

Department of Planning and Environment

Initial treatment and care guidelines for rescued birds of prey



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Cover photo: Wedge-tailed eagle (*Aquila audax*) in flight in a pre-release aviary. MK Images/Australian Raptor Care & Conservation Inc./Higher Ground Raptors

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Environment, Energy and Science
Department of Planning and Environment
Locked Bag 5022, Parramatta NSW 2124
Phone: +61 2 9995 5000 (switchboard)
Phone: 1300 361 967 (Environment, Energy and Science enquiries)
TTY users: phone 133 677, then ask for 1300 361 967
Speak and listen users: phone 1300 555 727, then ask for 1300 361 967
Email: info@environment.nsw.gov.au
Website: www.environment.nsw.gov.au

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1. Introduction

The purpose of this document is to standardise the initial treatment of birds of prey requiring rescue or rehabilitation, in line with the *Code of Practice for Injured, Sick and Orphaned Birds of Prey* (the 'Bird of Prey Code') (DPIE 2021).

Understanding that each case is different and should be assessed individually, this document aims to provide guidance for licensed wildlife rehabilitators in New South Wales on initial assessment and first aid treatment principles for rescued birds of prey.

The primary objective of rehabilitation is the successful reintegration of the individual into the wild population. This determines decision-making about the care and treatment provided to rescued birds of prey.

Thirty-one bird of prey species have been recorded in New South Wales, belonging to 4 families: Accipitridae (hawks and eagles), Falconidae (falcons and kestrels), Strigidae (hawk owls) and Tytonidae (barn owls).

This document provides guidance on the initial care and management of birds of prey following rescue, from capture to physical examination and initial stabilisation before presentation to a veterinarian. It provides advice on how to manage the more common rescue encounters in birds of prey, including trauma, entanglement, orphaning and intoxication.

Management of birds of prey in the initial period following rescue is critical to future outcomes for a rescued bird. A full return to fitness and hunting capability is essential for release. A raptor must be in perfect physical condition to hunt and survive in the wild.

2. Capture, restraint and physical examination

As outlined in the Bird of Prey Code, rescuers must aim to have the bird of prey assessed by a veterinarian or experienced bird of prey rehabilitator within 24 hours of rescue to establish an accurate diagnosis and provide the best outcomes for the patient.

Figure 1 provides an outline of the initial decision-making process for bird of prey rescue cases. It is important to keep in mind that the ultimate goal of rescue and rehabilitation is to ensure successful reintegration of the individual into the wild population.

Personnel safety

Before handling birds of prey, rescuers should be aware of possible safety risks and take necessary precautions to minimise harm to themselves and the animal. Sick or injured birds of prey can cause injury (bites or talon puncture), and disease transmission is possible both to and from humans.

- Protect yourself and the animal by using appropriate personal protective equipment (PPE).
- Avoid handling birds of prey if it is not necessary or you do not feel confident and capable to do so.
- Use PPE as a barrier where possible – wear gloves or use a towel as a barrier.

- Wear appropriate clothing – robust long sleeves, covered shoes, gloves.
- Wear a dust mask if available and particularly if the animal is showing signs of disease.
- Wash your hands before and after handling animals and removing gloves (or use alcohol-based hand sanitiser).
- If bitten or punctured, clean the injury with warm water and soap (or disinfectant) and seek medical advice. Always tell medical staff that you have been handling wildlife.

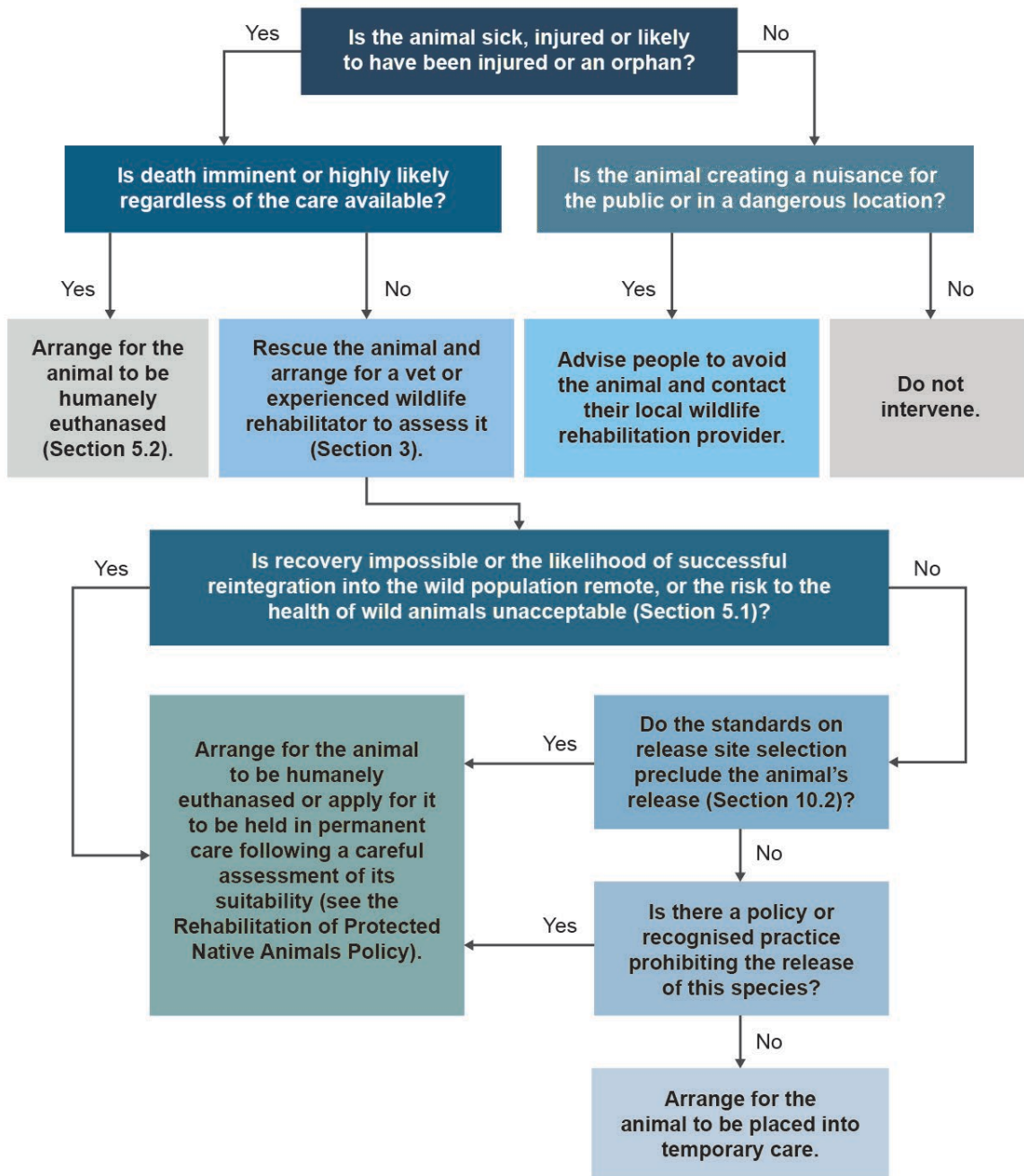


Figure 1 Decision tree directing the course of action for bird of prey rescue encounters

Source: Bird of Prey Code. Section numbers refer to numbering used in the Code.

