology: People should be informed about their ecology to understand the reasons behind the strong roost and habitat protective measures taken; the need to protect large land areas for a single maternity roost, and their vulnerability to human activities.

Potential conflicts involving pond bats and people in their homes: case examples of situations where conflicts have arisen and been solved should be discussed. These should reduce any unfounded anxieties people may have over the consequences of having bat roosts in their homes.

Information and education campaigns can be developed on bat and pond bat needs and opportunities for conservation both for the general public (differentiated with respect to adults and children) and for different specialist target groups following the guidelines listed above. There is a need to publicise where to seek advice and to ensure adequate resources to provide advice.

Actions:

4.5.1. Develop information and education campaigns on bat and pond bat needs and opportunities for conservation for the general public and for specialist target groups, and ensure adequate resources to provide advice are readily available.

4.6. Research and monitoring

Given the general lack of knowledge concerning the pond bat compared to various other European bat species, further research should clearly be given high priority. A better understanding of the pond bat‘s habitat requirements, distribution, status and trends in Europe, and the factors explaining these phenomena, is certainly needed. This will enable conservation to be based on the best available science. Conservation actions, including those not targeted directly at the pond bat, such as nature development and restoration of rivers or cleaning of river beds, should also be used as ecological experiments, and their effects on the pond bat should be monitored. As well as ensuring close co-operation between scientists and managers, this will provide tests of hypotheses with potential value for applied ecology.

Furthermore, it is important that scientific research on the pond bat is co-ordinated at the European level. A close link between all researchers working on the pond bat should be promoted and facilitated. Co-ordinated research implies that research funds, such as the European Union Funds, should be made available at the European level, including adjacent non-Union countries that conduct relevant research.

Mechanisms for discussion and exchange of information and literature with respect to occurrence, distribution, trends, status, conservation, methodology and general biology, ecology and physiology of the pond pat should be facilitated.

The species should be included in its list of priority species for autecological studies by the Agreement on the Conservation of Bats in Europe (EUROBATS Agreement).

We recommend that future research be concentrated on the following topics (not listed in prioritised order):

- distribution and status;
- migration and dispersal;
- monitoring;
- food and habitat quality;
- habitat use and habitat requirements;
- genetic studies.

4.6.1. Distribution and status

We must know the distribution and the nature of purported centres of population of the pond bat in Europe to ensure their adequate protection. Therefore all countries should organize and facilitate systematic survey programs to assess occurrence, distribution and abundance of pond bats in their maternity roosts, mating roosts, other undefined summer roosts, hibernation roosts, foraging areas, flight paths and migration roosts using appropriate methods (bat detector, inspection of attics and lofts, inspection of underground sites, publicity work to stimulate reports from the public, inspection of bat and bird boxes).

Such data can then be analysed in relation to natural landscape, land use, climate and other environmental factors, to be able to judge status more objectively. Data already available, for instance from the Netherlands, can be analysed in relation to such biotic and abiotic factors using a GIS system, to gain insight into habitat requirements, and to predict expected pond bat occurrence in unrecorded areas, or to predict effects of changes in the landscape on pond bat occurrence and distribution. Predictive models should be updated continuously while the survey is going on.

Specific survey methods targeted on identification of mating roost areas, should be developed to assess the ecological status of such roost areas (e.g. tests with bat boxes as a survey method in landscape types where mating groups are observed).

Climatic effects on the distribution of populations may be monitored through repeated or continuous assessment of distributional data and through monitoring of populations (4.6.3.).

4.6.2. Migration and dispersal

Patterns of seasonal movement should be reviewed, particularly in relation to transboundary movements.

Methods targeted on the identification of migratory routes in the field should be developed and tested (for example: point transect counts or automatic counts with detectors, recognizing flight direction and activity patterns, along the network of waterways in spring and autumn). The use of the European water system as migration routes should be surveyed. Key migration routes and possible threats should be identified.

The habitat requirements of migration routes should be established, and possible relations between migration activity and parameters like weather, landscape structure and shelter should be identified.

