



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

- Wedge-tailed eagle (*Aquila audax*)
- White-bellied sea eagle (*Haliaeetus-leucogaster*)
- Little eagle (*Hieraaetus-morphnoides*)
- Other eagle species

Purpose

This procedure was written as part of a suite of SOPs for the assessment of various raptor monitoring techniques. Population surveys and monitoring play a key component to many ecological research projects and are an important conservation tool. However, raptor monitoring is time consuming and expensive, resulting in a decline of monitoring raptor species in Australia. The project looks to optimise raptor monitoring by determining the efficacy of various monitoring technologies and techniques available to wildlife conservation. It is important to use traditional methods in concurrence with these novel methods to provide a baseline to compare against.

The purpose of this procedure is to fix GPS tracking devices with other built-in sensors to rehabilitated eagles. The GPS will provide location data, providing insight on home range of these species and dispersal from their release site. There has been limited data recorded for the home range of these species in other parts of Australia; this study plans to build on this to gain a better understanding. The impact of rehabilitation on home range has not been studied, nor the relationship between how long a bird is in rehabilitation and if it has lost its territory upon release. If its territory has been taken by another bird, in its weakened rehabilitated state it will likely be forced to disperse/ migrate to find/establish another territory. Understanding the likelihood of this happening will influence where future rehabilitated eagles are released; it may be more successful to release them away from the location they were originally found.

In addition to location data, activity data will be recorded using other built-in sensors such as accelerometers. This will be used to determine an activity budget for rehabilitated eagles and compared to what is typical for the species. If rehabilitated birds have significantly different activity budgets compared to non-rehabilitated, this will have conservation impacts as a higher energy expenditure may reduce the chance of its survival. This is likely as hunts will not be as successful and the birds will have depleted muscle strength and reduced muscle tone. Providing information on this will allow decisions to be made on if and how long it is necessary to supplementarily feed rehabilitated eagles upon release. This information is unknown in Australian eagle and raptor species in general and represents a significant knowledge gap.

This procedure must only be completed by trained rehabilitators and wildlife veterinarians.

Definitions

Eagle	In this SOP, 'eagle' can refer to any of the three eagle species listed or other species.
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Linked SOPs

SOP ID number	SOP title
RMT008	Recovery of GPS tags from injured individuals and cadavers

Potential hazard to Research Workers

UniSQ Risk Management Plan ID number	UniSQ Management Plan title
RMP_2021_5430	Raptor monitoring techniques research – fieldwork

Personal Protective equipment required

- Thick leather gloves – i.e. welding gloves
- Disposable surgical gloves
- Eye protection
- Surgical mask

Animal wellbeing considerations	
Perceived stressors	Management strategy
Capture of the rehabilitated eagle from the aviary	The eagle will be lured into a safe part of the aviary with food. Once on the food, the eagle will be captured using a net. The animal will then be restrained around the wings and talons. This is a stressful part of the procedure, but is necessary to release a rehabilitated bird, regardless of if it has been tagged or not. Stress will be minimised by only using rehabilitators the bird is familiar with for this procedure, and by minimising the number of people in and around the aviary. The persons conducting this capture should be trained specialist eagle rehabilitators with many years of experience. Members of the project from UniSQ will not be involved with this stage of the procedure.
Transport from aviary to operation room	Once restrained, the eagle will be moved quickly to a clean room where the anaesthetic equipment will be set up. This room will be on the same site of the bird aviary and transport time will be minimised to reduce stress. The bird will also have its head covered immediately after capture and remain covered with a hood, this minimises the stress of an unfamiliar environment and the transport process. A soft spacer must be placed between the restrained raptor legs.
Application of anaesthetic	Once in the sterile room, anaesthetic will be applied using a face mask by a team of qualified veterinarian and technicians. This will use standard procedures developed by the rehabilitation centre and the veterinary practice. Members of the project from UniSQ will not be involved with this stage of the procedure.
Risks associated with animal being under anaesthetic	To minimise the risk of complications under anaesthesia, firstly the individual will be fed additional food in the preceding few days to increase its body condition. A good body condition will help minimise risks under anaesthesia. This is also common practice for birds about to be released from rehabilitation as it provides them longer to find their next meal upon release. In addition, the time under anaesthesia will be kept to a minimum to reduce the chance of complications. It is anticipated that individuals will be under anaesthesia for less than 15 minutes. The bird will be kept at normal body temperature throughout the procedure by either warming or cooling the individual, dependent on atmospheric temperature. The body temperature of the animal will be monitored throughout the procedure using a thermometer. This will apply to both maintenance of anaesthesia and recovery. Maintaining body temperature reduces the chance of conditions such as hypothermia and capture myopathy. Members of the project from UniSQ will not be involved with this stage of the procedure.
Application of GPS tracking unit to animal	Transmitters are attached to the dorsocranial surface of the rachis of the two first rectrices (tail feathers). Tail mounted trackers are used as they do not constrict the birds in any way, there is less chance of abrasions as there is no harness around the bird that can rub, and they are light and are dropped when the feathers moult. Considering these are previously compromised birds, it is imperative that the trackers used do not impede the birds in any way. The trackers are attached to the two feathers using specially designed clamps. The GPS unit is designed not to cause any pain to