Distance examination

When attending a bird of prey rescue, conduct an initial distance examination to assess the situation and inform decision-making. Observations of a bird of prey can at times be more informative than assessment of the bird in the hand. For example, a drooping wing can be more easily identified on distance examination and may not be readily identified when the bird is physically restrained.

As part of its preservation reflex, a bird will attempt to look normal when it feels under threat; for example, by being stared at. It is important to try and observe the bird from an indirect location, and to observe it for at least a few minutes. It may appear normal at first but after some time, show behaviours and signs consistent with its health status.

Where possible, birds should be observed from a safe distance for behaviour, gait and posture, dishevelled or misplaced feathers, presence of external wounds or injuries, and for the presence of other birds of prey nearby. If the bird is in immediate danger; for example, from oncoming traffic, immediate rescue is required.

- **Behaviour:** A bird of prey should appear alert and be responsive to your presence. A dull demeanour and closing the eyes are considered abnormal behaviour in birds of prey and can indicate pain, injury, illness or severe stress. The absence of these signs does not rule out pain, injury or illness as birds can mask signs of pain.
- **Gait and posture:** Assess the bird for signs of wing droop, abnormal head position, lameness or inability to perch. If the bird of prey attempts to fly, assess if the wings are extending symmetrically, if the wings can elevate above the horizontal plane, if the bird uses its tail for balance and if the bird is able to gain height. An abnormal gait, including lameness or posture can indicate musculoskeletal or neurological injuries or disease.
- **Wounds or injuries:** From a distance, observe the bird's feather condition and look for the presence of blood, wounds, obvious musculoskeletal injuries (e.g. broken bones), ocular injuries or any evidence of entanglement. Fishing line or foreign material may be identifiable from a distance in entangled birds.
- **Respiration:** Observe the bird's breathing. Observe the breathing rate as well as the effort used. Obvious abdominal movement, a tail-bob when breathing, or open-mouth breathing can indicate respiratory abnormalities.
- **Plumage:** Feathers should be flat against the body. Fluffed feathers indicate illness or injury as the bird is trying to maintain body heat. Damaged tips of wing and tail feathers indicate the bird has been on the ground for some time, and soiled feathers around the vent may indicate diarrhoea.
- **Environment:** Observe the area for the presence of other birds of prey (e.g. a mate in species that pair-bond, or parent birds if chicks are rescued). If possible, it is also useful to seek more information about the bird from members of the public. In some instances, birds are known to landholders who may have observed the bird with its mate regularly returning to the same location. This may influence rehabilitation decisions for the bird, for example, the length of time in care and release location.

During the distance examination, assess the feasibility of capture.

Experienced personnel and appropriate equipment are required to successfully capture a bird of prey with minimal stress to the animal and ensuring safety of personnel involved. A distance examination and consultation with an experienced bird of prey rehabilitator allows the opportunity to consider the need for continued monitoring of the animal or if immediate rescue is indicated (see 'Rescuing birds of prey', below).

Rescuing birds of prey

The capture of birds of prey should be performed only by appropriately trained people. Even short periods of handling can cause considerable stress to birds of prey; therefore, start by ensuring the required equipment is available, the rescue planned and personnel are appropriately trained to perform the rescue. Ensure the facilities to transport and house the bird of prey are organised prior to rescue.

Personnel safety and animal welfare are primary considerations when undertaking bird of prey rescues.

Equipment to include in a bird of prey rescue kit includes:

- binoculars
- bird identification guide
- towels or blankets (or both) to cover the bird and cover its head
- sturdy, appropriately sized transport container
- net for capture
- heat source (e.g. heat packs) and thermometer to check temperature
- sharp scissors, pliers and wire cutters – for use in entanglements
- head torch or alternative light source
- PPE – gloves, alcohol-based hand sanitiser, long-sleeved shirts, hi-vis vest.

Methods of capture

Birds of prey have sharp talons and curved beaks. They have a unique tendon-locking mechanism and when coupled with a powerful grip, their talons can cause significant injury. It is important to always have control of the feet when handling birds of prey.

Towels are a very useful tool when capturing and handling birds of prey. Covering the head with a towel will reduce stress and help keep the bird calm. Wrapping the bird with a towel also helps to contain its wings and can avoid damage to the bird's feathers. Feathers are key to flight and aerodynamics in birds of prey; therefore, maintaining their structure and integrity during rescue and throughout rehabilitation is vital.

Birds do not have a diaphragm and breathe by expanding their chest. When handling and restraining birds, ensure you are not inhibiting respiration.

Hand capture

Grounded birds of prey can be captured by hand with minimal difficulty by appropriately trained rescuers. The talons are the most dangerous part of a bird of prey, however, some species can also deliver a painful bite. Always ensure you are aware of the position of the talons or have control of the limbs when capturing and restraining birds of prey.

When approached, birds of prey may lay on their back and display their talons towards you. Place a towel over the bird, allowing it to grab hold of the towel with its feet. Place another towel over the bird, ensuring its head is covered. Always be aware of the position of the talons under the towel. Try to roll the bird over onto its front and place gentle downward pressure on its back, keeping the legs under the body. Reach behind and under the towel to grasp both legs from behind, above the feet. In smaller species, the legs can be held with

one hand, with an index finger between the legs (Figure 2), whereas one hand per leg is required in large species (Figure 3). Once the legs are secured, use the towel to contain the wings and cover the bird's head, placing it into a transport container as soon as possible. Release your grip on the legs as the last thing you do and close the transport container.



Figure 2 Single hand used to restrain the legs of a small bird of prey, with index finger between the legs

Photo: Aditi Sriram



Figure 3 Restraining a large bird of prey with one hand holding each leg

Photo: Currumbin wildlife hospital

Use of nets

Nets can be very useful when capturing birds of prey. Ensure the net is large enough in volume and diameter for the bird of prey being rescued. A key consideration when using nets is the potential for feather damage caused by the netting. Nets must either be made using soft material or if using mesh, must have a small mesh diameter. Lining the rim of the net with soft foam can also reduce the risk of injury during capture. Birds of prey must be moved out of the net and into a suitable transport container as soon as possible.

Rescuing bird of prey chicks

Displaced nests, fledgling misadventure and predator attacks are a few of the reasons bird of prey chicks may require rescue. The ideal outcome for rescued bird of prey chicks is for the chick to be reunited with the parent birds. If the chick is injured, sick or hypothermic (low body temperature), it may need to be taken into care.

Rescuers must consult with an experienced avian rehabilitator to decide on the most suitable intervention for a bird of prey chick.

When deciding on the type of intervention required, consider and discuss the following with an experienced avian rehabilitator:

- stage of development of the chick. It is normal for fledgling birds to spend some time on the ground. Fledglings found on the ground should be monitored for the presence of adult birds nearby and for any signs of injury
- physical condition of the chick and the presence of injury or disease. Perform an initial assessment (see 'Physical examination') to identify any injuries or signs of disease. Injured, sick or hypothermic (low body temperature) chicks will need to be taken into care for further assessment and treatment
- if the chick is in immediate danger from predators (e.g. cats)
- whether the parent birds can be identified. Some parent birds can be absent for hours at a time. If the chick is in a relatively safe location, keep a regular watch from a good distance to monitor for the presence of parent birds.

Transport

Birds of prey should be transported in secure transport containers appropriate for their size, condition and stage of development. Transport containers should be well ventilated and ambient temperatures appropriate to the individual animal, must be maintained and regularly monitored during transport (see Table 1).

Transport should be planned and efficient, with minimal stressors. Avoid domestic animals, loud music, voices and cigarette smoke, and aim to keep transport times minimal.

