

Guidelines for the conservation of bats in building and the resolution of related conflicts



MINISTERO DELL'AMBIENTE
E DELLA TUTELA DEL TERRITORIO E DEL MARE



ISPRA
Istituto Superiore per la Protezione
e la Ricerca Ambientale

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(Eds.)

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2010



Quaderni di Conservazione della Natura

ISSUE 28 BIS

La collana “Quaderni di Conservazione della Natura” nasce dalla collaborazione instaurata tra il Ministero dell’Ambiente e della Tutela del Territorio e del Mare, Direzione Generale per la Protezione della Natura e del Mare, e l’Istituto Nazionale per la Fauna Selvatica (ora Istituto Superiore per la Protezione e la Ricerca Ambientale). Scopo della collana è quello di divulgare le strategie di tutela e gestione del patrimonio faunistico nazionale elaborate dal Ministero con il contributo scientifico e tecnico dell’ISPRA.

I temi trattati spaziano da quelli di carattere generale, che seguono un approccio multidisciplinare ed il più possibile olistico, a quelli dedicati a problemi specifici di gestione o alla conservazione di singole specie.

This publication series, specifically focused on conservation problems of Italian wildlife, is the result of a co-operation between the Nature Protection Service of the Italian Ministry of Environment for the Protection of the Territory and the Sea and the Italian Wildlife Institute (now Italian Institute for Environmental Protection and Research - ISPRA). Aim of the series is to promote a wide circulation of the strategies for the wildlife preservation and management worked up by the Ministry of Environment and for the Protection of the Territory and the Sea with the scientific and technical support of the ISPRA.

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Myotis emarginatus colony at Villa Demidoff (P. Agnelli).

MINISTERO DELL'AMBIENTE E DELLA TUTELA
DEL TERRITORIO E DEL MARE
DIREZIONE GENERALE PER LA PROTEZIONE
DELLA NATURA E DEL MARE

ISTITUTO SUPERIORE
PER LA PROTEZIONE E
LA RICERCA AMBIENTALE

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(Editors)

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QUADERNI DI CONSERVAZIONE DELLA NATURA
ISSUE 28 BIS

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Recommended citation:

Agnelli P., Russo D., Martinoli M. (Eds), 2010. Guidelines for the Conservation of bats in buildings and the resolution of related conflicts. Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Ministero per i Beni e le Attività Culturali, Gruppo Italiano Ricerca Chiroterteri e Università degli Studi dell'Insubria.

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ACKNOWLEDGMENTS

Authors are especially grateful to the General Direction for the Protection of Nature and Sea of the Ministry for the Environment and the Protection of Land and Sea, particularly Felice Cappelluti and Luisa Farina, for the support provided during the activities and the useful suggestions.

Special thanks also go to Silvano Toso and Piero Genovesi at the Institute for Environmental Protection and Research (ISPRA), for their collaboration and valuable discussions.

The authors are indebted to all members of the Italian Chiroptera Research Group who helped preparing this document by providing information on roost presence, and assisting with their knowledge and expertise, by commenting on previous drafts, and in particular:

Mara Calvini, Roberta Chirichella, Luca Cistrone, Elisabetta de Carli, Gianna Dondini, Felice Farina, Sabrina Mattioli, Mosè Nodari, Damiano G. Preatoni, Marco Riccucci, Maria Tiziana Serangeli, Martina Spada, Cristiano Spilinga, Roberto Toffoli, Simone Vergari.

Thanks to two members of the Italian Chiroptera Research Group willing to remain anonymous who contributed to the work. The following colleagues also provided useful advice, illustrations and precious suggestions for the completion of some document sections: Kristine Mayer and Andreas Zahn (Germany); Patty Briggs (UK); Marzia Mattei-Roesli and Marco Moretti (Switzerland).

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1. INTRODUCTION

Apart from rodents, bats are the mammalian order with the highest number of species. Many bat species are currently rare or threatened. Because of their significant contribution to biodiversity, and the general decline recorded for most populations, bats are a conservation priority. Bats are also an animal group of great interest yet still insufficiently known. Bats are found worldwide except at the poles, many species are specialist insectivores, and all are active at night. To ensure sufficient protection of bats, as in other European countries, research should be a priority in Italy, to develop conservation strategies. Appropriate management of foraging and roosting habitats are also key activities to protect bats effectively.

Roosts are crucial sites. Many bats congregate in roosts, so that the loss of an important roost is a real danger. Bat numbers at roosts peak in two periods: during reproduction, in late spring – summer, and during hibernation, in late autumn – winter. There are three main roost types: tree cavities, underground sites and buildings.

Roost selection is an important aspect of bat ecology, and many ambient variables characterizing roosts are subject to similar selection by many temperate species. For example, roost choice is influenced by the connectivity offered by surrounding spatial features in the landscape, distance to foraging or drinking sites, and roost microclimate (which is of major importance for critical life cycle phases such as hibernation and reproduction).

Bats spend over half of their life roosting, so it is no surprise that roosts are so important for bat ecology and evolution. Roost features and bat life traits are often linked. Strong relationships exist between roost type and features such as colony size, social organization, roost loyalty, foraging strategies, migration and even anatomy.

About a half of the ca. 1,100 bat species on earth use tree cavities for roosting. The others often roost in caves and crevices, but may also use buildings. Since the early history of modern humans, the number of potential artificial roost sites for bats has increased with the creation of

houses, bridges, tombs, mines, etc. However, natural roost sites have become much rarer due to human environmental impact. Loss of natural roosts has made artificial ones more important, so that many roosts in buildings are now crucial for the survival of several species relying on them.

Many species present in Italy roost in buildings. In most cases, summer roosts are in houses, monuments, castles, or churches, but in winter bats often hibernate in underground sites e.g. mines, cellars, bunkers or conduits. The numbers of bats in such sites range from single individuals to thousands. However, although in the past large colonies in buildings were common, these are now rare.

Demolition of old buildings, renovation or changes of use have often been overlooked in their importance for preserving bat colonies. Such changes in roosts represent a major factor affecting bat populations, which may push some species to local extinction even on a significant geographical scale. To promote and carry out effective conservation actions, it is necessary to provide appropriate guidelines to mitigate the conflict between people and bats in buildings. Bat specialists should also be more frequently involved in assisting professionals working on the management and preservation of historical buildings and archeological remains; such co-operation could ensure the survival of the historical heritage as well as its associated biological diversity.

This book stems from an Agreement between the Italian Ministry of Cultural Heritage and Activities and the Italian Ministry for the Environment, Land and Sea. Its underlying philosophy is to conjugate bat conservation with the use, maintenance or renovation of buildings. If appropriate measures are taken, the impact on bats of such changes to buildings will be negligible or null, otherwise bat populations will be seriously harmed – an offence according to Italian law.

In this book, the term “building” is used to mean all human-made structures potentially used by bats for roosting (i.e., houses, walls, bridges, viaducts, etc.).

2. BATS IN BUILDINGS: AN OVERVIEW

Wildlife may use human-made structures mainly when the latter 1) are found in urban settlements and are used by “urban” species; or 2) are outside urban areas (albeit not necessarily in well-preserved natural landscapes), i.e. they exhibit temporary or partial synanthropy.

The former situation occurs for some species (e.g. peregrine falcons, starlings, hedgehogs, foxes and stone martens), especially in recent times, and is related to the exploitation of urban-related resources to find food, dens or nesting sites.

This behaviour is typical of opportunistic, ecologically flexible species, which have to their advantage low predation pressure as well as high availability of food or spatial resources. Microclimate may also influence animals’ ability to colonize towns, since the latter often provide less humid and warmer conditions which may help some species to overwinter.

Some bat species are also among those animals favoured by urban areas thanks to high roost availability, favourable microclimates and – in certain cases – large concentrations of food (e.g. insects attracted to streetlamps). However, few bat species exploit urban areas significantly for foraging and roosting.

A larger number of bat species roosting in buildings move out of urban areas to reach their preferred foraging sites, which include natural or semi-natural habitats such as farmland. Often, as discussed below, buildings are used by maternity colonies, where – in late spring and summer – females congregate to give birth and rear their young.

2.1. Why bats choose buildings

The use of underground sites by bats, whether natural (caves) or artificial (mines, cellars, etc., provided they offer suitable environmental conditions), is well known. However, depending on the species, its life traits, the geographical area, the season, and the specific physiological conditions, bats

may also use other roost types (Kunz, 1982; Schober and Grimmberger, 1997; Lumsden and Bennett, 2006), such as tree cavities or buildings. Since microclimate is an important feature for roost selection, the ongoing anthropogenic process of global warming might soon influence roosting preferences by bats, and may even lead to considerable changes in selection patterns.

2.1.1 Use of roosts: reproduction, hibernation, mating, night roosting

Based on the use bats make of roosts, four main roost types may be distinguished, depending on the sex of bats and time of year, as follows:

- Temporary day-roost: used for a short time, albeit over a period of up to several years, by one of a few bats, often males. If they are used for swarming, such roosts may be used for a very short time (a few days) by very large numbers (hundreds or more) of bats.
- Maternity site or nursery: used by tens to thousands of females (but large colonies are today rare), generally of a single species, congregating to give birth and nurse their young. In some species, males are also found at maternity sites. In Italy, mainly observed from May to August.
- Winter roost or hibernaculum: generally used by hundreds to thousands of bats, also including several species and bats of both sexes. Temperature and humidity are the main factors driving the selection of hibernacula, as bats hibernate to reduce the energetic costs of overwintering. Generally, underground sites are used.
- Night roosts: unlike the other types of roost, night roosts are only used at night by one or a few bats taking a break from foraging, or dismembering large prey items. Bats are generally less selective for night roosts since the latter are only used for a short time. Roofs, bridges, viaducts, shelters or external parts of buildings can be used for temporary night roosting. Droppings can often be noticed at such sites on the ground or stuck to the spot where bats hang, as well as the remains of large prey. However, droppings at night roosts are much less abundant than they are at day roosts such as that shown in Figure 2.1.

Because night-roosts are not limiting for bats and pose no serious

conflict with humans, they will not be discussed further in this book. Many bats roost in buildings, and most large colonies are maternity ones which are present in the reproductive season (spring and summer), and made up of females only (with some exceptions) giving birth and rearing their young. These colonies leave the site after juveniles become volant and fully independent (Schober and Grimmberger, 1997).



Figure 2.1 – Large numbers of droppings at a day roost (photo by P. Agnelli).

The species frequently roosting in buildings are referred to as “house-dwelling”. This habit probably derives from the original tendency to roost in caves and rock

crevices. As human settlements expanded, bats started to exploit the new artificial landscape created by people, featuring elements similar to natural roosts in terms of structure and microclimate.

Synanthropy is thus an expression of ecological plasticity in roost choice. Some species such as the European free-tailed bat (*Tadarida teniotis*) select roosts that are structurally similar both in cliffs and buildings (fissures or crevices of different depth).

In many cases, house-dwelling bats use crevices or fissures. Just like in the natural environment, in buildings a range of possible roosting opportunities exists. For instance, the space beneath wooden elements of an attic are useful for species such as the brown long-eared bat (*Plecotus auritus*; e.g. Swift, 1998), whereas the space beneath gutters is often used by Kuhl’s pipistrelles (*Pipistrellus kuhlii*), common pipistrelles (*Pipistrellus pipistrellus*) or Savi’s bats (*Hypsugo savii*).

Because gutters are fully exposed to the sun and their material is prone to quick warming, they offer a microclimate especially suitable for

reproductive females, as we will see. Species such as *Myotis daubentonii* can roost deep in wall crevices, spaces between walls, holes in bricks or drainage ducts of buildings (Russo, 2002). Special cases are sometimes observed depending on the species involved and the local situation. In abandoned mines, it is not unusual to see *Myotis myotis* or *Myotis blythii* roosting in shot holes, i.e. drilled holes in which explosive charges were placed before detonation (Figure 2.2). Other species, perhaps using a strategy evolved for cave roosting, hang to the ceilings of attics, rooms or other large spaces. In the active season, when in colonies, bats may cluster together (Figure 2.3), as seen in small species of *Myotis* (*Myotis daubentonii*, *M. emarginatus*), or maintain a certain inter-individual space, as seen in rhinolophid colonies (*Rhinolophus ferrumequinum* and *R. hipposideros*). In these species tighter association is seen in nurseries (Figure 2.4) than in hibernation.

In winter, some species may roost in underground parts of buildings, such as cellars. Such spaces often provide cave-like conditions such as a constantly low temperature, darkness, high humidity and little or no human disturbance, all favouring hibernation. Hibernating bats such as rhinolophids are as common in caves as in cellars or similar artificial underground habitats.

In the remaining months of the year, buildings are used as either temporary roosts, or (in May-August) for reproduction and mating. Maternity colonies can either consist of females only (e.g. *R. ferrumequinum*) or of both sexes (*Myotis daubentonii*). Females give birth

in the roost. The newborn young are left alone when their mothers go foraging, and are nursed at least once per night, on their mothers' return. In this phase too, microclimate is paramount.

While in daytime males can become torpid and save energy, reproductive females must remain homoeothermic if they are pregnant or lactating (Racey, 1973). Warm roosts



Figure 2.2 – Bat roosting in a mine, using a shot hole (photo by P. Agnelli).



Figure 2.3 - *Myotis emarginatus* clustering together at a maternity site (photo by L. Cistrone).

are thus important to lower the costs of thermoregulation. Although some species are strictly dependent on caves or artificial underground habitats for reproduction (e.g. *Miniopterus schreibersii*), others can use buildings besides caves (*Myotis emarginatus*). In some cases, the same species reproduces in caves in the southern part of its range, but in buildings at higher latitudes, such as *Myotis myotis* and *Myotis blythii* (Arlettaz, 1995). One expected change related to global warming is an increase in the selection of caves for reproduction at higher latitudes by species such as the above-mentioned mouse-eared bats (Humphries *et al.*, 2002). Even some strictly cave-dwelling species may occasionally select buildings if their special micro-environment is suitable for reproduction. In Lazio, an abandoned spa building is partly flooded by thermal water, so that the ambient temperature and humidity resemble those of a warm cave. Unsurprisingly, the site is used by bats generally reproducing in caves, at least in Italy, such as *Rhinolophus euryale*, which form a large colony mixed with *M. schreibersii*, *M. myotis* and *R. ferrumequinum* (D. Russo, unpublished data). In the Campania region, abundant water percolating



Figure 2.4 – Day-roosting *Rhinolophus hipposideros* (photo by D. Russo)

from a water conduit crossing a viaduct has led to wet conditions suitable for a typically cave-dwelling species assemblage (*R. euryale*, *Myotis capaccinii*, *M. schreibersii* and *M. emarginatus*). Such “extreme” examples remind us how difficult it is to categorise bats as cave – dwelling and house – dwelling species.

The breeding season varies according to species, but mating generally takes place after the young become independent. Females leave the nursery colony and join males, whose testosterone levels peak at the same time. Sperms are then transferred

from the testicles to epididymes. Mating activity mostly starts at the end of August and continues for the entire winter, when it may involve arousal from hibernation, or may take place in early spring. Following copulation, the female retains spermatozoa within gonads long-term, and fertilization actually occurs only after hibernation. A known exception is the bent-winged bat (*Miniopterus schreibersii*), mainly cave-dwelling, in which the oocyte is fertilized soon after mating but the embryo is then stopped at an early stage of development (the blastocyst) and continues its development only after winter.

2.2. Phylopatry

2.2.1 Swarming

As seen above, the social behaviour of European bats in the active season results in reproductive colonies mainly made up of related females, and

males roosting solitarily or in small groups. In late summer or autumn, sudden, temporary aggregations of many bats (often unrelated) can be noticed, mainly at night, at so-called swarming sites. The biological meaning of swarming is not fully understood. Although it sometimes favours information exchange (especially for juveniles, which in this way can learn the location of hibernacula), the main function of swarming is mating: it promotes gene flow between individuals (Veith *et al.*, 2004; Rivers *et al.*, 2006).

Such sudden aggregations of bats are in fact likely to promote the performance of lek-like behavioral patterns by males, by acting as outbreeding centres (Kerth *et al.*, 2003; Parsons and Jones, 2003).

First identified in the 1960s in north America (Davies, 1964; Davies and Hitchcock, 1965; Fenton, 1969), swarming sites are special temporary habitats for bats. Bats perform a high rate of flight activity in and around the entrance of the roost, and mating takes place inside the roost (Fenton, 1969; Veith *et al.*, 2004).

Swarming takes place between August and November, peaking in September (Parsons *et al.*, 2003; Rivers *et al.*, 2006); the timing varies with species (*Myotis nattereri* swarms later than *M. daubentonii* or *M. mystacinus*) and probably with annual temperature variation. Swarming starts ca. 3-4 hours after sunset and peaks 3 hours after its onset, (Parsons *et al.*, 2003; Rivers *et al.*, 2006), then declines until dawn.

Because of the influence of environmental factors, the numbers of animals observed at swarming sites varies greatly between nights (Parsons *et al.*, 2003; Rivers *et al.*, 2006). Prolonged rain disturbs and interrupts swarming. Likewise, ambient temperatures < 13°C suppress swarming (Parsons *et al.*, 2003), which peaks on warm nights. Bats are probably only able to pay the energetic costs of swarming on nights when sufficient prey is available (Parsons *et al.*, 2003). Bats are loyal to swarming sites and cover long distances on single nights to reach them (up to 27 km; Parsons and Jones, 2003). While some bats use swarming sites for a prolonged time, others may visit them only on a single night. Overall, the turnover in individuals and species at swarming sites may be considerable (Kiefer *et al.*, 1994; Parsons and Jones, 2003).

The species performing swarming belong to the family Vespertilionidae, and especially the genus *Myotis*. The sex ratio at swarming site is strongly biased towards males (e.g. Parsons *et al.*, 2003). Unless it is due to a sex-dependent detection probability (e.g. sex-related differences in bats' ability to avoid nets, or differences in activity rates), the unbalanced sex ratio may be due to competition among males to gain access to females.

Swarming often occurs in hibernacula, and can often be observed in caves, quarries or mines. It also occurs in underground parts of buildings, and some cases of swarming at above-ground sites are known, such as at Marburg Castle (Assia, Germany), the cellar of which is home to a large (5000 bats) colony of common pipistrelle (*Pipistrellus pipistrellus*); numbers peak at swarming time (Sendor and Simon, 2003). In November 2005, in Tuscany (P. Agnelli pers. obs.), swarming was observed inside a building, a farm house which was suddenly colonized by several hundred bats that probably entered through the chimney.

Similar cases, involving numerous bats suddenly colonizing buildings, are known for *Pipistrellus* spp. and *Hypsugo savii* in August and September. The reason is unclear and it is not certain whether the colonizing bats were actually swarming. Apart from the behavioural explanation, no doubt such cases lead to a strong conflict with home-owners who experience a real "invasion". The peak of cases concerning bats entering houses reported in September to offices in Turin province may at least partly be explained by the occurrence of such phenomenon (Figure 2.5).

Because of their probable importance, swarming sites must be as protected as day-roosts.

Judging from the large numbers of bats concentrating at swarming sites and their loyalty to the latter, it is likely that such sites are also quite rare.

Because swarming lasts for a short time, the role of a building for swarming may be easily overlooked. On the other hand, if the building is used by people, this may lead to strong conflicts due to the sudden appearance of lots of bats (the well-known "bat invasions" sometimes reported in the media). In such cases, public reactions can be highly inappropriate, involving e.g. mass killing of bats, or wrong actions by pest controllers or the fire brigade.

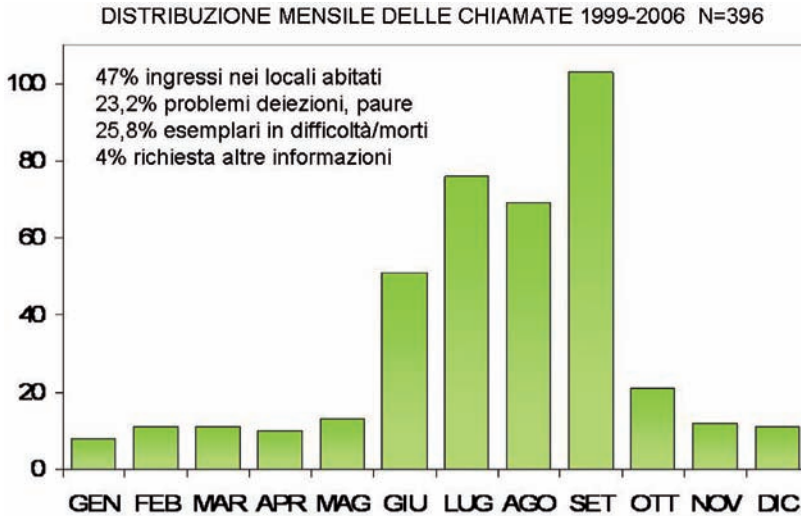


Figure 2.5 – Block diagram showing the temporal distribution of cases of bats entering houses as reported in Turin Province. Note the September peak, possibly due to swarming

2.2.2 Loyalty to Roosts

Many bat species are more or less faithful to roosts (nurseries and hibernacula, but also temporary roosts), using them for many years. Preserving the structural and microclimatic features of a roost over time is crucial for bat conservation. Loyalty to roosts has important implications for population dynamics, maintenance of social relationships and population genetic structure (Rossiter *et al.*, 2002). By using the same roosts, bats may preserve stable relationship with kin or sexual partners. This may have important consequences for e.g. kin selection (Rossiter *et al.*, 2002, 2005; Willis and Brigham, 2004). Species roosting at ephemeral sites, such as tree-dwelling barbastelles (Russo *et al.*, 2004, 2005), switch roosts frequently, perhaps to retain or increase the knowledge of roost location and suitability while maintaining social relationships among bats scattered over large forests.

In such cases, the concept of “colony”, generally used to refer to bats in a single cave or building, should be expanded to include the bats found in entire forest patches. When roosts are in structures which are stable in time, such as buildings or caves, a high degree of loyalty (bats re-using the site for several tens of years) is common. Good hibernation or reproduction sites are a rare resource, so those that are really suitable can be used for a long time by many bats.

The suitability of a roost critically depends on its structure, microclimate and the degree of human interference; distances to good foraging and drinking sites are also important (Entwistle *et al.*, 1996; Kerth *et al.*, 2001; Sedgeley, 2001).

Frequent use by bats may also increase roost suitability because urine and droppings can stabilize ambient temperature and humidity (e.g. McWilliam, 1988) and large concentrations of bats typically increase ambient temperature (McCracken and Gustin, 1991; Bonaccorso *et al.*, 1992).

Loyalty also has some negative effects, such as larger parasite concentrations. In *Myotis bechsteinii* (Reckardt and Kerth, 2007), a common bat parasite (family Nycteribiidae) is less common in reproductive colonies that switch roosts frequently. Males, which are more sedentary, are in fact more vulnerable to these parasites. Parasite load alone cannot explain all instances of roost switching, however, such as those recorded in *Barbastella barbastellus* (Russo *et al.*, 2005). Generally speaking, the optimal strategy (roost fidelity or lability) is a trade-off between costs and advantages associated with loyalty.

In Italy, several colonies of bats have been known to roost in historical buildings for tens of years.

Agliè castle (Turin province) has been home to a large mixed colony including *Rhinolophus ferrumequinum*, *Myotis blythii*, *M. myotis*, *M. daubentonii*, *M. nattereri* and *Eptesicus serotinus*, for over 50 years. A summer reproductive colony including *Myotis capaccinii*, *M. blythii* and *M. myotis*, roosting in the underground rooms of Palazzo Borromeo gardens, on Isola Bella (VB) is at least 150 years old (Victor Fatio, a naturalist who visited the site in 1865, noted that, judging from signs of

presence recorded, bats were likely to have roosted there since long before his survey). Likewise, the Aosta Cathedral is used by a 30-year-old colony of *Rhinolophus ferrumequinum*, and the *Rhinolophus hipposideros* colony in the Monastery of Nostro Signore della Montà (Imola) is likely to have used the site for over 60 years.

Some private houses are sometimes also used as bat roosts for long periods.

Common pipistrelles (*Pipistrellus pipistrellus*) may roost in the same building for 10-15, and sometimes over 20 years (Reiter and Zahn, 2006). A long occupation history highlights the ecological importance of a roosting site and raises more concern in case some human factors (from occasional visits to renovation) threaten roost survival.

2.3. Features of Buildings used as Roosts

Different species select different types of roosts in buildings, since they look for sites comparable to those chosen in natural habitats. In many buildings, including recent ones, narrow spaces resembling rock crevices or cracks in trees are not uncommon: e.g. roller shutter boxes, spaces beneath roof tiles, wall coatings, rain gutters, and chimneys. Other roosts in buildings are characterized by larger, cave-like, spaces: rooms with ceilings which bats can hang from (e.g. made of wood, bricks or stones, unplastered or coated with rough plaster), subject to little disturbance, dark, exhibiting appropriate ambient temperatures and humidity, and absence of airflow. Such conditions are sometimes observed in historical buildings such as castles, palaces and churches, generally in attics or cellars.