In European co-operation modern banding, other marking techniques or DNA analysis might be applied to study dispersal from roosts, exchange between summer roosts, exchange between summer and winter roosts within the summer haunts, changes in choice of hibernacula, size and range of metapopulations, migration behaviour, and to identify relationships between populations spanning international borders, as a basis for transboundary conservation strategies.

4.6.3 Monitoring

At the moment only very few and incomplete data on general population trends are available and data are very difficult to interpret. In order to judge objectively the effects of current threats, and the dynamics in the biotic and abiotic environment, and to evaluate effects of conservation, co-operative long-term measures to monitor populations trends should be established.

Trend indications deduced from counts in hibernacula should be reviewed and evaluated in an European perspective, and a co-ordinated approach developed. Experiments with new monitoring methods for this species, such as roost exit counts, flight path counts, point transect counts along waterways and counts in fixed light beams over water need to be further developed and tested in different parts of Europe.

The monitoring methodologies should be in line with recommendations of the Agreement on the Conservation of Bats in Europe (Bonn Convention).

Reasons for population change may be assessed through specific ecological research, but also through monitoring of the effects of specific conservation measures in specific sites or areas. New insight should lead to appropriate action in conservation, as well as to adjustment of the general monitoring strategy.

Population dynamics of bats in specific summer and winter sites should be studied in relation to the changes in the surrounding natural and artificial environment.

4.6.4. Food and habitat quality

The decline in the availability of the suitable prey items in intensively used agricultural and in urbanised areas, is recognised to be one of the most important factors causing the decline of a number of bats species. The pond bat, as a species hunting above water, on the other hand, might have profited from an increase in prey availability through eutrophication of the water. The diet of the pond bat, however, has not been studied in detail.

To gain more insight into its feeding ecology, samples of droppings collected throughout its range should be analysed. This should include assessment of variation in the diet in different areas of its natural range, different seasons, variation between maternity roosts, roosts of males, mating roosts, between adults and juveniles etc. Numerous examples of good methodology for feacal analysis from other species are available.

In combination with other ecological research methods (4.6.5) the diet can be related to the habitats used for foraging. Ecological knowledge on the insects in the diet can reveal insight into which parts of the landscape produce these prey insects. It is important to assess if knowledge on how to manage and restore these habitats is available.

The effects of eutrophication of the water environment on the spectrum and biomass of prey available to the pond bat could be analysed through comparison of different areas, or through monitoring of changes within an area. Where old samples are available, changes in diet could be related to past changes in water quality and other changes in the foraging habitat from one area. Effects of changes in diet on e.g. reproduction or survival could be analysed through comparison of areas and monitoring of future changes.

The risks and effects of foraging above polluted waters, i.e. effects of accumulation of microcontaminants like heavy metals, pesticides, PCBs, PAKs, etc., on the reproduction and survival of the pond bat have to be studied and evaluated. Suitable projects would be to identify contamination of prey, bats and their droppings, and to compare contamination between areas; to compare reproduction and survival in different areas in relation to toxic stress; to study distribution of foraging activity in the landscape in relation to pollution levels, and monitor changes in these preferences in reaction to cleaning of river beds; to monitor changes in toxic stress in larger areas through analysis of feaces.

4.6.5. Habitat use and habitat requirements

To establish and implement appropriate management more precise details of habitat requirements, particularly for roosting, foraging, commuting and migration, are needed.

4.6.5.1. Roosts

Based on a large sample of summer roosts, roost requirements should be analysed in detail and related to that section of the population using it (maternity colony, non-breeding females, males, mating), numbers and population dynamics, and to vulnerability to maintenance/management of the roost structures. Special attention should be given to requirements of their position in the landscape and their role in migration and mating behaviour, roosts of males and transitional roosts along the suspected migration routes. The role and importance of tree roosts, especially within the eastern range, should be identified, and adequate protection measures developed.

Based on a large sample of hibernation sites, roost requirements should be analysed in detail and considered in relation to numbers and population dynamics, and to (possible) vulnerability to disturbance, maintenance and management of the roost structures and other uses of the site. Special attention should be given to the function of hibernation sites for other uses, such as autumn swarming and transitional roost during migration.