	<p>the animal and to minimise the discomfort of carrying the GPS unit. The GPS trackers have been designed to weigh less than 5% of the individuals body mass as is standard for GPS tracking devices. GPS tracker fitting will be completed by experienced rehabilitation staff that have previously attached similar trackers. Members of the project from UniSQ will not be involved with this stage of the procedure.</p>  <p>An example of a GPS tracking unit attached to the tail feathers of a Powerful w/ (<i>Ninox strenua</i>) (John White Wildlife, 2016)</p>
Reversal of anaesthetic	<p>The restraints will be removed from the individual, it will be placed within the transport container for release. The container will be closed and the bird will be monitored by the veterinary staff and rehabilitation team whilst it regains consciousness. As the state of anaesthesia is maintained by the isoflurane, removal of the isoflurane, starts the recovery process and no reversing agent is required. Within 10 minutes the eagle should be fully recovered. Members of the project from UniSQ will not be involved with this stage of the procedure.</p>
Transport from facility to release site	<p>The transport container will be taken by vehicle to the release site by the rehabilitation team. The container will be kept dark and noise kept to a minimum in the vehicle to reduce stress on the individual. On some occasions, members of the project team from UniSQ will be involved with this stage of the procedure, under supervision of the rehabilitation team.</p>
Animal release	<p>The animal will be released by a single person opening the container, with other observers kept at an appropriate distance. The individual will be left to come out of the container as it wants to. The release site will be selected by the rehabilitation team. This will be close to the original area the bird was rescued from and away from any possible hazards such as power lines, buildings and vehicles. Members of the project from UniSQ may be involved with this stage of the procedure, but will only be involved in an observation role.</p>
Territorial conflict upon release	<p>It is possible that the individual may have lost their home territory to another eagle whilst being rehabilitated. Establishing how often this occurs is one of the aims of the study. The release site will be scouted before release to determine if there are any other individuals in the vicinity. If there are other territorial eagles in the vicinity an alternative release site will be identified. Engaging in immediate territorial conflict should be avoided upon release to maximise the chances of the rehabilitated bird surviving, conflict is energy intensive and the bird is likely to have been weakened by the rehabilitation process, leading to possible injury or death. A risk</p>

	assessment checklist for the release site must be completed prior to release. This checklist quantifies the above territorial considerations and other important considerations to ensure the maximum chance of release success and subsequent survival.
Depleted energy store upon release	Territorial conflict is likely for released rehabilitated eagles, and as such it is likely they will need to travel to a new territory. This is energy intensive. In addition, hunting success will likely be lower until muscle strength and tone has been regained, leading to higher energy expenditure as a result of fewer successful hunts. To counter these issues, as previously stated the bird will be fed additional food before release to increase body condition. In addition, food will be left near the release site just after release for the individual to eat during the first day.