Figure 2.6 - *Hypsugo savii* roosting beneath a gutter (photo by L. Cistrone)



Figure 2.7 – Hollow mortice joints used by roosting bats in barns (after Briggs, 2004).

Another important parameter is the access type. Some species require large openings (15x30 cm or more), which allow flying bats to enter. This is generally the case with large-volume roost sites. Species using narrow roosting spaces may climb through small circular openings or slits (height 2-5 cm; Figure 2.6). Virtually all buildings the structure and microclimate of which are suitable for a given bat species can be used as roosts. Below is an overview of the main roost types.

2.3.1 Barns

A study carried out in the UK showed that bats used barns especially when they were > 100 years old, covered an area of at least 300 m², and were timber-framed (Briggs, 2004). The timber frames of these old buildings offered gaps and hollow mortice joints where bats could roost (Figure 2.7). Of course enough room was needed to allow bats to fly.

2.3.2 Buildings

Bats may roost in small or large spaces located outside or inside buildings, in single buildings or large blocks, schools, churches or major historical buildings. In modern buildings, available spaces are often narrow (except attics) and are thus used by crevice-roosting bats. Historical buildings often feature larger spaces that, when subject to little disturbance, may be especially suitable for large colonies of species hanging from the

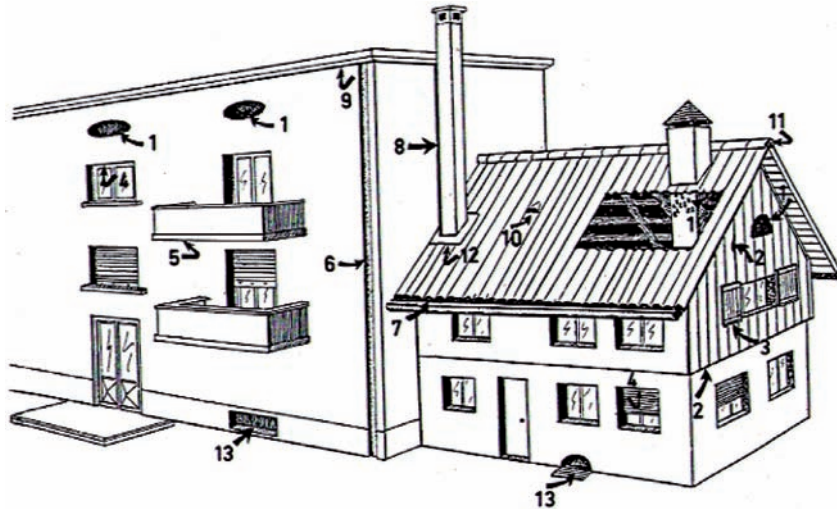


Figure 2.8 – Spaces used by bats roosting in buildings. 1. Attics. 2. Wooden claddings on walls. 3. Window shutters left open for long periods. 4. Roller shutter boxes. 5. Metal elements of balconies. 6. Spaces between walls and vertical parts of guttering (downpipes). 7. Spaces beneath gutters. 8. Spaces between walls and chimneys. 9. Metal structures bordering roofs. 10. Spaces between tiles. 11. Tiled roof apex. 12. Spaces between chimney base and tiles. 13. Cellars (after Patriarca and Debernardi, 2003)

ceiling rather than using crevices. Church attics are often used as maternity roosts; being well exposed to sun, they provide a warm microclimate suitable for pregnant females and developing young. They are also subject to little disturbance and often provide easy access to bats. However, the complex architecture of such buildings (e.g. the presence of roof beams) also offers narrow spaces used by crevice-roosting species.

In general, the spaces most often used by bats roosting in buildings are as follows (see also Figure 2.8):

- Roof spaces (space between tiles and insulation material, or between the latter and the inner coating, and attics).
- Rooms
- Spaces beneath false ceilings, beams, hollow mortice joints;
- Spaces and cavities in walls, holes in bricks, crevices or cracks

- Spaces around the chimney
 - Boxes of rolling shutters
 - Cellars (bats may hang or use spaces between bricks, wall cracks etc.)
- External features of buildings providing roosting opportunities are as follows:
- Spaces between tiles, between external beams and walls, and behind shutters
 - Spaces between wall stones, fissures or other cracks
 - Spaces behind coatings of outer walls (rendering), beneath roof cover structures, metal structures of balconies or flat roofs, spaces beneath guttering or chimneys.

2.3.3 Bridges and Viaducts

Stone bridges are especially suitable for roosting bats because of their numerous cavities (figure 2.9), especially if they are over water. Concrete bridges too may be suitable, as well as those made of steel and wood which may offer spaces used by bats.

Optimal cavities are probably at least 40 cm deep and 17-35 mm wide, but any cavity deeper than 50 mm and larger than 12 mm can be used for roosting or to access deeper, larger spaces. Suitable cavities include the spaces between stones or bricks, drainage holes or other spaces or splits in concrete structures.

Motorway bridges too, provided they are not crossed by intense car traffic, can be used by roosting bats as both day and night roosts. Vertical spaces delimited by bridge beams are often used, especially if sheltered from the wind, well insulated and exposed to the sun, so that they can accumulate heat during the day and slowly irradiate it at night. Cavities in large concrete structures too may be used if they have an opening 1.5-3m high and are >100 m long, provided they do not flood, light does not penetrate inside, and the inner surfaces are rough enough to allow bats to hang. Smooth surfaced bridges, with no suitable spaces or drainage conduits are avoided by bats (Keeley and Tuttle, 1999).



Figure 2.9 – Stone bridges such as this one often have spaces between stones suitable for roosting bats (Photo by P. Agnelli).

2.3.4 Docks

Docks or jetties, often found on lake shores, are ideal roosts for water habitat specialists such as Daubenton's bats (*Myotis daubentonii*) or long-fingered bats (*Myotis capaccinii*). They include large spaces but also several fissures and small cavities, and are often little disturbed. The dock tower of a private house in Lierna (Lecco) is home to a mixed nursery of *Myotis capaccinii* and *Myotis daubentonii* numbering ca. 2000 bats.

2.3.5 Underground habitats: cellars, aqueducts, necropolises

Underground sites are especially useful for hibernation because their thick walls keep temperature and humidity constant. Besides natural caves, many artificial underground habitats are used by bats for roosting: mines,



Figure 2.10 - A *Rhinolophus euryale* maternity colony roosting inside an Etruscan aqueduct (Photo by P. Agnelli).

cellars, railway tunnels, military bunkers, aqueducts and necropolises. They provide suitable microclimates, and are often subject to little or no disturbance. Underground habitats are used by both crevice-dwelling species (roosting in narrow spaces between bricks, cracks in walls, etc.) and bats needing large volumes such as rhinolophids, which hang from ceilings.

The Etruscan necropolis of Tarquinia, in Italy, is home to a mixed colony of *Rhinolophus ferrumequinum*, *R. hipposideros*, *Miniopterus schreibersii* and *Myotis myotis*, while at least 1,500 *R. euryale* roost in an

Etruscan conduit dug in tufa rocks (Figure 2.10).

Another interesting example of how artificial underground habitats are colonized by bats when no longer used by people is provided by the many Nazi bunkers built during World War II, and today used by roosting bats. The most famous example is Nietoperek bunker network, in Poland – the largest hibernaculum of Eastern Europe. This site consists of an 18-mile network of tunnels covering an area of 9 square miles. The tunnels are located ca. 30 m underground and are connected with the surface by vertical air pipes. The site has been used for at least 30 years by ca. 6,000 *Myotis myotis*, over 10,000 *M. daubentonii*, hundreds of *Plecotus auritus* and *Myotis nattereri* and smaller numbers of another six species, including the rare *M. bechsteinii* (Voute, 1991).

2.4. Species Roosting in Buildings

Most bats found in Italy (and other parts of Europe) use buildings either for part or their life cycle or all year round. In the list below, the number of asterisks show how often the various species roost in buildings (* = rarely; ** = moderately frequently; *** = frequently).

In this section we will present, for each species, the main roost types and the time of year such roosts are used.

- Greater horseshoe bat (*Rhinolophus ferrumequinum*) ***
- Lesser horseshoe bat (*Rhinolophus hipposideros*) ***
- Mediterranean horseshoe bat (*Rhinolophus euryale*) *
- Bechstein's bat (*Myotis bechsteinii*) *
- Daubenton's bat (*Myotis daubentonii*) ***
- Long-fingered bat (*Myotis capaccinii*) *
- Whiskered bat (*Myotis mystacinus*) *
- Geoffroy's bat (*Myotis emarginatus*) ***
- Natterer's bat (*Myotis nattereri*) *
- Greater mouse-eared bat (*Myotis myotis*) **
- Lesser mouse-eared bat (*M. blythii*) **
- Common pipistrelle (*Pipistrellus pipistrellus*) ***
- Soprano pipistrelle (*Pipistrellus pygmaeus*) *
- Kuhl's pipistrelle (*Pipistrellus kuhlii*) ***
- Savi's bat (*Hypsugo savii*) ***
- Leisler's bat (*Nyctalus leisleri*) *
- Common noctule (*Nyctalus noctula*) *
- Giant noctule (*Nyctalus lasiopterus*) – no use of buildings
- Parti-coloured bat (*Vespertilio murinus*) **
- Serotine (*Eptesicus serotinus*) ***
- Northern bat (*Eptesicus nilssonii*) **
- Brown long-eared bat (*Plecotus auritus*) ***
- Grey long-eared bat (*Plecotus austriacus*) ***

Alpine long-eared bat (*Plecotus macrobullaris*) ***

Sardinian long-eared bat (*Plecotus sardus*) ***

Barbastelle bat (*Barbastella barbastellus*) *

Bent-wing bat (*Miniopterus schreibersii*) *

European free-tailed bat (*Tadarida teniotis*) ***

Rhinolophus ferrumequinum. This bat is a cave-dweller in winter, but often uses above-ground roosts in the summer activity period. Colonies occupy large spaces where no air flow occurs; the access is normally large enough to be crossed by flying individuals.

Rooms are used as roosts even if weakly illuminated. Bats hang to the ceiling and rarely cluster together (as in rhinolophids in general, clustering may occur when females are pregnant or juveniles are present). Buildings are used for both reproduction and hibernation. For hibernation, underground parts of buildings are often used. Roosts are occupied by reproductive colonies from the end of April until August, but some bats can be observed there until around October. Single bats are seen in buildings year round, in winter generally in underground rooms (cellars, tanks, etc.), in above-ground structures (large spaces, sometimes ovens or chimneys too) in the summer activity months.

Rhinolophus hipposideros. Especially in winter a cave-dwelling species,



Figure 2.11 – Hibernating lesser horseshoe bats in a cellar (photo by M. Bertozzi).

which uses buildings in the summer activity period. Reproductive colonies, today unfortunately consisting of only a few females (Figure 2.11), generally roost in attics, but also inside large spaces within bridges, churches, chapels, castles, schools and private buildings, where little or no air flow occurs; dim light is tolerated. Large openings that can be crossed by flying bats are required for access. This species too can overwinter in underground parts of buildings. Reproductive colonies are generally formed by the end of May, and bats start leaving maternity roosts from the end of August (sites are completely abandoned by late September or the beginning of October). Single bats are seen year-round in buildings, in winter generally in underground spaces (cellars, tanks, etc.), above-ground in the summer activity months as in *R. ferrumequinum*.

Rhinolophus euryale. Natural roosts are caves, but maternity colonies are sometimes found in buildings. Large spaces and entrances that bats may cross in flight are needed. Maternity colonies are observed from April – May until August.

Myotis bechsteinii. A forest bat, which in summer roosts in tree cavities and also bat boxes. Hibernating or maternity colonies are rarely found in buildings. A crevice-dwelling bat, which may roost in narrow spaces that are entered by crawling. Reproductive colonies are found from early May until early September.

Myotis capaccinii. Roosts in caves for both hibernation and reproduction, rarely found in buildings. Strictly associated with water habitats; roosts are often found near lakes, ponds or rivers. Reproductive colonies are found from April until September - October.

Myotis daubentonii. Hibernates in caves; reproductive colonies are in tree cavities, bat boxes, but often also in buildings. Hunts in water habitats, so roosts are often found near lakes, ponds, and rivers. Nursery sites, but also colonies made up of males only (in Italy the latter are recorded above about 900 m a.s.l.; Russo, 2002), often in bridges or sometimes docks, rarely in attics or roller shutter boxes. May enter roosts by crawling. Reproductive colonies form from April until September-October.

Myotis mystacinus. Although a tree-dwelling species, can often form

nurseries in buildings. Rarely uses bat boxes or bat boards. Selected buildings are often houses, alpine huts, garages, barns, etc. Narrow spaces where bats can enter by crawling are often used. Roosts mainly found on the outer surface of buildings, sometimes inside roof spaces or barns. In such cases, narrow spaces or crevices are also used. Individual bats also found behind shutters, in brick holes or rarely in roller shutter boxes. Reproductive colonies form from May until August, but some bats are observed there until October.

Myotis emarginatus. Although originally a cave-dweller, this bat is now well adapted to roosting in buildings where it forms large maternity colonies. Uses large spaces such as attics, rooms, barns and stables, but may sometimes roost in narrow spaces such as within hollow bricks, accessed mainly in flight. Maternity colonies are found from May until the end of August – beginning of October (Figure 2.12). *M. emarginatus* nursery colonies often consist of several hundred bats. Both colonies and non-breeding, single bats may choose lit places for roosting.

Myotis nattereri. A tree-dweller, often forming large colonies in hollow trees, which may also use bat boxes or buildings. Roosts in narrow spaces reached by crawling: cracks or cavities in walls, fissures in roofs, or very rarely behind shutters or outer wall elements. Breeding colonies are also found in stables.



Figure 2.12 – A *M. emarginatus* nursery colony in a building (photo by M. Spada).

Reproductive sites are occupied from April and abandoned in September. Single bats can be found in rock crevices, stone walls or behind outer wall coatings (rendering).

Myotis myotis and *M. blythii* (= *oxygnathus*). We will deal with these species together since they show similar

roosting preferences and may form mixed colonies. Originally cave-dwelling bats, they are well adapted to buildings where both reproductive colonies and male aggregations occur, especially at northern latitudes (in southern Italy they mainly roost in caves). Large, dark spaces are preferred, such as attics (Figure 2.13). The species roost in crevices only when ambient temperatures are very high or low. Small spaces are very rarely used. Access to roosts may be either in flight or by crawling. Nursery colonies are formed from the beginning of April, male colonies from May; by the end of July females start moving to male roosts for mating. Single individuals or small numbers of bats are sometimes found in rock niches, holes, etc. In the Parco Fluviale Regionale del Taro (Ruggieri, 2000), in August – September males roost in old bridges (in drainage conduits), which are also used as mating sites. Similarly, these bats have been observed in shot holes in abandoned mines (which in some cases are used by bats of both species) in the Abruzzo region, central Italy (D. Russo and L. Cistrone, unpublished).

Pipistrellus pipistrellus and *P. pygmaeus*. Only recently known as distinct species (formerly classified as “*Pipistrellus pipistrellus*”), these species use similar roosts, but no mixed colonies are known. May use bat boxes or tree cavities; buildings are used for both hibernation and reproduction. Roosts are often in narrow spaces: wall cracks or fissures, roller shutter boxes, holes in bricks, roof structural elements. Hibernation takes place in cellars or underground parts of monasteries or castles (where the spaces between bricks are often used), as well as in rock crevices. Roosts are accessed by crawling. Nursery sites are used from early April



Figure 2.13 – Greater mouse-eared bats in a church attic (photo by M. Bertozzi).

and left in September, but single bats may be found there as late as November.

Pipistrellus kuhlii. This is the commonest bat species in buildings in Italy. A crevice-dwelling bat, maternity colonies are in narrow spaces in a range of structures, inside buildings or in external structures. Roller shutter boxes, cracks or fissures in inner or outer walls, spaces beneath roof tiles, and gutters are some common roost locations. Hibernating colonies often form in buildings, especially in walls or underground structures. Where winter temperatures are not especially low, reproductive sites may also be used to hibernate. Roost entrances are typically reached by crawling. Nursery sites are occupied from April, and vacated by September – October. At higher latitudes, this species is replaced by *P. pipistrellus*, which is more cold-tolerant.

Hypsugo savii. Another typical house-dwelling bat, which in natural areas roosts in rock crevices or underground habitats, or more rarely in tree cavities or spaces beneath loose bark. Uses narrow spaces in buildings, accessed by crawling, where nursery colonies are formed. Known roosts include cracks in walls, spaces beneath shutters, roof tiles, etc. Maternity colonies are found from April to September – October.

Nyctalus leisleri, *N. noctula* and *N. lasiopterus*. Because they have similar roosting habitats, these species will be presented together. Typical tree-dwelling bats, noctules roost in tree cavities or bat boxes, and rarely in rock crevices. May also roost in buildings or inside bridges, where narrow spaces are used e.g. in cracks in walls, beneath external wall coatings (render), roller shutter boxes etc., all of which are accessed by crawling bats. In general, *N. leisleri* is the species showing the most pronounced house-dwelling habits, *N. lasiopterus* the least. All three species do not generally reproduce in Italy but stay in the country through the winter and until May, when all females and some males migrate north for reproduction. They return in August for mating. In June-July roosts are mainly used by male groups. Local exceptions to this pattern may occur in Italy according to elevation, latitude and climate.

Vespertilio murinus. To date, no colonies have been found in Italy, but

the species occurs in other countries of the Alpine region, and records for northern Italy are available. Roosts are mainly in buildings with no airflow, and are accessed by crawling. Maternity colonies are mainly in narrow spaces (beneath external wall coatings or shutters, in chimneys, brick holes, etc.); preferred roosts are near lakes or other freshwater habitats. Males form large colonies in sites resembling maternity roosts. In Switzerland, maternity sites are occupied in late April or the beginning of May; births occur in early June, and some juveniles remain in nurseries until August. Male colonies are generally formed in buildings in August, and are occupied for a short time (a few days – ca. 8 weeks).

Eptesicus serotinus. Breeding colonies are typically in buildings, often in small inner spaces (especially attics), where bats roost in fissures or other narrow cavities. May also roost often beneath roof tiles, or in spaces surrounding chimneys where temperatures are high. Different buildings may be colonized – attics of private houses, churches, monuments, etc. Roosts are accessed by crawling. Maternity colonies start associating in early April, peak in May and disperse after mid-August. Some bats may remain in maternity roosts until October. Single bats also occupy artificial underground roosts.

Eptesicus nilssonii. Roosting habits are similar to those of *E. serotinus*. Roosts are often beneath false ceilings, roof tiles or between outer and inner roof insulation layers. Large male colonies form, as in *E. serotinus*, in May-August, but these roosts are used only for short periods. Access to roosts is often at joints between an outer wall and a roof.

Plecotus auritus. Naturally roosts in tree holes, but also often roosts in bat boxes or buildings. Uses both large and narrow spaces in attics and other room types. Reproductive roosts are used from April to October; they are accessed in flight or by crawling. Hibernation is in caves, artificial underground sites, rock crevices or spaces beneath bricks.

Plecotus austriacus. Rarely found in bat boxes, and more likely to be found in buildings than *P. auritus*. In buildings, often found in large attics where they hide in roof spaces. Reproductive roosts are used from April; bats are present as late as in October. In spring and autumn, bats tend to

use fissures or cavities, whereas in hotter months they hang. Access to roosts is generally by crawling.

Plecotus macrobullaris. Nurseries are in buildings, especially in large spaces such as attics. Several colonies are known from churches and castles. Access to roosts is mainly in flight. Colonies associate in May and disperse from August.

Plecotus sardus. A cave-dwelling bat, which can also both hibernate and reproduce in large spaces of buildings. The ecology of this recently described species is not yet well known.

Barbastella barbastellus. A typical tree-roosting bat, which occasionally uses buildings with structures mimicking its favoured natural roosts (spaces beneath loose bark or splits in trees): shutters, cracks in walls or bat boards. In the Alps, windows have shutters that, when left fixed open against the outer wall for long periods, form a narrow space often used by barbastelles. Such spaces are often used by small numbers of bats (F. Bontadina, pers. comm.). bats may frequently switch roosts from one window to another of the same building (O. Niederfringer, pers. comm.). Roosts are accessed by crawling or rarely in flight. Nurseries are found between late April – early May and late July.

Miniopterus schreibersii. A strict cave-dweller, which roosts year-round in natural or artificial underground habitats. In the northern part of its range, in summer, reproductive colonies and male colonies are found in buildings. Nursery colonies form from April, and disperse in August.

Tadarida teniotis. Typically roosts in rock crevices in cliffs. In buildings, often found in narrow spaces, especially of outer structures and mainly on higher floors. Sometimes found in roller shutter boxes. Accesses roosts by crawling.

3. EUROPEAN EXPERIENCES: A FEW CASE-STUDIES

3.1. Background

In recent years, bat conservation has received increasing attention in Europe. Although laws protecting bats in Europe have existed for over 20 years, their ratification and enforcement in different European countries have followed different paths. In fact, bats have received different levels of attention in the various countries, largely depending on the different public attitudes towards these mammals.

The legal framework aimed at protecting bats is mainly represented by the EC/92/43/Habitats Directive and by the European Bat Agreement (EUROBATS) stemming from Bonn Convention of 23 June 1979. The Bat Agreement has, so far, been ratified by 32 out of 48 countries, including Italy (Law 27 May 2005 n. 104). One of the duties of Eurobats member parties is to obtain detailed information on roost sites, and present appropriate information on the best approaches to protecting and managing colonies in buildings, including those in historical ones. Among the several bat conservation issues, protecting bats in buildings has significant social implications and may involve public authorities as well as citizens.

Some European countries are clearly far more advanced than others in dealing with issues such as monitoring bats (i.e. collecting data on species presence, abundance and roost location) and informing people about the importance of bat conservation. The more advanced countries often rely on many volunteers employed in surveys and coordinated by bat experts, identify specialists who can effectively design and implement conservation actions, and rely on national monitoring programmes – a situation that greatly favours effective active protection. Especially in the U.K., volunteers are organized in bat groups, often numbering many people, who mainly aim to protect bats and offer valuable assistance in surveys and monitoring – a situation which is certainly very different from that of other European countries.

In the following sections, we will present a brief overview of experiences concerning bat protection in several European countries, with particular reference to bats in buildings. Of course we are aware that such situations may change, sometimes quickly, over time. We will provide an overview of the situation in Germany, the U.K., Spain and Switzerland, countries from which we have been able to get sufficient information from experts and institutions. This brief overview will be useful for comparison with the Italian situation, and for the identification of the main objectives needed to implement our management and conservation policies. The countries that have developed effective bat conservation plans provide excellent examples of how to deal with the conflicts between bats and people that occur when buildings are colonized. Of course processes and procedures that have proven effective in other countries should not be passively imported, but can be carefully tailored to fit the specific situations of different countries.

3.2. European Case-Studies

The following analysis mainly concerns the way in which different European countries deal with conflicts with people arising from bats in buildings.

The case-studies are from various countries (listed in alphabetical order), selected on the basis of the wealth of available information from sources such as publications, public institutions, and bat specialists or bat groups.

We present only a brief overview, which should not be seen as a thorough picture of the often articulated and complex international conservation issues.

3.2.1 Germany

3.2.1.1. Legal Framework

All bat species occurring in Germany are protected under the Federal

Act for Nature Conservation of 21 September 1998, as well as under the various conservation laws made by the so-called *Länder*, i.e. the federal states of Germany (16 in total, all represented in the Federal council called *Bundesrat*).

In 2002, the German Parliament produced a revised and updated version of the Federal Act for Nature Conservation (*Bundesnaturschutzgesetz* – BnatSchG; BMU, 2002) which complements, on a national scale, the EC/92/43 Habitats Directive. According to section 42, it is forbidden to capture, harm or kill all bat species, as well as to damage, destroy or disturb reproduction or hibernation sites. Special Areas of Conservation for bat protection are designated by the *Länder*. Germany joined the Bat Agreement on 5 December 1991 and ratified it on 18 October 1993.

