

This Standard Operating Procedure (SOP) is applicable to all UniSQ Research Workers who care for and use Animals for Scientific Purposes. The procedure must only be performed by those persons who have been deemed competent, and who believe they remain competent to do so. Access to supervision by suitably qualified staff whilst undertaking this procedure is encouraged, where required.

Species

- *Antechinus*
- *Planigale*
- *Pseudomys*
- *Rattus*
- *Sminthopsis*
- *Mus musculus*
- Other small mammals species captured

Purpose

The purpose of this SOP is to provide information to people considering the use of pitfall traps in surveys and research on small mammals on how to remove small mammals from pitfall traps, process them and then release them.

Population surveys and monitoring play a key component in many ecological research projects. Population data is obtained through ecological survey techniques such as camera, cage, Elliott and pitfall trapping. Pitfall trapping is one of the most well-established techniques for ecological surveys, having been used for decades with many variations in designs (e.g. Woodcock, 2005; Ribeiro-Júnior et al., 2011) relating to size and depth of the pitfall trap and use of preservatives and fences. The success of a pitfall trap relies on the activity and locomotion of the target species; however, pitfall traps function as an opportunistic method of trapping any vertebrate or invertebrate species that drop in (Friend et al., 1989; Ribeiro-Júnior et al., 2011; Palmeirim et al., 2019). Trapping is an effective method of obtaining species diversity and abundance data, calculated from the number of species (and individuals in each species) caught over a set trapping period. This data becomes the foundation for conservation project development, aids in understanding wildlife ecology and improving current research practices. Typically, you decide the length of time that trapping will take place prior to the start of trapping, which can be as short as three days or extend to weeks. Depending on environmental conditions (typically rainfall and temperature) pitfall trapping capture rates can be 0% (no animals caught; typically in prolonged dry and cold conditions) or infrequently over 100% (e.g. over 100 animals caught per 100 traps in each day of trapping; this can occur on warm nights in spring/summer after regular rainfall for several years).

Pitfall traps are typically made from plastic and two main types of commonly used for small terrestrial vertebrates, i.e. amphibians, reptiles (e.g. dragons and skinks) and small mammals (e.g. native and introduced mice). These are a 10 or 20 litre bucket buried in the ground or 150 mm diameter PVC pipe buried 0.5 m in the ground with the opening of the bucket or PVC pipe flush with the ground. Both buckets and the PVC pipe (capped at the bottom) have 1 mm holes drilled in the bottom for drainage. Within the pitfall trap are typically placed a floatation device (a piece of polystyrene) and shade (half a plastic pie dish); both offer protection from the sun (at midday depending on the time of year), and the polystyrene allows animals to float on if unexpected rainfall occurs.

Once installed, pitfall traps are often left in the ground to conduct surveys at different times of the year or annually to record seasonal or annual changes in species diversity and abundance. If left in situ and not in use, pitfall traps are always sealed and covered with a solid cover. For 150 mm diameter PVC pitfall traps the top of the trap is closed with a 150 mm galvanised metal cap/lid covered with a 300 mm square 20 mm thick concrete slab. Before and after use the pitfall trap is cleaned (using a cloth such as a dish cloth/chux) so it is obvious there are no animals in the trap. Pitfall traps can be left open to capture diurnal and nocturnal animals, and if so, they must be checked each day at dawn to remove nocturnal animals and dusk to remove diurnal animals. If only capturing nocturnal animals, then pitfall traps are opened at dusk and closed after any caught animals are removed at dawn. To improve the capture rate of pitfall traps, depending on the landscape, drift fences can be installed. Drift fences are typically made of wood, plastic or metal, between 0.2 and 0.5 m high, partly buried, that may extend over 20 m from the pitfall trap to direct animals to a gap in

the fence where the pitfall trap is placed. Drift fences can be difficult to use depending on the substrate e.g. with the presence of large rocks, and involve clearing of vegetation to install with consequential environmental impacts.

