

Box

DOMAIN I: WATER DEPRIVATION, FOOD DEPRIVATION, MALNUTRITION

Impact category	Description of impact	Examples
NO IMPACT	No effect on food/water intake	
MILD IMPACT	Short-term water or food restrictions that are within usual tolerance levels for the species.	An animal has a few hours without water, in shade conditions. Short-term deprivation of food.
MODERATE IMPACT	Water or food restrictions which cause serious short-term or moderate long-term effects on physiological state or body condition, but such effects remain within the capacity of the body to respond to nutritional variations and allow spontaneous recovery after restoration of a good quality diet.	An animal has a few hours without water, in hot, sunny conditions. Deprivation of food long enough to bring about mobilisation of body fat stores.
SEVERE IMPACT	Severe restrictions on food/water intake that lead to significant levels of debility.	An animal has many hours without water. Deprivation of food for many days resulting in severe loss of body weight.
EXTREME IMPACT	Extreme restrictions on food/water intake that would likely result in the animal dying from dehydration or starvation.	An animal has many days without water and /or food and dies from severe dehydration and/or starvation.

Box

DOMAIN 2: ENVIRONMENTAL CHALLENGE

Impact category	Description of impact	Examples
NO IMPACT	Exposure to environmental challenge is not a feature of or consequence of the mode of action.	Exposure to ambient conditions that are within an animals' thermoneutral range.
MILD IMPACT	Short term exposure to environmental conditions which are outside the normal range encountered by the animal but remain within their physiological adaptive capacity.	Exposure to levels of heat or cold which are outside the thermoneutral range, but which do not lead to debility in the long-term.
MODERATE IMPACT	Marked short-term or moderate long-term environmental challenges that elicit body responses beyond the physiological adaptive capacity of the animal, but where the untoward effects are readily reversed by restoration of normal ambient conditions.	Short-term heat stress caused by exposure to high ambient temperatures combined with exercise.
SEVERE IMPACT	Severe environmental challenges that lead to serious physiological compromise or permanent dysfunction, injury or illness.	An animal is exposed to severe heat or cold which could possibly lead to failure of thermoregulation and collapse.
EXTREME IMPACT	Long-term exposure to extremes of heat or cold that bring about the death of the animal from hyper- or hypothermia.	Animals that are left in leg-hold traps, cage traps or yards in extremes of heat or cold and subsequently die from hyper- or hypothermia.

Box

DOMAIN 3: INJURY, DISEASE, FUNCTIONAL IMPAIRMENT

Impact category	Description of impact	Examples
NO IMPACT	Disease, injury or functional impairment is not a feature of or consequence of the mode of action.	
MILD IMPACT	Body responses remain within the homeostatic capacity of the animal to react with no or only minor debility or incapacity.	Minor injuries (e.g. minor skin laceration, oedematous swelling of foot and/or leg, mild mouth injuries). Minor functional impairment (e.g. mild vomiting/retching, diarrhoea).
MODERATE IMPACT	Disease/injury/functional impairment that results in moderately severe debility or incapacity but from which recovery would normally occur spontaneously.	Moderate injuries (e.g. damage to minor tendon or ligament, amputation of a digit, joint haemorrhage, single tooth fracture, major laceration of mouth or tongue, joint dislocation). Moderate or functional impairment (e.g. moderate vomiting/retching, diarrhoea, increased breathing, moderate haemorrhages, convulsions).
SEVERE IMPACT	Injury/disease/functional impairment that result in severe debility or incapacity and serious physiological compromise and would normally cause permanent disability. Includes injuries that are likely to reduce survival if the animal were to be released.	Severe injuries (e.g. deep and wide lacerations, severed tendons, broken foot and leg bones below elbow or stifle, joint dislocations, amputations). Severe or functional impairment (e.g. severe vomiting/retching, diarrhoea, abnormal breathing, severe haemorrhages, convulsions).
EXTREME IMPACT	Injury/disease/functional impairment that result in very severe debility or incapacity due to the effects of traumatic injury, infectious agent or toxin.	Extreme injuries (e.g. death caused by excessive blood loss or shock, spinal cord injury, severe internal bleeding, fractures of more than one limb, severe jaw fracture, fractures of limbs above elbow or stifle). Extreme or functional impairment (e.g. extreme persistent vomiting/retching, diarrhoea, laboured breathing, convulsions, blindness, immobility/prostration, excessive and prolonged haemorrhaging).

DOMAIN 4: BEHAVIOURAL, INTERACTIVE RESTRICTION

Impact category	Description of impact	Examples
NO IMPACT	No interference with the behavioural needs of an animal (an animal's behavioural needs being those activities which when thwarted produce untoward physiological or psychological effects).	
MILD IMPACT	Mild interference with the behavioural needs of an animal.	Mild and short-term physical restraint resulting in minor behavioural or interactive restriction.
MODERATE IMPACT	Moderate interference with the behavioural needs of an animal resulting in negative physiological or psychological effects which are readily reversed after restoration of normal conditions.	Restraint that results in agitation from not being able to perform natural behaviour that the animal is highly motivated to perform e.g. feeding, moving, resting, grooming, mating, caring for young.
SEVERE IMPACT	Marked interference with the behavioural needs of an animal leading to physiological or psychological compromise that may cause long-term or permanent negative effects.	Severe abnormal self-directed behaviour e.g. chewing/biting of feet and limbs when restrained. Normal defensive and/or escape reactions to visibility of or presence of predators are prevented.
EXTREME IMPACT	Extreme interference with the behavioural needs of individuals or groups of animals leading to psychotic-like behaviour or to agonistic interactions that result in very severe injury or death.	Restraint that results in extreme abnormal self-directed behaviour, excessive aggression, stereotypy (e.g. severe fighting among incompatible social groups, unfamiliar individuals that are in close proximity). Inability to escape attack by a predator.

Box

Impact category	Description of impact	Examples
NO IMPACT	Anxiety, fear, pain, sickness, breathlessness, nausea, lethargy/weakness. dizziness, greater than normal thirst and/or hunger or other negative affective experiences causing distress are not a feature or consequence of the method.	
MILD IMPACT	Mild anxiety, fear, pain, sickness, breathlessness, nausea, lethargy/weakness. dizziness, unsatisfied thirst and/or hunger or other negative affective experience causing distress.	Limited human contact with no physical handling.
MODERATE IMPACT	Moderate anxiety, fear, pain, sickness, breathlessness, nausea, lethargy/weakness. dizziness, unsatisfied thirst and/or hunger or other negative affective experience causing distress.	Moderate level of human contact with minimum of physical handling.
SEVERE IMPACT	Severe anxiety, fear, pain, sickness, breathlessness, nausea, lethargy/weakness. dizziness, unsatisfied thirst and/or hunger or other negative affective experience causing distress.	High level of human contact with a degree of physical handling.
EXTREME IMPACT	Extreme inescapable or unrelieved anxiety, fear, pain, sickness, breathlessness, nausea, lethargy/weakness. dizziness, unsatisfied thirst and/or hunger or other negative affective experience causing distress which is judged to be at or beyond the limits of reasonable endurance and results in the death of the animal.	Excitement, fear and distress in struggling restrained animals that result in death from capture myopathy.

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Standard Operating Procedure WP001: Cage trapping badgers

Introduction

Purpose of this SOP

The purpose of this SOP is to describe the procedure for cage trapping badgers at various sites in the UK.

Background information

Animal welfare considerations

When adverse weather conditions are expected (such as extreme cold, heavy rain or snow), badgers are potentially at risk from exposure. In these cases, the project/field manager will decide if trapping should be suspended, or plans made to check traps during the night.

Trapping is suspended between 1st February and 30th April inclusive when most cubs are very young, confined to the sett and totally dependent on their mother.