3.2.1.2. Reference Authorities

Bat conservation plans are developed by the Federal Agency for Nature Conservation (BfN). Additional guidance for federal states is provided by 1) special institutions, 2) associations and 3) citizens (Boye, 2000), as follows:

1. Coordination offices for bat conservation (Baden-Württemberg, Bavaria, Thuringia), or stations for nature conservation (Brandenburg).
2. NGOs protecting nature, e.g. *Naturschutzbund Deutschland* (regional body for the protection of nature in Germany) and especially its committees specifically dealing with bat conservation (Brandenburg, Saarland and Saxony among others), the *Bund Umwelt und Naturschutz Deutschland* (regional body for the protection of nature in Germany) in Brandenburg, *Vespertilio* in Berlin, *Arbeitsgemeinschaft für Fledermausschutz* (Bat conservation group) in Hesse, *Interessengemeinschaft Fledermausschutz und –forschung* (a group aiming to protect and study bats) in Thuringia and other groups devoted to bat conservation (Saarland, Saxony, Saxony-Anhalt, Schleswig-Holstein).
3. Bat specialists responsible for specific areas, species or roosts (Brandenburg, Lower Saxony, Saxony, Thuringia).

If renovation work is needed at a building where bats roost, one of the

above-mentioned reference bodies responsible for the relevant federal state is contacted. Technical support is provided to define the optimal time schedule and the safest way renovation can be carried out without harming or disturbing the bats (A. Zahn, pers. comm.).

Should the project potentially impact the colony directly or indirectly, a special licence needs to be issued by the federal authorities for nature conservation to derogate from the law protecting the colony (section 62, BnatSchG). The permit is issued only if the works will be compatible with nature or landscape preservation, or if outstanding reasons of public priority exist and no conflict occurs with sections 12, 13 and 16 of Habitat Directive. Federal states may authorize exceptions to *Länder* laws (section 62 of BnatSchG).

In general, works concerning buildings hosting bat colonies are authorized only when projects are of public importance, so private citizens may attempt to avoid requesting permits from the relevant authorities. Such situations are often noticed, and reported, by an effective network of volunteers and groups dealing with bat conservation. Occasionally, architects supervising building works stop operations when bats are found, and inform the relevant authorities (K. Mayer and A. Zahn, pers. com.).

When historical buildings or monuments are renovated, the relevant body may employ an “ecological observer”, i.e. a bat specialist, to carry out systematic monitoring during the course of the works (K. Mayer, pers. com.).

3.2.1.3. Monitoring and Data Storage Systems

To protect bat roosts, the relevant bodies of federal states develop management, research and monitoring programmes. Generally speaking, sites of major conservation importance are constantly subject to monitoring (e.g. large colonies and/or species of special conservation concern) by either periodical surveys or automatic counters (as with five main underground roosts in Schleswig-Holstein; Boye, 2003). Specific systematic surveys aimed at finding new roosts are also carried out. This approach has been followed in a project on the creation of a roost network for house-dwelling

bats through the protection of existing roosts and the creation of further sites, which started in 1996, and was published as a report by the *Federal Agency for Nature Conservation* (BfN) (Dietz and Weber, 2002).

A case worth mentioning is that of bats in public buildings in Lower Saxony, where funding has been provided to support the creation of artificial roosting sites and the management of known roosts within the *Länder*.

In some cases, the especially significant interest of some states to the issue of bat conservation may involve other countries and lead to trans-boundary conservation initiatives of special importance. For instance, the INTERREG programme “*Living Space Network*”, developed within the INTERREG IIIB Alpine Space (2003-2005) was aimed at achieving a well-coordinated habitat management strategy and effective protection of alpine bat colonies found in the boundary area of the countries involved.

The project was promoted by the Bavarian Ministry for the Environment, in cooperation with the national authorities for nature conservation of Bavaria and Baden-Wuerttemberg (Germany), Tyrol, Vorarlberg and Salzburg (Austria), the autonomous provinces of Bolzano and Trento (Italy), and the Swiss Cantons of S. Gallo, Grigioni and Ticino (StMUGV, 2007).

The experience gathered over the three years of the project has led to the publication of guidelines for the renovation of buildings housing bat roosts in Alpine regions (Reiter and Zahn, 2006). The document is especially interesting, since it illustrates the effects of renovation work on the various bat species according to their different ecological requirements, and provides information on intervention times and procedures to follow to minimize the impact on bats. It was mainly intended as a supporting document to allow bat specialists to standardize monitoring procedures and conservation strategies once the application of European laws will make them mandatory in all partner countries whenever a building housing a roost is undergoing renovation.

Databases of bat roosts and monitoring information are managed by the relevant bodies of the various *Länder*, such as those managed by the coordination offices for bat conservation of Thuringia and Bavaria (Boye,

2000; 2003): they can be accessed by external users and form an important data source for Geographic Information Systems applications.

3.2.2 *United Kingdom*

3.2.2.1. National Law

All bats and their roosts are protected nationally by the 1981 Wildlife and Countryside Act (England and Wales), the 1985 Wildlife Order (Ulster), the 1994 Conservation (Natural Habitats, &c.) Regulations (1995 for Ulster), and the 2000 Countryside and Rights of Way Act.

The UK has also ratified and implemented the main environmental European Directives and Conventions (Bonn Convention, Bern Convention, Habitats Directive), and has promoted the Bat Agreement, which was signed on 4th December 1991 and has been enforced since 9th September 1992.

Besides national laws, local guidelines have been produced (*Planning Policy Guidance Note 9*, PPG9 in England and *Technical Advice Note 9*, TAN9 in Wales) to deal with issues concerning local contexts, such as the development of urban areas that may have major negative effects on bats.

In such contexts, licences for urban development plans may be subject to feasibility assessments which take into account the possible impact on bats. According to U.K. law, killing, harming, capturing or disturbing bats is forbidden, and so is damaging or destroying roosts, or obstructing roost exits. Exceptions are made for bat rehabilitation and research – licenses are issued for temporary capture or access to roost sites (Richardson, 2003b).

3.2.2.2. Relevant Organizations

The National Trust owns some of the major U.K. roost sites and works for their protection. In 2001, it published a handbook called *Wildlife and buildings. Technical guidance for architects, builders, regional building managers and others. Manual of Buildings*. It highlights that the presence of bats in a building is of crucial conservation importance and that all

renovation or changes made must respect the main objective of preserving the colony. If a bat colony is observed, a licence to proceed with any building or remedial work must be issued by the *Statutory Nature Conservation Organisation* (SNCO) operating within the different regions (*English Nature*, EN in England, *Countryside Council for Wales*, CCW in Wales, *Scottish Natural Heritage*, SNH in Scotland, *Environment and Heritage Service*, EHS-NI in Ulster). When interior works in houses are planned, their approval is subject to the examination of a letter sent to the relevant body specifying times and types of intervention. In buildings other than houses (e.g. churches or barns), a licence is needed from national authorities (DEFRA in England, NAW in Wales, SEERAD in Scotland and EHS-NI in Ulster; Natural Heritage Council, 2003). The request should include a report prepared by a consultant (a certified bat expert) describing how operations will be monitored and the measures adopted to avoid all damage to bats. Should bats be noticed only after work has started, it must be stopped and the reference SNCO must be contacted immediately to avoid excessive delay of work, minimize loss of money and ensure the conservation of the colony.

3.2.2.3. Monitoring and Data Storage

In the U.K., there are several ongoing monitoring projects. The main data sources on bats can be summarised as follows (DETR, 2000):

- National Bat Monitoring Programme (Department of Environment, Transport and the Regions and Bat Conservation Trust) (BCT, 2004).
- Database of bat sites (managed by EN, SNH, CCW, and the Department of Environment of Northern Ireland, DOE-NI).
- National Database of bat habitat monitoring (managed by Joint Nature Conservation Committee, JNCC and University of Bristol).
- Annual count of bat colonies (by R.E. *Stebbings Consultancy*).
- Information on distribution (by *Biological Records Centre*).
- Exit counts at lesser horseshoe bat roosts in Wales (by CCW).

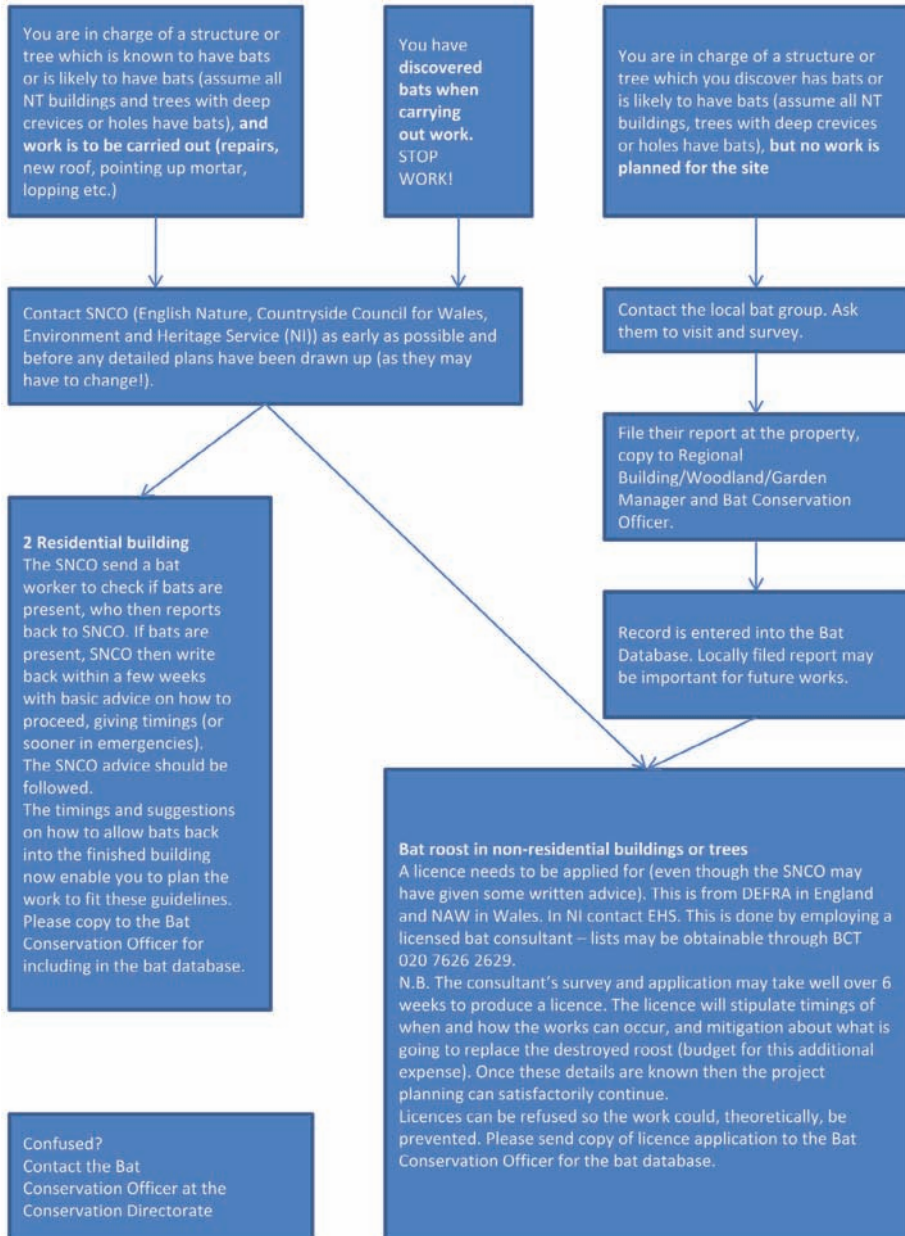


Figure 3.1 – The National Trust’s procedure when bats are noticed in buildings or trees undergoing work (after Richardson, 2003b).

- Bat box data collection (by *Forest Enterprise Regions*).
- Data on bats in churches (by BCT), databases on selected species (e.g. Bechstein's bats or barbastelle bats) or habitats.
- Monitoring lesser horseshoe bats in Wales and West Midlands County (by the *Vincent Wildlife Trust*, VWT).
- Database on bat boxes occupied by Bechstein's bats (by VWT).
- British network on environmental changes (by the National Environmental Research Council, NERC).
- Local datasets (managed by voluntary groups of bat conservationists).

In Northern Ireland, data on roost location are collected by EHS-NI members and by the Northern Ireland Bat Group. Such data are stored in the Centre for Environmental Data and Recording at Ulster Museum.

In Gibraltar, the Ornithological Society and the Natural History Society record data on bats and their roosts.

On the Isle of Man, data on bat roosts are managed by the Biological Records Centre, the Manx Wildlife Trust, and the Manx Bat Group (DETR, 2000).

In the U.K., monitoring programmes are largely run by volunteers, under supervision from experts. A network of over 90 bat groups is active in the country, relying on about 4,000 volunteers who carry out much of the bat monitoring work.

3.2.3 Spain

3.2.3.1. National Law

All bats are regarded as species of special interest in the National Catalogue of Endangered Species (MMA, 2006), created according to paragraph 30.1 of Law 4/89 ("Conservation of habitats and wild flora and fauna") and the Royal Decree 439/90 of 30th March 1990.

All species in the catalogue are subject to protection in the whole Spanish territory: killing, disturbing or capturing bats is forbidden, as it is

the possession, traffic or trade of live or dead specimens or their body parts (Paz and Benzal, 1991). According to the law, bat species listed in the group of special interest species require particular attention due to their scientific, cultural or ecological role, and management plans are needed to preserve their populations.

The Autonomous Communities are responsible for the development of these plans: some of the protection measures established by section III of Law 4/89 can be applied to all, or some, of the habitats used by the target species (Paz and Benzal, 1991). The Federal organization of Spain is such that environmental regulations are promulgated by regional institutions. For instance, Asturias and Catalonia have developed their own regulations on bat protection.

The Asturias Community adopted the 32/90 Decree of 8th March (implemented through section 30.2 of Law 4/89 and Hunting Law 2/89). Greater mouse-eared bats (*Myotis myotis*) and lesser mouse-eared bats (*Myotis blythii*) are included in the list of species sensitive to habitat alteration (i.e. those species whose habitat is especially at risk, quickly disappearing, fragmented or rare). Geoffroy's bat (*Myotis emarginatus*) and the bent-wing bat (*Miniopterus schreibersii*) are included in the list of species of special interest.

Because of their legal status, *M. myotis* and *M. blythii* roosts, reproduction, wintering or rest sites are strictly protected, and all unauthorised actions (capture, killing, disturbance, etc.) are forbidden.

In Catalonia, Law 3 of 4th March 1988 defines all bat species as belonging to the native fauna, so they are protected over the whole regional territory. Such species, included in Annex II of the law, cannot be hunted, captured, possessed or traded, whether as whole specimens or as their body parts, whether alive or dead, and including all their subspecific taxa.

For migratory species, all sites used for reproduction, hibernation or rest are protected by this law, which defines Nature Reserves for Wildlife, to protect species at risk, and Wildlife Reserves, to protect wildlife in general.

Regulations promulgated by the Autonomous Communities may be even stricter than national ones and include harder penalties.

As far as international laws are concerned, Spain has approved and

ratified the Bonn and Bern Conventions, which explicitly refer to all bat species occurring in the country, but do not include endemics of the Canary Islands and Macaronesia.

The Habitats Directive has been ratified through the Royal Decree 1997/1995 of 7th December, providing the basis for the development of the Natura 2000 network in the country. Spain has not yet joined the Bat Agreement.

3.2.3.2. Relevant Organizations

At the national level, in 1988 the bat roost archive of Spain was constituted (Benzal *et al.*, 1988) by the National Institute for Nature Conservation (ICONA) to contribute to the development of the Bonn Convention. The archive was later developed to include more roost records (Benzal *et al.*, 1988; Paz and Benzal, 1991).

Recently, the National association most involved with bat conservation has been the NGO *Sociedad Española para la Conservación y Estudio de los Murciélagos* (SECEMU, funded in 1991 and registered in the National Association Registry). In 2007, in co-operation with la *Sociedad Española para la Conservación y Estudio de los Mamíferos* (SECEM), SECEMU edited the new Red List and the Red Book of terrestrial vertebrates of Spain (SECEM, 2007). In the last few years, bat conservation projects have often been developed regionally under the patronage of relevant authorities from the Autonomous Communities.

Among the latter, the Gobierno de La Rioja (1996, 2006) has established a fund to preserve bats in buildings. In that region, the local government has promulgated the 56th Decree ruling for the payment of subsidies to help protect some bat species roosting in private properties (B.O.R. n 78, 30th June 1998). The aim of this programme is to compensate for any economical loss caused to householders by the conservation restrictions applied to buildings where bat species in Annex II of the Habitats Directive roost to hibernate or reproduce.

To receive the subsidy, the applicant must own a building used by at least 10 adult reproductive bats or 20 adult hibernating bats. In return, the

owner must agree not to disturb the bats when they occupy the roost. The annual subsidy is ca. 35 euros for each adult specimen, up to a maximum of ca. 1500 euros, but may vary according to fund availability.

Subsidies are provided following an official application by the building's owner, and a site survey to check that the situation deserves funding.

Available data, corresponding to four years (1998-2001), show that in this way 35 colonies were protected, in all numbering 1529 bats, by means of an expenditure of ca. 33500 euros.

Each of the protected colonies was made up of bats of one species, in 93% of cases *Rhinolophus hipposideros*, in the remaining situations *Myotis emarginatus*. This strategy has led to the discovery of new *R. hipposideros* sites, and to the protection by subsidy of 44% of known colonies, including the most important ones known for both species (Agirre-Mendi, 2003).

A second regional project worth mentioning was the three-year (2005-2008) EU Life Project "Conservation of endangered bats in Extremadura".

Promoted by the Agriculture Council and the Environment Ministry of Extremadura, the project aimed to protect and increase bat populations in that region, and minimize the impact of existing threats (SECEMU, 2006). A main target of this project was the protection of the largest known European colony of *Rhinolophus ferrumequinum* roosting in a Monastery (Real Monasterio de San Jerónimo en Cuacos de Yuste), along with another 11 species (SECEMU, 2006). The Monastery is also part of the World UNESCO Heritage, and some of its art treasures are being put at risk by the accumulation of bat droppings.

3.2.3.3. Monitoring and Data Storage

As seen above, monitoring and data storage systems in Spain vary strongly according to the region, as such systems are often supported by separate projects developed within the Autonomous Communities. When the national database was set up (Paz and Benzal, 1991), 333 roosts (buildings, trees and underground sites) were included. All sites were surveyed three times a year (spring, summer, and winter) to determine colony composition. Roosts were then classified by their importance

following Paz *et al.* (1990), by their ecological function (reproduction, hibernation, or transitory), and by their type (tree-, house- and cave-dwelling bats). Such data are property of ICONA.

Within the La Rioja project, in which the owners of roost buildings are subsidized, such sites are also surveyed each year. The number of subsidized roosts is constantly increasing thanks to numerous reports submitted online by citizens (Gobierno de La Rioja, 2006).

3.2.4 Switzerland

3.2.4.1. National Law

All bats are protected in Switzerland. The federal law for the protection of nature and the landscape (LPN) of 1st July 1996 sets out all necessary measures to be taken to avoid the extinction of native species (LPN section 18) and the Application Act of LPN (OPN, 16th January 1991) declares that all bats are protected (OPN, section 20). It is thus forbidden to kill or capture bats, as well as to alter or destroy their breeding sites (section 20 par. 2). The relevant authority may nonetheless issue permits for “technical interventions in a given place” (meaning in a given roost or reproductive site) in cases of outstanding public interest. However, even in these cases the best protection measures, or adequate compensation actions, should be taken (OPN section 14 par. 5, section 20 par. 3; LPN section 18, par. 1). No toxic substances which may harm bats can be used (LPN section 18 par. 2).

Bats are also protected by the Convention on the Conservation of European Wildlife and Natural Habitats of 19th September 1979 (known as the Berne Convention) which was ratified in Switzerland and became effective in the country on 1st June 1982. The Convention protects the reproductive sites of most bat species (section 6) and forbids the disturbance of these species during hibernation (Moretti and Maddalena, 2001).

3.2.4.2. Relevant Organizations

The different cantons of the Swiss Confederation are responsible for the

application of law. In the 1970s and 1980s, after the LPN was promulgated, a few cantons started conducting roost surveys and prepared inventories of the bat fauna of their territories.

We will describe the situation in the Ticino Canton since it is representative of all cantons.

In the Ticino Canton, the first thorough study of bats was carried out in 1989 (Haffner and Stutz, 1989). After that, Moretti and Lucchini (1992) carried out a pilot study that led to a project named “canton inventory of bat roosts” being officially accepted by the state council. The Ticino Centre for the Protection of Bats (CPT), in cooperation with the Federal Office for the Environment, Forests and Landscape, the Cantonal Office for the Protection of Nature (Bellinzona Department) and the Swiss Coordination Center for the Study and Protection of Bats (Zurich) prepared this inventory to:

- locate and describe roosts in public property sites
- identify the ecological role of such roosts, i.e. the species present and the phenology phase observed there
- develop criteria to assess the relative importance of sites (national, cantonal, local)
- develop strategies to protect roosts
- rank priorities to preserve species, habitats and geographical areas
- propose a programme to apply the inventory to the protection of species and roosts.

The inventory document also provides guidelines on how to protect colonies in buildings if renovation or maintenance work is needed, which can be summarized as follows:

- report planned works to the Office for the Protection of Nature (UPN) when they involve bats in buildings
- do not disturb the animals between April and September
- do not use toxic chemicals for timber treatment, or use timber that has been previously treated
- maintain existing roosting sites, structures and micro-structures
- maintain the existing microclimate and the space available to bats, as well as all materials granting thermal insulation, openings, exits, etc.

As far as roosts in monument buildings are concerned, the Ticino Centre for the Protection of Bats has started an informal collaboration with the office for cultural heritage, department of territory, which manages funds for restoration works of monuments. Once or twice a year, this office informs the Ticino Centre for the Protection of Bats which monuments will be restored in the next few years so that the centre has time to ask for possible changes to projects without substantially altering the works and causing extra costs (M. Matteri-Roesli, pers. com.).

3.2.4.3. Monitoring and Data Storage

In Ticino, the conservation benefits obtained by maintaining the inventory and applying the above-mentioned protection laws are reached as follows:

- All owners of roost buildings and the relevant city councils are periodically informed of the status of colonies which are being monitored
- Relevant authorities, operators involved in the maintenance or management of buildings and other structures (bridges, caves, trees, etc.) hosting bats, and landscape authorities or managers (responsible for planning, environmental impact assessments, etc.) are informed of the occurrence of colonies

To enable site monitoring, contact with the owners of buildings is ensured, e.g. by periodically (every 4-5 years) sending them the monitoring data from their site. Roost sites of national or cantonal importance are surveyed every 3-4 years. The most important colonies are checked by counting bats or by carrying out a semi-quantitative assessment of droppings accumulated by the end of each season.

If works are needed on buildings hosting roosts, the following procedure is adopted:

- Assessment of projects at their onset
- Roost survey to identify the species present and evaluate site importance. We highlight that under Swiss law, the person responsible for works must take all actions necessary to protect the colony or provide

alternative sites. Although private house owners should therefore pay for the work of a bat specialist, cantons often help indirectly, by funding the activity of specialised bat teams (M. Mattei-Roesli, pers. com.).

- Discussion of project details
- Agreement with works director and owner of measures to take to save the roost and the colony
- Report to the surveillance authority (UPN)
- Assistance to works in all phases
- Verification of the effectiveness of protection measures adopted

The results of the cantonal roost inventory are stored in an electronic archive at CPT. The archive is updated continuously with data on new roosts, monitoring observations, works on buildings, etc. Once a year, all data are sent to the office for nature protection in Bellinzona (UPN) and to the Swiss Coordination Center for the Study and Protection of Bats in Zurich (KOF), which forwards the data to the Swiss Centre for the cartography of the fauna (CSCF). CSCF and KOF receive only data on roosts of known species, but UPN receive all data on roosts in public buildings. Hard copies of all archive records have been updated to 31st December, 2001. Faunal and site data are electronically archived in the CPT databank in Windows Access 7.0, compatible with systems at the Canton Museum of Natural History (MCSN), CSCF and KOF (Moretti and Maddalena, 2001).

3.3. Final Remarks on the Situation in Other Countries

The cases we examined demonstrate the rather heterogeneous approach to bat conservation within Europe. Germany and the U.K. both have long histories of bat research and monitoring, may rely on numerous centres that coordinate protection and bat studies, and are able to collect data and act professionally to solve conflicts due to bats in buildings. The presence of numerous volunteers is remarkable and allows an exhaustive geographical coverage otherwise difficult to achieve. Switzerland has not many groups dealing with bat protection, but those groups that do operate benefit from

the support of national and cantonal authorities, and can provide a detailed picture of roosts present in the country and conservation status of bat populations by carrying out systematic surveys and building up long-term data essential for the assessment of population dynamics and trends.

Spain has not yet joined the Bat Agreement and has only recently started to promote major conservation projects, some of which are very challenging, to protect bats in buildings.

In all countries, bat conservation management is devolved into the various regions. The advantages are several: local actions can be more effective, quicker, and more responsive to the needs of local communities. On the other hand, effective conservation requires common objectives and large-scale coordination that may be lacking when single regions can act autonomously, especially if habitats and species are the protection targets. Thus, local action should always follow a large-scale coordination, i.e. on a macro-regional or national scale.