Methods to locate the ‘hidden‘ part of the hibernation population should be experimented with and developed (for example, temperature image analysis in winter of colonies known from hollow walls or roofs).

Modern techniques of banding and marking might be applied to gain insight in a possible change in the choice of the hibernation area from hibernacula further away to hibernacula within the summer haunts.

4.6.5.2. Foraging habitat, flight paths and migration routes

Studies using radio-telemetry and transects intensively sampled with detectors can be designed to assess time budgets, preferences in and requirements of foraging habitats and flight paths, range and distribution of foraging sites in the landscape in relation to habitat quality and structure, as well as variation with individual, sex or age of bat, weather, region or season.

The role and importance of the combination of forest and water for the pond bat, especially within its eastern range, should be identified, and adequate protection measures developed.

Effects of differences or changes in habitat quality or management, and of conservation measures on such parameters, should be studied through comparison of areas and repeated studies.

Effects of changes in the landscape as a result of regional development, infra structural development etc, on roosts, foraging habitat, flight paths, migration routes (see 4.6.2) and the overall continuity of the landscape, should be analysed in a landscape ecological sense.

4.6.6. Genetic studies

In an European co-operative approach, the genetic structure of European populations needs to be studied to identify relations between colonies within one area/region, size and range of metapopulations, possible population centres, and (relationships between) populations spanning international borders, as a basis for transboundary conservation strategies.

Actions:

4.6.1. Co-ordinate and prioritise scientific research on pond bats throughout its European range.

4.6.2. Co-ordinate the regular gathering of all necessary data and material to monitor the status of pond bats in Europe and identify the causes of any status changes.

4.7. Cross-referencing with other action plans

4.7.1. Bats

Activities for the conservation of the pond bat will also help other bat species, e.g. in the educational aspects of bat roosts in buildings, in the development of land use policies that also favour other bat species, the management of water habitats, and in the protection of underground habitats used by a wide range of bat species. As far as possible, the implementation of the Action Plan for the conservation of the pond bat should take account of other bat conservation initiatives, especially the Agreement on the Conservation of Bats in Europe (Bonn Convention), the Bern Convention (and its relevant Recommendations) and Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora of the European Union. Europe-wide the IUCN SSC Chiroptera Specialist Group’s Co-ordinating Panel for the Conservation of Bats in Europe can assist with liaison on bat conservation action internationally and nationally.

4.7.2. Wider cross-referencing

The implementation of the pond bat action plan should relate to wider activities for conservation.

With reference to the Pan-European Biological and Landscape Diversity Strategy (PEBLDS), the implementation of this action plan will assist in the delivery of and can be assisted by many of the general objectives and other Action Themes of PEBLDS; in particular to Action Themes 2, 3, 4, 6, 7 and 9. It can contribute to the Bern Convention’s Emerald Network of Areas of Special Conservation Interest.

The plan can also assist with cross-cutting policies for habitat and other species conservation and management plans at a national level and through international initiatives such as those of the EC, the Council of Europe, European Bats Agreement and other interest groups.

Actions:

Ensure that in the development and implementation of this plan there is full cross-referencing to appropriate habitat and other species conservation and management plans and wider initiatives for the development of relevant policy, programmes and legislation.

4.8. Factors that could jeopardise points of action

The implementation of a conservation and management plan for the pond bat requires national and international commitment and collaboration between governments and NGOs. In many areas of work, resources have to be developed, including financial support, in other areas it is more a question of moulding policies and practices to improve the conservation status of this species and the other wildlife that shares its habitats. Any conflicts of interest between economic and nature conservation interests will need to be resolved.

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Map 1: *Myotis dasycneme*: distribution in Europe (Country bounderies are only indicative).