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

- High
 Medium
 Low

Substances to be administered			
Substance	Dose	Route	Purpose
100% Oxygen	2 to 5 minutes, 1 – 3L per minute	Face mask	Anaesthetic substance, dose and route dependent on eagle species, size and veterinarian administering.
2 -3% Isoflurane	2 to 5 minutes via Oxygen intake	Face mask	Anaesthetic substance, dose and route dependent on eagle species, size and veterinarian administering.
1.5 – 3% Isoflurane	Maintenance via Oxygen intake (for procedure duration)	Face mask	Anaesthetic substance, dose and route dependent on eagle species, size and veterinarian administering.

Equipment/ materials required

- Bird capture equipment (large blanket/ towel for restraint and net)
- Anaesthetic equipment
- GPS tracking device and feather clamp
- Sim card with pre-loaded credit (is SMS based system)
- Computer for checking message transmission
- Bird transport container
- Small torch

Site specification or location requirements

Rehabilitation centres in Queensland and New South Wales.

Duration of the procedure

- The individual should be under anaesthetic for as short a period as possible to minimise complications. Fixing the GPS tracking device should take less than 5 minutes, and the bird should be under anaesthetic for less than 15 minutes. **Other health checks will be completed at the same time.**
- The whole procedure from capture to release will depend on how far away the release site is from the rehabilitation facility. However, the vast majority of these procedures would be completed within the timeframe of a morning.

1. Capture of eagle from rehabilitation aviary

- This is best achieved using two people in the aviary, to assist with cornering and if there are any issues.
- The main objective is to corner the bird in the aviary, so that its only means of escape is to come towards the two people trying to capture it. Approach the bird slowly holding at waist level your large blanket, ready to throw over the bird. The raptor will turn around and face you ready to strike at you with its talons or beak. The beak can give a fairly hard bite but it is extremely important to ensure that the feet of the bird are restrained. As you approach the bird ensure the two of you are on either side of the bird; one person can make small arm movements to keep the bird at bay - don't wave wildly as this will startle the bird.
- The bird will most likely slide down against the aviary wall and be panting and trying to look at a means of escape. It is likely to be terrified, so the quicker you can do this the better. With a fairly swift motion throw the towel over the bird making sure you get the head covered, this calms the bird down quite considerably as you have taken away its primary sense, its eyes. Follow the blanket throw swiftly with kneeling beside the bird and pushing the bird firmly to the ground, thus trapping its feet. Slide your hand along the side of the blanket feeling for the upper part of the leg, and then slide your hand down until you reach the ankle of the bird. Do the same on the other side and then lift and tuck the bird under your arm.
- When you stand up with the bird, the blanket should fall down over the bird covering its head and most of its body. **ENSURE** that the feet are pointing away from your body, and then you can tuck the bird safely under your arm, restraining the bird, gripping both ankles, with one hand, pointed away from your body and the wings firmly pinned. They are powerful creatures so this hold is using the strongest part of your arm and body to immobilise the bird.
- Now that you are holding the bird safely, you have what is known as five points of contact. The two wings, the two feet and control of the head. These five points of contact are extremely useful for examination of injuries and application of anaesthetic. The person holding the bird can pull a wing or leg out one at a time, whilst the second person examines the wing for any breaks or lesions. When doing this, ensure that you maintain a firm grip on the ankle and that the person who is examining does not stand in front of the bird, but to the side of the bird should it decide to strike out. This technique can be used for applying intravenous anaesthetic (not required for this procedure). This hold also provides access for the head for the application of anaesthetic through inhalation.
- The eyes of the raptor should be covered as soon as capture is secured using a hood. They should remain covered throughout the procedure and until released. This minimises the stress on the bird.
- To prevent nerve damage to the legs of raptors, a soft spacer must be placed between the restrained legs.