Safety

Personal protective equipment (PPE)

All staff working in the field must wear appropriate protective clothing which can be easily cleaned and disinfected.

All staff working in the field with badgers must wear the minimum additional PPE of disposable gloves, safety spectacles and a regulation FFP3 face mask. Staff must use the regulation FFP3 face mask recommended to them during face-fit testing.

If during the procedure, any PPE becomes soiled (e.g., from urine, faeces or handling of bite wounds and abscesses), it should be exchanged for clean PPE as soon as it is safe to do so.

Equipment

- Cage traps: Approved designs of steel mesh cage trap are used. These traps are of varying dimensions and mesh sizes. All traps are activated by means of a string trip line (2-ply garden twine), which is placed such that an animal entering the trap must push into it to reach a pile of bait at the back of the trap or pull back the stone that is attached to the wire if the wire/string/stone method is deployed. When the string is pulled, it activates a trigger mechanism, which releases a door (which closes and is held in place either by a rubber band or gravity).

• Coated gardening wire (2mm diameter).

- Spare rubber bands (cut tyre inners).
- 2-ply garden twine.
- Spade.
- 40mm PVC pipe for depositing peanuts inside the trap – alternatively a spade may be used for this purpose.
- Restraining wicket(s).
- Spare trigger bars and hinge plate flaps.
- Pliers or multi-tool.
- Container for carrying peanuts.
- Large stone or tile for wire/string/stone.

Procedure

Staff performing this procedure unsupervised must have been trained and signed off as competent to perform it in their training record. Staff being trained in the procedure must be supervised by a fully trained member of staff.

Pre-trapping

Before any trapping is carried out, all known setts in the zone to be trapped must be visited and their level of activity recorded. Once all the active setts have been identified, traps will be deployed and trapping can commence. In some circumstances, setts may be inaccessible or located just outside the study area resulting in remote trapping (trapping away from a sett) being employed. Maps of locations of traps must be kept allowing other members of staff to find all traps in the event of an emergency. Remote trapping should be kept to a minimum, as it may not be possible to correctly allocate animals caught for the first time remotely to specific social groups.

Trap placement

Cage traps should be positioned at or close to the active setts of a social group, ideally beside runs radiating from the sett. Traps should be 'dug in' to the soil using a spade so that the floor of the trap is covered with soil and the trap is securely positioned. Ideally, traps should not be positioned directly on spoil heaps and runs. Cage traps should be positioned to make the maximum use of any natural cover to give trapped animals some shelter from the elements and to reduce the risk of interference. Care must be taken to ensure that the vegetation does not foul the trip mechanism. Every care must be taken to ensure that traps are securely located in place, particularly where they are on a slope, when stakes may be required. Trapping details must be transferred from any field note books and the number of all traps set to catch at each sett recorded on the notice board in the field office.

Pre-baiting

Traps should be baited with animal-grade peanuts for 3-10 days before they are set to catch, to encourage the badgers to enter the traps and maximise the number of captures. Peanuts can be placed in the trap using a 40mm PVC pipe, spade or by hand. Approximately 1-2 handfuls of peanuts (or covering no more than half of the spade) should be placed in a heap near the back of the cage with a trail of peanuts laid down the centre of the trap and out of the open doorway. Peanuts should not be scattered widely in and around the trap because this may encourage badgers to dig under the trap from the outside, or reach in through the mesh, or encourage non-target species. On the first day of pre-baiting, some peanuts may be thrown down and around the active holes, or by placing bait-points under stones to encourage badgers to look for the bait. Once badgers are entering traps, other bait-points on the sett are not necessary. Pre-baiting should be done as late as possible in the day, to minimise the opportunity for non-target species to take the bait. A large stone can be used to cover the heap of peanuts to minimise interference from smaller non-target species. Cage trap doors should be securely tied open with wire (diameter 2mm) during the pre-baiting period, so that badgers may freely enter but are not accidentally trapped. Only place new peanuts in the trap if the previous pile of bait has been depleted by badgers or non-target species. There is a risk of overfeeding badgers peanuts. Piles of peanuts in traps may lead to badgers monopolising the bait and gorging on peanuts. This could lead to an impacted intestinal tract, which causes discomfort and in severe cases could result in death.

Setting and checking traps

After 3-10 days of pre-baiting, the traps are set to catch badgers for two consecutive nights. First, ensure that the trap is in adequate condition and replace any faulty or damaged parts as required (e.g., trigger arm, hinge plate) and replace rubber band on door mechanism if it has perished. Traps can be set to catch using the methods listed below:

Triangle method

When 'stringing up', the trap door can be held open by inserting the trigger arm on the door into the hinge plate on top of the trap. To install the string trip line (2-ply garden twine), attach one end of the twine to a 'stringing up' stick and thread it down through the roof of the trap to the rear of where the trap door hinges attach. The string is then fed out through one side of the trap just in front of where the bait will be placed (approximately 20-25 cm from the back and 10 cm off the ground, although this may vary according to terrain and trap type). The string is then threaded back into the trap through a different mesh square and passed straight through and out the opposite side. It is then threaded back into the trap, as for the other side, and out through the same mesh square in the roof that the string entered by. The two ends of the string are then tied together with a slipknot, which is pushed down the length of the string so that it forms a triangle inside the trap. Alternatively, the string can be threaded such that it runs down through the roof of the trap, to the rear, and is fed out through one side of the trap just in front of where the bait will be placed and back into the trap through a different mesh square as before, but then simply tied to the mesh on the opposite side.

Wire stone method

Where non-targets such as mice and squirrels are a major problem, they may bite through the string attempting to get to the peanuts under the stone. The result is a trap door that will not close when a badger moves the stone. To prevent this occurring, use a short length of wire (diameter 2mm) to wrap around the stone, which can then be attached to the string at the back of the trap. To do this, first select a large flat stone that the wire can be wrapped around once without slipping off (preferably the stone you were using during pre-baiting). With the wire wrapped tightly around the stone, twist the short end around the main wire to make secure. A length of wire (25 cm maximum) is required, to protrude from the wire-wrapped stone out through the mesh at the bottom of the back of the trap. A small loop at the end of the wire will enable string to be attached to link it to the trap hinge plate. Place the bait at the back of the trap and slide the stone off the spade to cover the peanuts, ensuring the length of wire with the loop goes through the back of the trap as close to the ground as possible. Bend the wire upwards so that it is parallel to the back of the trap but will not snag on the mesh. Tie the string to the loop and thread the string up the back of the trap and along the top of the trap and to the trap hinge plate. With the trigger arm set as above, secure the string to the top hole in the trap hinge plate, tight enough to set the trap off when the stone is moved, but with enough slack should the string shrink if it becomes wet or if an object or animal lands on top of the trap.

Checking traps

Traps should be checked at or near dawn the following day. Non-target species, except Schedule 9 species, and provided they are not injured, should be released at the point of capture.

Standard Operating Procedure WP002: Blood sample collection from a conscious badger in the field using a restraint cage

Introduction

Purpose of this SOP

The purpose of this SOP is to describe the procedure for collection of a small blood sample from a live conscious badger in the field using a bespoke restraint cage to provide safe physical restraint of the badger.

Background information

Diagnosis of *Mycobacterium bovis* infection in badgers is critical to understanding the epidemiology of bovine tuberculosis (bTB) in this wild host.

Serological (blood) tests are currently the most appropriate tests for *M. bovis* in live badgers. Therefore, testing live badgers in the field requires their capture and collection of a blood sample. The use of anaesthesia in this context is costly and logistically complicated and involves anaesthetic risks for the badger. The bespoke restraint cage facilitates safe collection of a blood sample from a conscious badger, without recourse to anaesthesia.