Sturdy cardboard boxes with ventilation holes are suitable temporary transport containers for birds of prey. The container should be big enough for the bird of prey to stand upright. The size of the container is also important to protect feathers, ensuring tail feathers are not touching the walls or floor of the container. Line the base of the transport container with a non-slip material, such as a towel, ensuring there are no loose threads. A rolled-up towel can be provided for the bird to grip onto during transport. Do not place perches or water in the transport container. Birds that are unable to perch must be supported during transport. Place

the bird in a U-shaped towel to maintain an upright posture and support the head (see 'Housing'). It is recommended to label the transport container 'Caution: live bird of prey, do not open'.

Hatchlings and nestlings can be placed within a makeshift nest created using towels in the transport container. If transporting multiple chicks from the same clutch, it is still advised to transport them in separate containers, or in the same container but with a barrier separating the chicks, to ensure they don't inadvertently injure each other. Ensure ambient temperature appropriate to the species and stage of development is maintained during transport (see Table 1). Supplementary warmth can be provided using hot packs, ensuring the heat source is not in direct contact with the bird. A thermometer can be used to monitor temperatures during transport.

Table 1 Ambient temperatures to be maintained during transport of birds of prey (adapted from the Bird of Prey Code)

	Ambient temp
Adult raptors	28–30°C
Owls*	29°C
Raptor chicks**	32–34°C

*Refers to owls unable to thermoregulate. Owls can get agitated when exposed to high ambient temperatures.

**Range depending on stage of development and feather cover

Physical examination

A detailed examination, investigating the parameters described below, provides an overall health assessment that is necessary to determine treatment needs and prognosis. While progressing through the physical examination, ensure to make notes and keep records (see 'Record keeping').

Within 24 hours of admission, all birds of prey must undergo a veterinary assessment or examination by an experienced bird of prey rehabilitator.

Before handling the bird to perform a physical examination, covertly perform a visual assessment of the bird while it is still in the transport container. A visual examination will provide valuable information (see 'Distance examination'). If there are severe injuries, for example a fracture with bone exposed, transport the bird directly to a veterinarian.

Restraint for physical examination

Physical examination is best performed by 2 people together, especially for larger species, where a handler restrains the bird while the other person examines it. In smaller species, confident and experienced handlers can perform assessments on their own. Equipment required for the physical examination should be prepared and available before initiating handling to minimise handling time.

When performing a physical examination, the aim is to perform a thorough, methodical examination with minimal stress to the animal. Handling should be tailored to each individual animal based on its health status and temperament.

Use a towel to wrap the bird and keep its head covered during examination. Capture the bird as described in 'Hand capture'. Ensure you have good control of the feet with one hand and that the bird is wrapped in a towel to contain the wings. Hold the bird supported against your body facing away from you (Figure 4). The assessor can manipulate the towel to access and assess different part of the bird (Figure 5). Always maintain awareness that even though the legs are restrained, the feet can still grab onto an arm or hand in front of them.

Birds with leg injuries should not be restrained by the legs as this can exacerbate the injury and cause pain. Wrap the bird in a towel to contain the talons while performing a physical assessment.

Hatchlings and nestlings should be handled with care to prevent injury to developing bones and joints. Support the entire body when handling chicks and use a towel or gloves for protection if required.

It is important to continually monitor the animal for signs of stress during handling (see 'Signs of stress' below). Even short periods of handling can be stressful and detrimental to the health of the bird.

If the bird of prey starts showing signs of stress (see below), place it back into the transport container and let it settle in a warm, dark, quiet location. Contact an experienced bird of prey rehabilitator or veterinarian to advise on the best approach to examine the bird of prey.

In the case of accidental taloning, where the bird of prey is still attached to you, it is best to release the bird in a small secure space, as it is more likely to release its grip when attempting to get away from you. Trying to pry the talons off can result in the bird tightening its grip and causing further injury.



Figure 4 Barn owl wrapped in a towel, with legs restrained. The bird is supported against the handler's body

Photo: Aditi Sriram



Figure 5 Barn owl with legs restrained, head covered with a towel and wing extended for examination

Note: Ensure wings are not extended above the horizontal plane (towards the bird's back) as this can result in injury if the bird struggles. Photo: Aditi Sriram

Signs of stress

Free-ranging birds of prey can experience significant stress in the presence of humans or when exposed to unnatural environments. Signs of stress are not readily recognisable, and birds are very good at masking these signs. Signs of stress in birds of prey can include:

- stiff, non-responsive to stimulation (may be mistaken for the bird appearing calm)
- threat displays such as opening mouth, beak clicking and mantling
- passing excrement
- rapid breathing, open-mouth breathing
- vocalisation
- birds of prey should be handled for as little time as required, and handling should only be for the purpose of physical assessment or treatment.

Species identification

Identifying the species and developmental stage in birds of prey is vital to providing optimal husbandry and care for each animal. Species identification in chicks can be particularly difficult. Use tools such as bird identification guides and consult with experienced bird of prey rehabilitators and local birding groups to assist with species identification.

Demeanour

Observe the behaviour and general demeanour of the animal before the bird is in hand and during the physical examination, and compare with what is expected of the bird based on its species and stage of development.

Although an understanding of normal behaviour in birds of prey may require experience, observations from the initial physical examination can be used to discuss the animal's condition with experienced bird of prey rehabilitators and as a comparison throughout the rehabilitation process.

Birds have a preservation reflex whereby even compromised and unwell birds can appear alert and responsive during handling and will become quiet and lethargic when away from human presence or disturbance. Birds that are noticeably lethargic and poorly responsive during handling are likely severely compromised and require prompt veterinary attention.

Body weight and body condition

Body weight is an important indicator of health (Table 2). Recording an initial weight, soon after rescue, will provide a baseline for each individual animal. Continued monitoring of weight at regular intervals throughout the rehabilitation process will provide valuable information on the health and development of the individual.

On admission, birds of prey must be weighed and the species identified.

It is easiest to weigh birds of prey while they are still in the transport container. When the bird is removed from the container for physical examination, weigh the container separately. The bird's weight can be calculated by subtracting the weight of the container from the total weight of the bird and the container.

Birds of prey can also be weighed by wrapping the bird firmly with a towel, ensuring its head is covered and the wings and talons are contained, and placing the bird on its back on the scales (Figure 6). Once you have completed handling and examination and the bird has been placed back into the transport container, weigh the towel separately and calculate body weight by subtracting this from the combined weight of the bird and towel.

Body condition is a subjective assessment and is assessed by palpating the pectoral muscle on either side of the keel. The pectoral muscles are the primary flight muscles. Birds in poor body condition will have a prominent keel and reduced pectoral muscle mass.

Chicks that are not yet flighted will have poorly developed pectoral muscles. This is not necessarily an indication of poor body condition. Use body weight and palpate muscle cover over the spine and pelvis to assess body condition in chicks.

Poor body condition, weight loss or failure to gain weight could indicate malnutrition, gastrointestinal problems (e.g. intestinal parasites, infections, dysfunction) or other disease, and requires further investigation.