Definitions	
AEC	Animal Ethics Committee
GPS	Global Positioning System – the location on the earth
PVC	Polyvinylchloride is one of the world's widely produced synthetic plastic polymer and used in a wide range of products
SD	Secure Digital memory card for portal devices

Linked SOPs	
SOP ID number	SOP title
WL002	Pipe trapping
WL003	Photographing small vertebrates
WL004	Ear notching small mammals
WL005	Removing amphibians from pitfall traps
WL006	Removing small reptiles from pitfall traps
WL008	Pouch checking small female marsupials
WL009	Microchipping cane toads
WL010	Handling cane toads
WL011	Euthanasia of cane toads
WL012	Dry pitfall trapping for vertebrates

Potential hazard to Research Workers

UniSQ Risk Management Plan ID number	UniSQ Management Plan title
RMP_2020_4960	Wildlife research and teaching fieldwork

Personal Protective equipment required

- Field appropriate clothing (e.g. long sleeve shirt, long pants, hat)
- Enclosed footwear
- Sunscreen
- Insect repellent
- Gardening gloves (for closing pitfall traps)
- Disposable examination gloves – various sizes

Animal wellbeing considerations	
Perceived stressors	Management strategy
Extreme weather	Close traps or avoid trapping extreme weather conditions. Close pitfall traps if there is excessive rain or heavy rain is forecast. Plan ahead and monitor long-range and daily weather forecasts.
Exposure in traps	Always ensure appropriate and adequate shelter in the bottom of pitfall traps to offer protection for animals against exposure to environmental conditions and predation or attack from other animals, i.e. half pie dish and float.
Trap located near ant nest	Pitfall traps should not be placed in the vicinity of an ant nest. Move trap to an area with no ant nest.

Location of trap in drainage area or low-lying area	Pitfall traps should not be placed in drainage channels or low-lying areas, and if found to be in such an area, it must be relocated to a nearby location not experiencing potential flooding.
Disease risk	All handling bags and equipment should be kept clean to minimise the risk of disease.
Handling of animals	Animals will be handled so as to cause minimal stress and, under normal circumstances, released as soon as processing is completed.
Stressed animal particularly associate with wet and cold conditions	Any signs of stressed animal particularly associated with wet and cold conditions will be immediately dealt with as a priority. In the event of extreme wet and cold conditions, traps will be shut down to prevent animals from entering.

The overall perceived level of risk to an animal undergoing this procedure is:

☐ High

☐ Medium

☒ Low

Substances to be administered

Substance	Dose	Route	Purpose
Not applicable			

Equipment/ materials required

- Latex gloves – various sizes
- Range of scales (10g, 40g, 100g, 200g, 1kg)
- Ruler – measured to 1mm accuracy
- Calico bags – approximately 20cm by 30cm in size with a drawstring or other method to securely close the bag, e.g. tape or string attached to the neck of the bag
- Microchip scanner
- Plastic bag for rubbish
- Washbag – to place used calico bags in for washing
- Datasheets
- Alcohol and alcohol wipes

Site specification or location requirements

At locations/ fields outlined in UniSQ AEC approved application that includes the use of this SOP.

Waste disposal

Nil.

Duration of the procedure

- Several hours to organise the equipment required.
- Check an open trap for the presence of animals – 20 seconds
- Removal of animal from trap – 30 seconds
- Processing of animal removed from the trap – 2 to 5 minutes
- Monitoring of released animal near to trap – 1 minute or until animals have moved out of sight into the surrounding vegetation