2. Application of anaesthetic

- The bird will be taken to a clean room that has been prepared for the procedure, including all anaesthetic equipment. Ensure the room is enclosed (shut doors/windows).
- **Anaesthetics will only be applied by an experienced wildlife veterinarian.**
- The dose of the anaesthetic will be calculated by the veterinarian according to their own procedures.

3. Application of sensor unit

- Once under anaesthetic, the sensor unit can be applied.
- The GPS unit should have a Sim card fitted prior to application if required, and the unit should be tested to ensure it is transmitting messages correctly.
- The tail feathers will be examined by the veterinarian to ensure they are not damaged and likely to moult in the near future.
- Transmitters are attached to the dorsocranial surface of the rachis of the two first rectrices (tail feathers). The trackers are attached to the two feathers using specially designed clamps. It is a quick procedure to attach the sensor unit.
- Tail mounted trackers are used as they do not constrict the birds in any way, there are less chance of abrasions as there is no harness around the bird that can rub, and they are light and are dropped when the feathers moult.
- The GPS unit is designed not to cause any pain to the animal and to minimise the discomfort of carrying the GPS unit.

4. Health check

- Whilst under anaesthetic, the veterinarian will perform the following health checks:
 - 1) Conduct pulse count

- 2) Record body temperature
- 3) Inspect beak structure and internal surface for any damage
- 4) Inspect oesophagus and entrance to crop. Take a sample of crop contents, if required
- 5) Inspect eyes
- 6) Inspect wing and tail feathers for damage
- 7) Visually check for parasites such as mites
- 8) Inspect feet and talons for damage
- 9) Take a faecal sample, if available

5. Recovery from anaesthetic

- Once the sensor unit is applied, and the health check is complete.
- The bird should be placed into the transport container whilst it is still unconscious, and the container must be closed securely
- The bird should be monitored whilst it recovers from anaesthesia by the veterinarian. Once the veterinarian is confident the bird has recovered, it may then be transported for release.

6. Transport & release of eagles

- The transport container should be kept in the dark by covering it with a blanket or towel.
 - 1) Walking away from the vehicle with the transport container so as to minimise flight obstruction of the bird once released.
 - 2) Minimise other flight obstructions in the way of the bird – select a large area clear of trees, power lines, buildings etc.
 - 3) The lead rehabilitator should inspect the bird in the transport container prior to release by looking through the gaps with a torch. If the bird has any obvious injuries or is looking unwell it should be taken for treatment to the veterinary clinic of the wildlife veterinarian that conducted the earlier procedure.
 - 4) Ensure there are suitable perching trees nearby for the eagle to fly to.
 - 5) Only one person should release the bird from the container (the lead rehabilitator). All other observers should be a safe distance away as instructed by the lead rehabilitator.
 - 6) The lead rehabilitator should crouch behind the transport container, opening the enclosure door from this position. By staying crouched behind, this minimises the stress to the animal and reduces the chance of collision with the rehabilitator when flying away. The rehabilitator should remain crouched until the bird has flown from the container.
 - 7) The bird should be observed for a period of time to ensure it is flying correctly, is not displaying any injuries and appears healthy.

Training, qualifications or competencies required

Appropriately trained rehabilitators and wildlife veterinarians can only conduct this procedure.

References

John White Wildlife, 2016, *How do our possum assassins use urban landscapes?* Available from: <https://johnwhitewildlife.com/2016/03/04/how-do-our-possum-assassins-use-urban-landscapes/> (Accessed 6th May 2021).

Payne, S. 2007, 'The Handling of sick and injured large wild birds of prey.' *National Wildlife Rehabilitation Conference Proceedings*, Fremantle, Western Australia

Licences and permits

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

SOP approval and review history			
Date	Version	Review Pathway	Notes
9 June 2021	0.0	15/04/2021 UniSQ AEC "Subject to Modifications." 9/06/2021 Reviewed and approved by the UniSQ AEC Executive.	N/A

23 June 2021	0.1	23/06/2021 Wording for “Licences and Permits” changed to: <i>“Any required licences and/or permits to undertake the procedure(s) under this SOP must be obtained before undertaking this SOP.”</i>	N/A
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