Figure 6 Towel, peg and cardboard box tared on scale (left) and bird of prey wrapped in towel, secured with a peg and placed in cardboard box for weighing (right)

Photo: Meredith Ryan/FAWNA

Table 2 Body weight of the 10 most commonly rescued birds of prey in NSW

(adapted from Australian Bird Society Association Inc. Bird in the Hand)

Species	Adult female (g)	Adult male (g)
Southern boobook owl*	195 – 370	176 – 321
Eastern barn owl	258 – 470	250 – 418
Nankeen kestrel	115 – 255	121 – 195
Wedge-tailed eagle	2250 – 4805	2025 – 3250
Peregrine falcon	657 – 965	500 – 660
Brown goshawk**	465 – 740	250 – 415
Collared sparrowhawk	162 – 300	101 – 156
Pacific baza	290 – 448	259 – 357
Powerful owl	1040 – 1465	995 – 2220
Australian hobby	190 – 365	132 – 280

*N. *boobook boobook***A. *fasciatus fasciatus* (subspecies in southern Australia)

Skin and feathers

Feathers function to provide insulation, waterproofing, camouflage and importantly, in raptors, flight (Scott 2020). Unique feather features in owls enable silent flight, crucial for hunting. As you examine different parts of the body, visually examine the feathers and skin. Wounds may be obscured or surrounded by feathers matted with blood. Gently part or lift matted feathers to examine the skin underneath for wounds and bruising. Bruises in birds appear reddish-blue and after a few days turn green (Figure 7). Using a cotton ball to wet and part the feathers will help you see the skin below. Avoid plucking feathers as it is painful and bird skin is very thin. Plucking feathers close to wounds can result in tearing the skin and inadvertently increasing the size of the skin wound. Carefully examine areas of bruising for evidence of puncture wounds in the skin and underlying fractures. Widespread bruising can be suggestive of anti-coagulant rodenticide toxicity.

Compromised birds may have broken feathers or feathers in poor condition. Broken tail feathers can indicate impact damage (e.g. motor vehicle collision) and frayed or scuffed feathers suggests the bird has been on the ground for some time. Birds that are unable to preen due to injury or illness may also present with poor feather condition.

Feather abnormalities can result from trauma, poor nutrition resulting in weakened feathers and ectoparasites. Abnormal feathers can also be associated with infectious disease such as beak and feather disease virus (BFDV). Birds with missing and abnormal feathers, clubbed or curled feathers, feathers that are easily broken or have retained feather sheaths should be isolated until the bird can be assessed by a veterinarian or an experienced wildlife rehabilitator.

Musculoskeletal and neurological examination

Distance examination provides an opportunity to assess motor function of the wings and legs (the animal's ability to consciously move limbs). Wing droop, abnormal stance or gait and incoordination or lack of balance can indicate musculoskeletal or neurological dysfunction. When performing an assessment of wings and limbs, it is also useful to assess neurological function.

Extend one wing at a time and gently palpate the bones and joints from the tip of the wing to the shoulder. Take care when examining wings. If they are extended above the horizontal plane there is a risk of injury if the bird struggles. It is best to extend the wings in a more forward direction – towards the front of the bird.

While the handler is restraining the feet, carefully palpate the legs, being aware of the talons. Identify areas of swelling and bruising, which is suggestive of trauma. Feel for instability of joints or a grating sound or sensation (crepitus) when palpating the bones, which suggests more serious injuries such as dislocation or fractures.

Palpate the keel for any deviations or abnormalities and part the feathers in this region to investigate any signs of bruising or wounds. Front-on collisions commonly result in injury to the keel and coracoid bones.

While palpating the limbs and wings, also assess neurological function, which can result from traumatic injury. Assess if the bird has good grip in both feet by providing a towel or washcloth for the bird to grip, a pencil works well with smaller birds. A 'withdrawal test' is used to assess neurological function to the wings and legs. This is performed by gently pinching the tip of the wing or feet. A normal reaction would be for the bird to pull the wing or limb away or react to the stimulus in some way (e.g. by turning its head). Stress can override this response, and this test can be difficult to interpret in birds of prey.

A 'tail flick' test can be used to detect injuries of the lower spinal cord and abnormal neurological function. While holding the bird well wrapped in a towel, tilting the bird backwards and forwards should result in a fanning of the tail as a mechanism of body balance. If the tail does not react to changes in body position, it may indicate neurological injury.

Dislocations and fractures are a common consequence of trauma. Not all fractures can be palpated or recognised on physical examination, therefore veterinary assessment and advanced imaging techniques, including radiographs are required to diagnose musculoskeletal injuries in birds of prey.



Figure 7 Wound on the wing of a peregrine falcon, note the green/blue areas of bruising

Photo: Jana Schader

Hydration

Hydration status is assessed by checking for skin turgor (elasticity) and assessing the mucous membranes. Bird skin has reduced elasticity compared to mammals meaning a mild skin tent can be normal. Severe skin tenting, where the skin remains in a tented position can indicate dehydration, as can subjective 'stickiness' of the skin over the keel and pectorals. In a hydrated bird the skin should glide easily over the underlying keel and muscle.

Pale, tacky mucous membranes are also indicators of more severe dehydration. Examine the oral cavity to assess mucous membrane colour and hydration.

Eyes

Eye trauma is common in birds of prey. All rescued birds of prey should have a thorough examination of the eyes performed by a veterinarian. Any changes in the appearance of the transparent, outermost surface of the eye (cornea), discharge from the eyes or lesions on the eyelids and around the eyes can indicate trauma or infectious disease (Figure 8). Examine the iris, pupil shape and size, and the appearance of the lens, which should be translucent. Traumatic injury to the eye can result in bleeding within the eye appearing as red discolouration, sometimes obscuring the pupil and lens. Compare the 2 eyes and check for asymmetry in the pupil's size and constriction in response to a focal light. Birds can voluntarily control pupil size; therefore, there may be little to no change of pupil size in reaction to light in stressed birds. Similarly, a slight unevenness in pupil size (anisocoria) can be normal in an unevenly lit room. A partially closed eye or squinting is indicative of pain and these animals should be seen by a veterinarian for assessment and pain relief as soon as possible.



Figure 8 Examination of the eye in a barn owl. The lens is abnormally opaque and irregular

Photo: Aditi Sriram

Head

Examine the beak and cere for asymmetry and wounds. Check for the presence of discharge from the nares. Bloody discharge from the nostrils or around the beak is suggestive of trauma, but can also result from infection. Traumatic injury to the beak, such as fractures, require immediate veterinary attention.

Carefully open the mouth and examine the oral cavity (Figure 9) using a light source (e.g. head torch). Excessive force or traction on the beak can result in injury. Healthy birds should have pink mucous membranes. Some species, for example, goshawks, can have naturally dark-coloured mucosa. Pale mucous membranes can indicate anaemia, blood loss or severe dehydration. In these cases, veterinary attention is warranted as soon as possible. Discharge from the choana (the opening between the nasal and oral cavities) or within the mouth, can be associated with infection or trauma. The choana communicates with sinuses in the head and infection or inflammation of the sinuses can result in discharge from the choana.

White/yellow discolouration or plaques in the oral cavity can result from fungal (candida), protozoal (trichomonas), parasitic (capillaria) or bacterial infections (Figure 10). In severe cases, plaques can occlude the glottis (airway opening) and result in respiratory difficulty. Do not disturb or try to remove lesions in the oral cavity as this can be painful and result in bleeding. Veterinary diagnostic tests are required to identify the cause of infection and determine the appropriate treatment.