Country	recorded in recent times	hibernation roosts	completeness of winter	recent summer roosts	recent maternity roosts	female roosts	male roosts	mating roosts	hunting habitat	flight path	completeness of summer survey	evidence of migration
Belarus	?											
Belgium	+	+	■■■					?	+	+	■	+
Croatia	?								?			
Czech Republic	+	+	■■■	+			+					?
Denmark	+	+	■■■	+	+				+	+	■■■■	+
Estonia	+	+	■■	+	+		+	?	+		■	+
France	+	+	■■■								■	+
Germany	+	+	■■	+	+		+	+	+	+	■	+
Hungary	+	+	■■	+	+	+		+	+	+	■■	+
Kazakhstan	+	+	■	+	+	+	+		+		■	?
Latvia	+	+	■■	+	+		+	+	+	+	■■	+
Lithuania	+	+	■	+				+	+		■	?
Moldova	+											
Netherlands	+	+	■■■	+	+	+	+	+	+	+	■■■■	+
Poland	+	+	■	+			+	+	+	+	■	-
Romania	+											
Russian Federation	+	+	■	+	+	+	+	+	+	+	■	-?
Slovakia	+	+	■■	+	(+)	+	+		+	+	■	+
Sweden	+	+	■	+	+				+		■	+
Ukraine	+	+	■		+		+	+	+		■	+
Yugoslavia, Federal Republic	+	+	■				+		+		■	?

Table 1. Data on the recent occurrence of the pond bat (*Myotis dasycneme*) in range states.

(■ = survey 1-25 % complete, ■■ = survey 25-50% complete,
■■■ = survey 50-75% complete, ■■■■ = survey 75-100 % complete).

Country	recorded in recent times	estimated summer population	estimated / observed winter population	estimate based on ?	trend winter	trend general	trend based on?
Belarus	**?**						
Belgium	+	?	>100	W	++		W
Croatia	**?**						
Czech Republic	+	?	20 - 30	W	++	++	W
Denmark	+	?	>3.000	W	=	=	W+S
Estonia	+	5.000 – 10.000	400	S+W	=/+		W
France	+	?	20	W	-		w
Germany	+	2.000 – 5.000	?	S	=/+		W
Hungary	+	10.000	?			=	SR
Kazakhstan	+	?	?				
Latvia	+	3.000 – 10.000	?	S	-		W
Lithuania	+	?	100-200	W	=		W
Moldova	+						
Netherlands	+	8.000 – 10.000	300-500	S+W	=	=	W+S
Poland	+	?	> 1000	W	+		W
Romania	+						
Russian Federation	+	> 100.000	?	S+W		=/+	W+S
Slovakia	+	?	?		++	++	W+S
Sweden	+	100-1.000	?		=/-	=/-	W+S
Ukraine	+	?	>2000	w	**?**	**?-**	W+S
Yugoslavia, Federal Republic	+	?	?		?	?	

Table 2. Estimated summer and winter populations, and on the trends in populations of pond bat (*Myotis dasycneme)* in its range states.

S = observations in roosts and foraging habitats in summer, SR = observations in roosts in summer, W = observations in hibernacula.

+++ strong positive trend, ++ positive, + weak positive, = equal, **-** negative, **--** weak negative, **---** strong negative trend.

Note: bat specialist throughout its range are almost unanimous in their opinion that they do not have reliable data on trends.

roost	attic – loft - dome	hollow wall	under roof tiles	roof edge	bird box	bat box	tree	bridges	cavity in stone or rock face	steam boat	natural cave	Quarries, mines, tunnels	drainage canals	ice cellar	cellar - basement	bunker	fortification	castle ruin	disused brick oven
hibernacula											+	+	+	+	+	+	+	+	+
summer roost	+	+	+		+	+	+	+	+	+	+	+							
maternity roost	+	+	+	+			+		+										
mating roost	+	+	+		+	+	+				+	+							

Table 3. Summary of roost types used as hibernation, maternity, summer or mating roosts by pond bat (*Myotis dasycneme)*.