Procedure

1. Locate the position of pitfall trap from flagging tape with the trap number written on it.

2. Use a stick longer than the pitfall trap to gently lift the plastic shelter and float to confirm if there is an animal in the pitfall trap.
3. Pre-fill trapping datasheet with non- animal related details, such as trap number/ day/ date/ bag weight.
4. Put on clean disposable gloves – ensuring they fit correctly.
5. Using a stick, gently remove the plastic shelter from the pitfall trap.
6. Weigh and record the weight of a clean calico bag on the datasheet in the row where you wrote the trap number in the column labelled 'Wt bag (g)'. Check that the calico bag does not have any holes in it except for the opening of the bag and that it has drawstrings used to close the bag
7. Turn the calico bag inside out such that any loose threads are not on the outside (so they don't get tangled up with the animal when it is in the bag) and use the calico bag as an additional glove; reach down into the pitfall trap and cup the small mammal in the palm of your hand such that the small mammal is held within the calico bag.
8. Remove your hand containing the small mammal from the pitfall trap, close the calico bag fully over the small mammal, and close the bag using the drawstrings such that the small mammal is secure in the calico bag. Record the species of the animal in the first column of the data sheet in the row where you wrote the trap number in the column labelled 'Species name'.
9. Weigh the small mammal in the calico bag using the appropriate size scales (e.g. 10 g scales for planigales) and record the weight on the datasheet in the row where you wrote the trap number, in the column labelled 'Wt bag + animal (g)'. From this, you can determine the animal's weight and write this number in the column labelled 'Wt animal (g)'.
10. While the animal is still in the calico bag, gently manipulate the small mammal such that the animal is held with one hand through the calico bag. To do this cup the animal through the calico bag such that it is held in the palm of your hand with the head pointing towards your fingers. The thumb and second (middle) finger can be utilised to restrain the animals head (fingers on either side of the head), and the index finger is placed on the top of the head.
11. Once the mammal is held firmly in the calico bag, using the three-finger hold, undo the drawstrings using your other hand, and open the calico bag to expose the animal, but not its eyes. Use the little finger of the hand holding the animal to wrap around the animals' body and support it.
12. While holding the animal in this position, carefully expose each ear individually to determine if it is tagged or notched. If it has an ear tag or notch, record the number in the column labelled 'ID #' and if necessary, ear notch the ear using the SOP 'Ear notching small mammals'. While an ear is exposed, use the ruler to measure the ear length – the length from the tip to the base of the ear and write this number in the column labelled 'Ear (mm)'.
13. While the head is exposed, carefully measure the head length from the back of the skull to the tip of the nose and write this number in the column labelled 'Head (mm)'. Be particularly careful that your fingers, holding the ruler, are not near the mouth of the animal.
14. Re-cover the animals head with the calico bag making sure the nose is not covered but the eyes are, and measure the hindfoot length (heel to tip of the longest toe but do not include the nail) to the nearest millimetre using the ruler while the foot is placed on a flat surface and record this number in the column labelled 'Foot (mm)'. The nail is not included in this measurement as they can be of varying length due to wear.
15. Then gently expose the tail and measure the straight tail length (from the tip of the tail to the cloaca or anus) to the nearest millimetre using the ruler while the tail is placed on a flat surface (e.g. clipboard) and record this number in the column labelled 'Tail (mm)'.
16. While the animal is still in the calico bag, measure the hind leg length (groin to tip of the longest toe but do not include the nail) to the nearest millimetre using the ruler while the animal is placed on a flat surface and record this number in the column labelled 'Leg (mm)'.
17. While the animal is still held in the calico bag using the three-finger hold, determine if the animal is a male (presence of scrotum and testes) or female (no obvious scrotum and testes, presence of pouch or teats) and record this in the column labelled 'Gender (M,F, U)' using M for male, F for female and U if the gender is not obvious.
18. If the scrotum and testes are obvious measure the width of the testes positioned side by side within the scrotum and record this number in the column labelled 'Scrotal width (mm)'. If the animal is a juvenile, its testes may not be obvious – record this as 'No obvious testes' in the column labelled 'Remarks'.