In the U.K. and Switzerland, laws and regulations concerning bats in buildings also apply to private citizens, who have to pay for consultancy work or compensation measures. In Spain, as described above, subsidies are available in some areas to encourage private owners to share the responsibility of protecting bats in roosts, not only without facing expenses, but even while gaining economically from the protection of the bats.

Collaboration, from the early planning phases (e.g. in Switzerland), between building owners and governmental authorities in charge of managing cultural heritage, is also an effective way to optimize resource utilization and achieve major results agreed by all involved parties. The U.K. has national bodies for monitoring and protection, so that despite relying on a network of volunteers, monitoring is still effectively coordinated and standardized at a central level.

4. THE LEGAL FRAMEWORK IN ITALY

4.1. Bats and Italian Law: an Overview

Rules concerning bat protection, within the Italian national legal framework, are provided by the national law on wildlife and hunting of 11 February 1992, n. 157 (“Rules for the protection of homoeothermic fauna and hunting”), as well as by international agreements and conventions ratified by Italy (such as the Bern Convention on the Conservation of European Wildlife and Natural Habitats, the Bonn Convention on the Conservation of Wild Species of Migratory Animals, and the Agreement on the Conservation of Populations of European Bats, respectively ratified in Italy by law on 5 August 1981, n. 42 and 27 May 2005, n. 104) and by the Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (ratified in Italy on September 8, 1997 by Presidential Decree n. 357, integrated by Presidential Decree n. 120 of 12 March 2003).

Bats are also protected according to the rules governing environmental damage (Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage; Legislation Decree of 3 April 2006 n. 152, rules on environmental issues, part VI).

Such regulations establish strict principles of bat protection.

Law 157/92 defines as “especially protected” all animal species deserving special conservation efforts. Although not specifically mentioned, bats are covered by this definition, since according to section 2, paragraph 1, point c, all species listed as threatened in international conventions or directives are regarded as especially protected.

The Bern Convention establishes that “endangered or vulnerable species” deserve special conservation efforts (section 1, par 2); Annex II (“Strictly protected fauna species”) lists species requiring stricter protection, including all threatened ones. The Annex lists all European bat species except *Pipistrellus pipistrellus*.

More recently, the Habitats Directive has pooled endangered or vulnerable species with rare or endemic ones, defining all of them as of “Community importance”. Annex IV lists all such species requiring rigorous protection. All European bat species feature in the list; some of them (Table 4.1) are also listed in Annex II of the Directive as species whose conservation requires the designation of Special Areas of Conservation.

The Bonn Convention also highlights the importance of the strict protection of bats, recognizing their worrying conservation status in Europe (Annex II), and so does the Agreement on the Conservation of Populations of European Bats (hereafter termed the Bat Agreement). The aim of the Bat Agreement is to achieve the goals set by the Bonn Convention for bats. Bats are defined as being under serious threat from habitat degradation, roost disturbance and the use of some pesticides.

The importance of bat protection is enforced by the application of Council Directive 2004/35. It defines environmental damage, in several cases, as any direct or indirect damage to species and natural habitats protected at the community level, which results in the alteration of their conservation state (section 2, par 1, point a). All Italian bat species are protected according to this Directive, because it concerns (section 2, par 3, points a, b):

- Species in Annexes II, IV of the Habitats Directive (all species in Table 4.1 and in general all species of bat occurring in Italy);
- Habitats used by species in Annex II of the Habitats Directive;
- Breeding or resting sites of species in Annex IV of the Habitats Directive;
- Natural habitats in Annex I of the Habitats Directive, including habitats which play important ecological roles for bats.

The Directive was ratified in Italy by Legislation Decree 152/2006, which defines protected species and natural habitats as those mentioned in Law 157/92 and in Presidential Decree 357/97, i.e. as cases covered by the Habitats Directive.

Further details on the above laws and regulations are given by the Guidelines for Bat Monitoring, also available in English (Agnelli *et al.*, 2004).

Table 4.1 – Bat species currently present in Italy, or reported in the past for the country, for which the designation of Special Areas of Conservation is required according to EC/92/43 Habitats, Annex II.

Blasius's horseshoe bat	<i>Rhinolophus blasii</i>
Mediterranean horseshoe bat	<i>Rhinolophus euryale</i>
Greater horseshoe bat	<i>Rhinolophus ferrumequinum</i>
Lesser horseshoe bat	<i>Rhinolophus hipposideros</i>
Mehely's horseshoe bat	<i>Rhinolophus mehelyi</i>
Barbastelle	<i>Barbastella barbastellus</i>
Bent-winged bat	<i>Miniopterus schreibersii</i>
Bechstein's bat	<i>Myotis bechsteinii</i>
Lesser mouse-eared bat	<i>Myotis blythii</i>
Long-fingered bat	<i>Myotis capaccinii</i>
Pond bat	<i>Myotis dasycneme</i>
Geoffroy's bat	<i>Myotis emarginatus</i>
Greater mouse-eared bat	<i>Myotis myotis</i>

4.2. Laws and Regulations Applicable to Bats in Buildings

The main laws and regulations that may apply to bats in buildings are presented below. They have wide applications concerning the protection of species and their roosts, and surveying bat sites.

Only national laws have been considered, as mentioned in the previous section, but in smaller administrative sections of the country (regions or provinces) local rules may also apply, leading to stricter protection.

4.2.1 Protection of bats and their roosts

4.2.1.1. National Regulations

Bats cannot be killed, captured, kept in captivity or traded (sections 21

and 30, Law 157/92; section III of the Bat Agreement; Section 6 of the Berne Convention; Section 8 of Presidential Decree 357/97). Offenders will be prosecuted (section 30 of Law 157/92).

For both bats and other faunal groups, derogations from such interdictions can be obtained if it is in the dominant public interest, for example, for scientific research, conservation, the protection of agricultural, forest or fisheries resources, the protection of cultural heritage, or in the interest of public health and safety.

For bats, derogations are commonly issued for temporary captures performed by scientists. Rehabilitating bats are also allowed to be held captive; regions are delegated by national law to promulgate regulations on this matter (section 5 of Law 157/92).

Current law prohibits disturbance to bats, especially during reproduction or hibernation, as well as roost alteration or destruction (section 6, par III of the Berne Convention; section 8 of Presidential Decree 357/97). All types of bat roosts are protected, including reproductive, stop-over, and resting sites.

Although such rules are not enforced in Italy, serious violations may be prosecuted as a form of environmental damage applying to all bat species in Italy. In Annex I of European Council 2004/35 Directive (Annex IV of Legislative Decree 152/2006), criteria for rating damage as significant are stated, which may be applied to cases of damage to bat colonies. For instance, the significance of the loss of a breeding colony by strong and persisting disturbance, or by the alteration or destruction of a roost site, can be quantified by reporting on the number of bats present in the roost and the remaining number of reproductive colonies in the area, as well as by recalling the scientific knowledge available on the reproductive biology of the species involved (e.g. the maximum distance between colonies needed to sustain viable population)

The regulations on environmental damage apply to all professional activities listed in Annex III of Directive, and all other professional activities, in case of intentional offence or criminal negligence. Criteria and objectives to be followed, to repair any damage, are set out by Annex II of Directive (corresponding to Annex III of Legislative Decree 152/06).

Given the importance of sites forming part of the cultural heritage for bat conservation (such buildings are often major bat roosts), we highlight the fact that in such cases, special care must be taken in the application of the above-mentioned regulations.

In fact, the code for cultural heritage and the landscape (Legislative Decree 42/2004) mentions neither bats nor other animal groups, but recognizes the natural value as a feature to consider when selecting elements in need of protection (section 2).

More generally, legislation pertaining to the environment and to the cultural heritage share the main objective of conservation, and this results in shared operational procedures (e.g. criteria to evaluate the importance of an item based on historical analyses; caution in management operations; a primary interest in preserving valuable items for the benefit of present and future generations). In the light of such considerations, practical tools should be devised for carrying out integrated protection of biodiversity and cultural heritage.

This is the scope of a biannual agreement on bat conservation signed in 2006 by the Ministry of Cultural Heritage and Activities (General Direction for Landscape, Fine Arts, Contemporary Architecture and Arts) and the Ministry for the Environment, Land and Sea (General Direction for Nature Protection).

These Ministries are committed to cooperating for the protection of bats, for identifying common and agreed ways to operate, and for coordinating their respective activities.

As a direct result of this agreement, the present guidelines have been accepted as a reference tool that the local subdivisions of the Ministry of Cultural Heritage (called “soprintendenze”) may use when they are faced with problems associated with bat protection, and to optimise their interactions with institutions devoted to wildlife conservation.

4.2.1.2. Specific regulations for SCIs, proposed SCIs, and SACs

Further regulations to protect bats and their habitats and roosts are applied to sites designated as SCIs (Sites of Community Importance),

proposed SCIs, and SACs (Special Areas of Conservation), through the EC/92/43 Directive. Such regulations, according to sections 4 and 5 of Presidential Decree 357/97 as modified and integrated by Presidential Decree 120/2003 and summarized below, concern bat species listed in Annex II (Table 4.1) since their occurrence can, alone or in combination with other factors, lead to the designation of Natura 2000 Sites.

Once a site has been identified as a proposed SCI, regions and autonomous provinces of Trento and Bolzano must adopt appropriate measures to avoid the degradation of habitats and species (including bat roosts), and any interference with species, for which the site was identified. Once SACs are designated, the same institutions have to adopt any measures necessary to preserve the sites within six months, and must apply appropriate administrative or contractual regulations to reach this aim. Any intervention not directly associated with, or necessary to maintain a satisfactory conservation state of the species and habitats occurring at such sites, and which may have significant impact on the site, is subject to a Habitats Directive Assessment.

The assessment is based on a study aimed at determining and evaluating the effects of the intervention on the site, given the conservation objectives for which the site has been designated.

Since one of these objectives is to preserve the bat species listed in Annex II, the assessment must especially target such species. As part of the assessment, a report is made by a bat specialist. The report includes the measures which need to be taken in order to minimize the impact on bats. If, despite the proposed mitigation or compensation, the impact on bats remains significant, the planned intervention should not be carried out unless special reasons of public interest, such as social or economic benefits, exist. If this is the case, major compensation actions should be requested.

Because bats are highly mobile, impact assessments should extend to areas outside Natura 2000 sites which are used by bats occurring within the sites. For instance, an assessment should be made for a site hosting an important bat colony which is not within in any Natura 2000 site, if the foraging grounds of the bats are within such a site. Clearly, any impacts on the colony would cause a decline in bat occurrence in the protected area.

4.2.2 Institutions enforcing the laws and regulations protecting bats

Many different institutions are tasked with checking that Law 157/92 (enforcing the Berne Convention in Italy) and related regional laws are respected: police forces of local institutions; volunteers for game species or environmental vigilance whose associations are members of the technical committee for wildlife and hunting, or environmental protection organizations recognized by the Environment Ministry; agents from the State Forestry Corps; park rangers; private guards authorized by the laws on public security; and ecological or animal welfare guards recognized by regional laws (section 27 of Law 157/1992). Criminal offences (such as the killing, capturing, keeping in captivity or trading of bats) can be prosecuted only by criminal investigation officers.

When live or dead specimens are seized, officers should deliver them to the local, official institution in charge or, when relevant, to a body dealing with the rehabilitation of bats and/or their subsequent release into the wild (section 28 of Law 157/1992).

The State Forestry Corps, the regional forestry corps and other bodies in charge of environmental surveillance (section 15 of Presidential Decree 357/1997, modified and implemented by Presidential Decree 120/2003) are tasked with ensuring that the EC/92/43 Habitats Directive is respected.

We have seen that the law on environmental damage may be applied to the most serious violations. In these cases, the identification and assessment of damage are carried out by the Ministry of the Environment, which may stipulate specific contracts with private or public bodies which have a high scientific profile (section 299, part VI, Legislative Decree 152/2006).

The law (sections 104 and 105) sets out who is legally responsible for reporting on environmental damage which is imminent (or has already occurred); Regions, Autonomous Provinces, local bodies, and physical or juridical persons that may be, or have been, damaged, can report (section 39) to the Ministry through the prefect's offices. NGOs for environmental protection may also report on the damage (section 13 of Law 349/1986).

For the assessment of damage, as well as for the application of conservation and punitive measures, the Environment Ministry can

delegate to the local Prefect, and be supported by the State lawyers, the State Forestry Corps, the police force, and all other relevant institutions. Technical analyses and damage assessment may be carried out by the Ministry itself, by other bodies involved in the trial, or by consultant specialists (section 312).

Checking that all regulations protecting bats have been fulfilled is sometimes difficult because bat surveys can only be carried out by qualified specialists. According to the Bat Agreement, the Party States are committed to identifying a relevant consultant body for bat conservation and management, especially as far as bats in buildings are concerned (section III), so the Italian Government should officially designate such a body. This designation is in fact one of the tasks of the Institute for Environmental Protection and Research (ISPRA) as far as wildlife in general is concerned (Law 157/92, section 7).

4.2.3 Regulations concerning bat research and monitoring

Because of the threats to bat populations, existing laws highlight the importance of scientific research and monitoring for conservation. Presidential Decree 357/1997, modified and implemented by Presidential Decree 120/2003, establishes that the Regions and the Autonomous Provinces of Trento and Bolzano must report every year on the monitoring and conservation status of all species of community importance to the Environment Ministry, which every six years must report to the European Commission on this matter (reporting started in 2007 – section 13).

Most Italian bat species roost in buildings, so that population size is estimated by counting bats in roosts, and conducting bat surveys in buildings is a crucial way to fulfill EC monitoring requirements. Because many important bat colonies are found in monuments, relevant bodies (local offices for cultural heritage such as the “Soprintendenze” and the regional offices) should support bat specialists by issuing permits allowing them to access such sites and report on the occurrence of bats.

Presidential Decree 357/1997, modified and implemented by Presidential Decree 120/2003, also established that the Regions and the

Autonomous Province of Trent and Bolzano should report annually to the Environment Ministry on continuous monitoring of captures and accidental killing of bats (section 8). This monitoring is related to bats in buildings, because when bats accidentally become trapped in buildings, this results in their death frequently enough for this issue to deserve adequate attention in the law.

Monitoring of such deaths is virtually impossible when bats are trapped by structures which are difficult or impossible to inspect. For instance, cavities inside lamp posts and bridge and motorway piers sometimes attract and trap bats, which cannot exit because of the smooth inner walls of the cavity. Most other cases, such as bats in houses, lead to frequent reporting from people – a major information source.

Once trapping of bats has been confirmed, data reporting is important because the Environment Ministry is legally committed to promoting investigations and determining measures to ensure that capturing or accidental killing have no significant negative impact on the species involved. This means that, for instance, structures or materials harmful to bats could be banned.

Further commitments for bat surveys in buildings and corresponding reporting at an international level stem from the Bat Agreement (see related issues in the periodically updated Eurobats Action Plan, and several resolutions adopted by the Agreement's Meeting of Parties). Further information is available at <http://www.eurobats.org/>.

5. ORGANISATIONS INVOLVED AND SPECIFIC PROCEDURES

5.1. People in charge of applying laws concerning wildlife

People responsible for vigilance and the application of laws concerning wildlife (paragraph 4.2.2) are committed to dealing with bats actively, so that all offences to individual bats or their (natural or artificial) roosts are prosecuted.

However, bat protection has been long neglected, due to the insufficient numbers of people charged with vigilance, and the general tendency to concentrate protection efforts on other species such as game animals or charismatic vertebrates, which are often far less threatened than bats. Difficulties in obtaining sufficient information on the ecology of bats and on the most appropriate conservation measures for these little-known mammals have also influenced this situation.

The recent EU conservation policies, and the transformation of the local “game and fishery” offices into “wildlife protection” services, have also been paralleled by the implementation of local projects aimed at preserving mammalian species of no value for hunting, but with special conservation significance. Although most efforts have been directed towards large, iconic mammals such as wolves, bears, lynxes and otters, some projects have also been focused on bats, which are less well-known to the public but include many management-dependent species. In the Red List of bats recently prepared for Italy (GIRC, 2007), 11 species were listed as vulnerable, 5 as endangered and one as critically endangered.

Thus, more efforts are needed to protect bats in Italy, and useful examples for application to a wider geographical area are provided by case-studies of local conservation and surveys.

For bats in buildings, laws and regulations protecting individual specimens and roosts must be applied as described in paragraph 4.2.1. To maximize conservation benefits derived from the often limited available resources, special attention should be devoted to identifying and protecting colonies that, in buildings, roost in large spaces and are thus easily detected

since bats do not hide in crevices but are clearly visible. In most cases, such colonies are formed by species of high conservation value.

In many cases such roosts are found in rooms or attics seldom frequented by people, so their protection should, in theory, be easier: buildings used for such roosts are historical ones (castles, palaces, towers, churches, bell towers etc.) or, more rarely, schools, hospitals or military buildings. In practice, when renovation works are planned, a preliminary survey of sites potentially used by bats is advised, prioritizing the attics and underground spaces of monumental buildings.

Staff knowing the basics of bat surveys (where to look for bats, how to identify droppings or other signs of presence) may be very helpful. Basic information can be acquired quickly, even through a one-day workshop.

As well as making sure that the law is applied correctly, active protection of bats in buildings may also involve working to solve problems occasionally caused by the presence of such mammals. Although this problem-solving is not required by law, neglecting it may expose the bats to conservation risks.

Besides, since wildlife is classed as ‘non-available state heritage’ according to Law 157/92, the State, i.e. its relevant bodies, should deal with conflicts caused by bats in buildings.

The services for wildlife protection of the local government institutions (Provinces), the State Forestry Corps, and the organisations managing reserves – depending on local conditions – should provide citizens with the necessary technical expertise to solve any problems caused by bats. In fact, this is often quite simple, because most problems are solved by providing information to members of the public, i.e. without specific surveys. The officers in charge can be trained very easily to answer public requests, since informative material is readily available (e.g. on the internet).

There are still cases, of course, which require a site survey, and specific situations that, due to their complexity or special conservation significance, require the advice of a bat specialist.

All operators are advised to be vaccinated against rabies (see paragraph 5.6).

5.2. Local offices for the protection of cultural heritage (*Soprintendenze*) and other bodies with similar scopes

When preparing the present guidelines, we considered three main points, agreed by the Ministries involved, and detailed in the Agreement they signed in 2006:

- Special importance should be given to protecting bats in buildings or sites which form part of the national cultural heritage;
- All bodies dealing with the management of cultural heritage buildings and monuments should be adequately informed about the issue;
- The institutions devoted to the management of this heritage and those managing wildlife should define agreed strategies for the optimal management of bats in buildings and related conflicts.

The first common initiative taken by the two Ministries was to send all local offices for cultural heritage (*Soprintendenze*) a document providing ecological and legal information on bats, and a questionnaire on the occurrence of bats in the buildings they manage.

The *Soprintendenze* will be provided with information (e.g. these guidelines), and meetings and other fora to discuss the issue will be encouraged. To allow such offices to deal with some of the problems caused by bats in buildings autonomously, they will be given information on how to record the occurrence of bats, which strategies are most effective for protecting colonies, and how to solve some conflicts, such as those caused by bats entering rooms frequented by people, or by the accumulation of droppings.

If the necessary skills are not developed by the staff of the local offices for cultural heritage, or if no resources are available (due to too few staff, lack of time, etc.), the local institutions in charge of wildlife management should be contacted.

The most complex situations, such as the activation of burglar alarms by flying bats (the management of which often requires information on flight paths obtained by using bat detectors or infra-red video-cameras) and, in general, situations involving species of major conservation importance, should always be handled by a bat specialist.

The Soprintendenze should be able to make a preliminary assessment and select the most appropriate solution or people to deal with each specific case.

The operational procedure presented in these guidelines may be an effective tool to deal with the need to solve any bat-related problems. It is founded on two main concepts:

- Current laws rigorously protect all bats and their roosts, whatever natural or artificial, and the law must also be respected in buildings or sites which form part of the national heritage according to the Legislative Decree 42/2004;
- Wildlife, which includes bats, is part of the State heritage, and the State itself should solve any conflicts it causes.

Therefore, there are clear responsibilities for both the local offices for cultural heritage (the above-mentioned Soprintendenze and the regional offices and those in charge of wildlife management (province offices, reserve staff, and State Forestry Corps).

To protect bats and develop effective management plans to avoid or minimize impacts on them, all works or activities potentially harmful to bats should be carried out only after a specific assessment by a bat specialist has been made, which should highlight threats and identify alternatives compatible with the persistence of bats at the site.

It is important to note that bat specialists have very specific training and expertise, so they cannot be replaced by a general zoologist or someone whose experience with bats is limited. Zoologists assessing issues relating to bats should have a thorough knowledge of bat biology, taxonomy, ecology and conservation. Future initiatives by the Environment Ministry such as workshops and training courses for zoologists, to improve their knowledge of bats and specific management issues, would be most welcome.

Expenses for studies and assessments should be paid by the people or institutions responsible for the site, as follows:

1. In SACs designated according to Presidential Decree 357/1997, the impact assessment should be paid for by the party commissioning the

assessment (section 5 of Presidential Decree 357/1997 and relevant modifications and implementations);

2. In the other cases, responsibility for bearing the cost of specialist work lies with governmental bodies, which should also pay for all consequent actions or works recommended by the specialist. This is also the case for private buildings or sites, since bat conservation is in the public interest.

To safeguard and maintain the cultural heritage, owners of sites or buildings, the Soprintendenze, or the regional governments may contact the institutional bodies in charge of wildlife protection (specific provincial offices, State Forestry Corps, reserve managers), which should do their best to solve any conflict.

In cases of special complexity and/or outstanding conservation importance, a bat specialist should be employed.

In recognition of the importance of protecting both the environmental and the cultural heritage, the Ministry for the Cultural Heritage and Activities, and the Ministry for the Environment, Land and Sea may operate, each in their own specific areas, to carry out actions in cases of outstanding conservation significance or to provide examples of best practice.

The procedure described here is a crucial step towards protecting bats, an area so far neglected. However, not all possible situations, only those with a high probability of impacting bats, are dealt with here.

Although there has been an increase in bat research in recent years, the information on bats available for Italy remains limited, so many cases of bats in buildings probably remain unrecorded. It would therefore be useful to analyze the potential impact on site structure and microclimate of planned works or management actions, even where no bats are reported but the site may be suitable for roosting. However, this approach currently appears to be unfeasible.

A more realistic objective is to identify and effectively protect all bat colonies in buildings and, should this be requested by owners or responsible institutions, to survey further, potentially suitable, sites.

The procedure offers the possibility of going well beyond problem-solving. Some of the recommendations provided are aimed at excluding

feral pigeons from sites where bats occur, since the presence of pigeons is harmful to both bats and monuments or buildings. We hope that this document will be widely used to improve knowledge and raise public awareness on the environmental and cultural value of bats.

5.3. Construction professionals

Violations of laws protecting bats during construction work most often occur because both legal and conservation issues regarding bats are ignored. To counter this, construction professionals should be adequately informed about the legal framework (paragraph 4.2.1) and the effects of construction work on bats, and be provided with advice on how to minimize the impact of any work carried out. Information bulletins for such professionals (architects, engineers, etc.) could present succinct notes on the most common legal issues (e.g. bats cannot be killed or disturbed, their roosts should be preserved), and mention the present guidelines for providing technical solutions respectful of the law.

In general, those who plan or supervise the works should be informed that:

- A work schedule respectful of bats' life cycle is very important. With some exceptions, bats use buildings at certain times of the year, and their sensitivity to disturbance varies during the year (it is highest during hibernation and at the time of parturition);
- It is possible to preserve spaces used by bats, and to find a balance between conservation and use of the site by people;
- Openings used to access or exit the site by bats should be preserved and, when necessary, can be fitted with barriers to feral pigeons;
- Some chemicals to treat timber are harmful to bats, but safe (for bats as well as humans) alternatives are available;
- Some structures may act as traps for bats by blocking their exit and leading to the death of many animals, but safer alternatives can be used;
- Internal or external illumination of spaces used as roosts or openings must be avoided, because light disturbs bats;

- Certain burglar alarms interfere with bat activity, leading to problems both for bats and the effectiveness of the alarms, but alternative devices can be used;
- Placing structures in buildings (houses, bridges, viaducts) or providing spaces, in the course of the works, that may be suitable roosting sites, increases the attractiveness of a building for bats and is simple. Technical advice is available on the internet.

It is important that even when no expertise on bats is available, people in charge of the works are able to identify situations of special conservation value.

Most bats in buildings use small spaces to replace natural roosts such as rock crevices or tree cavities. These spaces are largely available even in modern buildings, and in most cases species roosting there are of lower conservation concern.