This procedure allows a small blood sample to be obtained by capillary blood sampling. Physical restraint of the badger to be sampled is achieved by reducing the space available to the badger inside the restraint cage. Blood is obtained from a puncture wound to the main paw pad on one of the hind limbs; the puncture wound is made using a medical blood lancet.

Badgers are trapped in the field under the authority of a licence issued by Natural England. A badger fit for restraint and blood sampling is moved in a holding cage (smaller and lighter than a trap) from the trap to a temporary field facility (a pick-up truck close to the trap location). A holding cage is used for this transfer as it is impractical to transfer a badger from the trap direct to the restraint cage. Restraint and blood sampling are performed at the temporary field facility.

The restraint cage has features including a cushioned moving internal wall panel operated by a ratchet system, a solid floor and two sliding panels through which the hind foot of a restrained badger can be accessed. Pronged metal inserts (wickets) can be inserted horizontally to restrict internal cage height, which together with the moving internal wall panel, provide restraint. The ratchet mechanism makes it possible to increase the degree of restraint gradually and the cushions attached to the moving wall panel minimise the risk of injury to the badger.

Animal welfare considerations

Any staff performing this procedure must be trained and competent to do so, to ensure they cause the minimum pain, suffering, distress, or lasting harm to the badger, with supervision as necessary until such competence is obtained. A badger in the restraint cage is likely to suffer some distress because of the confinement and could potentially be injured during the physical restraint process. Throughout the procedure, care should be taken to provide the badger with adequate shade and protection from inclement weather as necessary. A badger in the restraint cage must be approached carefully and quietly to reduce panic, further stress, and risk of injury. The restraint and blood sampling procedure must be carried out carefully and quietly, in strict accordance with the method described in this SOP.

SOP WP001 describes the procedure for the initial cage trapping of badgers.

Safety

Personal protective equipment (PPE)

All staff working in the field must wear appropriate protective clothing which can be easily cleaned and disinfected.

All staff working in the field with badgers must wear the minimum additional PPE of disposable gloves, safety spectacles and a regulation FFP3 face mask. Staff must use the regulation FFP3 face mask recommended to them during face-fit testing.

If during the procedure, any PPE becomes soiled (e.g., from urine, faeces or handling of bite wounds and abscesses), it should be exchanged for clean PPE as soon as it is safe to do so.

Waste

All waste generated during the procedure must be regarded as potentially contaminated and (except for sharps) must be discarded into the contaminated waste bins (yellow Sulo bins). Sharps (including lancets) must be discarded into sharps containers.

Lancets

During this procedure, the operator will use a 4 mm stainless steel lancet with a triangular blade to make a small incision in the main pad on the paw of one of the badger's hind limbs. Care must be taken, both during and after the procedure, to prevent injuries caused by the lancet. All used lancets must be safely discarded into a sharps container immediately after use. If an operator inadvertently punctures their skin with a used lancet, they must seek immediate medical attention.

Equipment

- Restraint cage.
- Wickets.
- Karabiner clip.
- Equipment tray.
- Scissors.
- General-purpose coloured livestock spray.
- Water spray bottle.
- Cotton wool.
- Paper towel.
- Vaseline.
- 75 mm heparinised capillary tubes.
- Microcap micropipettes.
- 4 mm stainless steel blood lancets.
- Clinell spray.

Procedure

Staff performing this procedure unsupervised must have been trained and signed off as competent to perform it in their training record. Staff being trained in the procedure must be supervised by a fully trained member of staff.

This procedure starts at the point in time immediately after traps have been checked at or near dawn on the day after the traps were set to catch. Trapping will have been carried out in accordance with SOP WP001.

At any one time, this procedure will only be performed on badgers trapped at a single sett.

Blood sampling a conscious badger using the restraint cage involves the following series of steps:

1. Carry out a health and welfare assessment of the badger prior to restraint and blood sampling

This initial assessment of the badger to determine whether it is fit to restrain and blood sample should be carried out whilst the animal is still in the trap. If multiple badgers have been trapped at the same sett, a preliminary brief inspection of each badger must be carried out to check for any immediate welfare concerns. If there are no immediate welfare concerns, the badger can be left in its trap (at the trapping location), pending the main health and welfare

Assessment described below, which should be carried out just before the badger is transferred to the holding cage to move it to the temporary field facility. Badgers in traps awaiting the main health and welfare assessment should be left as undisturbed as possible. The main health and welfare assessment should only start once the badger is required at the temporary field facility (earlier transfer to a holding cage will only be required if multiple badgers are present in one trap).

It is possible that more than one badger is caught in one trap. If this occurs, the captured badgers must be promptly separated to leave one badger in the trap, with the other(s) transferred to an individual holding cage (one badger per cage). Transfer to a holding cage is achieved by the following process: place a holding cage on its side in front of the door of the trap and position one foot behind the holding cage so that it cannot move backwards. The holding cage door should be almost completely out but remain far enough within the runners so it can be closed quickly when necessary. Lift the front of the trap off the ground, so the door can be rested on top of the open end of the holding cage. The trap door will then open as it is lowered against the open end of the holding cage. If necessary, gently encourage the badger to move into the holding cage (wickets can be used to gently nudge the badger if necessary). Once the badger has moved into the holding cage, slide shut the holding cage door and secure it at the top with a karabiner clip. To assist transfer to a holding cage, multiple badgers in one trap can be segregated into different parts of the trap using wickets.

The initial health and welfare assessment should be carried out as follows: The badger must be checked to determine whether it is a recapture (as indicated by the presence of a fur clip and/or livestock marker on its back); if the badger is a recapture, then it must be released immediately after the health and welfare assessment has been carried out, unless it requires veterinary attention. The health and welfare of each badger must be assessed by following the badger assessment table and flow-chart provided in Appendix 1. The health and welfare assessment includes checking for any trap-related injuries, inspecting the paws, limbs, and head as thoroughly as possible within the constraints of a visual inspection from outside the trap. Mild stimulation of the badger by gently moving the trap may aid the assessment. Under no circumstances should fingers be poked through the mesh of the trap. If the operator is in any doubt about the fitness of a badger for restraint and sampling, they must consult the nominated veterinary surgeon. The veterinary surgeon will advise on the appropriate course of action for any badger they are called to examine. Badgers assessed as fit for restraint and blood sampling should be transferred to a holding cage (see step 2 below) and moved in succession, one at a time, to the nearby temporary field facility. Only one badger should be present at the temporary field facility at any given time.

2. Transfer the badger from the trap to a holding cage

The badger will still be in the trap, except for a badger that was caught in the same trap as one or more other badgers, in which case it may already have been transferred to an individual holding cage (see step 1 above). To transfer a badger from the trap to a holding cage, place a holding cage on its side in front of the door of the trap and position one foot behind the holding cage so that it cannot move backwards. The holding cage door should be almost completely out but remain far enough within the runners so it can be closed quickly when necessary. Lift the front of the trap off the ground, so the door can be rested on top of the open end of the holding cage. The trap door will then open as it is lowered against the open end of the holding cage. If

If necessary, gently encourage the badger to move into the holding cage (wickets can be used to gently nudge the badger if necessary). Once the badger has moved into the holding cage, slide shut the holding cage door and secure it at the top with a karabiner clip.

3. Transfer the badger in its holding cage to the temporary field facility

Transfer the badger in the holding cage to the nearby temporary field facility (the pick-up truck) by carrying the holding cage using a detachable handle or carrying strap. The temporary field facility will be located as close as possible to the sett where the badger was trapped and must be no more than 100 metres from the sett.

