Bats in Churches

Guidelines for the identification, assessment, and management of bat-related damage to church contents (furnishings, fittings, and works of art)

ENGLISH HERITAGE

ENGLISH NATURE

Introduction

It has been estimated that of the 8000 medieval parish churches in England, up to 60% may be used by bats for at least part of the year. Many have only a small number of bats, typically 50 individuals, although this may increase to much larger population sizes. The excreta from bats using churches, however, may cause damage to its contents and fittings. These guidelines advise on how to protect vulnerable objects and furnishings in churches. They expand upon, and update, suggestions offered in previous publications including *Bats in churches* (Council for the Care of Churches 1987) and *The bats in churches project* (Sargent 1995).

When addressing the problem of bats and church artefacts, there will, on occasion, be tension between those who are concerned with the religious functions of a church and the cultural value of its contents and those whose primary interest is wildlife. These guidelines offer a variety of approaches and solutions to these complex conservation issues.

Bats

There are now 16 species of bat in the UK, some of which have declined significantly in recent years. One species became extinct in the UK in about 1990 and, of the remainder, two are in danger of extinction and nine are threatened. The decline in bat numbers has been caused by changes in agricultural practice resulting in a reduction of insect abundance and loss of pasture, deciduous woodland, and hedgerows, and by the loss of roosts in buildings and old trees and by timber treatment practices in buildings. As a result, churches can provide significant roost sites for bats in some areas. All bats are now protected by the Wildlife and Countryside Act 1981 and English Nature should be consulted in advance of any work that might affect bats or their roosts. The presence of bats in a church will be most apparent generally between June and September, with declining activity from October to December. They are insectivorous mammals that hibernate during the winter months (November to April) and give birth to their young in June or July. This annual cycle affects the selection and movement between roosts, including breeding and hibernation sites. While new sites are continuously investigated (and colonised if suitable), bats will often return to traditional sites year after year. Bats may live up to 30 years, and produce no more than one offspring a year.

The value of church contents

Churches are a major repository of a wide variety of objects, both fixed and movable, many of which are of considerable historic and artistic interest, but are also vulnerable to damage from bats. In particular, many churches contain rare and irreplaceable wall paintings dating from the Middle Ages and post-Reformation periods. Churches also contain important fixtures such as tombs and screens (originally painted and often with the surviving paint or polychromy), monumental brasses, paintings on canvas, and textiles. Items such as organs, lecterns, and altar furnishings can also be of considerable artistic merit. These are all potentially vulnerable to damage from bat excreta.

The ownership of the fabric and furnishings of a church is generally vested in the incumbent and churchwardens, but responsibility for repair, maintenance, and

Common Pipistrelle bat, Pipistrellus pipistrellus *(photo: Frank Greenaway)*

Table 1 Bat species which typically use churches

species	*Where bats are recorded as using a church, the relative proportion of species type is given (Sargent 1995)*	*status in Britain*
Pipistrelle	51%	not threatened
Brown long-eared	36%	not threatened
Serotine	6%	threatened
Natterer's	3%	threatened
Greater horseshoe	2%	risk of extinction
Lesser horseshoe	1%	risk of extinction
Daubenton's	1%	not threatened

insurance lies with the Parochial Church Council. All churches, their contents, and churchyards, are under the jurisdiction of the Chancellor, who is an independent judge appointed by the Diocesan Bishop. No repair or alteration may be done to a parish church without the authority of the Chancellor. Included in the standard application form for a faculty is a question about the risk of bats being disturbed by the proposed work.

Use of churches by bats

Bats use churches for a variety of functions, including maternity, pre-hibernation, and hibernation roosts. The number of bats can vary greatly but numbers in most churches are usually quite low. The average number for a maternity colony may be about 50 but smaller groups of non-breeding animals also frequently use churches.

Access to the church is usually through gaps around doors, windows, or eaves and bats may fly within the interior of the church before entering their roost. The structure of the church may offer a wide range of potential roost sites, including gaps in walls around beam ends and crevices in wall plates or behind wall fixtures. One of the commonest locations is the gap between the chancel arch and roof rafter. Bat species typically found using churches are shown in Table 1.

Conservation problems

Bats, particularly pipistrelles, tend to urinate and defecate upon entering and leaving a roost or its access point. It is around these areas that the greatest concentration of material will be noticed, although, as bats may fly around the interior of a church for social purposes, faeces and urine may also be distributed over a wide range of surfaces and walls.

