

# Handling and veterinary care of British bats



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**Most wildlife casualties seen in veterinary practice are from common species living in close proximity to humans. Despite recent declines in bat populations, certain species are still relatively abundant in the UK. Many of these bats roost in buildings, increasing their potential exposure to man-made hazards. Their small size and adaptations to flight make them a challenge for the veterinary practitioner. Vets should be aware of the health risks of handling bats, and should have realistic expectations regarding their chances of survival. Practitioners should also be familiar with the legislation pertaining to bats and their roosts. The successful rehabilitation of bats is often time consuming and specialised, and relies on collaborating with local bat groups and those experienced in caring for bats. This article describes the general approach to dealing with bats and outlines the common conditions that might be encountered in these animals.**



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## Natural history and behaviour

Bats are divided into two suborders:

- Microchiroptera, which includes all the insectivorous bat species found in the UK;
- Megachiroptera (fruit bats).

There are currently 18 species of bat native to Britain (see table on page 255), although many are endangered or vulnerable. Identification of the species of bat presented as a casualty is important, and there are plenty of excellent identification guides and keys available. Most rescued bats are from just three species: common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*Pipistrellus pygmaeus*) and the brown long-eared bat (*Plecotus auritus*). Some of the less common species, however, can be quite abundant in certain localities.

Vagrant bats, mostly from continental Europe, are occasionally encountered.

Bats are relatively long-lived animals, with life expectancies of up to 20 to 30 years; however, their natural history is poorly understood. They are the only mammals to have developed true flight, with the wing being a development of the forelimb with elongated metacarpals and phalanges supporting a thin membrane. Bats are social animals, often inhabiting communal roosts, and are nocturnal, emerging around dusk. In the UK, most hibernate between November and March (with variations according to species and climate), interspersed with brief periodic arousal, and some species are thought to migrate to winter roosts. Mating occurs in the autumn/winter, with sperm stored in the female reproductive tract until ovulation

## Summary of important legislation relating to bats

Important legislation	Summary
Wildlife and Countryside Act 1981 (WCA)	<i>It is an offence to:</i> Capture, injure or kill a healthy bat (this includes the use of traps or poisons intended for other species)
The Conservation (Natural Habitats, &c.) Regulations 1994 (amended 2007) 'Habitats Regulations'	Destroy or damage any bat roost, resting place or shelter Disturb bats anywhere, including at roost. In addition, roof access must not be obstructed
Countryside and Rights of Way Act 2000 (CRoW)	Possess, transport, sell or exchange any bat (alive or dead) or any part of a bat, including long-term disabled captives*
Abandonment of Animals Act 1960	Release any animal that is unlikely to survive in the wild, including bats unable to fly or feed. This also includes releasing bats into an unsuitable habitat, or during unfavourable conditions
	<i>It is legal to:</i> Catch a disabled or injured bat if the intention is to care for and release it once it has recovered Humanely kill a bat if it has no reasonable chance of recovery

Note there are slight differences in the legislation for England and Wales, Scotland, Northern Ireland, the Channel Islands and the Isle of Man. It is recommended that appropriate legislation is consulted for the area of the British Isles involved

\*Certain exceptions may be possible under licence from the Statutory Nature Conservation Organisation

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the following spring. Females produce one offspring per year, which is suckled for about six weeks.

All native British bats feed on insects, which are either caught on the wing, or picked off vegetation, using echolocation to navigate and hunt during low light intensity.

Due to their small size, bats rapidly lose body heat, so, to conserve energy, they have evolved a strategy of heterothermic metabolism. This allows their body temperature to fall in line with the ambient environmental temperature during periods of inactivity. While in this torpid state, all metabolic processes are reduced and energy loss minimised.

Bat populations have been in decline for some time, mainly due to habitat loss. As some species are under threat, bat rehabilitation may have important conservation, as well as welfare, benefits.