4. Transfer the badger from the holding cage to the restraint cage

Transfer of the badger from the holding cage to the restraint cage should be carried out next to the pick-up truck being used as a temporary field facility. To transfer the badger, place the door end of the holding cage adjacent to the open door of the restraint cage. Ensure both cages cannot move; this can be achieved by locating the other end of the restraint cage against a wheel of the pick-up truck and by placing one foot behind the holding cage. The restraint cage door should be almost completely out but remain far enough within the runners so it can be closed quickly when necessary. Open the holding cage door and, if necessary, gently encourage the badger to move into the restraint cage (wickets can be used to gently nudge the badger if necessary). Once the badger has moved into the restraint cage, shut the restraint cage door, and secure it at the top with a karabiner clip.

5. Placement of the restraint cage for the restraint and blood sampling procedure

The restraint cage containing the badger must be placed on a solid level surface at a safe and comfortable working height for the operator. This should be achieved by placing the cage on a non-slip rubber mat on the dropped-down tailgate of the pick-up truck.

6. Undertake physical restraint of the badger

Physical restraint of the badger is achieved by reducing the space available to it inside the restraint cage. First, the height available to the badger can be reduced, if necessary, by inserting a wicket or wickets in the horizontal plane. Next, the width available to the badger should be reduced by pulling the moving internal wall panel, which runs the length of the cage, towards the operator. The moving wall panel should be pulled towards the operator by pulling on the horizontal arms located outside the cage; these arms have a ratchet mechanism to avoid the moving wall being pushed back by the badger. The moving wall is padded with cushions on its inner surface to provide a soft contact surface with the badger; the moving wall should be used to gently squeeze the badger against the side of the restraint cage. Effective physical restraint of the badger is characterised by an animal that is unable to rise, twist or turn, but the force of the squeeze against the side of the restraint cage does not result in any physical injury to the badger and does not compromise effective breathing. Although the use of wickets is optional, the badger is always restrained for blood sampling by the moving internal wall panel.

Box

7. Extract a hind limb from the restraint cage

Once the badger has been safely physically restrained, the appropriate sliding access panel on the restraint cage should be opened (the panel adjacent to a hind limb) and the operator should introduce a hand through the panel to gently but firmly hold the hind limb above the hock. Once the hind limb has been safely grasped, it should be extracted through the open access panel to exteriorise the paw, such that the pads are facing upwards.

8. Collect the blood sample

Holding the exteriorised portion of the hind limb gently but firmly with one hand, the operator should use their other hand to carry out the following sequence of steps: a) Clean the main paw pad using water-soaked cotton wool. b) Dry the main pad with paper towel. c) Apply a very thin layer of Vaseline to the pad surface. d) Use a 4mm stainless steel lancet with a triangular blade to make a small incision at the edge of the main pad – achieve this by inserting the triangular blade full depth into the edge of the main pad, followed by making a small upward incision in the pad – make the incision with one quick, continuous, and deliberate stroke. Immediately after use, the lancet must be safely discarded into a sharps container. If more than one incision is required, use a new lancet for each incision. The maximum number of incisions permitted for each badger is three. e) If necessary, apply gentle pressure to the pad tissue near the puncture site to promote sufficient flow of blood – avoid excessive massaging of the paw/pad as this may damage the red blood cells in the blood sample. f) Collect the blood that flows out onto the surface of the paw pad using a single 75 mm heparinised glass capillary tube attached to a Microcap micropipette. Apply the tip of the capillary tube so it touches the drop of blood that has formed on the pad surface, avoiding the tip of the capillary tube coming into contact with the pad itself if possible; the blood should flow into the capillary tube by the passive process of capillary action. Blood flow into the capillary tube can be enhanced by holding the tube slightly downwards if this is possible. Note: The Microcap pipette attachment should not be used to draw blood from the paw pad surface but can act as a useful handle to aid fine movements of the capillary tube during the blood collection process. f) Pass the full capillary tube to a colleague. g) Apply direct pressure to the incision site using a clean paper towel until bleeding has stopped.

9. Return the hind limb to the interior of the restraint cage.

The operator should gently guide the exteriorised portion of the hind limb back into the interior of the restraint cage and release their grip once all the limb has been returned to the interior of the cage. The operator should then remove their hand from the cage and close the sliding access panel and secure the panel in the closed position.

10. Mark the badger if necessary

If necessary, the blood sampled badger can be given a fur clip using curved scissors and marked using a general-purpose livestock spray. If this is required, the badger should be fur clipped and marked on its back with a spot of the coloured spray (approximately 5 cm diameter). The clip and/or spray mark must

Be easily noticeable in the event of the badger being recaptured. Care must be taken to avoid spraying the livestock marker into the animal's eyes, nose, or mouth. The fur clip should remove the outer guard hairs revealing the lighter under-hair. The scissors used to make the fur clip must be disinfected after use on each badger; the scissors should be sprayed with Clinell disinfectant spray, allowing a contact time of two minutes prior to wiping dry with clean paper towel. Any attempt to mark the badger in the restraint cage can either be carried out before the restraint is released or after the restraint has been released as described in step 11, dependent on the individual badger's behaviour during the marking attempt. Alternatively, if it is necessary to mark the badger and this proves difficult at this stage in the procedure, the mark can be made by the technique described above after returning the badger to its trap (between steps 13 and 14). To assist marking a badger in its trap, wickets can be used to confine the animal to part of the trap. Marking a badger in this way is optional, conditional on whether the sett will be trapped again the next day and the proximity of the sett to other setts that will be trapped over following days.

11. Release the physical restraint of the badger

Release of the physical restraint applied to the badger should be achieved by reversing the process describe in step 6. First, using the exterior arms, push the moving wall panel away from the badger until the panel reaches the far side of the restraint cage. Next, remove the wickets from the cage. The badger will now have all the interior space of the restraint cage available to move around in.

12. Action in the event of a badger becoming excessively distressed

If a badger becomes excessively distressed at any point during the procedure described above (e.g., constantly scrabbling or constantly spitting or vocalising), the attempt to restrain and blood sample the animal must be abandoned.

13. Transfer the badger from the restraint cage to the holding cage

This transfer should be carried out next to the pick-up truck vehicle being used as a temporary field facility. To transfer the badger, place the door end of the restraint cage adjacent to the open door of the holding cage. Ensure both cages cannot move; this can be achieved by locating the other end of the restraint cage against a wheel of the pick-up truck and by placing one foot behind the holding cage. The holding cage door should be almost completely out but remain far enough within the runners so it can be closed quickly when necessary. Open the restraint cage door and, if necessary, gently encourage the badger to move into the holding cage (wickets can be used to gently nudge the badger if necessary). Once the badger has moved into the holding cage, shut the holding cage door, and secure it at the top with a karabiner clip.

14. Carry out a health and welfare assessment of the badger prior to its release

A health and welfare assessment must be carried out on every badger that has been placed in the restraint cage immediately prior to it being released. The health and welfare of each badger must be assessed by following the badger assessment table and flow-chart provided in Appendix 1. The health and

Welfare assessment includes checking for any new restraint cage-related injuries (not identified at the initial health and welfare assessment prior to restraint), inspecting the paws, limbs, and head as thoroughly as possible within the constraints of a visual inspection from outside the holding cage. Mild stimulation of the badger by gently moving the holding cage may aid the assessment. Under no circumstances should fingers be poked through the mesh of the holding cage. If the operator is in any doubt about the fitness of a badger for release, they must consult the nominated veterinary surgeon. The veterinary surgeon will advise on the appropriate course of action for any badger they are called to examine.

15. Release the badger

Immediately after completion of a satisfactory health and welfare assessment for release, the badger should be returned in the holding cage to the immediate vicinity of the sett at which it was trapped. Cubs should be released at entrances to the sett. To release the badger, stand behind the holding cage and pull the door open. The procedure of blood sampling a conscious badger using the restraint cage is now complete.