Droppings, perhaps the most obvious indicator of the presence of bats, are largely made up of the indigestible exoskeleton of their insect prey, with additional nitrogen compounds and a small percentage of fats and oils. Droppings act as a source of nutrients for bacterial and fungal decay. They may range from dry and crumbly to sticky and gelatinous, depending on species, diet, and season. Bat urine is 70% urea, decaying to form dilute ammonia and other compounds and is therefore alkaline.

Droppings may cause pitting, long-term staining, and etching to porous materials such as painted wall surfaces, stone, and wooden monuments and sculptures, while urine causes the characteristic spotting and etching of wooden, metal, and painted surfaces. Urine is chemically more aggressive than droppings and its deposition, although harder to observe, is therefore of greater conservation concern.

The internationally renowned scheme of wall paintings (dated c 1100) at Clayton Church, East Sussex, has been exposed to bat excreta as the result of this church being used as a roosting site. While the presence of urine can often be difficult to see because of the porous nature of a wall surface, droppings are more easily identifiable, as seen here

A brass at Broughton Church, Oxfordshire, of Philippa Byschoppesdon, dated 1414, which has suffered disfiguring surface erosion from droplets of bat urine

At Brinkburn Priory, Northumberland, a nineteenth-century pew displays evidence of both visual and surface damage to the wooden surface from the development of microbiological organisms forming on an area of extensive urine deposition

Assessment of bat activity and effects on church contents

Those with responsibility for the maintenance of churches, members of parochial church councils, and church architects may all notice that church contents are suffering damage from bat excreta. Before any remedial measures are proposed, accurate information on the bats, church contents, the rate of deposition and the seasons when it occurs, and extent of damage should if possible be collected. This assessment, which will help determine the appropriate management, can usually be undertaken by the parochial church council, incumbent, or volunteers. But professional advice on the species and status of the bats, and on the value and risk to church contents, must be obtained before management begins.

Information about bats should include:

- identification of the species
- assessment of the number of bats
- location of roosts in the church
- the seasons when the bats occupy the church
- significance of the church for bats

Advice should be sought from English Nature, the Bat Conservation Trust, or the local bat group.

Information about church contents should include:

- evaluation of the historic, artistic, and cultural value of all works of art, and other objects, in the church in both local and national terms
- assessment of the risk of damage from bat excreta

Advice should be sought from the Diocesan Advisory Committee, the Council for the Care of Churches, and/or English Heritage.

Any wooden surface previously treated with an organic varnish layer or wax coating is particularly vulnerable to the effects of bat urine. Here the polished top to an organ at Clayton Church, East Sussex, displays the typical effects of surface etching resulting from the strong alkalinity of bat urine when in contact with such coatings

Information about the pattern and rate of deposition should include:

- assessment of the distribution of faeces and urine marks to establish whether deposition is localised or broadly distributed throughout the church. The rate of deposition and the pattern of droppings will give an indication of the likely location of roosts or access points in the church and be a guide to the number of bats involved.

Initial comments can be obtained from those responsible for the routine maintenance (eg cleaning) of the church. For a more accurate assessment of both the amount and distribution of bat excreta, however, recording onto a scale plan of the church is very useful. Divide the plan up into one-metre square sections, count the number of spots of urine or droppings in each square, and record on the plan. A hand-held one-metre square frame or quadrant may help.

A roost site at Heydon Church, Norfolk, has been positioned above a sixteenth-century monument, which also covers part of an earlier fourteenth-century wall painting. The accumulation of bat droppings is not only visually impairing, but will also be responsible for a variety of other deterioration phenomena, both to the stonework and to the pigments of the wall painting

A brass candlestick displays the typical effects of surface erosion and staining that can result from bat urine

Since evidence for the presence of bats can be detected through damage to woodwork, stone, metals, and other vulnerable surfaces, it is useful to chart these effects by counting the visible damage marks on surfaces and plotting these on a plan of the church. A measuring frame, as shown here, assists in developing a systematic approach to this exercise. Such information will give a useful indication of both the rate and distribution pattern of bat excreta throughout the building

A nineteenth-century memorial board at Little Hadham Church, Hertfordshire, shows the dramatic consequences of a bat roost positioned immediately above. This concentration of excreta around the roost is typical, causing great risk to any exposed object below

The church at Broughton, Oxfordshire, was used as part of the experimental work in developing a number of ways that parishes could begin to monitor and ameliorate a bat problem. Here one metre square cards were positioned over an area of the chancel floor. These were left in place for a number of months during which time individual droppings and urine droplets were systematically counted. This yealded useful baseline data on the active rate over time of the deposition of bat excreta occuring in this part of the church

The results will show the total accumulation, possibly over many years, but if recording is repeated it will allow an assessment of current deposition and so an insight into the movements of bats within the church. When combined with information on the location of roosts and access points, the areas of concentrated bat activity will become more clearly defined.