In contrast, bats using large spaces (rooms, attics, etc.), are often species of high conservation value. They generally roost hanging from the ceiling so their presence is seldom overlooked. At the times of year when they do not use the roost, droppings beneath the roosting site may still be clearly visible. The identification of bat droppings is generally straightforward, but does require more observational skills than the identification of bats. Therefore, we recommend prudence when working at sites where bats are not seen (they may be roosting elsewhere at that time, but use the site in other months) but environmental conditions appear to be suitable for bats. Large spaces such as attics or cellars, which are subject to little disturbance, are dark, and have suitable temperature and humidity levels and low airflow, in monument buildings (castles, churches, palaces, bell-towers, etc.), are likely to be used as roosts by rare species.

In the Operational Procedure agreed by the Ministry for Cultural Heritage and Activity and the Environment Ministry, best practice approaches for dealing with such situations are recommended.

Some structural interventions recommended in the procedure should be incorporated in the work-plan by the architect or technician in charge. Planning safe solutions for bats is very important because it avoids situations that, once the works are over, may be much more difficult or

expensive to deal with. Not all large spaces used by bats are found in heritage sites. Stables, even modern ones, are not subject to the operational procedure but may host reproductive colonies (e.g. those of Geoffroy's bats); and similar situations may occur in schools, hospitals, military buildings or cemeteries. The person responsible for planning or supervising the works should report the presence of bats to the relevant offices or services (provincial offices for wildlife management, reserve managers, or State Forestry Corps). The latter should provide the information needed to protect the colony, and should, if necessary, involve a bat specialist.

The most common situations involving bats in buildings and construction professionals are presented below, with recommendations about how to deal with them. In the simpler cases, management actions can be carried out by construction professionals; in the most complex cases, the institutions in charge of wildlife management or bat specialists should be contacted and asked to identify the best procedures. The same recommendations apply to owners of buildings who commission works that may harm bats.

5.3.1 Procedures for construction professionals, relevant administration services and owners

Buildings or other constructions protected by the Ministry for the Cultural Heritage and Activity and subject to operations such as those described in the Operational Procedure (Chapter 4).

Owners, Soprintendenze, relevant regional governmental bodies, project designers, and workers should respect the Operational Procedure agreed between the Ministry for Cultural Heritage and Activity and the Ministry for the Environment, Land and Sea.

Buildings and other constructions not protected by the Ministry for the Cultural Heritage and Activity or, if protected, not described as castles, palaces, towers, fortifications, churches, abbeyes, bell-towers, ancient aqueducts, necropolises, catacombs, historical rural buildings, ice stores, tanks, rupestrian settlements and underground sites, used by bats hanging from the ceilings of inner spaces (attics, underground spaces, rooms), in which works have to be

carried out, or the site use has to be changed, in areas where bats roosts or fly.

Report on the matter to the service locally responsible for wildlife management/protection (e.g. provincial services for wildlife protection, reserve directions, or State Forestry Corps); copy the report to the Ministry of the Environment, Land and Sea. The relevant institution will commission an assessment by a bat specialist. In some cases (e.g. buildings within or near Natura 2000 sites or proposed sites) a Habitats Directive Assessment is necessary, and a specific assessment for bats is needed.

Buildings and other constructions not protected by the Ministry for the Cultural Heritage and Activity or, if protected, not described as castles, palaces, towers, fortifications, churches, abbeys, bell-towers, ancient aqueducts, necropolises, catacombs, historical rural buildings, ice stores, tanks, rupestrian settlements and underground sites, used by bats roosting in small spaces or crevices (roller shutter boxes, space beneath rain gutters or wall coatings, etc.), in which works have to be carried out in the spaces used by bats.

Apply solutions recommended in the guidelines (see Chapter 8).

Other problems caused by bats (accumulation of droppings, bats entering rooms used by people, bats found dead or moribund, etc.).

Contact local institutions in charge of wildlife protection (where applicable, wildlife protection services of provinces, reserve directions, or State Forestry Corps). They will have to cover all consultancy and intervention expenses.

5.4. Local administration bodies and agencies responsible for construction and urban planning

Paragraph 5.5. pertains to roads. Here, we will deal with other aspects of infrastructures and constructions managed by technical offices, and the public administration services responsible for construction and urban planning.

The way the latter operate has profound implications for the conservation of bats in buildings. Public administration services should contact local institutions dealing with wildlife management whenever an activity takes place which is potentially harmful to bats (see Chapter 4).

In Paragraph 5.3.1., simple guidelines on relevant actions for the most common situations concerning bats in buildings were presented.

Special attention should be devoted to bats if works or use change occurs in large attics or cellars kept undisturbed for long periods, as is often the case in public buildings, e.g. schools or hospitals. Such spaces might be colonized by bat species of high conservation value. Should there be evidence of bats hanging from ceilings, the institutions locally in charge of wildlife protection should be notified immediately (when applicable, also inform the wildlife protection service of provinces, technical staff of parks, rangers, and State Forestry Corps). They should provide the information needed to safeguard the bats, also by getting advice from bat specialists.

For cultural heritage buildings, the Operational Procedure agreed by the Ministries for Cultural Heritage and Activity, and the Environment, Land and Sea should be applied (see Chapter 8).

In the various regions, local governments may promulgate territorial laws and regulations for landscape planning: this may influence bat conservation.

As mentioned earlier, some features of buildings and accessories may interfere with bats or even cause their death, whereas others may favour the presence of bats.

Since decisions and rules adopted by the public administration in urban planning and construction may favour useful or harmful features of buildings, such institutions contribute to the fate of bat populations even if wildlife management is not their duty.

Examples, unfortunately mostly of harmful actions, are provided by the construction regulations of city councils, and the common obstruction of openings used by “undesired” animals.

Within the regional legal frameworks for construction and land use or protection, reference regulations have been defined for implementation and adoption at a more local scale: that of the city council.

The sections of such regulations dealing with the environment in which buildings are set and building features allow city councils to use the original text, often with potentially harmful implications for management-dependent wildlife. For instance, although intended for species not relevant for conservation, the sections dealing with the obstruction of openings potentially used by animals often do not specify the allowable target species, and are too generic to allow the exclusion of pest species but not bats.

The construction regulations of Florence city council state that “in existing or future buildings, specific features are needed to avoid rodents, flying animals or animals in general gaining access” (section 102). In Turin: “in all new buildings as well as those undergoing renovation, technical features should be adopted to avoid the entrance of rats, flying animals or pest / harmful animals in general” (section 42).

The regulations in Milan are more precise: feral pigeons are identified as the species to exclude (section 4), but as in Florence and Turin, measures applied are likely to be harmful to a lot of species, including bats, because airflow conduits of attics not inhabited by people or of spaces beneath roofs, etc. are required to be protected with grills or fine mesh nets (section 42).

To fulfill the requirements of international (especially EU), national and regional laws on wildlife protection, such exclusion interventions should be selective, only targeting feral pigeons and, possibly, murid rodents. Non-selective interventions clearly violate protection laws and pose serious threats to bats. It is paradoxical that the penalties for violating city council regulations are much more serious (up to 2,500 euros) than those for harming bats, since in the latter case there is either no law enforcement (such as for alteration of roost sites) or crimes are difficult to detect (such as when bats are trapped in roosts by obstructing exits).

The relevant local government bodies should therefore adapt their regulations to current scientific knowledge and protection laws, and offer straightforward guidelines for citizens. Simple technical solutions adopted in new buildings and in renovation, maintenance or insulation works could be beneficial both for bats and public hygiene, and may even favour the presence of threatened wildlife.

Another key issue is the night lighting of monument buildings. In recent

decades, increasing numbers of monuments are artificially illuminated, in order to emphasize their public perception. Although people's attitude towards illumination is often positive, and it is seen as a way to promote sites culturally, concerns have been raised about both the energetic cost of lighting and the impact of light pollution.

In the Lombardy Region, for instance, the current law pertaining to illumination of buildings (regional law 17/2000 and subsequent modifications) limits the size of the illuminated area, light intensity and duration of illumination (lights must be switched off by midnight – section 6 of law). One of the law's aims is to protect the ecological equilibrium both within and outside protected areas, but no specific ecological component is mentioned.

Simple changes to this law might make it work successfully to protect bats too. Lights directed towards roost sites and entrances have serious consequences. As well as disturbing bats, which may even abandon the site, they lead to incorrect perceptions of circadian rhythm in bats (and, in turn, to shorter feeding times), with detrimental effects on life expectancy.

By establishing that roost sites have to be sheltered from light, regional laws might become an important conservation tool, leading more local government bodies to apply such limitations to the territories they manage.

Further useful recommendations to be considered for laws, regulations and planning guidelines are as follows:

- discourage or forbid structures or urban features negatively impacting bats, as well as timber treatment chemicals known, or suspected, to harm bats, favouring the use of safer alternatives;
- avoid unnecessary artificial illumination of streets, squares, etc. and in all cases use low-pressure sodium lamps rather than high-pressure ones or mercury lamps. The latter attract insects: although some bats exploit such unusually high prey concentrations, most species perceive lights as a barrier or avoid light in order to avoid predation by birds of prey relying on vision for hunting;
- avoid, in public offices, burglar alarms interfering with bats;
- encourage construction practices which increase roosting opportunities (in houses, bridges, viaducts, etc.);

- grow native plants in green areas, and retain old or dead trees.

As well as benefiting bat conservation, these strategies also have a high demonstrative value, encouraging other local administrations or citizens to take similar initiatives. For private citizens, financial subsidies or tax relief from Regions, in return for actions targeting bat protection, would greatly help.

The proposed initiatives would raise awareness about the value of bats in urban biodiversity, and form part of larger actions aimed at favouring other management-dependent species such as falcons, owls, martens, swifts, etc. whose presence is an index of environmental quality.

5.5. Bodies involved in the management of road network infrastructures

The suitability of a building as a bat roost depends on its structure and microclimate, but the importance of a roost depends on its position relative to other roosts used by the same species. If several roosts are available over a small area and colonies are well connected by gene flow, the damage resulting from the loss of a single site may be limited. However, when the distances between sites are great enough to interrupt gene flow among the remaining colonies, such a loss may even lead to local extinction.

In general, spatial clustering of roosts allows bats to switch to another roost should a roost be subject to disturbance or other forms of interference (but the degree of roost fidelity may pose limits to this option), whereas large distances between roosts have implications for gene flow and functionality of the spatially discontinuous ecological network (Cavallini *et al.*, 2002).

An appropriate spatial patterning of roost locations favours movements, improves colonization of new areas, and enhances intra-population gene flow.

Within this context, we highlight the value of all infrastructures located along the main railway or road networks (such as abandoned buildings, houses, storehouses, bridges, and other buildings), which are rarely or never

entered by humans, and which may offer many, and often high-quality, roosting opportunities to bats.

5.5.1 State railways

The Italian railways owns thousands of buildings spread throughout Italy. Many of them are no longer used, and their maintenance conditions vary from case to case. Especially those not close to the railway are sold to be renovated as houses. However, 840 buildings cannot be used as houses since they are closer than 4.5 m to the railway (*case cantoniere* or *caselli ferroviari*). They are more promising for bats. They are generally two-storey buildings, with 2-8 rooms. In most cases they are no longer used and are thus potentially good bat roosts.

Ceilings are often smooth so bats cannot hang from them, but when present they are found hanging from shelves, light fittings, etc., or hidden in wall cracks or crevices. Passing trains do not seem to disturb bats. These



Figure 5.1 – Abandoned railway buildings – note walled up doors and windows.

buildings are not maintained by the State railways, even if the roof starts to collapse. The only works generally carried out are to ensure the safety of the structure, or keep unauthorized people out of the buildings, which are mostly fenced and have their windows walled up (Figure 5.1).

When only ground floor access points are blocked off, the buildings are suitable for bats (in contrast, when all access points are closed, of course the building is not useful for roosting).

Bat researchers made contact with state railway staff in Florence and Bologna, to develop a project aimed at analysing bat community composition and devising conservation measures to be carried out in the Prato Province by Florence Museum of Natural History. The aim was to raise awareness of the potential value of such buildings for bats. Railway staff showed an interest in conservation and in collaboration with researchers.

5.5.2 Motorways

The Italian motorway network is ca. 5,600 km long, and is mostly the responsibility of Gruppo Autostrade, but management is carried out by eight societies. Bridges and viaducts are the only infrastructures relevant for bat roosting; they are managed by the company *Spea Ingegneria Europea S.p.a.* Given the involvement of several companies, it is difficult to estimate the number of bridges forming part of the motorway network: 3000-4000 are estimated, but to give a more precise idea, in Tuscany alone there are 500 bridges, all managed by *Spea*. Of them, only ten have large inner cavities possibly suitable for bats. The latter are regularly checked; after repeated colonization by feral pigeons and expensive cleaning up, in the '80s their access points were closed with 1x1 cm mesh-size nets. Unfortunately, they exclude bats as well as pigeons. We highlight that it is possible to make such spaces available only to bats, and thus to avoid to accumulation of pigeon droppings. The officer in charge of *Spea* for Tuscany informed us that no worker has ever come across bats in such sites or in other motorway infrastructures. Of course bats in small spaces are likely to be overlooked by non-specialists, however. Inspecting such sites

would offer an important chance to identify those bridges which may be useful bat roosts, but the high numbers of sites would require significant co-operation from the companies in charge of site management.

5.5.3 ANAS Azienda Nazionale Autonoma delle Strade (Autonomous national road company)

The company called *ANAS S.p.A.* is responsible for 27,000 km of state roads and motorways. State roads they manage cover an overall network of 20,000 km, plus another 1,200 km of motorways managed directly by ANAS.

The typically red ANAS roadworkers' houses were built to host the staff employed for road maintenance and are found along all main "historical" state roads (Figure 5.2). Tools used for maintenance works are also stored there. In the surroundings there are also garages and storehouses.

In the '80s, due to their excessive maintenance costs, many such buildings were decommissioned, especially in the most isolated places. Then, following the declassification of many state roads in 2001, more were decommissioned – some simply closed, others assigned to regional or provincial institutions. In this case too, because they are managed by different organizations, evaluating the actual number of roadworkers' houses is difficult. In Florence province alone, half of the 160 roadworkers' houses are now managed by the provincial government. These buildings vary in terms of structure and size. Ceilings are often not favourable to bats, as their structure is the same as that in railway buildings. However, bats are relatively more common in roadworkers' houses, possibly because car traffic annoys bats less than passing trains, but probably because they provide more structures for bats to hang from or hide in.

Roadworkers' houses which have been shut are generally maintained by companies employed for that duty by ANAS.

Buildings associated with roads and railways provide good opportunities for bat conservation, but to make such structures (as well as bridges, etc.) available to bats, it should be noted that:

- Stabilization of buildings and their availability to bats are compatible.



Figure 5.2 – ANAS roadworkers' house.

All bats need is some open access points (flyways or climbing access points);

- In many cases, simple accessory structures with rough surfaces (e.g. wood, concrete – sawdust, refractory material) might greatly improve roost suitability in buildings or bridges (see Keeley and Tuttle, 1999);
- New construction practices should be adopted to increase roosting availability in bridges or viaducts, and to create new rooms and avoid smooth walls in small spaces which might trap the animals by preventing climbing.

5.6. People involved for various reasons, or improperly

When citizens are faced with bat issues, they often contact people not skilled in wildlife management who, in particular, should not handle bats,

such as firefighters, environmentalists, animal right volunteers, health offices, staff from zooprophyllactic institutes, vets, city council officers, and pest management staff.

Although all of them might greatly help to spread correct information on bats among their final users (e.g. by telling people bats are protected, innocuous and ecologically important), provincial wildlife services, reserve managers and the State Forestry Corps are the institutions officially in charge of dealing with such issues.

In special circumstances, specifically trained staff from pest management companies might well operate, e.g. to prevent guano accumulation or obstruct access points to roller shutter boxes, to prevent bats entering houses. They should of course refrain from handling bats, and more generally from disturbing bats and altering their roosts. The use of chemical or mechanical dissuaders must be ruled out: should they be effective (and in many cases the effectiveness is unverified), their use would be an offence in law, should they not be effective, it would be cheating citizens paying for the intervention. All actions involving the occlusion of roost access points are very likely to cause bat fatalities, especially among young bats unable to fly. Pest management companies are often inappropriately involved in such situations, so providing them with correct information is crucial. In some cases “problem bats” are dealt with by environmental associations or other bodies who may be in charge of wildlife rescue and rehabilitation following agreements with the official wildlife management institutions. In such cases, their staff should be well aware of how to proceed (information is available on the internet) and all people who handle bats should be vaccinated against rabies.

Rehabilitation centres should provide minimum standards of housing for bats. So that they can assess the effectiveness of their work, they should keep detailed records of all rehabilitation activities - especially their outcome. Dead specimens should be sent to official animal health laboratories for the detection of possible pathologies.

In the last few years, zooprophyllactic institutes and local government bodies have carried out limited monitoring for the presence of bat rabies in some areas of the country. All exams led to negative results. However,

bats are known to migrate over very long distances: since rabies has been detected in neighbouring countries (20 instances in France, 3 in Switzerland; Rabies Bulletin, 2007) the presence of rabid bats in Italy cannot be ruled out. Therefore, surveillance is needed and a significant number of bats, including those found dead or which died in rehabilitation centres, should be screened for rabies. Most importantly, health institutions should be aware that bats are protected by law. This means that the collection of wild bats and their sacrifice is forbidden, even in the case of apparently unhealthy specimens (which may be treated, and which in all cases are more likely to be affected by diseases other than rabies). Likewise, disturbance to roosts to collect infected dead specimens (that are, in any case, unlikely to be found) must be avoided, especially during crucial parts of bats' life cycle (hibernation or parturition).

Bats in buildings are an issue requiring an appropriate information spread. As highlighted by the WHO (http://www.who-rabies-bulletin.org/About_Rabies/Bat/General_Information.aspx), the occurrence of bats in buildings does not pose any health hazard to people living there or frequenting the building. Bat rabies is a significant risk only for those handling bats for professional reasons, who should be vaccinated against rabies.

Post-exposure treatment should be given to non-vaccinated people involved in potentially harmful contacts (bites or contact with oral membranes secreting bat saliva). Should rabies be found in Italy, colony eradication will not become acceptable. In countries where the virus is present, bat protection law is nonetheless respected. Besides, it is scientifically proven that destroying infected colonies is ineffective or even detrimental, since it may lead to increased dispersal of rabid bats. Positive colonies should be monitored by means of non-invasive techniques applied to live specimens (saliva testing, Mutinelli, 2005).

It is therefore vital that all surveillance actions are carried out by both health and environment or wildlife institutions, through agreed strategies involving bat biologists for specialist matters such as species identification.

5.7. *Vademecum* on bat protection and roost management for wildlife management staff

5.7.1 Introduction

The following *vademecum* can be adopted by technicians working with regional or provincial government institutions or other bodies dealing with wildlife management, especially State Forestry officers, province policemen and park rangers. In summary, it covers the most common issues regarding bats in buildings, and highlights situations requiring a survey or those when a bat biologist should be involved.

The cases, operational procedures and some of the solutions we consider here were decided upon partly by discussion among bat specialists that are members of the Italian Chiroptera Research Group. The document was modified after the document prepared by the regional bat centre of Piedmont (<http://www.centroregionalechiropteri.org>) was developed from local experiences. It offers a synthesis of the operational procedures and recommends websites for further reading.

As remarked above, a skilled bat biologist should be contacted to deal with more complex cases (if a specialist is not available within the staff of regional or provincial institutions). Workshops on bats in buildings might also be periodically held at a national level, targeting staff of private companies, survey personnel etc. to train them on how to deal with situations explicitly addressed in the *vademecum*.

To coordinate local initiatives effectively at a national level, a single regional reference organization should promote bat conservation. Proposals for funding consultancy or operational costs are also made in the *vademecum*, based on the following criteria:

- The State should act to solve problems caused by bats, since Italian law classifies wildlife as “State property”;
- People have the right to contact private companies (rather than public bodies) to solve problems caused by bats, as long as this is done in accordance with the law;
- Costs to citizens should be minimized, because bat conservation is in

the public interest (wildlife is protected in the interest of national and international community according to section 1 of Law 157/1992);

- Citizens' respect of the law protecting bats and their roosts should rely on co-operation rather than mere imposition, and financial tools supporting private efforts to safeguard bats should be identified;

Activities covered in the *vademecum* also include rescuing bats needing help and the management of dead specimens. Weak, injured or dead bats are often found in buildings that in some cases may act as a trap. Storing data on these situations and providing them to the relevant authorities is mandatory and should be done by public services in charge of wildlife management.

Surveying buildings for wildlife may also result in the discovery of colonies important for monitoring the conservation status of species of community importance, as requested by the EU. In this case too, effective co-operation between the surveying institution, the regional government, the Environment Ministry and the relevant European Commission is needed.

5.7.2 *Vademecum*

5.7.2.1. Law

Bats are specifically protected by law, and all violations will be prosecuted.

Sec. 2, point 1 c), Law 157/1992.

Killing, catching or holding bats is a penal offence punishable by imprisonment for 2-8 months, or a fine of 774 – 2065 euros.

Sec. 30, point 1, b), Law 157/1992.

Bats must not be harmed or disturbed, especially during reproduction or hibernation. Roosts must not be damaged or destroyed.

Chapter III, sec. 6, Berne Convention, ratified by Law 503/1981. Sec. 8, point 1, Presidential Decree 357/1997. Sec. III Agreement on the Conservation of European Bats, ratified in Italy with Law 104/2005.

Serious damage to colonies or roosts may be punished according to the law on environmental damage.

EC/2004/35 Directive, part VI Legislation Decree 152/2006.

Bats are species of community importance. Their conservation, as well as the capture or non-deliberate killing of bats, must be monitored over the whole country.

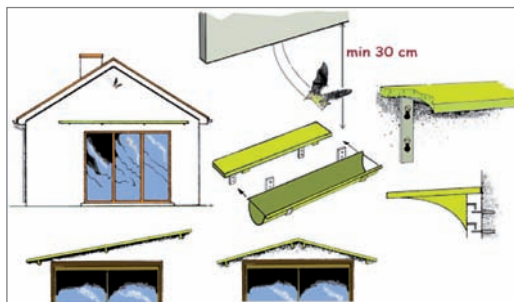
Annex B and D, sections 7 and 8 of Presidential Decree 357/1997 modified and implemented by Presidential Decree 120/2003.

5.7.2.2. Procedures

1. Problems reported by members of the public, due to bats roosting in a building.

Case A. *Roosting site has a small volume (roller shutter box, space beneath wall and open shutters, space beneath rain gutter or behind coating or rendering of roofs or walls, etc.).*

- *Problems related to accumulation of droppings.* Explain that bat droppings are harmless to humans, and are an excellent fertilizer. There are simple ways to avoid accumulation: remove droppings periodically, collect droppings on a plastic sheet, or in a box or plate (especially on windowsills), or protect structures with a deflector (e.g. wooden board or plastic sheet, see figure). In the latter case, a wildlife management staff member may need to visit, to illustrate the operation of the deflector. All these actions might also be taken by pest management companies certified (following specific courses) for bat management issues.
- *Problems related to the fear of bats.* Many people claiming they cannot stand the idea of having bats in their house change their attitude if appropriate information is provided. Explain that bats are



innocuous (they do not cling to one's hair; their presence is not a health hazard), precious controllers of mosquitoes and other insect pests, and their presence is mostly seasonal, limited to the summer months.

- *Extremely negative attitudes towards bats.* Should people suffer from extreme bat phobia, seek the advice of a bat biologist, who will assess the naturalistic value of the species or colony present and, when possible (for common species), and inevitable, will seal the entrance to roost at times bats are not present, and after derogation has been issued by the Ministry for the Environment, Land and Sea.

Case B. *Bats roost in a large space (attic, cellar, room), hanging from the ceiling.*

Seek a bat biologist's advice – the bats are likely to belong to species of great conservation value.

2. Bats enter rooms where people live or where activities are carried out which conflict with the presence of bats (this may be related to the presence of a roost, but it is generally an accidental, occasional phenomenon)

Case A. *The phenomenon is occasional.*

Reassure people (see above). If bats are flying, advise on how to let them out of a room: close the door, switch off the lights and open the window, do not wave clothes or things around, stay silent and still. Generally, bats fly out very quickly. If they do not (which may happen from late August to early October), and whenever bats are found resting in daytime, catch them with a hand-net or gloved hand. In daytime, put them in ca. 25x25 cm cotton bags to be hung in a safe place out of sunlight. Alternatively, put them in a box containing some cloth to make them more comfortable (make small – a few millimetres – holes in the box if needed for airflow. Do not make holes > 1cm; the bat might escape). If the bat does not seem to be suffering or injured, free it in the evening near the capture site, otherwise take it to a local institution dealing with bat rehabilitation. Although such operations should, in the main, be carried out by staff in charge of wildlife management, in some cases they may be carried out by members of the public who have been provided with the necessary advice.