Appendix 1

ASSESSING THE HEALTH AND WELFARE OF A BADGER

The following tables and flow chart aim to describe and explain:

- **Methods for assessing the health and welfare of a badger**
- **How to use this assessment in the decision-making process**

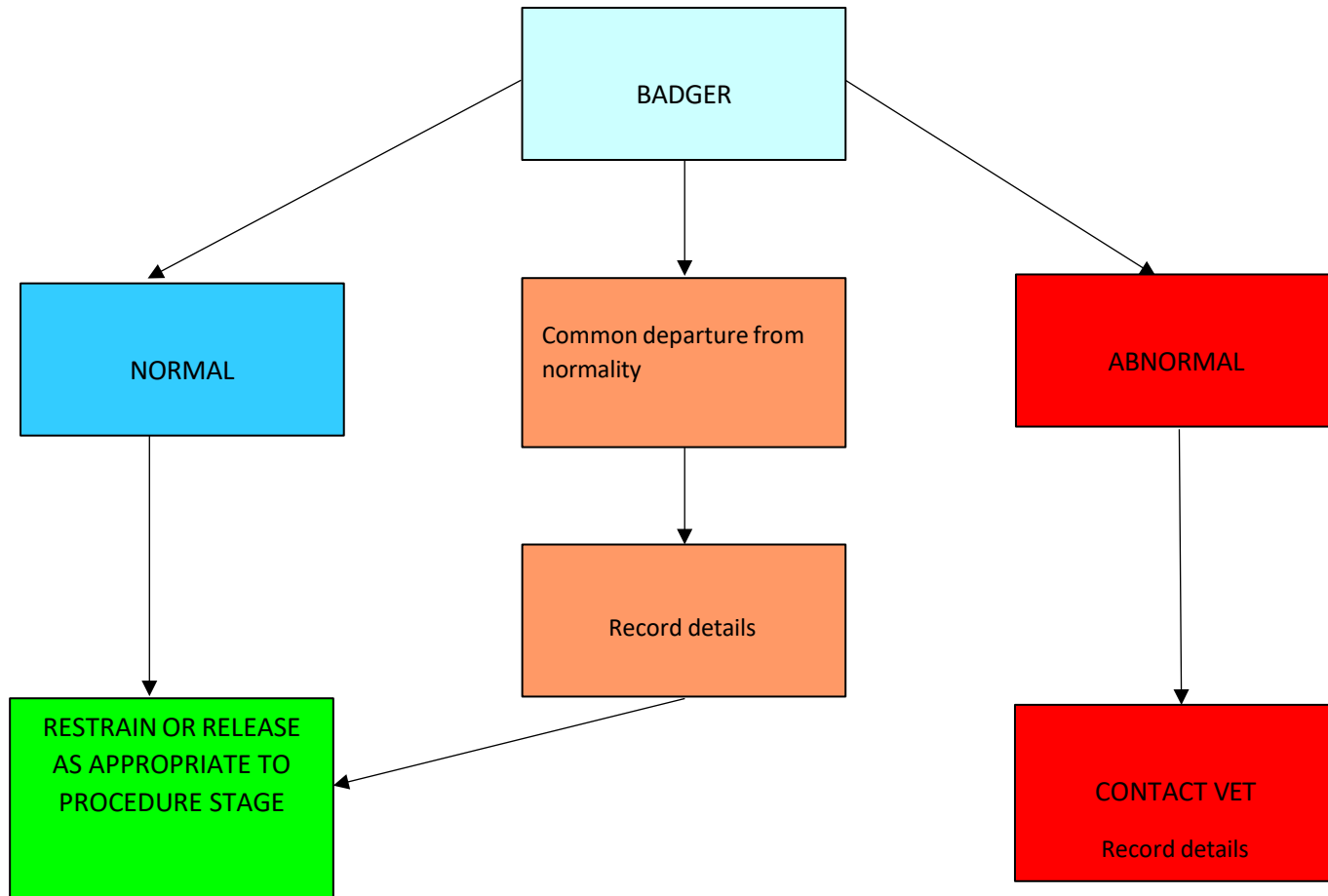
PARAMETER	METHOD OF ASSESSMENT
Demeanour	Observe – important to take time. Gently moving the cage to stimulate (mildly) may be useful
Respiration	Observe – amount of chest movement/effort associated with respiration
Body condition	Observe – assessing body and coat condition is not easy in a cage, requires quiet close observation
Injuries	Observe - important to take time. Gently moving the cage to stimulate (mildly) may be useful
Movement	Observe – important to take time. Gently moving the cage to stimulate (mildly) may be useful

It is necessary to acquire information about a badger's general health from quiet, unrushed, calm observation and some prior knowledge of normality and the commonly seen departures from normality in a wild badger (see next page).

NORMAL vs ABNORMAL

Parameter	Normal	Common departures from normality	Abnormal
Demeanour	Highly variable from "very quiet but responsive" to "scrabbling in cage".	Individual variation can be high.	Very depressed and unresponsive to mild stimuli.
Respiration	Highly variable. Dependent on weather conditions/level of stimulation in the cage. Normal resting: 15-25 breaths per minute	Expect respiratory rate to increase in hot temperatures and with stimulation such as handling or disturbance.	Very low respiration rate/no observable respiration. Panting – open mouth breathing. Laboured movement of the chest wall during respiration. Obvious noise on inspiration or expiration. Discharge from nose.
Body condition	Coat should be clean, unmatted and in good condition. (wet weather on trap night may cause coat to be matted with mud).	Seasonal changes in body condition can be dramatic with maximum weight reached in autumn and minimum weight in late spring/early summer.	Thin, dull, staring coat. Prominence of spine, ribs. Excessive loss of hair.
Injuries	None.	Abrasions on top of forelimb or nose. Ripped/shredded claws. Bite wounds over rump/around head, especially in males - can be extensive, often associated with hair loss.	Fracture. Open wounds (other than bite wounds). Excessive bleeding. Limb fractures. Broken Jaw. Tooth and gum injuries.
Movement	Using all four feet when standing or turning in the cage. Moving freely and in a coordinated manner.		Not able to stand or move easily. Repeated lifting of limb(s). Inability to move when stimulated. Incoordination.

Box



Standard Operating Procedure WP003: Blood sample collection from an anaesthetised badger in the field

Introduction

Purpose of this SOP

The purpose of this SOP is to describe the procedure for trap-side collection of a blood sample from an anaesthetised badger in the field.

Background information

Diagnosis of *Mycobacterium bovis* infection in badgers is critical to understanding the epidemiology of bovine tuberculosis (bTB) in this wild host.

Serological (blood) tests are currently the most appropriate tests for *M. bovis* in live badgers. Therefore, testing live badgers in the field requires their capture and collection of a blood sample. In the absence of a method for blood sampling a conscious badger, blood sample collection is performed with the badger under a general anaesthetic.

General anaesthesia is a state of controlled unconsciousness; it is defined as an induced state of unconsciousness accompanied by partial or complete loss of protective reflexes, including loss of the ability to respond purposefully to physical stimulation. The anaesthetic cocktail mixture used to anaesthetise badgers consists of ketamine hydrochloride (100 mg/ml, Ketavet, Zoetis UK Limited), medetomidine hydrochloride (1 mg/ml, Domitor, Vetoquinol UK Limited) and butorphanol tartrate (10 mg/ml, Dolorex, MSD Animal Health UK Limited) at a ratio of 2:1:2 by volume respectively. The anaesthetic cocktail mixture is administered by intramuscular injection and produces a state of balanced anaesthesia in the badger. The animal exhibits complete unconsciousness and relaxed muscle tone. General anaesthesia is usually induced within 5-10 minutes following the injection and lasts for about 30-50 minutes.