Country	attic – loft - dome	hollow wall	under roof tiles	roof edge	bird box	bat box	tree	bridges	cavity in stone or rock face	steam boat	natural cave	quarries	mine	drainage canals	ice cellar	cellar / basement	bunker	fortification	castle ruin	disused brick oven
Belarus																				
Belgium s																				
Croatia																				
Czech Republic																				
Denmark	**s**	**s**				**?**														
Estonia	**s**		**s**		**s**							**s**				**s**		**s**		
France																				
Germany	**s**	**s**		**s**	**s**	**s**					**s**	**s**								
Hungary	**s**	**s**	**s**				**s**	**s**	**s**											
Kazakhstan	**s**	**s**					**s**			**s**	**s**									
Latvia	**s**	**s**			**s**	**s**	**s**													
Lithuania		**s**																		
Moldova																				
Netherlands	**s**	**s**	**s**	**s**																
Poland	**s**			**s**	**s**															
Romania																				
Russian Federation	**s**	**s**	**s**	**s**	**s**	**s**	**s**				**s**	**s**								
Slovakia	**s**																			
Sweden	**s**						**s**													
Ukraine	**s**			**s**			**s**													
Yugoslavia, Federal Republic											**s**									

Table 4. Roost types used as unspecified summer roosts by pond bat (*Myotis dasycneme*) in the different range states.

Country	attic – loft - dome	hollow wall	under roof tiles	roof edge	bird box	bat box	tree	bridges	cavity in stone or rock face	steam boat	natural cave	quarries	mine	drainage canals	ice cellar	cellar - basement	bunker	fortification	castle ruin	disused brick oven
Belarus																				
Belgium																				
Croatia																				
Czech Republic																				
Denmark	**m**	**m**																		
Estonia	**m**		**m**																	
France																				
Germany	**m**			**m**																
Hungary	**m**	**m**	**m**				**m**		**m**											
Kazakhstan	**m**																			
Latvia	**m**	**m**																		
Lithuania																				
Moldova																				
Netherlands	**m**	**m**	**m**	**m**																
Poland	**m**																			
Romania																				
Russian Federation	**m**	**m**	**m**	**m**			**m**													
Slovakia	**m**																			
Sweden	**m**						**m**													
Ukraine	**m**						**m**													
Yugoslavia, Federal Republic																				

Table 5. Roost types used as maternity roosts by pond bat (*Myotis dasycneme*) in different range states.

Country	attic – loft - dome	hollow wall	under roof tiles	roof edge	bird box	bat box	tree	bridges	cavity in stone or rock face	steam boat	natural cave	quarries	mine	drainage canals	ice cellar	cellar - basement	bunker	fortification	castle ruin	disused brick oven
Belarus																				
Belgium																				
Croatia																				
Czech Republic																				
Denmark																				
Estonia					**mt**								**mt**							
France																				
Germany						**mt**					**mt**									
Hungary											**mt**									
Kazakhstan							**mt**													
Latvia					**mt**		**mt**													
Lithuania		**mt**																		
Moldova																				
Netherlands			**mt**		**mt**	**mt**														
Poland				**?**	**?**															
Romania																				
Russian Federation											**mt**	**mt**								
Slovakia																				
Sweden																				
Ukraine	**mt**																			
Yugoslavia, Federal Republic																				

Table 6. Roost types used as mating roosts by pond bat (*Myotis dasycneme)* in different range states.

	attic – loft - dome	hollow wall	under roof tiles	roof edge	bird box	bat box	tree	bridges	cavity in stone or rock	steam boat	natural cave	quarries / tunnels	mine	drainage canals	ice cellar	cellar / basement	bunker	fortification	castle ruin	disused brick oven
Belarus																		**h**		
Belgium											**h**	**h**	**h**		**h**			**h**		
Croatia																				
Czech Republic											**h**	**(h)**	**(h)**							
Denmark												**h**					**h**	**h**		
Estonia												**h**						**h**		
France												**h**	**h**				**h**			
Germany				**h**							**h**	**h**				**h**				
Hungary											**h**									
Kazakhstan											**h**									
Latvia											**h**					**h**		**h**		
Lithuania																		**h**		
Moldova																				
Netherlands			**h**									**h**				**h**	**h**	**h**		**h**
Poland											**h**					**h**	**h**	**h**		
Romania																				
Russian Federation											**h**	**h**		**h**		**h**				
Slovakia											**h**	**h**	**h**							
Sweden																		**h**	**h**	
Ukraine																				
Yugoslavia, Federal Republic																				