Case B. *The phenomenon occurred several times in a year.*

Proceed as for case 2A but also check whether bats are entering through inner fissure in a roller shutter box, when the shutter is down and the windows are open. If so, place a brush barrier such as those used as draught excluders on the inside of the roller shutter, to prevent bats from entering.



This intervention may be done by pest management companies, once they have been certified to have attended specific courses on bat protection.

3. Bats activate burglar alarms

To solve the problem, consider several factors: alarm features, the reasons bats are entering the building, the way they activate the alarm. It is generally necessary to understand whether bat presence is occasional, or frequent, due to a nearby roost, and which entrances and flyways are used. Contact a bat specialist.

4. Potential harm to bats linked with construction work or changes of use of buildings or sites of cultural heritage value, or other construction work

Case A. *Buildings or other structures protected by the Ministry for the Cultural Heritage and Activity, which are subject to works described in the Operational Procedure (Chapter 8).*

Owners, Soprintendenze or relevant regional authorities, architects and members of the public carrying out the works should apply the Operational Procedure agreed between the Ministry for the Cultural Heritage and Activity and the Ministry for the Environment, Land and Sea.

Case B. *Buildings or other structures not protected by the Ministry for the Cultural Heritage or, if protected, not buildings such as castles, palaces, towers,*

forts, churches, abbeys, bell towers, rupestrian settlements and underground sites, hosting bats hanging from the ceilings of large spaces (attics, cellars, rooms).

Report the case to a bat specialist, who will survey the site and, if necessary (if works are likely to interfere with buildings within or near a Natura 2000 site or a proposed one) request a Habitat Directive Assessment (including a specific assessment for bats).

Case C. Buildings or other structures not protected by the Ministry for the Cultural Heritage or, if protected, not buildings such as castles, palaces, towers, forts, churches, abbeys, bell towers, rupestrian settlements and underground sites, hosting bats roosting in small spaces (roller shutter boxes, spaces beneath rain gutter or in gaps behind rendering or coatings on roofs, outer walls, etc.).

Check the internet for information on how to proceed (a website list is given below, vade mecum section 8, point B).

5. Finding newborn bats

Newborn bats, which are almost or completely hairless, may be found from late May to mid-July. To allow the newborn to be reunited with its mother, offer it a drink (from a needless syringe, keep the animal upside down in the palm of the hand) and, if the roost is known, hang it from a wall or ceiling within it. If the roost is in a crevice out of reach, place the bat near the roost exit just before sunset. If the roost is unknown, replace the bat, in the evening, where it was found, in an open basin-like container (place an object inside from which the bat may hang). It is hoped that the mother, attracted by the newborn's calls, will come and rescue it. Should this attempt fail, take the bat to a local organization dealing with bat rehabilitation. The chance that the bat can be hand-raised and released into the wild will be evaluated.

6. Bats found injured or in poor physical condition

Offer the bat a drink (see above) then take it to a local organization dealing with rehabilitation. Unless a bat is so seriously injured that no treatment is viable, it should be treated and rehabilitation should be attempted. All bats which are rehabilitated should be released.

In accordance with section 8 of Presidential Decree 357/1997 (on

monitoring accidental captures), the following relevant data should be recorded: date, species (if the bat is difficult to identify, the most likely genus or, in the worst case, ‘unidentified bat’ should be recorded), district and site of retrieval (specify whether it was found outdoors or in a building, and in the latter case identify the building by giving the exact location or address), condition (injured or debilitated), likely cause of injury (e.g. wounded by a cat; injured by a roller shutter; injured by works in building; bat trapped in structure implying a “falling trap” effect; bat entered the building accidentally or found inside the building for unknown reasons; or bat probably passed through inner fissure of roller box shutter).

7. Dead bats

Collecting dead bats is crucial for science and conservation planning, so dead bats should always be collected. Get advice from a bat specialist to identify the species. If the conservation status is good enough, specimens should, by law, be delivered to official organizations analysing dead bats (e.g. to study rabies).

Preserve corpses in a freezer or in non-denaturated alcohol. Should that not be possible, using denaturated alcohol will preserve the specimen but prevent all analyses.

In accordance with section 8 of Presidential Decree 357/1997 (on monitoring accidental captures), the following relevant data should be recorded: date, species (if difficult to determine, at least the most likely genus or all hypothesized species should be recorded), district and site of retrieval (specify whether the bat was found outdoors or in a building, and in the latter case identify the building by giving the exact location or address), cause of death (when known).

8. Recommended websites for further public information

For more information on the issues dealt with in the guidelines, and to learn more, please see the website of the Ministry for the Environment, Land and Sea (<http://www.minambiente.it>, Eurobats pages). More specific websites are as follows:

A. Favouring bat presence, bat boxes, mosquito control (in Italian)

www.msn.unifi.it/CMpro-v-p-461.html

B. Hand feeding and rescuing of bats needing help (in Italian)

http://fauna.dipbsf.uninsubria.it/chiroptera/primo_soccorso.pdf

C. Italian bat species and their conservation status (in Italian)

<http://www.msn.unifi.it>

<http://www.parchilagamaggiore.it/pippi10.htm>

<http://www.pipistrelli.org>

D. Online documents on the management of bats in buildings

Bat Conservation Trust, 2006. A review of the success of bat boxes in houses. Scottish Natural Heritage. Commissioned Report No. 160 (ROAME No. F01AC310).

http://www.snh.org.uk/pdfs/publications/commissioned_reports/F01AC310.pdf

Debernardi P., Patriarca E., 2007. Guida alla tutela dei pipistrelli negli edifici. Regione Autonoma Valle d'Aosta. Assessorato Agricoltura e Risorse Naturali. Direzione flora, fauna, caccia e pesca. Servizio aree protette: 23 pp.

<http://www.centroregionalechiropteri.org/download/edifici.pdf> (in Italian)

Fairon J., Busch E., Petit T., Schuiten M., 1998. Guide pour l'aménagement des combles et clochers des églises et d'autres bâtiments. Centre de Recherche Chiropterologique, Institut des Sciences naturelles de Belgique - Groupement Nature: 89 pp. (in French)

<http://mrw.wallonie.be/dgrne/sibw/especes/ecologie/mammiferes/chauvessouris/chiroptieres.html>

<http://mrw.wallonie.be/dgrne/dnf/comblesetclochers/typedamenagement.htm>

Groupe Mammalogique Breton, 2005. Fiche technique briques creuses (briques platrières) pour chauves-souris.

http://www.gmb.asso.fr/PDF/fiche_briques.pdf (in French)

Meech H. (ed.), 2001. Wildlife and buildings. Technical guidance for architects, builders, regional building managers and others. Manual of Buildings. The National Trust, UK: 78 pp. <http://www.nationaltrust.org.uk/main/w-wabman.pdf>

Mitchell-Jones A. J., 2004. Bat mitigation guidelines. English Nature: 76 pp.

<http://www.english-nature.org.uk/pubs/publication/PDF/Batmitigationguide2.pdf>

Mitchell-Jones A. J., McLeish A. P. (eds.), 2004. The Bat Worker's Manual. Joint Nature Conservation Committee: 179 pp.

<http://www.jncc.gov.uk/default.aspx?page=2861>

Moore N. P., Jones S., Hutson A. M., Garthwaite D., 2003. Assessing the outcome of

English Nature advice on bat colony management and mitigation works. English Nature Research Reports, Number 517: 60 pp.

<http://www.english-nature.org.uk/pubs/publication/PDF/517.pdf>

Reiter G., Zahn A., 2006. Bat roosts in the alpine area: guidelines for the renovation of buildings. INTERREG IIIB Project Habitat Network: 131 pp.

www.livingspacenetwork.bayern.de

Scottish Natural Heritage, 2003. Bats in buildings. A guide for buildings professionals: 12 pp. <http://www.snh.org.uk/pdfs/species/BatsBuildings.pdf>

6. INTEGRATING SURVEYS IN BUILDINGS WITH GENERAL BAT MONITORING

6.1. Bat monitoring: an overview

Despite the recent increased interest in bats and the general growth in scientific research on bats, gaps remain in our knowledge of the bat fauna of Italy, especially in some basic information, e.g. species distribution and location of nurseries and hibernacula, are concerned. This information, crucial for developing appropriate conservation measures, is still incomplete because researchers sometimes target other issues. Also, bat monitoring is not at all easy, and this may discourage people from investing resources in this field. It is worth noting that many research activities have led to significant results.

For instance, molecular and bioacoustic surveys have been used to produce a thorough checklist, unveiling the presence of previously overlooked cryptic species. Although not exhaustive, distribution and persistence data available at the national level highlight a worrying conservation situation for most species.

A recent classification carried out by applying the IUCN criteria for bat populations in Italy showed that 17 species may be listed as vulnerable, endangered or critically endangered (GIRC, 2007).

Monitoring the conservation status of bats is explicitly required by law; specifically the EC/92/43 Habitats Directive establishes that all member states must periodically report on monitoring. Information contained in these reports is needed to tackle three main objectives:

- To ascertain geographical distribution areas for all species, and monitor their variation (distributional trends as expressed by geographical range changes);
- To assess population size and monitor temporal changes (demographic trends as expressed by changes in demographic statistics in time);
- To characterize habitat quality for all species and monitor factors

affecting it (habitat trends, as assessed from qualitative and quantitative changes in habitat).

To reach these goals, finding the main bat roosts and determining which species of bats are present there (i.e. knowing at least about species identity, colony size, times inhabited, and the biological role of the site) are essential activities. There is also a need to monitor factors that may negatively or positively influence bats (human disturbance, works, site use change, etc.). The latter are also internationally recommended actions for the fulfillment of the objectives of the Bern and Bonn Conventions. For more information, please see the “Bat Monitoring Guidelines” volume (Agnelli *et al.*, 2004).

A further monitoring activity, mandatory according to the Habitats Directive, is to keep a record of all accidental captures and deaths of bats. The law establishes that such monitoring activities are important for conservation (to promote actions aimed at minimising the occurrence of such events), but there are additional advantages. Data on injured or dead bats may help scientists to assess environmental quality (e.g. by estimating pesticide-related mortality) and monitor epidemiology, and help towards integrated assessments of species conservation status.

6.2. Using data on bats in buildings for monitoring purposes

Since colonies in buildings are often numerous, and may consist of endangered species, they deserve attention for conservation, and data on them should be carefully recorded, as required by law. Several people may be involved in reporting on colonies (building owners, users, people visiting sites for renovation works or management, wildlife managers, or bat specialists). To fulfil the requirements of EC/92/43 Directive, Regions and Autonomous Provinces should periodically report to the Environment Ministry, which in turn should report to the European Union. The same information may be used by the Ministry to report within the EUROBATS agreement. The Ministry may solicit further details from Regions and Autonomous Provinces to report appropriately on bats' conservation status. According to national law, Provincial authorities too may be delegated to

report to the Ministry. Hence, many people can be involved in data reporting, so cooperation and synergy are needed to optimize it (as for other issues). This objective may be easily achieved as follows:

- All involved organizations should be well informed;
- Their interaction network should be developed or improved to optimize the results;
- Data recording should be standardized.

To reach such goals, the Environment Ministry may play a pivotal role by promoting research to improve monitoring (section 14 of Presidential Decree 357/1997 and subsequent integration and modifications) and defining guidelines for monitoring habitats and species. Section 7 of the Decree establishes that the Ministry can define such guidelines by its own decree, taking into account the views of the Ministry of Agricultural Policies and the Institute for Environmental Protection and Research (ISPRA), as well as the permanent conference for the relationships among State, Regions and Provinces and the Autonomous Provinces of Trento and Bolzano (when relevant). The latter will regulate the adoption of measures needed to guarantee monitoring work.

Table 6.1 - Criteria to select hibernacula or nurseries of outstanding national importance (Agnelli *et al.*, 2004). Monitoring such sites should be a priority.

No. SPECIES	SPECIES	No. SPECIMENS
> 4	Any	≥ 50
3	Any	≥ 100
2	Any except if both are among the following species: <i>P. kublii</i> , <i>H. savii</i> , <i>P. pipistrellus</i> and <i>P. pygmaeus</i>	≥ 150
> 1	<i>M. punicus</i> and species in Ann. II EC/92/43 except <i>M. schreibersii</i>	≥ 50
1	<i>M. schreibersii</i> and all species not mentioned in the above row except: <i>P. kublii</i> , <i>H. savii</i> , <i>P. pipistrellus</i> and <i>P. pygmaeus</i>	≥ 200

It is certainly advisable to encourage regional coordination, to improve data recording and transfer from the Provinces and the Reserve directions to the relevant monitoring offices of the Regions.

In Piedmont (northern Italy), a reference organization for all bat monitoring issues exists (http://www.centroregionale_chirotteri.org).

In Tuscany, staff at the Natural History Museum of Florence collect and manage data on endangered flora and fauna, including all bats, and make them available on the internet (<http://web.rete.toscana.it/renato/>). Certain data, such as the exact location of roosts, are accessible only after special permission is granted for conservation reasons by specialists in charge of the project (Agnelli, 2005).

Consultancy with bat specialists at the local (provinces or across several provinces) or regional level is advisable, for issues requiring specific expertise (e.g. species identification) and for information transfer (e.g. workshops, communication with the media, and publications in magazines or scientific journals). To promote epidemiological studies, cooperation with Zooprohylactic Institutes and other organizations (e.g. regional agencies for the environment, health offices, and universities) is also needed.

To standardize monitoring, techniques are described in the “Guidelines for Bat Monitoring” (Agnelli et al. 2004); as far as data to be collected are concerned, the information provided below updates and implements the above-mentioned guidelines.

6.3. Roost Surveys

Roost surveys have been carried out in the past and continue to be carried out at the local scale. The first nationwide roost survey was carried out by the Italian Chiroptera Research Group in 1990-2002 (GIRC, 2004). The aim was to make a roost site inventory, identify the bats occurring in the roosts, and identify the threats to them. For each roost, data were collected on the numbers of bats in each biological phase. No historical data series (i.e. colony size recorded over repeated counts) were included.

The project has been temporarily put on hold, to await the development

of a data storage system for more effective data collation and retrieval. Further information is available at <http://www.pipistrelli.org>.

To select the most important sites for monitoring bats over time (in terms of the species and the colony size), and taking into account roost features (e.g. accessibility for people, inclusion in reserves, and overall conservation status), criteria were established to define the most important national roosts by Agnelli et al. (2004) – see Table 6.1.

Such roosts, the monitoring of which is absolutely necessary, are rare in most regions (GIRC, 2004). Besides monitoring such sites, further surveys are needed to discover new sites for detailed monitoring. In some regions all nurseries in Annex B of Presidential Decree 357/1997 (= Annex II species of Habitats Directive) and all hibernacula containing at least ten bats are monitored.

Such criteria provide only very general guidelines, and may be improved upon in future. The decision to focus on Annex II species was made because of their conservation importance and because so little information is available on their status in Italy. Further studies may lead to the criteria being changed in future, to match the situation in Italy.

We have already discussed the duties of the various people contributing to reporting and data collection. We will now highlight the role that those managing monuments or historical buildings may have in reporting unknown colonies (and roosts) of high conservation importance. Because of their features (bats clearly visible in large rooms) such colonies are easily seen by those visiting the site. Moreover, since many colonies in sites protected by the Ministry for the Cultural Heritage and Activity should be included in monitoring schemes, it is important that the relevant authorities (territorial *Soprintendenze*, regional organisations for cultural heritage) allow bat surveyors access at the right time (often in the evening).

6.4. Monitoring accidental captures or killing

We already mentioned situations that may lead to the retrieval of dead bats from buildings. People finding such specimens should contact the

authorities responsible for wildlife protection. Procedures to follow are summarized in the above *vademecum*.

The Appendix includes a data recording sheet, followed by instructions clarifying the terminology, so that data collection can be standardized. Dead or moribund bats may also be found outside buildings (although they are more commonly found inside buildings), so the sheet is suitable for recording bats found in a wider range of cases potentially relevant to fulfill the law established by section 8 of Presidential Decree 357/1997. Clearly, acquiring all data to fill out the sheet is not obligatory by law, though it is recommended. Some information is required by law, the remainder (e.g. environmental variables) may nonetheless be useful for the development or improvement of site management strategies.

7. ASSESSING IMPACTS ON BATS IN BUILDINGS AND DEVELOPING MANAGEMENT STRATEGIES

In the present technical document we have already recommended the intervention of a bat specialist to assess the level of interference caused by proposed works in buildings housing bat roosts, and to identify management, mitigation or compensation strategies, especially for complex situations, i.e. when renovation work or changes in site use may lead to strong impacts on bats.

The operational procedure to follow includes making a detailed assessment of the bat fauna present before interference takes place, predicting the consequences of planned work, and proposing, when needed, corrections or alternatives to eliminate or minimize the negative impact on bats (Figure 7.1). This analysis will be part of a Habitats Directive Assessment, where relevant according to EC/92/43 Directive (in Italy, ratified by the Presidential Decree 357/97 and subsequent integrations and modifications, and by regional regulations where applicable).

The information given in the descriptive section of a thorough assessment, can be summarized as: species present (at any time of year), number of bats present, season of presence, location of bats within the site, and location of exits and flyways. If, as is likely, the bat specialist is not be given enough time to collect all these data, he or she will carry out a simpler analysis still including the minimum information necessary for management planning. For instance, should species identification not be feasible, the genus or the species possibly present might be considered; should exact counts not be feasible, estimates or colony size bands may be used, etc.

For all aspects lacking adequate information, a cautionary approach should be adopted for decision-making. For instance, if the exact time when a reproductive colony uses a site is not known, it is best to refer to the longest period documented in the scientific literature or other sources, for the relevant species.

Assessing the consequences of planned intervention requires both the

identification of actions potentially affecting bats, and the evaluation of the sensitivity of the bats occurring at the site for these actions. The sensitivity in turn depends on several factors, i.e. the species involved and their life cycle phase.

Consequences are seen as positive when they can increase the site's environmental value for bats or create conditions to favour the presence of further bats without affecting those already present.

Actions which have no, or insignificant effects, are those not affecting bats or leading to negligible consequences, typically not altering the site's suitability for bats, or not causing qualitative and quantitative changes in the bat fauna present there. This is the case e.g. if temporary site abandonment by a single or a few bats is likely, and if the bats are likely to return soon afterwards.

Negative consequences are those caused by actions leading to serious impacts on bats (long-term reduction in colony size or species disappearance) and/or to the alteration of the site's suitability for bats (e.g. exit obstruction, changes in illumination, use of toxic chemicals, microclimate alteration, acoustic pollution, repulsive odours, etc.)

Should any action lead to such serious problems, its intensity of impact should be evaluated according to a standard scale. A three-level classification is recommended, e.g. low, medium-high, or very high impact. The evaluation depends on the type of effects predicted (e.g. bats leaving the site, casualties, loss of site suitability), their reversibility, the conservation value of the species involved (consider global and regional status and legal classification, especially with respect to Habitats Directive Annexes), and the significance of the specific colony (assess the impact on the local population / metapopulation deriving from the impact on that colony).

When certainty on some features of intervention is lacking, variable judgments can be produced with respect to different scenarios; e.g. the impact's intensity may vary according to the life cycle phase involved. Should all consequences be positive, non-existent or insignificant, the overall intervention will be judged as sustainable; advice may still be provided on how to increase the site's value for bats.

If consequences are judged to be negative, solutions should be provided

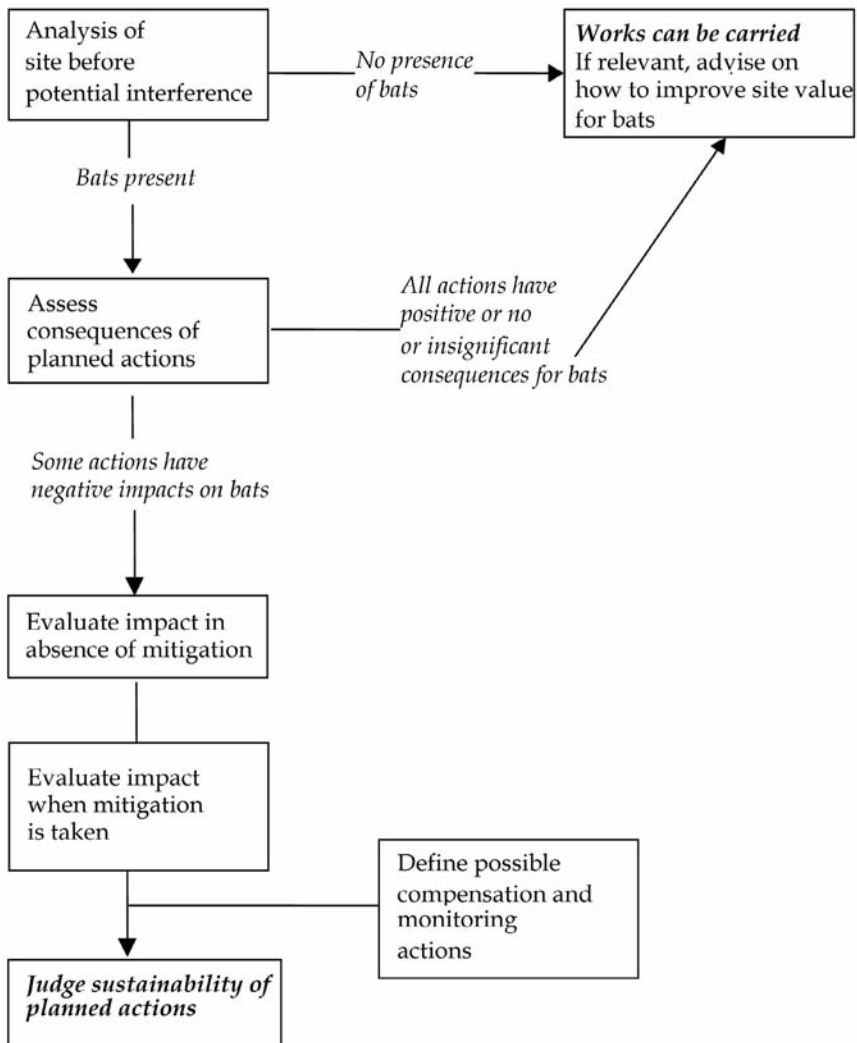


Figure 7.1 – A summary of activities to be carried out in the assessment of impact on bats.

to make them sustainable for bats, and a new impact assessment should be made once such solutions are planned.

In general, changing the works schedule, protecting access points used

by bats, and avoiding entering rooms hosting the colony, eliminate all, or most, of the risks associated with interference.

Should impacts be unavoidable, compensation measures should be planned, possibly associated with a monitoring scheme to assess their effects. Compensation measures the success of which is unpredictable, e.g. setting up an alternative roost, should never be seen as comparable with protecting already existing roosts, and should be evaluated against their actual effectiveness, i.e. for the target species. Positive effects on non-target species should not be taken into account.

Should the intervention still be quite harmful, despite compensation and mitigation, the assessment should recommend abandoning the planned actions and, if needed, to the entire project.

8. OPERATIONAL PROCEDURE TO PROTECT BATS AND AVOID CONFLICT ARISING IN BUILDINGS OR SITES MANAGED BY THE MINISTRY FOR THE CULTURAL HERITAGE AND ACTIVITIES

8.1. Background

Many buildings and structures protected by the Ministry for the Cultural Heritage and Activities are also important for bats, since they constitute dayroosts often used for reproduction or hibernation. If bat occurrence is not taken into account, operations such as maintenance, renovation, restoration or use change can contribute to the decline of bat populations.

Although the presence of bats may lead to conflicts with human needs or site features, conflicts can normally be avoided provided appropriate measures are taken.

Therefore, the Ministries for the Environment and the Protection of Land and Sea and for the Cultural Heritage and Activities recognize the importance of operating according to agreed principles and strategies to safeguard both bats and the cultural heritage, and hereby establish the operational procedure set out here.

8.2. Reporting on bat occurrence is mandatory

The local authorities managing the cultural heritage (*Soprintendenze*) *must* take special care to detecting the occurrence of bats in the sites they manage.

Since bats are protected under Presidential Decree 357/97, they are also committed to report on the presence of bats to both the Institute for Environmental Protection and Research (ISPRA) and the Environment Ministry (General Direction for the Protection of Nature and Sea).

8.3. Bat protection and routine management of sites

Bats are very sensitive to human disturbance. We recognize the commitment of the Ministry for the Cultural Heritage and Activities to take all necessary measures in order to safeguard the persistence of bats while carrying out the management and routine use of sites under its control. Special attention should be given to members of the public and, in general, human disturbance, while the seasonal presence of bats, artificial illumination and all potential sources of disturbance should also be considered.