The sedative (and analgesic) effects of medetomidine can be reversed with atipamezole (5mg/ml, Antisedan, Vetoquinol UK Limited) by intramuscular injection. The Antisedan dose in millilitres is half of the dose volume of medetomidine solution given. This equates to 1/10th of the total volume of triple anaesthetic cocktail injected. In this SOP, reversal of the sedative effects of medetomidine with atipamezole is reserved for situations where this is clinically indicated, such as respiratory or cardiac depression or prolonged recovery. It is important to note that atipamezole does not reverse the effects of the other components (ketamine hydrochloride and butorphanol tartrate) of the anaesthetic cocktail. If the effects of medetomidine are reversed whilst the ketamine is still active, there is a risk of ketamine causing undesirable excitement effects in the badger. In addition, hypersalivation is a possible side effect of atipamezole administration.

Badgers are trapped in the field under the authority of a licence issued by Natural England. A badger assessed as fit for anaesthesia and blood sampling is anaesthetised whilst still in its trap. Subsequent to induction of anaesthesia, the badger is removed from its trap and blood sampling by jugular

Venepuncture is performed close to the trap (trap-side sampling). After collection of the blood sample, the badger is returned to its trap to recover from the anaesthetic.

Animal welfare considerations

Any staff performing this procedure must be trained and competent to do so, in order to ensure they cause the minimum pain, suffering, distress or lasting harm to the badger, with supervision as necessary until such competence is obtained. A badger subjected to this procedure is likely to suffer some distress and could potentially be injured attempting to escape from its trap. Throughout the procedure, care should be taken to provide the badger with adequate shade and protection from inclement weather as necessary. A badger trapped for this procedure must be approached carefully and quietly to reduce panic, further stress and risk of injury. The procedure must be carried out in strict accordance with the method described in this SOP. Badgers recovering from a general anaesthetic must be monitored carefully. Any observed or suspected adverse effects of the anaesthetic must be brought to the immediate attention of the nominated veterinary surgeon.

Experience has shown that, if treated calmly and gently, wild badgers are relatively easy to anaesthetise by intramuscular injection. Most badgers are stationary at the start of the injection procedure and a substantial majority remain still throughout the injection procedure. Anecdotally, it has been reported that a quiet working environment is key to reducing initial and provoked responses to the injection procedure. Noise and disturbance should be kept to an absolute minimum at the procedure location. Cubs are more challenging to inject, because they are smaller, with more space to move out of reach of the needle.

The physiological responses of badgers to the anaesthetic cocktail specified in this SOP have been recorded. This research demonstrated that only a small proportion of badgers anaesthetised with this cocktail demonstrate undesirable effects such as rocking of the head and paddling of limbs. Sneezing and muscle rigidity, common undesirable effects of anaesthesia by ketamine hydrochloride alone, were not observed in badgers anaesthetised with this cocktail. A common observation in badgers anaesthetised with this cocktail is pale colouration of gingival mucous membranes, possibly a result of vasoconstriction induced by medetomidine. Experience of using this anaesthetic cocktail to facilitate blood sampling of badgers in the field suggests that the risk of anaesthetic death is very low.

SOP WP001 describes the procedure for the initial cage trapping of badgers.

Safety

Personal protective equipment (PPE)

All staff working in the field must wear appropriate protective clothing which can be easily cleaned and disinfected.

All staff working in the field with badgers must wear the minimum additional PPE of disposable gloves, safety spectacles and a regulation FFP3 face mask. Staff must use the regulation FFP3 face mask recommended to them during face-fit testing.

If during the procedure, any PPE becomes soiled (e.g., from urine, faeces or handling of bite wounds and abscesses), it should be exchanged for clean PPE as soon as it is safe to do so.

Waste

All waste generated during the procedure must be regarded as potentially contaminated and (except for sharps) must be discarded into the contaminated waste bins (yellow Sulo bins). Sharps (including needles) must be discarded into sharps containers.

Needles

Do not recap needles by hand; do not remove used needles from syringes by hand; do not bend, break or otherwise manipulate needles by hand. Care must be taken, both during and after procedures, to prevent injuries from needles. All used needles and syringes must be safely discarded into a sharps container immediately after use. If an operator inadvertently punctures their skin with a used needle, they must seek immediate medical attention.

Equipment

- Anaesthetic cocktail.
- Antisedan.
- Syringes (1 ml and 3 ml).
- Needles (0.6 mm x 25 mm and 0.8 mm x 38 mm).
- Portable anaesthetic machine.
- Wickets.
- Straw-filled hessian sack.
- Rectal thermometer and probe covers.
- Hair clipper kit.
- Blood vacutainers.
- Vacutainer holders.
- Vacutainer needles (0.8 mm x 38 mm).
- Paper towel.
- Cotton wool.
- 70% ethanol.
- Clinell spray.

• Water spray bottle.

- Scissors.
- General-purpose coloured livestock spray.
- Disposable bench cover.
- Bubble wrap.
- Equipment tray.
- Watch.
- Spring balance.

Procedure

Staff performing this procedure unsupervised must have been trained and signed off as competent to perform it in their training record. Staff being trained in the procedure must be supervised by a fully trained member of staff.

This procedure starts at the point in time immediately after traps have been checked at or near dawn on the day after the traps were set to catch. Trapping will have been carried out in accordance with SOP WP001.

At any one time, this procedure will only be performed on badgers trapped at a single sett.

Blood sampling an anaesthetised badger at the trap-side involves the following series of steps:

1. Carry out a health and welfare assessment of the badger prior to induction of general anaesthesia

This initial assessment of the badger to determine whether it is fit to anaesthetise and blood sample is carried out on the animal in its trap. The badger should also be checked to determine whether it is a recapture (as indicated by presence of a fur clip and/or livestock marker on its back); if the badger is a recapture (previously captured for blood sampling) then it must be released immediately after the initial health and welfare assessment has been carried out, unless it requires veterinary attention. The health and welfare of each badger must be assessed by following the badger assessment table and flow-chart provided in Appendix 1. Mild stimulation of the badger by gently moving the trap may aid the assessment. Under no circumstances should fingers be poked through the mesh of the trap. If there is any doubt about the fitness of a badger for anaesthesia and sampling, the nominated veterinary surgeon must be consulted. The veterinary surgeon will advise on the appropriate course of action for any badger they are called to examine.

If multiple badgers have been trapped at the same sett, the health and welfare assessment must be completed for all these badgers prior to moving to the next stage of this procedure. Badgers assessed as fit for this procedure should be anaesthetised and blood sampled in succession, one at a time. Pending induction of anaesthesia, badgers should be left as undisturbed as possible.

It is possible that more than one badger is caught in one trap. If this occurs, the captured badgers must be promptly separated to leave one badger in the trap, with the other(s) transferred to an individual holding cage (one badger per cage). If transfer to a holding cage is required, the following process should be followed: place a holding cage on its side in front of the door of the trap and position one foot behind the holding cage so that it cannot move backwards. The holding cage door should be almost completely out but remain far enough within the runners so it can be closed quickly when necessary. Lift the front of the trap off the ground, so the door can be rested on top of the open end of the holding cage. The trap door will then open as it is lowered against the open end of the holding cage. If necessary, gently encourage the badger to move into the holding cage (wickets can be used to gently nudge the badger if necessary). Once the badger has moved into the holding cage, slide shut the holding cage door and secure it at the top with a karabiner clip. To assist transfer to a holding cage, multiple badgers in one trap can be segregated into different parts of the trap using wickets.

2. Induce general anaesthesia

General anaesthesia is induced by intramuscular injection of the anaesthetic cocktail. The injection procedure is usually carried out on the badger in its trap. The dose rate of the anaesthetic cocktail is 0.2 ml/kg. The dose to be administered is based on a visual assessment of the approximate bodyweight of the badger. The dose should also take into account the general condition of the animal. In the case of small cubs (<2 kg), the health and condition of the animal must be assessed, and a decision made whether anaesthesia is likely to present a risk or not. If a small cub is considered at risk from anaesthesia, it must not be anaesthetised; it must be released at its sett immediately after the initial health and welfare assessment has been carried out, unless it requires veterinary attention.