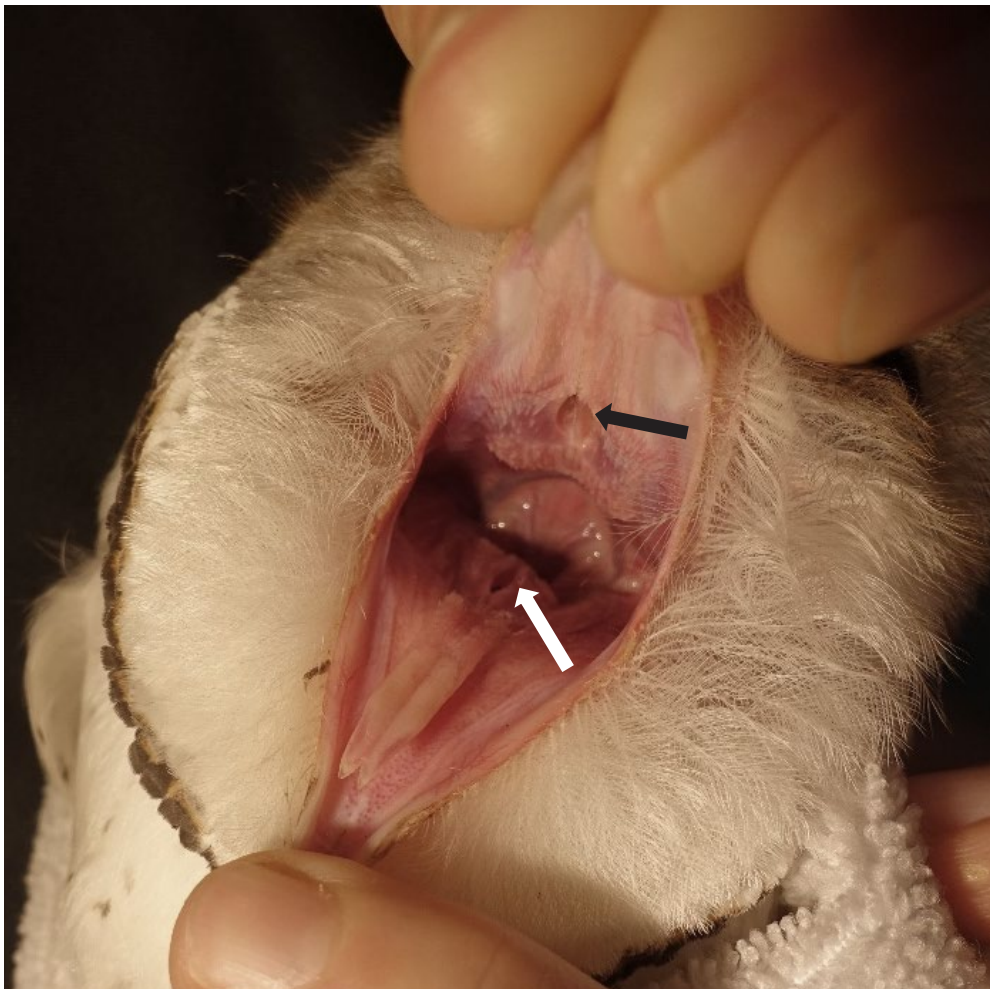


Figure 9 Oral examination in a barn owl. The glottis at the base of the tongue (white arrow) and choana (black arrow) are easily seen

Photo: Aditi Sriram



Figure 10 Yellow plaque-like lesion (white arrow) in the oral cavity of an adult wedge-tailed eagle. Further testing confirmed diagnosis of trichomoniasis

Photo: Bob Donnelly

Respiration

Respiration at rest is best observed during the distance examination. Normal respiratory movements of birds are subtle and difficult to observe. Birds showing signs of open-mouth breathing, exaggerated abdominal movement or tail-bobbing at rest suggests respiratory compromise. These birds should be handled with care as stress from capture and handling can lead to increased respiratory effort and worsen underlying respiratory disease.

When the bird is in hand, monitor for abnormal breathing sounds, such as clicking or crackling noises, as these can also indicate respiratory dysfunction. An abnormal vocal sound may also indicate a lesion or injury at the voice-box at the termination of the trachea. If you are concerned about respiratory compromise while handling or examining a bird, it is best to place the bird back in its container, in a warm, dark and quiet location to rest. Contact an experienced bird of prey rehabilitator or veterinarian to discuss your findings and next steps.

Mutes

Assess the quality of mutes. There are three components to bird mutes: faeces, urates and urine. Birds can pass mutes when stressed, and stress-induced droppings can be watery and may not contain faeces or urates. Faecal colour and consistency can vary with diet. Urates appear white or off-white in healthy birds. Green or yellow urates are indicative of metabolic abnormalities and should be recorded and discussed with a veterinarian. Urine is generally clear, but colour can also vary with diet and hydration levels. Assess the vent and surrounding area for matted or soiled feathers.

3. Euthanasia

As stated in the Bird of Prey Code, a bird of prey must be euthanased where recovery is not possible, the animal is suffering from an incurable disease, death is imminent, or the animal is suffering from chronic, unrelievable pain. Birds of prey that are incapable of consuming food unaided or are missing any part of their wing must be euthanased. Refer to the Bird of Prey Code, including the decision-making tree (Figure 1), for further standards on euthanasia.

Euthanasia should be performed by a veterinarian where available.

Anaesthesia, followed by intravenous or intracardiac barbiturate overdose prescribed by a veterinarian, is the recommended method of euthanasia for birds of prey in care. Anaesthesia provides a better opportunity for venous access and reduces the stress associated with restraint.

Where access to a veterinarian is not possible, a method appropriate for the species, ensuring minimal pain and suffering, should be employed, e.g. gunshot to the brain for large birds of prey and stunning followed by cervical dislocation for small birds (<0.5 kilograms). Shooting should be undertaken by a licensed, skilled and experienced wildlife rehabilitation provider or an appropriate agency, such as the National Parks and Wildlife Service (NPWS), the Royal Society for the Prevention of Cruelty to Animals (RSPCA) or NSW Police.

The Bird of Prey Code provides standards and guidelines on disposal of the carcass following euthanasia.

4. Initial treatment – stabilisation

Rescued birds of prey are generally hypothermic, dehydrated and depending on the duration and severity of illness or injury will likely be malnourished and in pain. The aim of initial treatment is to rectify these problems and stabilise the bird's condition before it can be thoroughly assessed by a veterinarian.

Temperature

Sick or injured birds, particularly chicks and birds in poor body condition, are unable to maintain their core body temperature and commonly present as hypothermic. Accurately measuring body temperature in birds is not straightforward, but birds that feel cold to the touch and appear quiet in demeanour will benefit from supplemental heat.

Birds of prey can be actively warmed using external heat sources such as heat packs or heat lamps or using thermostatically controlled warming devices such as incubators or humidicribs. If using external heat sources, ensure they are not directly in contact with the bird. Monitor ambient temperature at regular intervals to ensure it is maintained at a range appropriate to the species and stage of development (see Table 1).

Fluid rehydration

The primary routes of fluid supplementation in birds of prey are oral (PO), subcutaneous (SC) and intravenous (IV). Mild dehydration can be treated by the PO route. Ensure hypothermia is corrected before offering oral fluids. In severe cases of dehydration, the animal should be referred to a veterinarian for assessment and IV fluids.

Oral fluids

For birds of prey able to stand, hold their head up and without signs of head trauma or neurological deficits, fluids can be given orally using an appropriately sized crop tube and syringe. Rubber crop tubes with a diameter and length appropriate for the species are ideal. In birds of prey, crop tubes are passed into the mouth, down the oesophagus (food pipe) and into the proventriculus (the glandular stomach). The length of the crop tube needed can vary depending on the size of the bird, and length can be measured from the mouth to just past the keel.