## Housing and feeding

All wildlife casualties should be kept away from domestic species (especially cats and dogs) as these are perceived as potential predators. Bats should be housed singly in a warm, quiet area with supplementary heating if required, and only handled when necessary. The optimum temperature range is 25 to 32°C, preferably with the heat source located at one end so the bat can move away if it chooses. The requirements for lifelong captive bats are different from those being rehabilitated for release, and are not discussed in this article.

Bats must be kept in an escape-proof container, with a secure lid and small air holes. It should be disposable, or easily cleaned and disinfected, with sufficient space for a bat to fully extend its wings, exercise

## Bat species resident in Britain

Common name	Scientific name	Current status in UK*
Greater horseshoe bat	<i>Rhinolophus ferrumequinum</i>	Very rare and endangered
Lesser horseshoe bat	<i>Rhinolophus hipposideros</i>	Rare and endangered
Daubenton's bat	<i>Myotis daubentonii</i>	Common
Brandt's bat	<i>Myotis brandtii</i>	Locally common
Whiskered bat	<i>Myotis mystacinus</i>	Locally common
Alcathoe bat	<i>Myotis alcathoe</i>	Status unconfirmed
Natterer's bat	<i>Myotis nattereri</i>	Widespread and common
Bechstein's bat	<i>Myotis bechsteinii</i>	Very rare and endangered
Greater mouse-eared bat	<i>Myotis myotis</i>	Status unconfirmed
Common pipistrelle	<i>Pipistrellus pipistrellus</i>	Widespread and common
Nathusius's pipistrelle	<i>Pipistrellus nathusii</i>	Rare
Soprano pipistrelle	<i>Pipistrellus pygmaeus</i>	Widespread and common
Serotine bat	<i>Eptesicus serotinus</i>	Uncommon and restricted
Noctule bat	<i>Nyctalus noctula</i>	Uncommon
Leisler's bat	<i>Nyctalus leisleri</i>	Scarce
Barbastelle bat	<i>Barbastella barbastellus</i>	Rare
Brown long-eared bat	<i>Plecotus auritus</i>	Widespread and common
Grey long-eared bat	<i>Plecotus austriacus</i>	Very rare

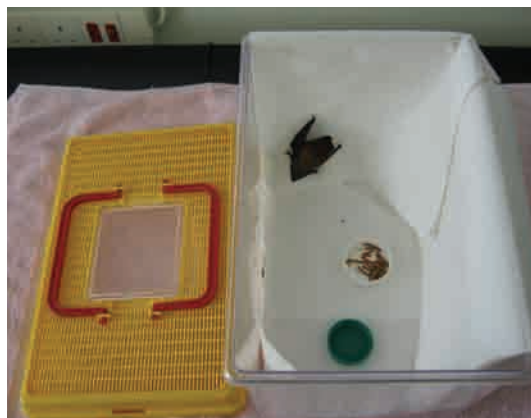
\*Based on the Bat Conservation Trust's National Bat Monitoring Programme

and crawl around, unless it is being confined due to specific injuries. Small plastic pet containers are ideal. A piece of cloth hung down the inside of these containers gives the bat something to cling to and hide within. Water and food should be provided in shallow dishes. Baby bats (pups) have different requirements and need specialised care (see section on infant bats).

Regular flying exercise is essential for recovering bats, remembering to warm the bat beforehand. An



Custom-built wooden bat box containing a brown long-eared bat



Plastic bat box with the lid removed



Brown long-eared bat being fed a mealworm



Noctule bat self-feeding on mealworms

empty room free from hazards and escape routes is ideal, but often difficult to achieve within the confines of a busy veterinary clinic. Bats that have been in care for prolonged periods, including hand-reared youngsters, need more intensive pre-release flight training in a specialised bat flight cage.

Insectivorous bats in captivity are generally fed mealworms, which are widely available for feeding to exotic pets and birds. Although not a natural food for bats, most quickly adapt to eating them. Initially, mealworms should be decapitated and the insides squeezed into the bat's mouth. With patience, most bats will progress to self-feeding on live mealworms, kept in a smooth-sided dish to prevent escape. The daily intake of mealworms depends on the size, health status and activity level of the bat, and the size and nutritional value of the mealworms. However, as a guide, an adult pipistrelle bat typically eats up to 40 mealworms per day. The mealworms themselves should be kept in wheat bran supplemented with shredded vegetables and non-citrus fruit, plus a proprietary vitamin and mineral supplement.