N.B. Noise and disturbance should be kept to an absolute minimum. A sheathed needle (0.6 mm x 25 mm or 0.8 mm x 38 mm) should be pushed onto a syringe of a suitable size for the volume of anaesthetic required. The sheath should be removed from the needle. The syringe plunger should be drawn back slightly to pull air in through the needle. The foil cap of the anaesthetic vial should be removed, and the rubber diaphragm punctured with the needle. The syringe can then be charged with anaesthetic by pushing the plunger forward to force air into the vial and then back gently to draw fluid in. The negative pressure created in the syringe should enhance the inward flow of fluid. To prepare the charged syringe for injection, air bubbles should be removed from the fluid by tapping the side of the plastic syringe with a finger whilst holding it with the needle pointing upwards. The air bubbles will rise to the needle and can be dispelled by applying gentle pressure on the plunger. If air bubbles remain then repeat the procedure. The required dose of anaesthetic cocktail is administered by intramuscular injection into the badger's thigh muscle. Badgers in traps can often be anaesthetised without need for restraint. Keeping the noise levels low will greatly facilitate this by decreasing the likelihood of aggressive reactions when the badger is approached and will also improve an individual badger's response to the anaesthetic. In some badgers, it is possible, with care, to insert the needle into the badger's thigh muscle through the trap with little or no behavioural response. This will require approaching the badger quietly, using slow movements so as not to alarm it and distracting its attention by moving the free hand in front of the animal within its field of vision. However, some animals, particularly cubs, will require restraint. This can be achieved by using the wickets. The prongs of the wickets are pushed downwards through the mesh of the trap at an angle of 90 degrees to the top of the trap. The prongs of the wickets can then be angled upwards to squeeze the badger against one end of the trap. With the badger held in this position, the

Injection can be administered through the trap mesh into the thigh muscle. Small cubs may need to be transferred to a holding cage (see step 1) for administration of the anaesthetic cocktail. After transfer of the cub, the holding cage should be stood on its end with the door at the top. With a swift movement, the holding cage door should be opened, and a hessian sack stuffed with straw should be pushed gently into the cage by hand to force the cub down into the bottom of the cage. With the badger cub restrained like this, it is possible to administer the injection through the cage mesh. To administer the anaesthetic cocktail, the needle should be pushed into the thigh muscle. An entry angle of 90 degrees will maximise the chances of hitting muscle rather than fat. The required dose should then be administered by gently pushing down on the syringe plunger. The needle should then be gently removed from the muscle. The used syringe and needle must be immediately discarded into the sharps container. Record the initial dose, time of injection and administrator initials on the Anaesthetics Log Sheet.

If the badger does not receive the full initial dose, a 'top-up' of anaesthetic cocktail may be needed. After waiting 5-10 minutes to judge the effect of the first dose, the amount of 'top-up' needed should be judged by assessing the animal's state of consciousness and its weight. A 'top-up' should only be administered before the badger leaves the trap. Approximately 10–15% of badgers anaesthetised in field conditions require a 'top-up' injection of anaesthetic cocktail. Record all 'top-up' injections on the Anaesthetics Log Sheet.

3. Assess the depth of general anaesthesia prior to removal of the badger from the trap

Assess the depth of anaesthesia by lifting the back end of the trap briefly (never open the trap or touch the badger with your hands at this stage because the depth of anaesthesia is not confirmed). Flinching or blinking are signs of insufficient depth, as is resistance to being tipped in the trap. Once reflexes have disappeared and the animal appears to be fully relaxed with no resistance to tipping, the anaesthesia can be considered established. Old, very fat and cold animals generally have a prolonged induction time.

4. Remove the anaesthetised badger from the trap

Once general anaesthesia has been induced, the badger can be lifted from the trap. Place the end of a holding cage door lightly on the badger's neck. With the other hand, which is now protected by the door, grab the loose skin of the neck (the badger cannot easily reach this part of the body if it does wake). Lift the head to remove the badger from the trap and, with the other hand, support the animal's rump. Once the anaesthetised badger has been removed from the trap, place it on the work surface (a suitable surface is the top of the trap or the dropped-down tailgate of a pick-up truck, covered with a mat that can be cleaned and disinfected). Check the badger's breathing and the colour of its mucous membranes/tongue (blue colouration of the mucous membranes/tongue indicates hypoxia). Protect the badger's eyes from direct sunlight. If required, the bodyweight of the badger can be checked at this stage by weighing it in a holding cage using a spring balance. Always have the trap or a holding cage near to the work area, in case the badger needs to be urgently confined.

5.0 Ongoing monitoring of general anaesthesia

Anaesthesia normally lasts for about 30–50 minutes. Anaesthetic depth must be monitored closely throughout by checking vital signs and reflexes. An anaesthetised badger must never be left unattended until it has been safely returned to its trap. Torpid badgers (badgers less active during the winter) are of particular concern and must be observed at all times due to the higher risk of adverse effects. The badger's rectal temperature should be recorded. The electronic thermometer probe should be sheathed with a probe cover and entered into the badger's anus and the end positioned so that it is in contact with the wall of the rectum. Hold the thermometer in this position until the thermometer displays the temperature. Record the temperature (normal range is 36°C-40°C).

Possible adverse effects of general anaesthesia and how to deal with them

Body temperature regulation of badgers under a general anaesthetic is impaired and heat loss can be significant. The badger should be kept warm by wrapping in bubble wrap whilst it is anaesthetised if necessary. Cubs weighing 4 kg and less are at increased risk of hypothermia.

General anaesthesia can produce respiratory depression with apnoea (temporary cessation of breathing), increase in heart rate and blue colouration of mucous membranes. Breathing rate can be measured by observing abdominal movements. Apnoea should be managed by immediate delivery of oxygen via a mask, using a portable anaesthetic machine. If spontaneous breathing does not resume after approximately 5 minutes, the anaesthesia must be reversed with Antisedan (see below). Oxygen delivery must continue until the animal starts to regain consciousness.

Cardiac arrest may occur under a general anaesthetic. Heart rate can be measured by palpation of the heart beat in the chest area. If cardiac arrest occurs, immediately start heart compressions and reverse the anaesthesia. Deliver oxygen via a mask as described above.

Reversal of medetomidine by intramuscular injection of Antisedan if necessary

The effects of medetomidine can be reversed with atipamezole (5 mg/ml Antisedan, Vetoquinol UK Limited) by intramuscular injection. The Antisedan dose in millilitres is half of the dose volume of medetomidine solution given (equivalent to 1/10th of the volume of triple anaesthetic cocktail). If the dose of anaesthetic given is unknown, the dose rate for Antisedan is 0.02 ml/kg.

Very few badgers will require medetomidine reversal, but this reversal may be necessary if recovery from anaesthesia is prolonged (see step 12) or there are other clinical indications (e.g., old age, low body temperature, cardiac or respiratory depression etc.). Unless clinically indicated, Antisedan should not be administered until 40 minutes have elapsed since the initial anaesthetic injection, by which time the effect of the ketamine will have worn off. If reversal is required, inject the appropriate dose of Antisedan intramuscularly using the method of injection described in point 2 above. Reversal is expected within 5 minutes of injection of Antisedan. Record the amount of Antisedan administered, the time of injection and the administrator's initials on the Anaesthetics Log Sheet.

Box

6. Wash the badger's neck area if necessary

If necessary, the badger's neck area can be washed to remove encrusted mud prior to blood sampling. Care should be taken not to immerse the badger's head in water. Encrusted mud can be gently removed by hand. After washing, the badger should be dried thoroughly using paper towels. This washing the neck area step should only be carried out if it is not possible to obtain a clean blood sample site by hair clipping alone.