To reduce the risk of aspiration (fluid in the airways) and trauma while passing the tube, oral fluids should **ONLY** be administered by individuals trained and confident in the technique or by trainees under the supervision of an experienced avian rehabilitator.

- It is helpful to have two people, one to restrain the bird and the other to administer oral fluids, especially when working with larger species. Wrap the bird with a towel to contain the wings and ensure the handler has a good grip of the legs. Hold the bird in an upright position. Try to keep the bird's eyes covered with the towel if possible.
- Use one hand to keep the mouth open while passing the crop tube with the other (Figure 11). Pass the tube beside the tongue into the oral cavity, avoiding the glottis (opening to trachea) and then down the oesophagus (food pipe). If you cannot see the glottis or are unsure if the tube is in the correct position, do not administer fluids and instead withdraw the tube and try again. Never force the tube. Gentle pressure with some rotatory movement is all that is required.
- Once confident the tube is in the correct position, slowly administer the fluids while observing the back of the mouth. If the bird struggles or if you observe fluid welling up at the back of the throat, remove the crop tube and release your hold on the bird's head so it can swallow or shake its head to clear the fluid.



Figure 11 Oral fluid delivered using a crop tube in a barn owl. Head restrained and mouth held open with one hand while crop tube is passed into the mouth

Photo: Aditi Sriram

Quantities of fluid supplementation are based on calculation of the fluid deficit replaced over 24–48 hours. The maintenance fluids requirement for birds is 50 millilitres, per kilogram of body weight, per day. This is usually divided into two doses over a day; however, there is variability between species in the volume of fluids they can tolerate in one sitting. Therefore, consultation with experienced bird of prey rehabilitators is recommended.

Consult an experienced bird of prey rehabilitator for assistance and advice on the volume of fluids to be administered to an individual bird.

There are a range of commercially available electrolyte solutions that can be used for the purposes of fluid rehydration in birds; for example, Spark Liquid (Vetfarm), Vytrate and Lectade (Jurox). Intravenous fluid solutions such as Hartmann's solution can also be used for oral fluid supplementation. Ensure fluids are warmed to around 30–32°C.

Subcutaneous fluids

Subcutaneous fluids are an effective and common route of fluid administration (Scott 2020). It requires experience and sterile technique and is best done with a handler to restrain the bird while the other person administers the fluids. The 2 sites for SC fluids administration in birds are the interscapular region (between the shoulder blades) and the skin fold in the inguinal region (groin area). The volume administered depends on the size of the bolus that can be administered without causing excessive pressure on overlying skin.

Intravenous fluids

This is the recommended route for rehydrating a moderately or severely dehydrated animal; however, it requires a qualified and experienced veterinarian, sterile techniques and appropriate equipment.

If severe dehydration is suspected, and in cases where oral or subcutaneous fluid supplementation is not possible or inadequate, urgent referral to a veterinary facility for IV fluids is warranted.

Pain relief (analgesia)

Birds of prey may not always show obvious signs of pain. Signs of pain can include:

- lethargy, quiet, fluffed up
- increased aggression
- wing droop, lameness, wounds or injuries
- biting at parts of the body, e.g. feet or carpi (wrists)
- lack of appetite (inappetence).

In most rescue cases, especially with signs of trauma, pain relief is **crucial** for the welfare of the animal. The provision of pain relief must be a priority and should be based on veterinary advice.

Depending on the assessment of injuries, and in consultation with a veterinarian, appropriate drugs can be administered to alleviate pain. Certain medications are avoided in case of

adverse metabolic effects, especially in dehydrated animals. Non-steroidal anti-inflammatory drugs (e.g. meloxicam) are commonly used analgesics in birds; however, adverse effects occur if the bird is dehydrated or has underlying kidney disease. Therefore, once initially assessed, consultation with a veterinarian regarding the most appropriate drug and route of delivery is imperative. Ensure animals are hydrated before or in addition to the provision of certain medications to reduce the risk of adverse effects.

Musculoskeletal injuries

Fractures

Fractures are a common consequence of trauma in birds of prey, and the prognosis for recovery depends on the fracture type and location. Open fractures, where bone is exposed through the skin, generally carry a poorer prognosis when compared to closed fractures (skin overlying the fracture is intact). Fractures close to joints also carry a poor prognosis as they can affect joint stability and range of motion. This is especially a concern for birds of prey.

Where a fracture is suspected, veterinary assistance must be sought as soon as possible to relieve pain, confirm the diagnosis and prognosis and, where appropriate, provide appropriate treatment. In the interim, it is important to restrict movement and minimise stress.

There are several bandaging techniques that can be used to temporarily stabilise fractures to reduce pain. If bandaging is not possible, try to restrict movement by placing the bird in a warm, secure container and ensure it is in a dark and quiet location prior to being assessed by a veterinarian.

Wound care

Birds of prey with wounds should be assessed by a veterinarian to diagnose and treat the wounds appropriately. Depending on the severity of wounds, surgery or medical (antibiotic) therapy may be required.

Contaminated wounds can be flushed with saline. It may however, be best to do this under anaesthetic as this will provide an opportunity for the veterinarian to thoroughly assess the wound and apply appropriate treatment without prolonging handling and stress. Due to the unique anatomy of birds, where air sacs and some bones connect to the respiratory system, flushing is best done under veterinary supervision to avoid fluid entering the respiratory system.

Bleeding wounds can be managed by applying pressure using gauze swabs and bandaging with a non-adherent wound dressing (e.g. 'Melolin'), wound padding (e.g. 'Softban'), and cohesive bandaging (e.g. 'Vet Wrap') to apply even pressure. Ensure the bandage is applying pressure but is not constricting, as this can impede blood supply and damage tissue below the bandaged area. If you can still pass a finger between the skin and the bandage, that is adequate pressure. For wounds in a location that cannot be bandaged, apply pressure with your fingers using gauze swabs and hold the pressure for a minimum of 3–5 minutes.

Wounds and injuries to the feet are best assessed under anaesthetic to reduce the risk of injury from the talons and to allow for a thorough examination. Birds of prey housed in inappropriate conditions or with disproportionate weightbearing on one leg can develop pododermatitis ('bumblefoot'). Birds with bumblefoot may have swollen pads or ulcerative lesions on the feet. Birds of prey with injuries to the legs and feet should be maintained on clean and appropriate substrate while awaiting veterinary assessment (see 'Housing').

Dressings and bandaging

Temporary dressing and bandaging can be used to protect wounds and to stabilise fractures until the bird of prey can be seen by a veterinarian. Bandaging can prevent desiccation, flystrike and further contamination of wounds. Superficial dressings such as low-adherent, absorbent wound dressing (e.g. 'Melolin') can be applied to protect open wounds and bandaged in place with layers of wound care padding (e.g. 'Softban') and a cohesive bandaging material (e.g. 'Vet Wrap') to stabilise the bandage (Figure 12). Ensure bandages are not constricting as this can disrupt blood supply and consequently healing.

Do not use adhesive banding such as Elastoplast in birds of prey as it can damage feathers. Instead use low adhesive tape such as paper tape (3M Micropore).

Depending on the location of musculoskeletal injury (e.g. fracture), bandaging techniques can be applied to temporarily restrict movement and help to reduce pain and further tissue trauma.

These bandaging techniques should only be used by those trained and experienced in their application as incorrect bandaging has the potential to worsen injuries. If unsure, do not apply a bandage, and instead place the bird in a secure container with sufficient space to stand and maintain normal posture, and transport the bird to a veterinarian.