- more accurate, further assessment of the rates of deposition in those more specific areas. This can be achieved using light-coloured one-metre square sample cards located beneath known roosts, access points, other areas with a concentration of urine spotting, or near objects of particular historic or artistic concern (eg tomb top or floor-mounted brass). The cards should be in place between May and at least October or November. Count the number of urine spots and faeces which fall during two- or four-weekly periods over the season (see Table 2). A hand-held UV lamp available from conservation supply specialists (see below for stockists) will help illuminate

Table 2 Broughton Church, Oxfordshire: 1m² collection cards at three locations in the church, of accumulate droppings and urine spotting at different rates through the summer season, depending on the level of bat activity. (Although monitoring ceased in October, the deposition of excreta does not. Activity on a decreasing scale should be anticipated throughout the latter part of the year.)

card number and position	*July*		*August*		*September*		*October*	
1 chancel	faeces	110	faeces	175	faeces	200	faeces	210
	urine	65	urine	109	urine	120	urine	130
2 chancel	faeces	33	faeces	50	faeces	63	faeces	75
	urine	16	urine	23	urine	37	urine	48
3 south aisle, west	faeces	1	faeces	3	faeces	5	faeces	6
	urine	0	urine	5	urine	5	urine	6

dried urine drops and ease counting. These results can be compared with the distribution map to distinguish areas where deposition is currently high from those where deposition occurred in the past.

The example of Broughton Church, Oxfordshire, shown in the plan below and Table 2 indicates that the area of highest deposition is in the chancel (1) and lowest deposition in the south aisle, west end (3). In this case the pattern of deposition is mirrored by both assessment methods (accumulative and current). Pipistrelle bats enter the church near the West Door but the roost is at the extreme east end, in the chancel. Deposition is highest in these areas. Bats fly the length of the church from their access point to their roost. There is less bat activity in the south aisle. Although there is a Natterer's bat roost in the south porch, these bats do not enter the church.

Information about the degree of damage should include:

- an estimate of the extent, rate, location, and severity of bat-related damage, in order to establish which church artefacts are under the greatest threat and to enable a management strategy to be formulated

This assessment will need to be made in collaboration with an appropriately qualified conservator.

Management of bat-related damage

The assessments carried out above will have helped to establish the importance of historic or cultural fixtures and fittings, and the risk posed to them from bat excreta. It will also establish the location of the bats, the species, and the functional requirements of the church for them. Different approaches to management should be taken where an object of great importance is exposed to damage from a few relatively common bats as opposed to an object of relatively low value damaged by larger numbers of rare bats. Recommended management solutions are outlined in Table 3.

Table 3 Potential range of interventions in the management of bat related damage to the contents of churches

increasing vulnerability of bats
increasing 'value' of object

• No action required

Buildings where contents are considered to be at no risk; no contents; contents of little 'value' and/or, limited occupancy by very small bat population.

• Interventions not requiring the modification of bat behaviour

material types	*protective measures*	*effectiveness*
	moving objects	Applicable if object is free standing and tests show 'safer' location. May require Faculty.
	covers: linen, carpet, others	Only natural fibre materials should be used. Non-porous materials such as polythene may result in the retention of moisture, and must be avoided. There are aesthetic implications, and covers are only suitable for individual objects. Covers may deny the spectacle of the object to visitors. The installation of covers may risk damage to some fragile objects.
painting on wood painting on stone/plaster stone metals textiles wooden furnishings glass	coatings: waxes-natural/synthetic, laquers, polishes	Coatings generally have serious conservation implications for a wide range of objects and are not normally recommended. Some synthetic lacquers (for metals) can be effective in the short to medium term, but will have an effect on patination of surfaces. Requires regular stripping and re-application. Will require advice from conservator for important objects. Organic waxes (eg beeswax) are ineffective for the protection of surfaces.
	deflector boards	May be effective in reducing total amounts of excreta when placed beneath a roost; variations in trajectory of excretion not necessarily deflected. Aesthetic problems. Regular maintenance required to remove accumulated droppings. Will require a Faculty.
	deterrents: lights, sound, smells, screens, chancel nets, helium-filled balloons, aluminium foil, etc	No firm evidence yet that lights can be used as a long-term deterrent mechanism. May be effective in the short term. No evidence that bats are discouraged in the long term by smells, ultra sound or other artificial decoys. Aesthetic and some practical problems with other deterrents devices. May require a Faculty.

increasing 'value' of object
increasing vulnerability of bats

• Actions requiring the modification of bat behaviour

intervention	*method*	*effectiveness*
Relocation of roost/access points within the church	Original access/roost blocked to prevent future use. Establish alternative access/roost in another part of building, away from vulnerable areas. Ensure any potential new access/roost sites near vulnerable areas are blocked first.	The localised high concentrations of excreta deposition can be solved by this method, but problem may be moved to other areas within the same building. No effect on background excretion deposited throughout the building during internal flying. Requires advice from English Nature.
Exclusion: from interior of church	The complete blocking of all access points to the building. Re-establishment of new roosting sites away from church.	Difficult to block all access points, and to dissuade re-occupation outside of building. Encouraging use of new roost sites is problematic. Requires advice from English Nature.