Severely ill or starving bats, and those refusing mealworms, can be syringe-fed with 0.2 to 0.5 ml (depending on the species) of a recovery diet paste (eg, a/d diet, Hill's Pet Nutrition) several times a day. Bats persistently refusing to eat may have other problems, such as internal injury, dental disease, jaw injury, and so on.

### Handling and clinical examination

A good relationship and collaboration between the vet and local bat carers are necessary for the proper care and outcome for casualties. Bat workers usually have knowledge of local bat populations, handling techniques, species identification and relevant legislation. Some may also have experience of caring for injured bats.

A bat found on the ground, especially during daylight, is always in need of attention. The finder should be warned not to handle the bat, but instructed how to contain it safely, by placing a suitable box over the bat and gently sliding a card underneath to make a lid. If bitten or scratched, or otherwise concerned, they should seek advice from a medical professional and the Bat Conservation Trust.

It is important to record the finder's details and the exact location that the bat was found for possible release back to familiar territory. A full history should include details of any roost disturbance from building works, recent adverse weather, accidental indoor confinement or cat predation. Records may also be required to justify possession, as bats are protected species, or for legal investigations (eg, illegal roost interference).

Most rescued bats will be torpid, cold and immobile. An accurate assessment of their true debility is only possible once they have been warmed up. Initially, cases should be observed, taking note of posture, behaviour and mobility on a horizontal surface. Any discharges, blood, urine and faeces in the box should be noted (including diarrhoea, melaena, or haematochezia). A visual assessment of body condition is possible; thin bats have sunken flanks and a bony pelvis, in contrast to healthy bats, which have a more rounded shape.

Suitable puncture-proof gloves must be worn when handling bats due to the disease risk of being bitten. The Bat Conservation Trust produces recommendations for appropriate gloves according to the bat species and handling task. After removal from the box, taking care to disentangle claws, the bat can be gently restrained in the palm between closed fingers or finger and thumb.

Magnification using a hand lens or headband loupe will aid the examination of small bats. Bat wings



(left) Suitable puncture-proof gloves must be worn when handling bats.  
(right) Magnifying loupes are useful for inspecting small bats



(left) Correct handling technique for examining the wings in bats.  
(right) Dehydration in bats is demonstrated by reduced skin turgor (skin tent)



are prone to injury and should be assessed by fully extending each wing in turn to check the bones and membranes. Back lighting is helpful when examining the wings. Viewing the extended wing in front of a bright light can highlight bruising and fractures, and inspection of the phalangeal epiphyses will also help to determine the bat's age (see later). Left and right sides should be compared for swellings and restrictions. The skin should be checked for ectoparasites and contaminants, and the fur parted by gently blowing to check for wounds, swelling and bruising. Dehydration can be detected by reduced skin turgor. Other features should be examined systematically. Auscultation is possible, but only to confirm respiratory disease. Resting heart rates in bats are in excess of 300 bpm. The bat should be turned over to examine the ventrum, noting the sex and whether it is lactating or carrying a pup, after which it should be weighed using accurate scales.

### Analgesia and anaesthesia

Manual restraint is usually sufficient for bat examination, but chemical restraint is required for ancillary diagnostic work and many procedures. Anaesthesia should always be deferred until after adequate patient stabilisation and assessment, as concomitant problems are common. Anaesthetic duration should be as short as possible, and the bat must be kept warm and hydrated throughout.

Most injectable anaesthetic agents are unsuitable for use in bats due to their narrow safety margin. Volatile anaesthetics are preferred and relatively safe. Induction is best achieved via an anaesthetic chamber or improvised facemask using 4 to 5 per cent isoflurane in 1 litre/minute oxygen and maintenance with 2 to 3 per cent isoflurane via a non-rebreathing circuit. Other volatile anaesthetics, including halothane and sevoflurane, have also been used. Endotracheal intubation is rarely a realistic option.