Figure 12 Bandaging material commonly used for wound care: 'Melolin' (left), 'Softban' (centre) and Vet Wrap (right)

Nutrition

It is vital that birds of prey are assessed and stabilised (dehydration corrected, temperature normalised) and veterinary treatment provided where necessary before initiating feeding.

Birds of prey have very specific diet requirements and, given the stress of rescue and handling, are unlikely to self-feed in the initial period following rescue. Providing nutrition in this initial period is not a priority. Feeding a bird of prey before it is stabilised can result in metabolic derangements and gastrointestinal disease.

Following stabilisation, transfer the bird to an experienced bird of prey rehabilitator for nutritional support and continued care as soon as possible.

Hatchlings and nestlings have a higher metabolic rate compared to adults and may require nutritional support in the initial 24-hour period following rescue. Contact an experienced bird of prey rehabilitator for advice on the type of food and techniques for providing nutrition to nestlings and hatchlings.

Husbandry

Husbandry requirements for birds of prey in the initial period following rescue differ to requirements for birds in longer-term care and should be adapted to each individual bird depending on its developmental stage, injuries and health status.

Birds of prey are prone to stress associated with human presence and captivity. The following section provides guidelines on housing in the initial period following rescue. Birds of prey must be assessed by a veterinarian or experienced bird of prey rehabilitator within 24 hours of rescue. Chicks must be transferred to an experienced bird of prey rehabilitator as soon as possible.

Housing

Birds of prey should initially be housed individually, until they have had a thorough assessment by a veterinarian or experienced wildlife rehabilitator. Isolating newly arrived birds of prey, until their disease status has been determined, reduces the risk of disease transmission among birds of prey in care.

Birds of prey should be maintained in 'intensive care' housing for the initial 24 hours at least.

Birds of prey must be housed in a warm, dark and quiet environment free from stressors, including loud noises, domestic pets and noxious smells.

External heat sources (heat pads, heat lamps) can be used to maintain temperatures appropriate to the species and developmental stage of the bird of prey (see Table 1). Ensure heat pads and heat lamps are not in direct contact with the bird to avoid burn injuries, and regularly monitor ambient temperature using a thermometer. Electrical heat sources must be regulated by a thermostat.

Humidicribs or incubators are ideal for intensive care housing of small raptor species and for chicks. Larger raptors such as eagles, falcons and hawks require a minimum of 1.5 metres x 1.5 metres x 1.5 metres intensive care housing.

Be aware of the potential for feather damage when deciding the size and type of housing for a bird of prey. Wire mesh cages and housing that is too small or with unsuitably positioned perches can also result in feather damage.

Use towels as substrate and provide a stable perch for birds that are able to perch. Suitable perches include stable branches and stumps. To protect the feathers, ensure the perch is positioned so the bird's tail feathers are not touching the ground. Birds that are unable to perch should be supported using a rolled-up towel placed in the shape of a 'U' (Figure 13). The U-shaped towel supports the head and helps maintain the bird in an upright position. A similar rolled-up towel can be used for hatchlings and nestlings to replicate a nest.

Food or water containers should not be placed in the intensive care enclosure in the initial 24-hour period following rescue. Birds of prey are unlikely to self-feed in this initial period (see 'Nutrition') and food and water bowls can be a hazard resulting in wet or damaged feathers. Water bowls can pose a drowning risk to birds that have neurological disorders or are unable to stand.



Figure 13 Brown falcon supported by a rolled-up U-shaped towel in an incubator

Photo: Jana Schader

Minimising stress

Birds of prey are particularly vulnerable to the detrimental effects of stress. Excessive handling, sounds, exposure to humans or animals and exposure to unfamiliar environments must be minimised while the raptor is in intensive care. Disturb the bird as little as possible. It is important to ensure birds are not handled unnecessarily.

5. Common rescue encounters

Trauma

Motor vehicle trauma is the most common reason for rescue of birds of prey in New South Wales. Trauma resulting from collision with buildings and other objects, attack by birds and predation are the other commonly reported reasons for rescue in birds of prey.

Follow the basic principles for initial stabilisation (as set out above). Following a traumatic incident, the majority of animals will be in shock. Therefore, following an initial assessment, if there is no immediate requirement for medical intervention, it may be useful to allow the animal to rest in a warm, dark and quiet location. Pain relief is crucial for birds of prey with evidence of traumatic injury. If there are injuries requiring immediate medical attention (e.g. fractures, head trauma), treatment should not be delayed, and the animal referred for veterinary care as soon as possible.

Head trauma

Birds with head trauma may display a variety of clinical signs and care must be taken when handling these patients. Eye injury is particularly common in raptors with head trauma. Neurological injury can result in an inability to swallow, therefore oral fluids should be avoided. Signs related to head trauma can include:

- blood from the mouth, nares or ears
- fractures of the beak
- injury to the eyes (see 'Physical examination')

- neurological abnormalities – mental dullness, disparity in pupil size, head tilt, tremors, incoordination, inability to stand.

Birds with head trauma require immediate veterinary attention. Timely medical intervention can prevent progression of clinical signs and prevent longer-term or permanent neurological injury.

Spinal trauma

Blunt force trauma can result in traumatic injury to the spinal cord. Clinical signs can vary depending on the severity of injury and include:

- incoordination, inability to stand or perch
- weakness or paralysis of the wings or legs
- soiled tail feathers, which can indicate loss of function of the vent/cloaca
- loss of 'tail flick' reflex.

Spinal trauma can be difficult to diagnose and prognosis depends on the severity of injury. Birds with suspicion of spinal injury should be assessed by a veterinarian as soon as possible. Ensure the bird is well supported in the transport carrier (see 'Housing') and minimise handling and stress.

Fractures

Fractures are a common consequence of trauma in birds of prey. The prognosis for birds with fractures is dependent on fracture location, the duration of the injury, presence of infection and the degree of soft tissue damage around the fracture site. Birds with fractures may also have nerve damage resulting in reduced or loss of function of the limb.

Open fractures (where there are external wounds or bone is exposed) are at increased risk of infection and complications and carry a poor prognosis. Similarly, fractures close to or involving a joint carry a poor prognosis as they can permanently affect the range of motion in the joint.

Immobilising a fracture, by bandaging or confinement, is vital to reduce pain and tissue trauma.

The aim of fracture repair in birds of prey is to restore complete function as even minor alteration to a bird of prey's flight capability can affect its chances of survival in the wild. Where a fracture is suspected, veterinary assistance must be sought as soon as possible to relieve pain, confirm the diagnosis and prognosis, and provide appropriate treatment.

It is important for birds of prey with fractures to undergo a thorough veterinary examination to identify concurrent injuries, as this can influence treatment decisions and outcomes. For example, a bird of prey with a treatable fracture of the wing may have a concurrent injury to the eye. Depending on the severity of the eye injury, this bird may not be an ideal candidate for rehabilitation.

Predation

- Bird attacks are one of the more commonly reported reasons for rescue of birds of prey in New South Wales. Predation events by birds, cats and other animals can result in significant internal injury, which may not be readily apparent on physical examination. In some cases, the only noticeable signs may be matted or missing feathers. On thorough

assessment, there may be areas of bruising, swelling or more severe trauma such as fractures.

Superficial injuries from predator attacks might appear minimal, however, injury to deeper structures such as muscle, bone, joints or internal organs may be severe.