This carpet at Broughton Church, Oxfordshire, offers some protection to an exposed stone floor slab. This example amply demonstrates not only how harmful bat excreta can be, but also emphasises how important is the need to instigate appropriate measures to safeguard historic and artistic objects in churches where bats are present

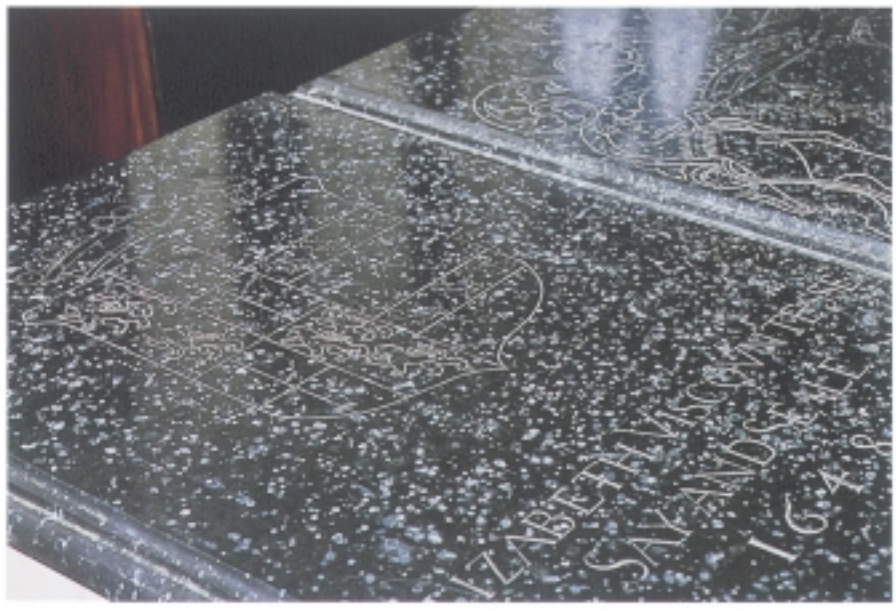
Church cleaning

The cleaning of a church is not a specific conservation measure, but rather part of the routine maintenance of a building. While it is generally desirable to remove droppings, although their constituency and location (eg on a wall painting) may sometimes negate such an intervention, the urine marks usually remain. Droppings should be removed only from robust and historically insignificant objects. Cleaning with water should be avoided in most circumstances as it can remove protective patination, dissolve surface layers of the object, and risk initiating harmful salt activity and microbial growth. Fragile surfaces can be seriously damaged by inappropriate cleaning techniques and should only by carried-out by professional conservators.

Conservation options (see Table 3)

The opinion of qualified professionals in both conservation fields should be sought to help decide on appropriate management options for different circumstances.

- *No action required* Bats may not be a problem if they occur in very small numbers or only use parts of the building without vulnerable or significant objects.
- *Moving objects* If a free-standing object is exposed to bat excreta it may be appropriate to move it to a location where sample cards have shown a low rate of deposition. This may require Faculty permission if, for example, the original position has liturgical or historical significance.
- *Covers* Covers may be appropriate when deposition is localised or when there are only a few vulnerable objects. Covers are less suitable when deposition occurs throughout the church, as the aesthetic impact would be significant. Porous materials such as linen or natural carpet are suitable, but polythene, which may create a moist microclimate around the object, should not be used. All covers should be placed and removed with care to avoid any mechanical damage. A layer of carpet or underfelt would be suitable for a floor-mounted brass but any grit should be removed regularly to avoid damaging the brass surface. Underfelt can be sewn onto a layer of natural fibre carpet for added protection but foam backed carpet or plastic sheeting should not be used.
- *Coatings* Synthetic lacquers offer some protection against bat damage and may be acceptable on historically and artistically insignificant metal and wooden objects. All coatings are problematic, however, and they are only acceptable for a few objects of low artistic and historic significance. They should not be used for historic brasses and woodwork. Natural organic coatings (beeswax and microcrystalline wax) provide little protection against bat urine.
- *Deflector boards* Deflector boards are conventionally used to control the build up of bat droppings to the outside of domestic houses and may be useful in churches to reduce deposition to specific areas. A wooden board 100–150mm wide and 1–2m long positioned at an angle beneath the roost or access point will deflect and/or catch any droppings. The board can be erected during the summer and removed at other times of the year or for cleaning. The local bat group will be able to advise on the most appropriate location, which also needs to consider the aesthetic appearance. The potential risk of fitting boards to historic plaster, stonework, or timber must also be considered. Faculty permission will be required.