Table 7. Roost types used as hibernacula by pond bat (*Myotis dasycneme)* in different range states.

country	lakes – artificial lakes	canals	ponds	rivers	river branch – ox-bow	streams	marshes	brackish water / coastal reeds	over land	wet peat bog	meadows	natural pastures with trees	gardens	wooded banks	forest edges	tree lines
Belarus																
Belgium	+	+	+													
Croatia																
Czech Republic																
Denmark	+	+	+	+		+		+	+					+		
Estonia	+	+	+	+				+								
France																
Germany	+	+		+	+											
Hungary	+	+	+	+					+							
Kazakhstan	+			+												
Latvia	+		+	+		+			**?**							
Lithuania	+		+													
Moldova																
Netherlands	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+
Poland			+	+												
Romania																
Russian Federation	+	+	+	+	+	+	+		+						+	
Slovakia	+	+	+	+												
Sweden	+	+	+	+				+	+			+				
Ukraine	+		+	+												
Yugoslavia, Federal Republic																

Table 8. Foraging habitats used by pond bat (*Myotis dasycneme)* in different range states.

	insufficient data	disturbance unspecified	timber treatment	renovation/demolition of	making roosts inaccessible	disturbance of hibernacula	loss of hibernacula	using hibernacula as dump site	low availability of suitable hibernacula	food availability	pesticides & heavy metals in food	area and quality of hunting	loss of landscape structures	area and quality of forest	loss of hollow trees
Belarus															
Belgium	?					+	+	+	?						
Croatia															
Czech Republic	?														
Denmark				+	+	+			+			?			
Estonia						+	+								
France						+	+								
Germany			+	+	+	+	+				?	+	+		
Hungary		+		+		+						+		+	
Kazakhstan				+								+		+	
Latvia				+		+									
Lithuania	?														
Moldova															
Netherlands			+	+	+	+	+				+	?	?		
Poland	?	+	+	+		+					+				
Romania															
Russian Federation			?	+		+	+			?		+		+	+
Slovakia				+											
Sweden	?		?	?		+	+	+				?			
Ukraine				+							+			+	+
Yugoslavia, Federal Republic	?										+				+

Table 9. Threats (actual and potential) effecting pond bat (*Myotis dasycneme)* in different range states.

Country	Red List status	bats in general	pond bat as species	roosts in general	pond bat roosts	hunting habitats in general	pond bat hunting habitats	no legal protection	legislation adequate	needs enforcement	Ecological requirements in legislation	party to European Bats Agreement	Natura 2000	national action plan
Belarus														
Belgium	EN	+		+	+				+	+			+	+[1]
Croatia														
Czech Republic	VU		+						+	+		+		
Denmark	VU	+	+			+/-	+/-		+	+	+	+	+	-
Estonia	VU	+	+	+		+/-	+/-		+/-	+				-
France	EN	+	+						+			+	+	-
Germany		+		+						+		+	-	-
Hungary	not listed	+	+			+			+	+	-	+	-	-
Kazakhstan	not listed							X	-		-		-	-
Latvia	EN	+												
Lithuania	DD		+		+				?	+	-		-	-
Moldova														
Netherlands	S / SU	+	+			+/-	+/-		+	+	+	+	+	-
Poland	not listed	+							?	+		+	-	-
Romania														
Russian Federation	LRnt	+							-		-		+/-	-
Slovakia	VU:B1	+		+[2]								+	-	-
Sweden	EN	+							+	+	+	+	+	-
Ukraine	VU	+								+		+		-
Yugoslavia, Federal Republic	DD	+							-	+	-		-	-

Table 10. The protected status of pond bat (*Myotis dasycneme)* in different range states.

IUCN Red List: EX = extinct, EW = extinct in the wild, CR = critically endangered, EN = endangered,
VU = vulnerable, DD = data deficient, LR = lower risk, in combination with cd = conservation dependent,
nt = near threatened, or lc = least concern.

1. Regional Action Plan for the Walloon Region
2. All caves are protected