The small size of bats and their unpredictable metabolic rate increases the toxicity risk of many drugs, including analgesics. Pain assessment and the therapeutic effects of analgesics are generally extrapolated from other species. Pain reduction by restricting exercise, immobilisation and support of injured tissues should not be overlooked.



General anaesthesia of a common pipistrelle bat using a modified face mask



Radiograph showing a fractured humerus in a common pipistrelle bat

### Routine investigations

Further investigation in bats is difficult due to their small size, so diagnosis usually relies on a comprehensive history and clinical examination.

- Radiography can be useful to assess fractures, especially of the pectoral/pelvic girdle. Images of diagnostic quality are best achieved using single-sided, slow-speed mammography film, with an ultra-fine screen.
- Microsamples of blood can be collected from the vein in the interfemoral membrane or the cranial edge of the propatagium (in larger bats), but this is technically difficult and the volumes obtained are insufficient for most tests.
- Endoparasites can be detected by microscopic faecal examination, but are rare and of little clinical significance.

### Common conditions

Relatively little is known about the natural diseases of bats, but most grounded bats will be suffering from traumatic injuries and/or starvation.

### Conditions affecting infant bats

Groups of nursing females often share communal maternity roosts, sometimes using several roosts, depending on the weather conditions and insect availability. Pups are born between June and August, and are left in the roost while the adults hunt. Abandoned or orphaned



Bat pup being syringe-fed. (Picture, Paul Kennedy)

**Main medical problems encountered when hand-rearing pups**

Condition	Predisposing factors	Prevention and treatment
Bloat (gastric tympany and delayed gastric emptying), and/or constipation	Many factors, including low body temperature, unsuitable milk composition or temperature, inconsistencies in the feeding regimen and timing, and aerophagia	Husbandry problem(s) should be identified and corrected. It is important to ensure pups are hydrated first, and subsequently gradually introduced to milk feeds Simethicone is useful for alleviating symptoms
Diarrhoea	Usually dietary in origin, or similar factors to those listed above for bloat. Infection is rare	As above, plus probiotics, and antibacterial therapy if there is infection or dysbiosis
Inhalation pneumonia	Insufficiently warmed milk may increase the risk. Also, feeding pups too quickly might result in milk going up the nostrils	Ensure milk is adequately warmed before feeding Keep the pup's head slightly below the body and introduce the feed utensil from below
Nutritional metabolic bone disease	Relative or absolute calcium (vitamin D) deficiency due to unsuitable or insufficient diet	Provide feed milk replacer (eg, Esbilac; PetAg) in sufficient quantities based on the experience of bat carers. Only mild or early changes are reversible

infants may be found on the ground, having been driven by hunger to leave the roost. They can be differentiated from adults by their smaller size and lack of adult fur. Very young pups are furless, and gradually develop a suede-like greyish juvenile pelage. Such pups are unable to fly and still dependent on their mother.

If a bat pup is found, it should be warmed to around 30°C, rehydrated with oral electrolyte solution and examined for signs of injury and disease. If seemingly healthy and if no roost disturbance or maternal mortality is suspected, attempts to reunite mother and pup should be made. This is best carried out by licensed bat workers with knowledge of local roosts. If all attempts fail, the pup can be hand-reared (see table above), but this is a specialised task and should only be attempted by experienced bat carers with the necessary expertise and facilities. Otherwise, euthanasia is the kindest option.

**Conditions affecting inexperienced juveniles**

Recently flying juveniles lacking experience and stamina are at greatest risk from hazards such as cats, adverse weather, food shortage and getting trapped in buildings. Despite being similar in size to adults, they can be differentiated by transillumination of the wings – the interphalangeal joints of juveniles are translucent cartilage, while adults have rounded, ossified joints.