8.4. Protecting bats when changes in the structure and/or use of sites are planned

In all contracts concerning works at sites or buildings protected by the Ministry for the Cultural heritage and Activities, where bats are known or suspected to occur (castles, palaces, towers, churches, abbeys, cellars, cisterns, rupestrian settlements, underground sites, etc), all relevant *Soprintendenze* or regional authorities must require that work plans follow the present “guidelines for preservation of bats in buildings”. Many operations including renovation or change of use, even if apparently minor (e.g. placing a gate, changing visit schedules, etc.) may seriously affect bats. All efforts required by law should be made to preserve bats. In the following situations, an assessment by a bat specialist is needed. It should also be pointed out that the presence of bats in buildings is sometimes difficult to detect, and may be overlooked by non-specialists. Any renovation or restoration works and / or use change (including opening a site to the public after a long period in which it was not accessed) concerning roofs, attics, cellars or other underground sites, may interfere with bat presence, even if the latter is unnoticed.

We recommend paying careful attention and, when possible, taking advice from a bat specialist.

8.5. Restoration, renovation, modification or use change potentially affecting the persistence of bats in buildings or sites where their presence is known.

The following operations are recognized to pose threats to bat persistence. In accordance with current law protecting these mammals, in these cases all precautions should be taken, including an assessment by a bat specialist before the changes are made.

1. Restoration or renovation works (including those to remake or adjust fittings) and /or change of use (including opening a site to the public after a long period in which it was not accessed) concerning roofs, attics, cellars or other underground sites, and rooms with rough ceilings (at any height above or below ground level).
2. Any other works involving external scaffolding, which may act as an obstacle or obstruction.
3. Placing barriers (gates or others) to restrict people's access to underground sites.
4. Sealing access points (doors, windows, air flow pipes, etc.) to attics or other spaces beneath roofs.
5. Setting up burglar alarms in rooms used or crossed by bats.
6. Setting up new illuminations or increasing existing lighting, internally or externally, at buildings or sites for aesthetic reasons or as a tourist attraction.
7. Ordinary or extraordinary maintenance works (the former can be scheduled with the help of a bat specialist) in spaces used by bats as roosts or flight paths.

In such buildings the following measures must be taken:

- In any of the above situations, the architect, designer or planner should request an assessment by a bat specialist and follow all recommended actions. At sites for which no Habitats Directive Assessment is needed, and at buildings or sites owned by members of the public, an assessment by a bat specialist should be commissioned by the authority for wildlife

protection. In all other cases it should be commissioned by the person responsible for the project.

- In any of the above situations, when no plan is required, a bat specialist's assessment is needed. This should be commissioned by private owners or, for public sites, by the relevant *Soprintendenze* or regional administrations.
- For more complex cases included in the above situations and concerning sites within or near proposed or established Natura 2000 sites, an assessment by a bat specialist will be part of the Habitats Directive Assessment, and therefore mandatory for those who commission the works according to Presidential Decree 357/97 and subsequent modifications and integrations.
- Private owners, or, for public sites, relevant *Soprintendenze* or regional authorities, are committed to follow all recommendations provided in the bat specialist's assessment.

8.6. Protecting cultural heritage

Whenever, in sites or buildings protected by the Ministry for the Cultural Heritage and Activities, the occurrence of bats leads to conflicts with site conservation or use, private owners or, for public sites, relevant *Soprintendenze* or regional authorities should report on such problems to the authorities locally in charge of wildlife protection, which must operate to safeguard both bats and cultural values.

The latter authorities are responsible for: use of equipment and staff involvement; requesting the advice of a bat specialist (when needed); and reporting on the situation and adopting limited mitigation measures (e.g. protecting structures from bat droppings, capturing bats that have accidentally entered the site, preventing bats from gaining access to rooms which cannot support bats).

8.7. Direct ministry action and other support for integrated protection of bats and the cultural heritage

The Ministries for the Environment and the Protection of Land and Sea and of Cultural Heritage and Activities, each for their relevant aspects, may operate (administrative issues and budgets permitting) directly by funding actions for the integrated protection of both bats and sites of cultural values, especially when such sites are of national or international conservation importance or have a special demonstrative value.

These Ministries, along with the Regions and the Autonomous Provinces of Trento and Bolzano, should identify ways to support private site owners financially, in order to carry out integrated protection of bats and the cultural heritage.

9. CASE STUDIES

In this chapter we summarize the available information on 11 case studies of potential conflicts between site renovation or changes in site structure or use, and the persistence of important bat colonies. The sites, reported by GIRC (Italian Chiroptera Research Group) members, have been selected because of the conservation importance of the bats present, and the type of management problem. The case studies include a range of situations, from very preliminary stages when problems may be predicted and appropriate procedures adopted, to examples of good practice where all recommendations have been adopted, allowing bats to persist.

9.1. Aosta Cathedral

Region: Autonomous Region of Valle d'Aosta

Province: Aosta

Council: Aosta

Roost type: Church, in the attic

Owner: Church

Relevant local authority (*Soprintendenza*): Autonomous Region of Valle d'Aosta

Elevation: 565 m a.s.l.

Surveyors: P. Debernardi, E. Patriarca

9.1.1 *Characterization of site and bats*

9.1.1.1. Historical and current occurrence of bats

In the attic, a large *Rhinolophus ferrumequinum* colony occurs, consisting of up to 148 bats (juveniles and adults; maximum count on one day). The building's northern wing is used as a maternity site by the bats from the middle of June until the first half of August; rooms in the southern wing are used before and after that time.

The first survey was carried out on 22 May, 2000. The building's guardian reported that when he started working there (at the beginning of the 1970s), the colony already existed in the northern wing, and was far larger than it is today (G. Vacca, pers. comm.).

9.1.1.2. Assessment of conservation value

This is the only breeding colony of *R. ferrumequinum* known for the whole territory of Piedmont – Valle d'Aosta. Its disappearance might make the species locally extinct and produce strongly adverse effects on its metapopulation with large-scale implications.

9.1.2 *Threats*

In the short term, presumably within 1-2 years, the electric wiring in the whole building will need to be replaced. Since no plans to carry this out have been made yet, it is impossible to predict the precise level of disturbance caused to bats by this operation. Far more worrying is the prospect of any works in the attic room used by the nursery colony. Unlike all other spaces beneath the roof of the cathedral, this room's roof has not been recently renovated.

Although such works have not yet been planned, they appear inevitable in the medium term due to the roof's poor condition. Soon before parturition, and when juveniles are weaned, the colony moves to other attics (one adjacent to the nursery room, the other in the southern wing). These

other attics have already been renovated and provide a better insulation from external conditions.

Renovating the nursery room roof, besides preserving the building, is also relevant to preserve the colony. The works are complex, however, because should they be done without due care for the bats, they might create unsustainable levels of disturbance and result in the loss of the site's suitability for bats, with highly adverse implications for the rhinolophids.

9.1.3 Actions

The Aosta Bishop's Staff and the Regional Government have been informed of the site's importance and the need to protect the colony. They are sensitive to the issue and willing to take all necessary actions. The Bishop's Staff has allowed and supported surveys; the Regional Government (Assessorato Agricoltura e Risorse Naturali, Direzione Flora, Fauna, Caccia e Pesca, Servizio Aree Protette) has suggested including the cathedral in the SAC IT1205034 and has produced information for the public on bat conservation, which mentions the case of the cathedral.

9.1.3.1. Agreed or proposed actions

- Electrical re-wiring: do not work in any room beneath the roof when bats are present (from the middle of April to the beginning of October).
- Renovation of nursery room: 1) work when bats are absent (from the beginning of October to the middle of April); 2) never disturb the colony, including in the planning phase; avoiding surveying the site when bats are present.
- Roof renovation: 1) do not add any intermediate insulating layers, at least in part of the roof, to leave spaces for crevice-dwelling bats; 2) replace the current roof beams besides the new ones, to keep elements bats are familiar with and encourage their return to the site; 3) in all treatment against fungus or wood-boring insect attacks, use only borate salt (borax), which is harmless to bats.
- Preserve access points used by bats and do not change their current size

(the space leading to the nursery is quite large however, and could be reduced to the size of an ordinary door).

- Keep some of the droppings removed from the nursery and replace them once works are over.
- Monitor the colony for at least one year after works are completed.
- If necessary, place humidifiers or a large pool filled with water in the site, to allow sufficient evaporation and keep humidity high enough.
- Install a webcam in the nursery for monitoring, and to allow observation by visitors.

Once the Office for the Architectural Heritage of the Department for the Cultural Heritage and Activities of the Valle d'Aosta Autonomous Region has examined the proposal, it has informed all subjects involved in the electrical rewiring, so that prescriptions can be applied.

Should the nursery room be renovated, the Office has expressed its willingness to collaborate. Interest and support have also been expressed by the Nature Reserve Service of the Department for Agriculture and Nature Resources of the Region.

9.2. Agliè Castle

Region: Piedmont

Province: Turin

Council: Agliè

Roost type: Castle. In the underground rooms historically used as a buffer between the garden and the count's apartments.

Owner: Public property

Relevant local authority (*Soprintendenza*): Soprintendenza per i Beni Architettonici e il Paesaggio del Piemonte

Elevation: 325 m a.s.l.

Surveyors: P. Debernardi, E. Patriarca

9.2.1 Characterization of site and bats

9.2.1.1. Historical and current occurrence of bats

There is no specific information about the occurrence of bats in the Agliè Castle before 1990, since the first bat survey of site was carried out on 19 September 1990. People working at the castle mentioned that the colony has used the site for over 50 years, and that some decades ago the number of bats was higher (D. Druetto, pers. comm.). According to observations carried out since 1990, the castle is used by *Myotis myotis*, *Myotis blythii* and another 6 bat species at least – *Rhinolophus ferrumequinum*, *Pipistrellus kuhlii*, *Hypsugo savii*, *Plecotus sp.*, *Eptesicus serotinus*, *Myotis daubentonii vel nattereri* – of which at least 3 (*R. ferrumequinum*, *E. serotinus* and *M. daubentonii vel nattereri*) roost in the underground rooms of the building.

9.2.1.2. Assessment of conservation value

The *M. blythii* and *M. myotis* mixed colony reproducing at the site is one of the largest known for these species in Europe. Its size matches the selection criteria for the best bat sites in Italy (Agnelli et al., 2004) and justifies the designation of the site as a SAC according to the EC/92/43 Habitats Directive. The colony regularly uses, from early April until early October, the underground spaces, made up of many rooms.

9.2.2 Threats

The underground spaces where bats roost have not been used by people for decades, and bats have long enjoyed the lack of disturbance. The *Soprintendenza* responsible for the building now plans to open the main underground corridor to visitors, by setting up an exhibit of tools used in the past by the gardeners and possibly other materials of ethnographic interest. The underground space would then be part of the visitor's route through the Castle's garden, and would be mainly used in spring and summer, i.e. when the mouse-eared bats are present.

Should any change be made without consideration for the presence of bats, the consequences would be extremely serious, and could include increased mortality and partial or total site abandonment by bats.

This, in turn, would have major detrimental effects on the whole metapopulation to which the colony belongs, interrupting gene flow among the remaining colonies, causing loss of genetic variation, and increasing the risk of local extinction for *Myotis blythii* and *M. myotis*.

Minor negative effects would also occur for the other bat species occasionally roosting in the site, for which the site's use change would mean the loss of a day roost.

9.2.3 Actions

Sindaco *et al.* (1992) first reported on the presence of the *Myotis* colony at the site. Further information on demographic and genetic aspects is published in Baratti *et al.* (1997) and Castella *et al.* (2001). The regional government and the Soprintendenza have been carefully informed of the site's conservation value, and know that measures must be taken to safeguard the colony should any potentially impacting action be carried out.

9.2.3.1. Agreed or proposed actions

- Visitors will be allowed access to the underground rooms only via the two existing entrances, one at each end of the corridor. One of the two gates has a large upper window which must be preserved because it is used by bats as an entrance.
- The section to be opened to the public will be isolated from all remaining rooms, to avoid visitors being able to access other rooms, and being close to, and therefore producing acoustic interference in, the two most important rooms for bats (the stairwell and the nursery).
- The inner artificial illumination will be made so that it will not directly affect the rooms used by bats and the corridor ceiling.
- Visitors should be informed of bat presence: their conservation

significance adds value to a visit to the Castle. Therefore, it is suggested that an information panel is placed along the underground route followed by visitors, and a leaflet should be provided at the entrance, to increase the visitors' interest and to spread awareness about bat conservation. Infrared video cameras at the main roost sites, and monitors positioned along the visitors' route showing the colony would increase the action's effectiveness.

At present, in the whole territory of Piedmont and Valle d'Aosta only 7 *M. myotis* and/or *M. blythii* nurseries are known, four of which are of a significant size (including Agliè). Any interference to them would therefore represent serious environmental damage (EC/2004/35/Directive and Legislation Decree 152 of 2006), whereas the adoption of appropriate measures during renovation will allow the protection of the environments, preserving both the historical and natural value of the site.

9.3. Villa de Angeli Frua

Region: Lombardy

Province: Varese

Council: Laveno-Mombello

Roost type: Historical villa dating mid 1700s; attic and dependance

Owner: Public property

Relevant local authority (*Soprintendenza*): Soprintendenza per i Beni Architettonici e per il Paesaggio per le province di Milano, Bergamo, Como, Pavia, Sondrio, Lecco, Lodi e Varese

Elevation: 205 m a.s.l.

Surveyors: A. Martinoli, M. Spada

9.3.1 Characterization of site and bats

9.3.1.1. Historical and current occurrence of bats

Villa De Angeli Frua is home to a maternity colony of *Myotis emarginatus* numbering ca. 40 bats. It roosts in several rooms of the villa and its dependance. The nursery was first observed in 2006, but some council staff members had noticed it in the three previous years.

9.3.1.2. Assessment of conservation value

The colony uses several rooms (attics and dependance) for breeding and is of conservation interest despite being small, since the species is listed under Annex II of Habitats Directive and the colony is the only one known for Lombardy.

9.3.2 Threats

The premises of Laveno Mombello city council and the library are in Villa Frua, which is also used for recreational or tourism activities (exhibits, outdoor cinema, etc.). Therefore, many people frequent the areas adjacent to the colony's site. Before parturition, bats use the external beams of the roof for roosting, and are therefore well visible from the outside.

Moreover, a currently abandoned dependance, used only by some bats, is likely to be renovated soon, thus altering the site.

The small colony size (this species normally forms large aggregations) and the tendency for several rooms to be used by females carrying their newborn young also suggests that disturbance may have occurred in the recent past. Provided no killing of bats has occurred, appropriate intervention might lead to a recovery in colony size.

9.3.3 Actions

The city council authorities have been informed of the site's conservation

importance, and of the need to preserve the colony, and have shown interest in this issue. The suggestion has been made to plan the dependance renovation to safeguard bats by adopting an appropriate timetable, and to highlight the colony's importance, by e.g. positioning a webcam, and by promoting it to raise conservation awareness among visitors.

9.3.3.1. Agreed or proposed actions

In a meeting on 14 September 2006 convened by the city council, the problems and the possible management options were discussed. The head of the culture, tourism and leisure department of the city council (Mr Corrado Roi) joined the meeting.

If renovating the areas where bats roost, Mr Roi expressed on behalf of the city council the best willingness to cooperate as well as to promote and popularize among the local population the importance of the colony.

Appropriate information and contact with city council authorities will make it possible to plan all future work so that the colony will be protected and its importance highlighted.

9.4. Dock Tower in Lierna

Region: Lombardy

Province: Lecco

City council: Lierna

Roost type: ornamental building on the perimeter of a dock.

Owner: private

Relevant local authority (*Soprintendenza*): none (building not protected)

Elevation: 200 m a.s.l.

Surveyors: E. de Carli, F. Farina

9.4.1 *Characterization of site and bats*

9.4.1.1. Historical and current occurrence of bats

A large maternity colony (maximum number of bats counted on one visit: 2489) of *Myotis capaccinii* and *M. daubentonii*. Data from a survey in 1995 show that the colony is made up of over a thousand adult bats. The site is also used sporadically by *Rhinolophus ferrumequinum*. The colony settles at the site from late March until the end of October. The site is unused in the cold months.

9.4.1.2. Assessment of conservation value

The colony is of outstanding conservation value since it is one of the largest *M. capaccinii* roosts known for northern Italy. It fully matches the criteria set to select the best bat sites of Italy (Agnelli *et al.*, 2004).

9.4.2 *Threats*

The tower, where the colony roosts, is part of a private villa that has been subject to renovation works. Specifically, in the dock to which the tower belongs, a swimming pool has been built. The resulting new situation could have led to interference with bats due to increased human presence and artificial illumination.

9.4.3 *Actions*

The owners have been informed of the colony's importance since its discovery. As soon as the owners expressed their willingness to proceed with renovation work, the wildlife service of Lecco province was informed to ensure all recommendations provided were adopted, in order to minimize the impact on the colony.

9.4.3.1. Agreed or proposed actions

FaunaViva Association and the province wildlife service have recommended, since the preliminary planning phase, adopting the following measures:

- No alterations should be made to the tower and the peripheral wall, in order to preserve the nursery site's structure. The swimming pool should be positioned in a way to avoid interfering with bat emergence from a narrow tower window.
- Direct illumination of the tower should not be allowed, especially if lights were directed towards the window. All swimming pool lights should point down towards the pool, to avoid light pollution at the site.
- Renovation works must not take place at the colony's most sensitive time of year (from the beginning of April to the end of August). Work should not be allowed to produce loud noises or to cause vibrations of the tower. The start of works should be communicated to the wildlife service, so that the situation can be monitored.

Work ended in July 2006. After completion, a survey at the end of July showed that an optimal situation for the colony persisted, so bats faced both the works operations (presence of people and machines) and the agreed modifications with no problems.

The tower was not modified and is now fully devoted to the colony, the original conditions having been preserved.

The new swimming pool has been built above ground level and above the tower entrance window, and it provides a further sheltered space that might even attract other bat species. The only unsolved problem is the presence of pylons supporting the pool – obstacles the bats have to avoid when flying around. The owner has expressed his willingness to preserve the colony and allow future monitoring.

9.5. Nostra Signora della Montà Sanctuary

Region: Liguria

Province: Imperia

Council: Molini di Triora

Roost type: Church, inner spaces

Owner: Catholic Church

Relevant local authority (*Soprintendenza*): Soprintendenza per i Beni Architettonici e per il Paesaggio della Liguria; Soprintendenza al Patrimonio Storico e Artistico della Liguria

Elevation: 470 m a.s.l.

Surveyors: M. Calvini, R. Toffoli

9.5.1 Characterization of site and bats

9.5.1.1. Historical and current occurrence of bats

There is no information on the occurrence of bats in this church before 1990, and the first bat survey of the site was carried out on 4 August 2000. The Church's custodian, however, confirms that bats have been there for at least 60 years (I. Negro, pers. comm.). The *Rhinolophus hipposideros* nursery (maximum number, young included, of 60 bats) uses the church's main room. Depending on the weather conditions, the colony moves and uses different sites on the ceiling.

9.5.1.2. Assessment of conservation value

This is the most important *R. hipposideros* colony so far known for the region. Only four colonies of this species are known for the Liguria region, and in the neighbouring whole Piedmont- Valle d'Aosta territory, only one other small colony (of 11 adult females) is recorded.

9.5.2 Threats

The Church needs urgent renovation work to the outer walls and inner roof structure; cracks and collapsing materials are putting the whole building's stability at risk.

In July 2006 the *Soprintendenza* ordered the placement of some supports to the outer walls and scaffolding inside the building, which forced the bats to move to the relatively less disturbed wing of the building. In Spring-Summer 2005, partial roof renovation involving the replacement of some cover elements had led to a decrease in the size of the colony.

The church is part of the council's cemetery and is only open to the public on request. Religious services take place twice a year. This limited level of human disturbance is not a serious problem for the colony's survival, so it is especially important that the renovation work will not disturb the bats, and will allow the persistence of the colony in such a normally undisturbed place. Works were planned for the end of summer 2006.

9.5.3 Actions

The provincial government of Imperia, the Liguria regional government, Genoa University (through its biodiversity observatory) and the two relevant *Soprintendenza* have been informed about the site's importance and the need to protect the colony from potentially interfering works. The Province (Office for the Coordinating Territorial Plan and Parks) has solicited a reaction from the *Soprintendenza per i Beni Architettonici e per il Paesaggio della Liguria* but got no reply.

9.5.3.1. Agreed or proposed actions

The following actions are needed:

- All work should be carried out at the time of year when bats are not at the site

- The access point used by bats (a window with currently broken glass) should be kept open.

The Office for Cultural Heritage of the *Soprintendenza dei Beni Architettonici e per il Paesaggio della Liguria*, represented by Dr Roberto Leone, has examined the proposal and expressed a willingness to collaborate should the work actually start. The work is subject to public fund availability, which at present is being checked for by the relevant authorities.

9.6. S. Gregorio Church

Region: Liguria

Province: Imperia

Council: Baiardo

Roost type: church

Owner: Catholic church

Relevant local authority (*Soprintendenza*): Soprintendenza per i Beni Architettonici e per il Paesaggio della Liguria; Soprintendenza al Patrimonio Storico e Artistico della Liguria

Elevation: 700 m a.s.l.

Surveyors: M. Calvini, R. Toffoli

9.6.1 Characterization of site and bats

9.6.1.1. Historical and current occurrence of bats

No information on bat occurrence at the site is available for before 1990. The first bat survey took place on 24 June 2001. A family living near the church confirms that bats have been there for at least 20 years (S. Fazio, pers. com.). The *Rhinolophus hipposideros* colony, numbering up to 30 bats, occurs at the site from May to October. It uses the whole church except the area around the altar, and moves from the church's main room to the

narrow attic (which are connected by large holes in the ceiling) in response to microclimate variation or human disturbance.

9.6.1.2. Assessment of conservation value

The site's importance is illustrated by the small number of *R. hipposideros* nursery colonies (4) occurring in Liguria, and by the presence of only one other colony (of 11 bats) in the nearby Piedmont- Valle d'Aosta (where the species was regarded as very common a century ago).

9.6.2 Threats

Renovation works at the site are needed. In July 2006, staff from the relevant *Soprintendenza* surveyed the site and took measurements. The most urgent works are the renovation of the roof, wooden mezzanine, and inner walls. Should this take place without considering the presence of bats, the colony might be lost and the site permanently altered. The church is 3 km from Baiardo village and is constantly open to public, even if no religious ceremonies are taking place. When people enter the church, bats move to the attic.

9.6.3 Actions

The provincial government of Imperia, the Liguria regional government, Genoa University (through its biodiversity observatory) and the two relevant *Soprintendenza* have been informed about the site's importance and about the need to protect the colony from potentially interfering works. The Province (Office for the Coordinating Territorial Plan and Parks) has solicited a reaction (ref. 48906, 12 October 2005) from the *Soprintendenza per i Beni Architettonici e per il Paesaggio della Liguria* but got no reply.

9.6.3.1. Agreed or proposed actions

The Office for Cultural Heritage of the *Soprintendenza dei Beni Architettonici e per il Paesaggio della Liguria*, represented by Dr Roberto Leone, has examined the proposal and expressed willingness to collaborate should work actually start. The work is subject to public fund availability, which at present is being checked for by the relevant authorities.

Requested actions include:

- to carry out the works when bats are absent (between October and the beginning of April);
- when the wooden mezzanine is renovated, only non-toxic chemical treatments should be used;
- passages between the attic and the church's main room should be kept open;
- people's access should be regulated to avoid all interference with reproducing bats.

9.7. Ex SMI Schools in Pistoia

Region: Tuscany

Province: Pistoia

Council: San Marcello Pistoiese

Roost type: Attic of a 1920's school building of special architectural value

Owner: private, but the City Council of San Marcello Pistoiese is legally authorized to use the building

Relevant local authority (*Soprintendenza*): Soprintendenza per i Beni Architettonici e il Paesaggio per le province di Firenze, Pistoia e Prato

Elevation: 700 m a.s.l.

Surveyors: G. Dondini, S. Vergari

9.7.1 *Characterization of site and bats*

9.7.1.1. Historical and current occurrence of bats

There is no detailed information or accounts of the presence of bats at the site before 1990, since the first bat survey was carried out on 6 September 1999. An important *Plecotus austriacus* nursery occurs there, numbering ca. 150 bats; a few individuals of *Hypsugo savii* and *Eptesicus serotinus* are also occasionally present.

9.7.1.2. Assessment of conservation value

The *P. austriacus* colony is one of the largest long-eared bat aggregations known for Italy, and is among the most valuable bat sites of the country, a fact making the roost worth protecting. The colony regularly uses the site from May to October.

9.7.2 *Threats*

Overall, the site is not under serious threat apart from by the possible roof renovation.

The outer fibre cement roofing should be removed, but all axes and wooden elements will be retained.