The original quality of the polished stone surface of this eighteenth-century tomb at Broughton Church, Oxfordshire, has been dramatically compromised by spots of bat urine. These marks are not removable by any normal cleaning process

- *Deterrents* A variety of deterrents such as stuffed owls, nylon wires, and sound generating devices have been used in the past, but with limited or no success. A barrier of sheeting may be effective, although aesthetically problematic. Bright lights may affect bat behaviour in churches causing them to move to darker areas or reduce social flight activity. Draughts directed at roosts may have some temporary effect but may simply cause the bats to move to another area within the church.
- *Relocation* of roosts or access points for bats This technique has been used with some success in churches. Although relocating or excluding bats from an individual roost site will reduce the impact on a particular part of the church, there is the risk that the bats may simply move to another part of the church and have an adverse effect there. It may, therefore, be necessary to block other potential roosts first. Proposals to relocate bat roosts should be thought through carefully and appropriate professional advice obtained. Relocation will not affect background deposition throughout the church as a whole. Professional advice from English Nature and the local bat group will be required.
- *Exclusion* The decision to exclude bats from a church will depend upon a variety of criteria, both in terms of the value of the object at risk and rarity of the bat species – a judgement that would require joint consultation with both those responsible for the welfare of bats and those for cultural and historic artefacts. Exclusion may have its own problems, not least from the practical difficulties of dissuading re-entry elsewhere within the structure of the building. It may also be expensive. As with relocation procedures, it will be essential that the timing of such operations is appropriate.

All the above mitigation measures should be monitored to assess their effectiveness. This may be a periodic visual assessment or a more methodical approach, repeating some of the assessments of activity and risk described above. Such monitoring will help to evaluate the effectiveness of any chosen interventions and the necessity for further work, as well as to assist in the improvement of advice such as that given here.

Conclusion

Although bat occupation causes damage in churches, these buildings serve as important roost sites. The regard for conservation in its widest sense raises some very difficult issues, where cultural and nature conservation conflict in the church environment. There are no easy solutions and each case will require an individual approach. Decisions should be made upon objective criteria assessing both the importance of the historic features and the bats.

Acknowledgement

These guidelines result from an English Heritage research project examining the effect of bat faeces and urine on historically important church artefacts. The author would like to acknowledge the help of English Nature, the Bat Conservation Trust, the Council for the Care of Churches, the Courtauld Institute of Art, and the Movement Against Bats in Churches (MABIC) in drawing up these guidelines.

Useful addresses:

English Nature, Northminster House, Peterborough PE1 1UA; (01733) 455000. English Nature also has 25 local offices.
English Heritage, 23 Savile Row, London W1X 1AB; (0171) 973 3000.
Council for the Care of Churches, Fielden House, Little College Street, London SW1P 3SH; (0171) 222 3793.
The Bat Conservation Trust, 15 Cloisters House, 8 Battersea Park Road, London SW8 4BG; (0171) 627 2629. Acts as liaison body for the local volunteer groups.

Further reading

Mitchell-Jones, A J, 1992 *Focus on bats,* Peterborough

Paine, S, 1993 The effects of bat excreta on wall paintings, *The Conservator,* 17, 3–10

—, forthcoming *Identification, assessment and management of the effects of bat excreta on historic works of art,* Ancient Monuments Laboratory Reports, London

Sargent, G, 1995 *The bats in churches project,* London

Equipment stockists

Conservation Lighting Equipment, CLE Design Ltd, 69 71 Haydon Road, London SW19 1HQ; (0181) 540 5772

Conservation Resources Ltd, Units 1, 2 & 4, Pony Road, Cowley, Oxon OX4 2RD; (01865) 747755

Note:
These guidelines should only be regarded as a guide to the law. For further details, reference regarding bats should be made to the Wildlife and Countryside Act 1981 and to the Conservation (Natural Habitats, etc) Regulations 1994, and regarding churches to ecclesiastic Faculty Law. Legislation pertaining to Scheduled Ancient Monuments, should also be sought

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