**Cat predation**

Domestic cats are responsible for many traumatic injuries sustained by bats. They often find roost holes and



**Wounds sustained by a common pipistrelle bat from a cat attack**

lay in wait for emerging bats to appear. Bat injuries from attacks include bruising, fractures and puncture wounds. Routine antibacterial therapy is advisable due to the risk of developing septicaemia from bacteria such as *Pasteurella multocida*, which can be transmitted via the saliva in cats. Subcutaneous emphysema can develop after such attacks and may indicate more severe injuries. This can be deflated, especially if it is compromising breathing. Severe undetected injuries, including haemorrhage and internal trauma, are often discovered on postmortem examination in cat attack victims that do not survive.

**Wing injuries**

Bat wings are prone to injury due to their large area and delicate structure. Lesions may be restricted to



**Transilluminated bat wings showing (left) translucent cartilage of the finger joint in a juvenile and (right) a rounded bony finger joint in an adult**



the wing membrane, although the bones and joints are also commonly affected.

Simple membrane holes heal spontaneously with time, requiring no treatment. If flight is unimpaired, bats can be released before lesions are fully healed. Full tears extending to the wing membrane edge carry a guarded prognosis, as most fail to heal. Surgical repair can be attempted using cyanoacrylate adhesive applied using a small pipette to tack together the membrane edges at several points, not a continuous line. Torn edges naturally curl inwards, and must be fully uncurled to appose adjacent epidermal tissues. Sutures are unsuitable as they usually pull through. Repeat interventions are often necessary, due to the adhesive being groomed off or becoming brittle. In some cases, the membrane heals but the resultant scar tissue reduces the area of the membrane. Healing failure is common due to compromised vascular supply and tissue viability. Tears to the tail are less common, but also need good repair as the tail is important for flight and the capture of prey. Healed tissue is paler and, as such, previous healed injuries may sometimes be noticed on wing membranes as an incidental finding.

Fractures affecting joints or those that expose bone generally carry a poor prognosis, as repair must be near perfect if the bat is to regain the full ability to fly again. Any restriction to joint movement or a significant shortening of the wing will impair flight, although small reductions in wing membrane area may be tolerated and compensated for. Closed fractures of the humerus and radius can be immobilised by micropore splints. Intramedullary pinning using hypodermic needles or small dental pins may be possible in larger species. Fractures of the metacarpals or phalanges sometimes heal with simple external coaptation; however, bone fragments are often devitalised and need excision, and dressings and splints can evoke self-trauma. Following successful treatment of a wing injury, pre-release flight exercise is essential if the bat is to regain the necessary strength and stamina to survive.



Large membrane tear in the wing of a bat. (Picture, Paul Kennedy)



## European bat lyssaviruses

Rabies is a disease caused by several different genotypes of lyssavirus, that is RNA viruses within the Rhabdoviridae family. All mammals are potentially susceptible to infection, and some bat species can act as natural reservoir hosts. In Europe, the four rabies-virus variants are:

- Classical rabies (genotype 1) found in terrestrial mammals;
- West Caucasian bat virus;
- European bat lyssavirus (EBLV) type 1 (EBLV-1)
- EBLV type 2 (EBLV-2).

Although classical rabies virus is detected in bats in the Americas, in Europe, it is replaced by the European bat lyssaviruses. In mainland Europe, EBLV-1 is the most common strain and has been reported in many species, especially the serotine bat (Racey and Fooks 2005). EBLV-2 is much less frequently isolated and seems to be limited to *Myotis* bats, especially Daubenton's bats and pond bats (*Myotis dasycneme*).

In the UK, passive surveillance for European bat lyssaviruses began in 1986. The findings suggest a low prevalence of EBLV-2 in Daubenton's bats, with virus isolated from approximately 4 per cent of submitted specimens (Harris and others 2007). To date, EBLV-1 has not been isolated from a bat in the British Isles, although antibodies to this strain have been recorded in two Natterer's bats (Scottish Natural Heritage 2009) and one serotine bat.