19. If the teats are visible within the fur on the abdomen (eutherian females), then record a teat score in the column labelled 'Teat (1-3)'; where Teat: 1 teat is barely visible (never lactated before); 2 teat is visible with fur at the base (lactated previously); and 3 teat is visible, large, with no fur at the base (lactating). If the animal is a juvenile, its teats may not be obvious – record this in the column labelled 'Remarks'. For this female also record the outside appearance of her vulva by using the score Vulva: 1 = not open, with membrane (never mated); 2 = not open, without membrane (previously mated); 3 = open, pin-sized hole (breeding condition); or 4 = open, large hole (breeding condition) and record the number in the column labelled 'Vulva (1-4)'. While you are doing this, also record the size and feel of the abdominal area – if it is obviously distended, then score 2 (pregnant); otherwise, score it 1 – no or not sure if it is pregnant in the column labelled 'Preg (1-2)'.
20. If there is an obvious pouch, it is a marsupial female and use SOP WL008 'Pouch checking small female marsupials' to determine the number and size of the pouch young.
21. If there is a possibility that the animal has been microchipped previously (under someone else's research) then using the microchip scanner, scan the length of the animal while it is still in the calico bag and if present, record the microchip number in the column labelled 'Microchip #'. If the animal has a microchip, write Y in the column labelled 'Recapture (Y/N)'; if the animal has no microchip, then write N in this column. Data on microchipped animals can be used to determine the population size of that species, movement from one site it was trapped and microchipped to another site where it was recaptured, and longevity.
22. The last data to be recorded is in the column labelled 'Fate (1-4)' write the appropriate number; where Fate: 1 = released unharmed; 2 = escaped while being handled; 3 = died in a trap or while handling; 4 = to be euthanised. For small mammals, this should be 1, unless the small mammal has escaped, died or has a reason to be euthanised (e.g. obvious major trauma).
23. In the vicinity around the pitfall trap (ideally within a 1 to 2 metre radius) find vegetation that would offer safe refuge to the small mammal and untie the calico bag and release the animal into that vegetation. Being a small mammal, the animal will normally disappear into the vegetation very quickly once it is released. Observe the animal until it has moved into the vegetation and if there appears to be a problem, e.g. unstable movement, record this and any other observations, e.g. missing the second toe on the left hind leg in the column labelled 'Remarks'.
24. If there was more than one small mammal in the pitfall trap, replace gloves and repeat steps 1.6 to 1.23 for each additional animal until the trap is empty of small mammals. If there are any reptiles or amphibians, follow their respective SOP's for removing them from pitfall traps.
25. If there are no more animals in the pitfall trap, place all calico bags in the 'wash' bag, remove gloves and put them in the rubbish bag. It is important not to use the same gloves/bags between small mammals to prevent the spread of ectoparasites (e.g. ticks and fleas) and diseases. Ensure all equipment is cleaned after use.
26. Move onto the next pitfall trap and repeat this procedure until all pitfall traps have been checked and all animals processed.

NOTE: All equipment, including microchip scanners, need to be cleaned with either detergent (i.e. calico bags) or alcohol wipes (i.e. ruler) between sites to reduce the risk of pathogens and parasites transmission.

Training, qualifications or competencies required

Researchers with relevant experience or qualification can only undertake this SOP to complete the procedures required.

Student researchers must receive appropriate training and supervision from UniSQ research supervisors or qualified individuals prior to undertaking procedures.

References

- FRIEND, G. R., SMITH, G. T., MITCHELL, D. S. & DICKMAN, C. R. 1989. Influence of Pitfall and Drift Fence Design on Capture Rates of Small Vertebrates in Semi-Arid Habitats of Western-Australia. *Wildlife Research*, 16, 1-10.
- PALMEIRIM, A., BENCHIMOL, M., PERES, C. & VIEIRA, M. 2019. Moving forward on the sampling efficiency of neotropical small mammals: insights from pitfall and camera trapping over traditional live trapping. *Mammal Research*, 64, 445-454.

- RIBEIRO-JÚNIOR, M. A., ROSSI, R. V., MIRANDA, C. L. & ÁVILA-PIRES, T. C. S. 2011. Influence of pitfall trap size and design on herpetofauna and small mammal studies in a Neotropical Forest. *Zoologia (Curitiba)*, 28, 80-91.
- WOODCOCK, B. 2005. Pitfall Trapping in Ecological Studies. In: SR>, L. (ed.) *Insect Sampling in Forest Ecosystems*. <https://doi.org/10.1002/9780470750513.ch3>

Licences and permits

Any required licences and/or permits to undertake the procedure(s) under this SOP must be obtained before undertaking this SOP.

SOP approval and review history			
Date	Version	Review Pathway	Notes
17/12/2020	0.0	3/12/2020 UniSQ AEC "Subject to Modifications". 17/12/2020 Reviewed and approved by the UniSQ AEC Executive.	Approved
23/06/2021	0.1	23/06/2021 Inserted under "Licences and Permits", the words: "Any required licences and/or permits to undertake the procedure(s) under this SOP must be obtained before undertaking this SOP."	Update
18/10/2022	0.2	18/10/2022 Converted SOP to new UniSQ branding and revised all reference of 'USQ' to 'UniSQ' ('waste disposal' not included in previous version)	UniSQ 2022 Rebrand