9.7.3 *Actions*

The surveyors immediately informed the city council, which in its deliberation 94 of 6 August 2002 highlighted the colony's importance and a willingness to protect it.

It is proposed that accessing the attic will be allowed only to carry out specific maintenance work and monitor the colony. All works should be carried out at the time of year when the colony is absent (mid-October to the beginning of April). In this way all interference by workers will be avoided.

The intervention will have to be planned together with a bat specialist, who will advise on material selection, timber treatment, preservation of roost entrances and microclimate.

9.7.3.1. Agreed or proposed actions

- Renovation of part of the roof
- Replacement of fibre cement roofing with a copper cover
- Preservation of access points used by bats
- Shift of timing of renovation work (initially planned for July 2006) to November, when bats are absent.

The replacement of the fibre cement roofing was carried out by using laminate material instead of copper, with no apparent disturbance or microclimate alteration.

In fact, the number of bats only showed a slight decrease after the works, possibly due to other factors (the magnitude of natural oscillations could only be assessed from a long-term temporal series of data, which unfortunately is not available). From the available data, a long period (30 September to 1 April) is suitable for carrying out the remaining renovation works without harming the bats.

It is crucial to preserve the original roof openings. Such crevices, between roof beams and airflow tiles, are necessary to allow bats to move in and out. The renovated portion of the roof was not used by bats, but should the whole roof be replaced, some special tiles should be inserted in the laminate material to allow access. Moreover, the small windows used by bats should be sheltered appropriately, so they can remain open in summer allowing bats to enter, while protecting the site from rain.

9.8. Buildings and Monuments of Villa Demidoff Park

Region: Tuscany

Province: Firenze

Council: Vaglia

Roost type: Attics of monument buildings, cellar of old mill, historical fountains and related hydraulic fittings.

Owner: Florence Province

Relevant local authority (*Soprintendenza*): Soprintendenza per i Beni Architettonici e il Paesaggio per le province di Firenze, Pistoia e Prato

Elevation: 350 m a.s.l.

Surveyor: P. Agnelli

9.8.1 Characterization of site and bats

9.8.1.1. Historical and current occurrence of bats

No information on bat occurrence at the site before 1990 is available. Subsequent faunal surveyors reported on the presence of single bats, but species were either not identified or identification was not reliable. Recent ongoing work has shown the presence of a *Myotis emarginatus* nursery made up of 350 bats. Surveys of the buildings present at the park in the various seasons showed also that *Rhinolophus ferrumequinum* occurs at the site, with a nursery (90 bats), an autumn colony (130 bats) and a wintering colony (35 bats).

There are also other roosts of different species, occurring in smaller numbers, i.e. *Rhinolophus hipposideros* (12), *Miniopterus schreibersii* (1), *Myotis* sp. (2).

9.8.1.2. Assessment of conservation value

The size of the *M. emarginatus* colony is significant on a national scale,

and meets the selection criteria for the colonies of national importance set by Agnelli et al. (2004). It is sufficient to require the designation of a SAC according to the EC/92/43 Habitats Directive. The seasonal presence of another Annex II species, *R. ferrumequinum*, is also worth mentioning.

9.8.2 Threats

The 160-ha Park, on the hills near Florence, is characterized by a mosaic of agricultural habitats (arable land, vineyards and olive groves) and unmanaged land or woodland, offering ideal conditions to support a rich bat community. Its closeness to Florence means it can strategically support biological diversity and act as a wildlife source in a largely built-up area. At least ten buildings and monuments are used by bats or offer suitable roosting conditions. Many of them are now undergoing renovation work coordinated by Florence Province. So far the presence of bats has been ignored, so that at least two species (*M. emarginatus* and *R. ferrumequinum*) switched roost during the same reproductive season. The main objective we tackled was to preserve the *M. emarginatus* colony, which was moving to sites altered by recent works (Silos of *La Fattoria* building) or unsuitable in terms of microclimate (*Dei Medici* mill). From interviews and direct surveys we established that the optimal roost where the colony flourished in the past was the attic of *La Paggeria* building, so conservation efforts are now focused here. Besides conducting technical actions, we are conducting a careful information campaign targeting the Park's staff and management, to achieve the most effective possible impact.

9.8.3 Actions

Following the discovery of such an important colony in the Mill, Florence Province was immediately alerted; specifically the Environment Direction, the central Direction for Infrastructures and the Park direction were told about the colony. A meeting was arranged at the provincial central direction for the landscape, where the need to take appropriate action to safeguard the colony's persistence was highlighted.

9.8.3.1. Agreed or proposed actions

- Planning renovation work for the *La Fattoria* silos and the Medici mill, so that their features will still allow their use by bats in summer. Avoid works in April – September.
- Interventions on the *La Paggeria* attic to re-create the original conditions suitable for bats, specifically by removing the metal grill currently closing the entrance window. Florence provincial government will replace the grill with a structure which allows bats, but not birds, to enter the site. Works should commence by the spring preceding the return of bats.
- Some doors within the attic should be open to allow bats access to other attic rooms
- No chemical timber treatment should be used, to avoid harming the bats
- All artificial illumination of the building near the entrance window should be removed
- Movements by the *M. emarginatus* and *R. ferrumequinum* breeding colony between roosting sites should be monitored, at least until the *Paggeria* attics are re-colonised.
- Potential roost sites in small buildings or monuments, largely available in the Park and currently hosting single bats or small groups of juveniles or adult males, should be improved to encourage roosting.

Although the *Paggeria* attic has not yet been restored, the entrance window grill has been removed and the first positive records show the settlement of colony of 12 *R. hipposideros*, and two *R. ferrumequinum*, in summer 2007.

9.9. Alfieri Theatre

Region: Toscana

Province: Lucca

Council: Castelnuovo di Garfagnana

Roost type: Attic of monument building

Owner: Comune di Castelnuovo di Garfagnana

Relevant local authority (*Soprintendenza*): Soprintendenza per i Beni Architettonici e il Paesaggio per la provincia di Lucca

Elevation: 290 m s.l.m.

Surveyor: P. Agnelli

9.9.1 Characterization of site and bats

9.9.1.1. Historical and current occurrence of bats

No information is available on the occurrence of bats at the Alfieri theatre in Castelnuovo di Garfagnana before 1990. The building dates to 1860 and is an example of “Italian theatre”, which shows the original architectural elements in terms of both general structure and outer and inner decorations. After a long abandonment, during which the building was colonized by bats, in 2000 the theatre was bought by the city council government which started renovation in order to reopen it. In September 2002, 30 *Rhinolophus ferrumequinum* were first reported, but the highest number of bats (50 / 80) was counted in September 2006.

9.9.1.2. Assessment of conservation value

The theatre is home to one of the three *R. ferrumequinum* nursery colonies known for Tuscany (the remainder having been only recently discovered in the San Rossore Park, Pisa, and in the town of Montignoso, within the Lucca provincial territory). The overall number of colonies

known for Italy is itself small, according to GIRC (2004) – only another 21 reproductive colonies, each consisting of 4-127 bats.

9.9.2 Threats

Since renovation works started (in 2000) and for much of their duration, bats remained in several spaces as well as in the attic (including in the underlying scenic tower and stalls). Droppings are most abundant in the attic, however, where bats give birth and raise their young. The partition between the attic and the stalls is the so-called reverberating ceiling, made of wooden supports and a decorated plastered layer. This ceiling is weight-bearing (can be stepped on) only in some narrow places. Bats cross a narrow window in the back of the building, leading to a 2x3 m room where many droppings are visible and large numbers of bats congregate in the reproductive season; then they get to the center of the attic through a 4-m segment of the 1.5-m large peripheral corridor. Before works started, the central attic section was a crucial roosting site. Restoration works made to safeguard the ceiling and the stalls involved adding axes and cables, now forming obstacles to bat flight, to anchor the floor to the roof beams. The ceiling of the stalls had been also damaged by the accumulation of droppings. After the droppings had been removed and the ceiling paintings had been restored, a way had to be found to prevent further guano accumulation. Besides, the bats could no longer be allowed to enter the stalls or the scenic tower they used to reach from the attic by flying through a narrow pass, if disturbance of performances was to be avoided. Not only was preserving the roost in the central attic section now difficult because, as we have seen, renovation works had compromised it, but also because the floor was hard to access and a protective sheet could not be placed on it.

9.9.3 Actions

The engineer responsible for site renovation, Leonardo Paolini, took great care to adopt some simple techniques to limit disturbance to bats and

to exclude them from the stalls during the inaugural performance. In a meeting with the city council's mayor Sauro Bonaldi (3 October 2006) the decision was made to adopt the structural changes necessary to preserve the colony, while allowing performances to take place at the theatre.

9.9.3.1. Agreed or proposed actions

- The passage between the attic's peripheral corridor and the central attic section should be closed by appropriate layers or by a thin wall, which is easy to remove.
- The window aperture currently leading to the new 2x3 m roost room should be bricked up, and the glasses should be removed from the other window ca. 6 m away from it, leading to the peripheral corridor, to keep that window permanently open.
- The peripheral corridor should be closed ca. 2 m beyond the new access window, leaving sufficient space for the bats to perform light-sampling flights before emergence.
- Works should be completed by March 2007, i.e. before the colony returns for the summer.
- The colony should be monitored from Spring or Summer 2007 to check whether the changes are readily accepted; if not, it may be necessary to reopen access routes into the central attic. Bats should also be counted from photos taken immediately before parturition, in order to obtain an initial assessment of colony size and monitor its trend in the future.

Bats proved tolerated the space reduction, since the main roosting site was not affected. The new entrance is used by bats; the roost is structurally unaltered, and now better protected from light and wind.

9.10. National Archeological Museum of Umbria at Saint Domenico architectural Complex

Region: Umbria

Province: Perugia

Council: Perugia

Roost type: loggia of a cloister in a historical building used to exhibit archaeological finds. The site is confined by an attic and peripheral windows.

Owner: Ministry for the Cultural Heritage and Activities

Relevant local authority (*Soprintendenza*): Soprintendenza per i Beni Archeologici dell'Umbria

Elevation: 400 m a.s.l.

Surveyors: C. Spilinga, M. T. Serangeli, B. Ragni, D. Russo

9.10.1 Characterization of site and bats

9.10.1.1. Historical and current occurrence of bats

Bats have been noticed at the site by the museum staff for many years. In summer 2006, their presence became more conspicuous, so the museum directors decided to contact specialists, in order to find out how to handle the situation. Bats were noticed flying even in daytime inside the museum, and flights were not related to any structural changes made at the site.

9.10.1.2. Assessment of conservation value

The presence of house-dwelling bats such as *Pipistrellus kuhlii* provides an effective example of conflict, since the species is commonly found in buildings in Italy, and interferes with peoples' activities. Although common, *P. kuhlii* may be put at risk by human impacts, and, along with

all other bat species occurring in the country, it features in Annex IV of the Habitats Directive.

9.10.2 Threats

Museum activities may threaten colony persistence. The loggia hosts valuable Etruscan travertine urns from necropolises in the Perugia area of the Hellenistic Age. It is regularly frequented by visitors. Separated by windows from the remaining cloister, the museum is illuminated at night, a fact which clearly affects bats.

The building has a complex structure and surveyors aimed to identify the main areas used by bats rather than to obtain detailed counts.

Conflicts may arise when bats make frequent flights within the loggia before evening emergence, when the museum is still frequented by visitors. Bats also sometimes roost in the ash-urns and are sometimes trapped at the site when the windows are closed.

9.10.3 Actions

The survival of the colony has been discussed with staff at the archaeological museum and with the relevant *Soprintendenza*; both parties were open to dealing with the issue.

9.10.3.1. Agreed or proposed actions

- Further monitoring at the site.
- Controlling potential illumination disturbance.
- Controlling potential acoustic disturbance.
- Controlling potential disturbance by visitors.
- Setting up bat boxes.

9.11. Santo Spirito al Morrone Abbey in Sulmona

Region: Abruzzo

Province: L'Aquila

Council: Sulmona

Roost type: Attic of a monument abbey

Owner: Treasury Ministry

Relevant local authority (*Soprintendenza*): Soprintendenza per i Beni Architettonici e per il Paesaggio de L'Aquila

Elevation: 360 m a.s.l.

Surveyors: D. Russo, L. Cistrone

9.11.1 *Characterization of site and bats*

9.11.1.1. Historical and current occurrence of bats

The colony was discovered during renovation works at the site. In 2006-2007 surveys led to an estimate of 3-400 bats (reproductive *Myotis emarginatus* and *Rhinolophus ferrumequinum*). The large amount of droppings at the site suggests that bats have been there for many years.

9.11.1.2. Assessment of conservation value

This is the most important roost of house-dwelling bats in the Majella National Park – in fact it is the largest roost of this type known for the entire Abruzzo area so far surveyed for bats (e.g. the Abruzzo, Lazio and Molise National Park). It is regarded as of notable importance on a large geographical scale (central and southern Italy). The site meets the selection criteria defined for national roosts of special conservation importance (Agnelli et al., 2004).

9.11.2 Threats

Renovation works were carried out independently by the Park authorities and the *Soprintendenza*, since the two institutions will have their premises in different wings of the building. The works did not affect the attic where bats roost. The building is structurally very complex, so surveyors mostly aimed to determine the flight paths followed by bats leaving the roost in the evening. Bats leave the attic, cross a small church part of the architectonic complex, and emerge in a cloister after crossing a niche communicating with a side room of the church. Potential conflict may arise because at present bats cross the church (which has been renovated, but is not yet frequented by people) before leaving the site. Setting up artificial lights would also disturb bats on their evening emergence.

9.11.3 Actions

The issue was discussed with the Majella National Park Directors, who, in agreement with the *Soprintendenza*, made efforts to manage it, and instigated bat surveys to determine the main management strategies.

9.11.3.1. Agreed or proposed actions

At present the following actions are either being undertaken or are planned:

- Further monitoring by automatic recording with an infra-red video camera.
- Opening access points (skylights and windows) at present closed with grills or nets, which could be used by bats, and setting up devices to selectively exclude house-pigeons but not bats.
- Taking care in locating artificial lights.
- Acoustic disturbance mitigation.
- Installing doors to protect corridors in the building from undesirable access by bats.

- Linking the video camera's output with the Park's website, for educational or scientific purposes.

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A. Agreement between the ministry for the environment and the protection of sea and land (general direction for nature protection) and the ministry for the cultural heritage and activities (general direction for the architectural and landscape heritage), for the protection of bats in buildings and sites of historical, architectural, archaeological or landscape value

The Ministry for the Environment and the Protection of Land and Sea and the Ministry for the Cultural Heritage and Activities, recalling that:

- According to law, all bats occurring in Italy are strictly protected (section 2 of Law 157/92; appendices II and III of Bern Convention, ratified in Italy with L. 503/81; appendix II of Bonn Convention, ratified in Italy with Law 42/83; appendices B and D of Presidential Decree 357/97); individual bats must not be disturbed, especially during reproduction and hibernation, and their roosts must not be altered or destroyed (section 6, point 3 of Bern Convention; section 8 of Presidential Decree 357/97);
- Italy is committed to bat protection as also established by the fact that it joined the Convention for the Protection of European Bats (EUROBATS) ratified with Law 27 May 2005 no. 104;
- Almost all bat species in Italy more or less regularly roost in buildings, and this presents the challenge of preserving bats while allowing the use of buildings and their maintenance, renovation or restructuring;
- Monument buildings are generally important for bat conservation because of their large spaces, which are used by selective and threatened species. Monument buildings are also quite often subject

to renovation or maintenance work, which can lead to the loss of bat colonies and even to local extinction when work is planned without consideration for bats;

- The Environment Ministry – Direction for Nature Protection has stipulated a one-year convention with the University of Insubria called “Conservation, study and management of bats” also featuring specific actions aimed at the “conservation, information and awareness raising to protect bats in buildings and solve related conflicts in monument buildings and at sites under management by the Soprintendenza authorities”;
- For this achievement, the Insubria University is supported by the Italian Chiroptera Research Group (GIRC), a network of specialists well represented in the various regions of the country; scientific supervision is provided by the National Institute for Wildlife (INFS);
- The above-mentioned convention includes the following actions:
 1. Preparing guidelines for bat conservation in buildings and related problem-solving;
 2. Carrying out a survey to identify important bat colonies in buildings or sites managed by the Soprintendenze, and developing an operational protocol to be submitted for approval by the two contracting Ministries;
 3. Carrying out urgent bat surveys and consultancy work;
- Action 1 also includes a part specifically devoted to monument buildings and sites protected for historical, cultural, architectural, archaeological or landscape reasons;
- Action 3 includes providing the Soprintendenze with advice from bat experts, to solve possible conflicts arising from the occurrence of bats in buildings managed by the latter;
- The relevant authorities have already started a collaboration, especially to prepare a questionnaire for Action 2;
- It is necessary to develop constant collaboration between the parties, in

order to manage cases of bats in monument buildings managed by the Soprintendenze optimally;

Have agreed what follows:

Section 1

The contracting institutions are committed to collaborating to protect, according to the law, wildlife that occurs occasionally or permanently in areas and sites preserved by the Soprintendenze for their historical, cultural, architectural, archaeological or landscape value, with special reference to bats. They will thus identify agreed strategies and work jointly to achieve this goal.

Section 2

Within the actions for “conservation, information and awareness raising to protect bats in buildings and solve related conflicts” planned in the above-mentioned convention between the Environment Ministry and Insubria University, the institutions signing the present agreement are committed to:

- Monitor project realization;
- Prepare guidelines together, and agree jointly on the final version detailing their respective responsibilities;
- Involve, as appropriate, the territorial or regional Soprintendenze;
- Identify, and agree on, appropriate information, awareness raising and popularization actions to achieve the goals of the agreement.

Section 3

The enforcement of the present protocol is to be accomplished by means of negotiation talks involving representatives from the Ministry for the Environment and the Protection of Land and Sea (General Direction for

Nature Protection) and the Ministry for the Cultural Heritage and Activities (General Direction for the Architectural and Landscape Heritage), with scientific support from National Wildlife Institute (INFS) and Italian Chiroptera Research Group (GIRC).

Negotiation talks are coordinated by the Ministry for the Environment and the Protection of Land and Sea, and the parties may be joined by further parties if their involvement is considered to be relevant. Participation costs are paid by participating subjects.

Section 4

The contracting institutions will have the right to check on the progress made in the negotiation talks, and on the achievements made.

Section 5

The present agreement is prepared in three original copies and will be valid for three years beginning on the registration date of the protocol (registration will be carried out by the Environment Ministry).

Rome, 14th November 2006 20692

Ministry for the Environment
and the Protection of Land and Sea
*General Direction
for Nature Protection*

Ministry for the Cultural Heritage
and Activities
*General Direction for Architectural
and Landscape Heritage*

B. Data collection sheet for bats found dead or in difficulty

Storage of this information is useful for reporting, as established by section 8 of Presidential Decree 357/97 (monitoring of accidental captures or casualties), and more generally to get information on species distribution or abundance (for preparation of atlases, assessment of conservation status, etc.)

The following column headings are suggested for data recording sheets:

Surveyor	Identifying person	Date	Province
City Council	Altitude	Location	Site/Habitat

Species	Age of bats		Physical condition			
	Newborn (n°)	Unknown (n°)	Dead (n°)	Injured (n°)	Weak (n°)	Healthy (n°)

Cause	Destination of bats
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Surveyor. The person who collects the bat(s). Record name.

Identifying person. The person who identifies the bat(s). Record name (if different from surveyor).

Date. Date of retrieval of specimen(s). Record a different exact date in each row, rather than longer periods (months or years).

Province. Code of province where the bat(s) was (were) found.

City council. City Council where the bat(s) was (were) found.

Location. Location where bat(s) was (were) found. When found in a building, note street name and building number, otherwise if possible provide location references, such as geographical coordinates, specifying the projection system adopted.

Altitude. Elevation above sea level (entrance elevation for underground sites).

Site/Habitat. Features of site/habitat where bat(s) was (were) found.

- *When found in a building*, specify type: house, school, hospital, barrack, church, bell tower, castle, fort, etc.
- *When found at an underground site*, specify: cave, mine, etc.
- *When found outdoors*, specify the habitat at the site:
 - built-up areas, parks and urban gardens;
 - arable, little natural vegetation;
 - arable, significant natural vegetation;
 - orchard, vinyard;
 - poplar tree plantation, conifer plantation or other tree plantation;
 - broadleaved woodland;
 - mixed woodland;
 - conifer woodland;
 - coastal pine woodland;
 - Mediterranean evergreen woodland (holm oak, cork oak);
 - Mediterranean scrubland;
 - other scrubland;
 - pasture or meadow;
 - talus slope, scree or other surface dominated by rocks;
 - cliff;
 - sea coast;
 - lake, swamp or pond;
 - river, stream or canal.

Species. When insufficient expertise is available to identify the bat(s) confidently, simply record as UND (undetermined). If identification is carried out, please record the species only if it is certain.

Suggested codes for identifying the bat(s): Refer to scientific name and code the species by using the first three letters of genus followed by the first three letters of specific name, separating them with an underscore e.g. *Myotis blythii* as Myo_bly.

For species pairs which may be confused use the following codes: *M. myotis* and/or *M. blythii* MYO_BIS; *M. brandtii* and/or *M. mystacinus* MYO_TER; *P. pipistrellus* and/or *P. pygmaeus* PIP_BIS.

When attribution to species, or “species pairs”, is not possible, refer to genus e.g. genus *Plecotus*: PLE_SPP.

When bats belonging to different taxa are found, please use a different row in the recording sheet for each taxon.

Specimen age. Note the number of specimens found specifying whether they are newborn or not. From the end of May to late July, newborn bats are commonly found – they are recognizable because they have little or no hair. The number of such bats should be recorded in the newborns column. In all other cases, including when it is unknown whether bats are newborn or not, simply record them in the “unknown age” column.

Physical conditions. Record the number of bats according to their condition: dead, injured, weak (when they have been trapped for several days they generally cannot fly), apparently healthy (in case of uncertain classification to either weak or healthy, record bat as belonging to the latter).

Cause. When it can be ascertained, record the cause of the phenomenon. E.g. if a bat is dead or injured, was this caused by: a cat; mosquito net; rolling shutter; works in building; trapped by sharp structures or “pitfall trap”-like structures (specify type, e.g. trapping in narrow spaces preventing the bat to take flight, between glasses or smooth walls).

Should bats be found inside a building, record whether access to inner

rooms was accidental or for unknown reasons; whether, as is likely, access to inner rooms was through the slit of a roller shutter box (roller shutter left down and window open), etc.

Destination of bats. Specify who took the specimens.

THE SERIES

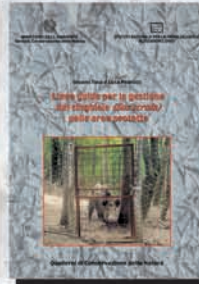
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7
Piano d'azione nazionale per il Chiurlottello (*Numenius tenuirostris*)



8
Piano d'azione nazionale per il Pollo sultano (*Porphyrio porphyrio*)



9
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10
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11
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12
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12 BIS
Forensic genetics and the Washington Convention - CITES



13
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14
Mammiferi d'Italia

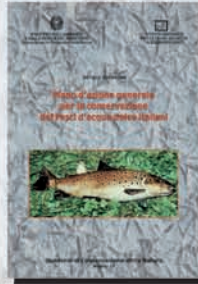
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conservazione
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dolce italiani



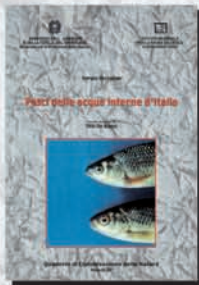
18
Atti del Convegno
"La conoscenza
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(*Marmaronetta
angustirostris*)



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Piano d'azione
nazionale per il
Lanario (*Falco
biarmicus feldeggii*)



25
Piano d'azione
nazionale per la
Moretta tabaccata
(*Aythya nyroca*)



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Piano d'azione
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Linee guida per
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Linee guida per la
conservazione dei
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aspetti conflittuali
connessi



28 BIS
 Guidelines for the conservation of bats in buildings and the resolution of related conflicts



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 Anfibi d'Italia



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 Piano d'azione nazionale per il Capovaccaio (*Neophron percnopterus*)



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 Piano d'azione nazionale per il Capriolo italico (*Capreolus capreolus italicus*)



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 Piano d'azione interregionale per la conservazione dell'Orso Bruno nelle Alpi Centro-Orientali (Pacobace)



33
 Ricerca scientifica e strategie per la conservazione del lupo (*Canis lupus*) in Italia



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 Linee guida per la gestione del Cinghiale (*Sus scrofa*) nelle aree protette 2ª edizione

Finito di stampare nel mese di settembre 2010
da Arti Grafiche Solimene, Casoria (Napoli)
per conto della CUEN srl, Napoli