Serological testing of live Daubenton's bats has confirmed the low seroprevalence (<4 per cent) of EBLV-2 in the UK population (Scottish Natural Heritage 2009, Harris and others 2009). Further research is ongoing to investigate why some bats exposed to the virus go on to develop antibodies, while others develop fatal clinical disease. Infected bats have non-specific signs such as changes in behaviour and temperament, tremors and incoordination. However, seemingly healthy bats may also have virus in their saliva. Rabies is a notifiable disease, so any suspected cases must be reported to the office for Animal Health.

EBLV has been implicated in 'spillover' infections in other animals and is capable of causing clinical disease that is indistinguishable from classical rabies. Since 1977, there have been five human deaths associated with EBLV infection in Europe, including a Scottish bat worker in 2002 (Fooks and others 2003). Virus is transmitted in bat saliva by a bite or a scratch, or through broken skin or mucous membranes. Rabies in humans causes an invariably fatal encephalitis. The best prevention therefore is to avoid handling bats, especially as bats can bite in self-defence. Workers who must handle bats should wear suitable bite-proof gloves. Rabies vaccination is recommended for anyone regularly handling bats. Anyone bitten or scratched by a bat, regardless of their vaccination status, should thoroughly clean the wound and seek immediate medical attention. The bat should be safely contained, if possible, and the Bat Conservation Trust contacted for further advice. Human post-exposure prophylaxis, if started early, is highly effective in preventing disease.

All dead bats (not just those suspected of having rabies) should be submitted to the Veterinary Laboratories Agency for continued lyssavirus surveillance.

## Blunt trauma

Blunt trauma may occur when people attempt to catch a flying bat indoors. Severe injuries can be caused in this way including spinal injury with hindlimb paralysis, and damage to the respiratory system, including rib fractures and pneumothorax. Injuries to the hindlimb are usually sustained when the leg is trapped or crushed by a door. Fully functional legs are needed for grooming and roosting. Trauma to the thumb on



(left) Common pipistrelle bat with a ripped wing that is unlikely to heal. (Picture, RSPCA). (above) Brown long-eared bat with a hole in the wing, which will heal without intervention

the wing can interfere with climbing, roosting and feeding. Each case should be assessed individually, although many have severe injuries and carry a poor prognosis.

### Ectoparasites

Most bats harbour one or two ectoparasites of little significance (see table on the right). Heavy ectoparasitic burdens on young bats are common in summer, or when grooming is decreased due to injury or disease. It is essential, therefore, to fully examine individuals with large numbers of ectoparasites. Manual removal with a paint brush dipped in alcohol is the safest way of getting rid of them, although permethrin powder can be applied sparingly between the scapulae or directly onto larger parasites such as ticks.

### Ectoparasites of bats

Ectoparasite	Significance
Mites (Macronyssidae, Spinturnicidae and Trombiculidae)	Common, especially on juvenile bats
Fleas (Ischnopsyllidae)	Quite common, usually only one or two
Bat flies (Nycteribiidae)	Wingless, often difficult to spot
Bat bugs (Cimicidae)	Rarely found on bats but live in roosts, climbing onto bats for a blood meal
Ticks (Argasidae, occasionally Ixodidae)	Some bats have large burdens. May transmit <i>Babesia</i> species
Blowfly larvae (Calliphoridae)	Usually secondary to wounds or debility



Macronyssid mite. Magnification x40



(left) Mite belonging to the Spinturnicidae family and (right) *Cimex* species found on bat wings. (Pictures, Christian Dietz)

### White-nose syndrome

During the winter of 2006 in the USA, high mortality was noticed in hibernating bats in New York State. Dead and dying bats were found in and around hibernacula, and bats were observed flying during the day. Affected bats were in poor body condition. Many had white powdery deposits on the nares and other extremities, and the disease was named white-nose syndrome. Subsequent investigations have shown this to be the result of a cutaneous mycotic infection, with epidermal ulceration and hyphae invading hair follicles and skin adnexa (Meteyer and others 2009), caused by a newly described fungus, *Geomyces destructans* (Gargas and others 2009). Despite the extensive fungal invasion of skin and connective tissue, there appears to be no associated inflammation (Meteyer and others 2009). It is unclear whether the mycotic infection is the primary cause of death.