7. Collect the blood sample

For blood sample collection, the badger should be on its back with its neck outstretched. The blood sample should be collected from one of the jugular veins. In the event of two unsuccessful attempts at taking blood from one jugular vein, one further attempt can be made to take blood from either jugular vein by a more experienced sampler. If a blood sample has not been harvested after three attempts, the procedure must be abandoned. Record the time of blood collection, volume of blood taken (or 0 ml if unsuccessful) and the initials of the sampler for each attempt at taking blood. To locate a jugular vein, with the badger lying on its back, crop the hair on one side of the throat with hand held hair clippers so that the jugular vein becomes visible. The clippers must be disinfected after use on each badger; spray with Clinell disinfectant spray, allowing a contact time of two minutes prior to wiping dry with clean paper towel. A small brush may be needed to clear hairs from the clipper blades prior to disinfection. The plastic sheath should be unscrewed from the shorter shaft of a vacutainer needle and discarded into the waste. The uncovered end of the needle should then be inserted into the threaded end of the vacutainer holder and firmly screwed in place by rotating the holder clockwise. A 2 ml heparinised (green top) vacutainer tube should then be pushed into the other end of the vacutainer holder up to the stop mark on the holder so that the exposed end of the needle enters the rubber bung of the vacutainer tube but does not break the vacuum seal. The plastic cover can now be removed from the other end of the needle and discarded into the waste. The jugular vein should be raised by applying gentle pressure over the vein with a forefinger, just cranial to the thoracic inlet. The vein should be punctured by the needle at an approach angle of less than 30° with the needle aperture facing upwards. Once the needle is located in the vein, the vacutainer can be pushed into the vacutainer holder with the palm of the hand, thus breaking the vacuum and forcing blood into the tube. Once the required volume of blood (2 ml) has been obtained, the vacutainer tube should be removed from the holder and passed to an assistant, followed immediately by removal of the needle from the vein. As soon as the needle has been removed from the vein, gentle pressure should be maintained on the puncture site by placing a finger on it for approximately 30 seconds. If more than one attempt at taking blood is required, then a new needle should be used. Used needles must not be re-sheathed by hand. Whilst holding the vacutainer holder, the used needle should be released into the sharps container using the release mechanism.

8. Assess the badger for trap-related injuries

The badger must be assessed for trap-related injuries by examining the paws, limbs, head and teeth.

Box

9. Mark the badger

The blood sampled badger must be given a fur clip using the hair clippers or curved scissors and marked using a general-purpose livestock spray. The badger should be fur clipped and marked on its back with a spot of the coloured spray (approximately 5 cm diameter). The clip and spray mark must be easily noticeable in the event of the badger being recaptured. Care must be taken to avoid spraying the livestock marker into the animal's eyes, nose or mouth. The fur clip should remove the outer guard hairs revealing the lighter under-hair. The clippers or scissors used to make the fur clip must be disinfected after use on each badger; spray with Clinell disinfectant spray, allowing a contact time of two minutes prior to wiping dry with clean paper towel.

10. Record the badger's rectal temperature again if indicated

If the badger recorded a rectal temperature close to 36°C or 40°C at the initial temperature check, record the rectal temperature again to determine whether body temperature has deteriorated or improved. Measures to assist recovery in a cold or hot badger are described in step 12.

11. Return the badger to its trap

The badger must be returned to its original trap. The badger should be gently placed rear end first into the trap and aligned on one side with its neck extended to aid breathing during recovery. Its limbs should be in a natural position. The trap door should then be closed and secured. If the badger's original trap is in a location that is not conducive to a good anaesthetic recovery e.g., it is located in wet mud, then the badger should be placed in a holding cage in a suitable location, rather than the trap.

12. Monitor the badger's recovery

Once the badger has been returned to its trap, it must be observed frequently until it regains consciousness. The time of onset of recovery (the waking process) depends on age, health status and body condition. Obese animals usually go through a recycling phase (sleepiness after signs of recovery) due to a secondary effect of the anaesthetic drugs metabolised from fatty tissue. If recovery is prolonged, anaesthesia may need to be reversed by administering an intramuscular injection of Antisedan (see step 5).

Measures to assist recovery if necessary

Cold badgers (rectal temperature under 36°C) – Dry the badger if it has wet fur. Place the trap in a warm area if possible. Cover the trap if required.

Hot badgers (rectal temperature over 40°C) – Water can be lightly sprayed over the badger's abdomen or wet towels can be placed over the trap.

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13. Carry out a health and welfare assessment of the badger prior to release

A health and welfare assessment must be carried out on every badger that has been anaesthetised and blood sampled subsequent to its recovery from the general anaesthetic and immediately prior to it being released. This health and welfare assessment should include observation of the badger's behaviour to establish that no late adverse effects of the anaesthetic drugs have occurred. The health and welfare of each badger must be assessed by following the badger assessment table and flow-chart provided in Appendix 1. Mild stimulation of the badger by gently moving the trap may aid the assessment. Under no circumstances should fingers be poked through the mesh of the trap. If there is in any doubt about the fitness of a badger for release, the nominated veterinary surgeon must be consulted. The veterinary surgeon will advise on the appropriate course of action for any badger they are called to examine.

14. Release the badger

Immediately after completion of a satisfactory health and welfare assessment for release, the badger should be released where it was trapped. Cubs should be released at entrances to the sett. To release the badger, stand behind the trap and open the door. The procedure of blood sampling a badger under general anaesthesia is now complete.

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Appendix 1

ASSESSING THE HEALTH AND WELFARE OF A BADGER

The following tables and flow chart aim to describe and explain:

- **Methods for assessing the health and welfare of a badger**
- **How to use this assessment in the decision-making process**

PARAMETER	METHOD OF ASSESSMENT
Demeanour	Observe – important to take time. Gently moving the cage to stimulate (mildly) may be useful
Respiration	Observe – amount of chest movement/effort associated with respiration
Body condition	Observe – assessing body and coat condition is not easy in a cage, requires quiet close observation
Injuries	Observe - important to take time. Gently moving the cage to stimulate (mildly) may be useful
Movement	Observe – important to take time. Gently moving the cage to stimulate (mildly) may be useful

It is necessary to acquire information about a badger's general health from quiet, unrushed, calm observation and some prior knowledge of normality and the commonly seen departures from normality in a wild badger (see next page).

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NORMAL vs ABNORMAL

Parameter	Normal	Common departures from normality	Abnormal
Demeanour	Highly variable from "very quiet but responsive" to "scrabbling in cage".	Individual variation can be high.	Very depressed and unresponsive to mild stimuli.
Respiration	Highly variable. Dependent on weather conditions/level of stimulation in the cage. Normal resting: 15-25 breaths per minute	Expect respiratory rate to increase in hot temperatures and with stimulation such as handling or disturbance.	Very low respiration rate/no observable respiration. Panting – open mouth breathing. Laboured movement of the chest wall during respiration. Obvious noise on inspiration or expiration. Discharge from nose.
Body condition	Coat should be clean, unmatted and in good condition. (wet weather on trap night may cause coat to be matted with mud).	Seasonal changes in body condition can be dramatic with maximum weight reached in autumn and minimum weight in late spring/early summer.	Thin, dull, staring coat. Prominence of spine, ribs. Excessive loss of hair.
Injuries	None.	Abrasions on top of forelimb or nose. Ripped/shredded claws. Bite wounds over rump/around head, especially in males - can be extensive, often associated with hair loss.	Fracture. Open wounds (other than bite wounds). Excessive bleeding. Limb fractures. Broken Jaw. Tooth and gum injuries.
Movement	Using all four feet when standing or turning in the cage. Moving freely and in a coordinated manner.		Not able to stand or move easily. Repeated lifting of limb(s). Inability to move when stimulated. Incoordination.

Box