High mortality rates have continued to affect many species of insectivorous bats hibernating in caves and mines in the USA. Although *G destructans* has recently been isolated from bats in Europe, it has not been associated with mortality, and so far similar devastating disease has not been recorded in other countries (Puechmaile and others 2010). Surveillance has begun in the UK (Barlow and others 2009) and incidents involving abnormal winter behaviour, unusual mortality, or bats with white fungus should be reported to the Bat Conservation Trust.



Little brown bats (*Myotis lucifugus*) with white-nose syndrome. (Picture, Alan Hicks)

### Poisoning

Bats are susceptible to toxins from two sources:

- Direct contact in the roost by inhalation of vapours or chemical ingestion during grooming; or
- Secondary poisoning from ingesting pesticide-affected insects.

Clinical signs of toxicity are non-specific. Bats and their roosts are legally protected and timber treatments must be approved before usage.

### Entanglement

Bats can easily get entangled or caught in fine garden netting or fishing line and hooks, or get stuck to fly-paper traps.

### Skin contaminants

Skin contaminants affecting bats include oil, dust, paint, soot, fly paper and cockroach adhesives. Each individual case needs to be considered carefully, depending on the nature of the contaminant and how long the bat has been affected. Bats covered in pitch tar, thick oil or diesel require immediate euthanasia in most cases. Chronically affected bats are often exhausted and emaciated, and should also be euthanased to prevent further suffering. Treatments can be intensive, and consideration must be given to the stress involved to the bat, and the likelihood of successful removal of the contaminant. As bats groom regularly (more so when contaminated), they are likely to have already ingested some of the substance (possibly with toxic effects).



Brown long-eared bat that died after becoming stuck to fly paper

## Drugs and doses

Generic name	Trade name	Oral dose rate (for guidance only)	Dilution	Volume of diluted product per 5 g bat	Notes
Enrofloxacin	Baytril 2.5% Oral Solution (Bayer)	10 mg/kg twice daily	Dilute 0.1 ml solution with 4.9 ml water	0.1 ml (two drops) twice daily	Make up a fresh dilution daily
Amoxicillin/clavulanic acid	Synulox Palatable Drops (Pfizer) (Dry powder contains 150 mg clavulanic acid plus 600 mg amoxicillin)	30 mg/kg twice daily	Reconstitute by adding 100 ml water to dry powder	0.02 ml twice daily	Refrigerate after reconstitution and discard after seven days
Meloxicam	Metacam 0.5 mg/ml Oral Suspension for Cats (Boehringer Ingelheim)	0.2 mg/kg once daily	Dilute 1 ml suspension with 9 ml water	0.02 ml once daily	Use for up to three days
Simethicone	Infacol (Forest Laboratories UK)	400 mg/kg four times daily	Use undiluted	0.05 ml (one drop) four times daily	Fruit-flavoured and palatable

No products are licensed for use in bats. This table is for guidance only based on the authors' experience. Bats should be kept warm throughout the course of the treatment

Oily and sticky contaminants can be loosened with vegetable oil or milk, and then a mild diluted detergent. Thorough rinsing and drying are essential. Repeated washes are often needed, with adequate rest and recovery periods in between. Even if all the contaminant has been removed, bats will often subsequently pluck out fur when grooming, and possibly develop skin sores. They should be monitored for a minimum of two weeks for adverse effects of ingestion or skin contact.

### Burns

Burns can be sustained when bats come down chimneys. Affected skin is dry and brittle, and the wing membrane darkened. Respiratory distress due to smoke inhalation carries a grave prognosis.

### First aid and therapeutics

The large surface area of bats means they rapidly lose heat and moisture. Therefore, the initial priorities for dealing with these animals is to provide warmth and fluid therapy, either orally (preferred) or by subcutaneous injection. Warmed Hartmann's solution can be given at 0.1 to 0.2 ml per 5 g bodyweight up to four times daily for two to three days.

Bats are therapeutically challenging due to their small size and fluctuating heterothermic metabolism. Allometric principles do not strictly apply, and no veterinary drugs are licensed for bats (see table above). Generally, while in care, bats are kept warm to prevent torpor and speed recovery. This is especially important for bats on medication, as torpor slows the metabolism making drug pharmacokinetics unpredictable.



Thin common pipistrelle bat with sunken flanks

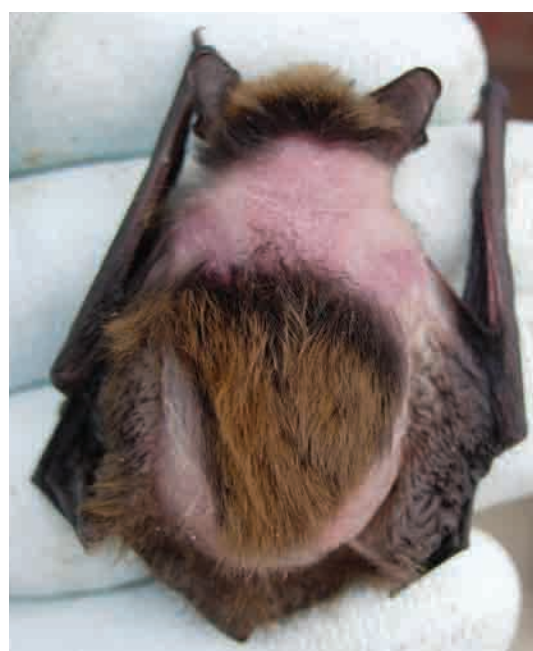
Oral administration using a small catheter or pipette is the safest method of dosing bats. Small volume subcutaneous injections can be given using 27 to 30 gauge, 1.25 cm needles, but other injection routes are either inaccessible due to their small size or associated with an increased risk of iatrogenic damage or overdose.

Bats groom themselves regularly, so any topical products must be used carefully due to the risk of ingestion.

### Euthanasia

Euthanasia should be performed if a bat is unlikely to make a full recovery and survive following release, or if the resources needed for its rehabilitation are not available. The only alternative to euthanasia in such cases is permanent captivity. However, captive bats are long-lived, and prone to skin problems and obesity, so this is rarely in the best interests of the animal.

Appropriate methods of euthanasia include both chemical and physical means. Chemical methods involve anaesthetic overdose with either inhalational or injectable agents. Physical methods include cervical dislocation or compression.



Alopecia can be a problem in bats kept in permanent captivity



**Bat flight cage for pre-release training.**  
(Picture, RSPCA)

## Release and post-release monitoring

Only bats with a good chance of survival and reintegration should be released. They must be in good body condition and be capable of sustained flight (for over 10 minutes), exhibiting the ability to avoid obstacles, and to land and take off from suitable surfaces.

Bats should be released at dusk in fine weather. Wherever possible, they should be returned to the area where they were found; if this is not feasible, a suitable alternative site should be found. Bats that have been in captivity for prolonged periods, exceeding three to four weeks, should not be released without first spending time in a bat flight cage to regain strength and fitness.

Soft release methods, whereby bats are allowed to gradually acclimatise to new surroundings by providing food and shelter after release, are suitable for juvenile bats. A hard (unprovisioned) release technique is generally suitable for adult bats. Recent preliminary radiotracking studies have shown that hand-reared juveniles can survive in the short-term after release, if given sufficient opportunity to learn to fly well, echolocate, catch insects and integrate with others in a large bat flight cage.

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## Further information

- Bat Conservation Trust, 15 Cloisters House, 8 Battersea Park Road, London SW8 4BG. Telephone 0845 1300 228. [www.bats.org.uk](http://www.bats.org.uk)
- Veterinary Laboratories Agency, Rabies Diagnostic Unit, Woodham Lane, New Haw, Addlestone, Surrey KT15 3NB. [www.vla.gov.uk](http://www.vla.gov.uk)

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Steve Bexton and David Couper

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