- Bruising and wounds to the head and neck are a common pattern of injury associated with bird attacks. Birds of prey with injuries to the head and neck should have a neurological examination to assess for head trauma. Examine the mouth and ears for signs of bleeding.
- In animals with bruising or wounds around the chest or abdomen, internal injuries must be assessed, and this requires veterinary assessment and imaging techniques (e.g. radiographs or ultrasound). Predation injuries may require surgical and antibiotic treatment prescribed by a veterinarian.
- Ensure an initial assessment has been performed once the animal is stabilised, and part the feathers to check for puncture wounds and bruising.
- Talon and bite wounds are contaminated wounds and require antibiotic treatment. Antibiotics need to be prescribed by a veterinarian, and the choice of medication and duration of treatment will depend on the severity and extent of injuries.

Entanglement

Birds of prey can become entangled in a range of foreign material including fishing line, netting, plastic, etc. It is not always easy to recognise entanglement as the entangled material may be buried in the skin or covered by feathers.

Simple, uncomplicated entanglement may be resolved with a handler to restrain the bird of prey and the examiner to assess the bird and remove foreign material. In cases of complex entanglement, it is best to seek veterinary assistance and resolve the entanglement with the bird under anaesthetic, to avoid the stress of prolonged handling and provide an opportunity to thoroughly examine the bird.

Do not attempt to pull or try to retrieve entangled material (e.g. fishing line) from within the mouth as this can result in internal injury. Birds with foreign material in the mouth should be presented to a veterinarian as soon as possible for evaluation.

Entanglement can result in deep tissue injuries, loss of blood and nerve supply and necrosis (death of tissue). Necrotic tissue will appear dry, hard, cold to touch and may be discoloured compared to surrounding tissue. Entangled birds may also have ingested foreign material (e.g. fish hooks). Even in cases of simple entanglement, a thorough veterinary examination is recommended to ensure there is no ingested foreign material or secondary injuries.

Anticoagulant rodenticide toxicity

Anticoagulant rodenticides (ARs) are widely used for agricultural and urban rodent control. Predatory and scavenging birds are most likely to be exposed to ARs through consumption of poisoned prey. ARs inhibit an enzyme that recycles vitamin K in the liver. Vitamin K is crucial for normal blood clotting and lack of vitamin K results in an inability to clot blood and increased risk of bleeding.

The concentration of ARs required to cause lethal bleeding in birds of prey is not yet fully understood as it can vary between and across species. Even sub-lethal levels of exposure are considered to have an effect on birds, however, as it may increase their likelihood of injury due to collisions with motor vehicles and may increase their susceptibility to parasites (Lohr 2018).

AR toxicity is difficult to diagnose definitively, but should be considered in birds of prey with signs of anaemia or blood loss including:

- pale or blue-tinged mucous membrane colour
- blood in mutes
- bleeding from the mouth or nostrils
- bruising or bleeding without evidence of physical trauma (e.g. fractures).

Specific veterinary diagnostic tests to assess clotting times (e.g. prothrombin time) can be used to diagnose bleeding disorders, however, this can sometimes be difficult as information on 'normal' clotting times across the various raptor species is not available.

Treatment for AR toxicity involves supplementation with vitamin K prescribed by a veterinarian, and supportive care following a thorough assessment.

Orphaned dependent chicks

Bird of prey chicks requiring care are commonly rescued due to fallen nests, misadventure or may be rescued from members of the public. It is not uncommon for chicks to be cared for by a member of the public before being brought to a licensed wildlife rehabilitator. In such cases, collecting a thorough history about the orphaned chicks is vital as it informs and directs the health assessment of the chick.

The decision to intervene and how to intervene will depend on a variety of factors (see 'Rescuing bird of prey chicks'). Consult with an experienced avian rehabilitator to determine the most appropriate intervention for each rescue.

The rehabilitation of orphaned bird of prey chicks is an intensive process. Following initial rescue, long-term care of chicks should be undertaken by experienced bird of prey rehabilitators as it requires extensive experience and time commitment. Aim to contact an experienced bird of prey rehabilitator as soon as possible for advice on husbandry, feeding and care of the chick until the animal can be transferred.

If the chick is rescued and brought into care, following an initial examination, aim to have the chick assessed by a veterinarian or experienced bird of prey rehabilitator. Bird of prey chicks are prone to imprinting and can develop inappropriate behaviours in captivity. The approach and experience of the rehabilitator is a vital factor influencing the development and severity of imprinting.

Rescued chicks with a history of poor husbandry and diet may present with musculoskeletal, gastrointestinal, respiratory or dermatological disease (feather abnormalities). Inappropriate or inadequate nutrition can result in metabolic bone disease, abnormal feathers, poor body condition, lethargy and neurological abnormalities. Metabolic bone disease affects bone density and can result in abnormal formation of bones and joints, and fractures. A thorough history is vital in such cases and veterinary referral is recommended for further diagnosis and treatment.

6. Quarantine and managing infectious disease

Quarantine practices are vital in controlling and preventing infectious disease being transmitted between birds in care.

Treat all birds of prey as potentially infectious and take precautions to minimise disease transmission between birds, to humans, and from humans.

- House birds separately until disease status is determined by a veterinarian or experienced wildlife rehabilitator. Chicks from the same clutch can be housed together.
- If a bird of prey shows any signs of disease (nodules on the skin, sneezing, discharge from the eyes or nostrils, unusual behaviour, neurological signs), it must be isolated and managed as potentially infectious until assessed by a veterinarian.
- Birds of prey in quarantine must have their own cleaning equipment, feeding equipment and perches that are not to be shared with other birds.
- Thoroughly clean all enclosures, food and water bowls and equipment between birds.
- Ensure towels, mats, etc., in enclosures are thoroughly cleaned before and after use.
- Ensure biological materials such as wood, branches, etc., are disposed of after use to prevent contamination between animals. Permanent perches in enclosures should be thoroughly cleaned.
- Wash hands thoroughly before, after and between treating and handling individual birds of prey.
- Use PPE as required: disposable gloves, covered clothing, alcohol-based hand sanitiser, dust mask, eye protection (see 'Personnel safety' in Section 2).

A range of disinfectants are available, with varying levels of efficacy against different pathogens. Follow the manufacturer's instructions when using disinfectants as contact time, and dilution rates vary between products. Only surfaces that are impervious to water and completely free of organic material can be disinfected. Before disinfection, ensure surfaces are cleaned to remove organic debris.

If an unusual disease or mortality event is suspected, the wildlife rehabilitator must immediately contact their species coordinator to notify the Department of Primary Industries (DPI) Emergency Animal Disease Watch Hotline (24 hours) on 1800 675 888 for immediate assessment of emerging health threats.

7. Zoonotic disease

Zoonotic diseases are diseases transmissible from animals to humans. As a group, wildlife rehabilitators are at increased risk of zoonotic disease due to regular and close contact with wildlife (Hulst 2019). Knowledge of the disease, appropriate PPE, hygiene practices and vaccination where available are vital in reducing the risk of disease transmission. Zoonotic diseases of specific importance to birds of prey are listed below. Further information about zoonotic diseases can be found on the DPI Zoonoses – animal diseases that can infect people webpage.

Salmonellosis

Transmission: The bacterium is shed in faeces and can be contracted through direct contact or indirect contact through fomites (inanimate objects that act as germ transfer sites).

Signs in birds of prey: Most animals that shed salmonella are asymptomatic. In some birds that show clinical signs, these are non-specific and can include anorexia, diarrhoea and lethargy.

Symptoms in people: Can include nausea, vomiting, diarrhoea, fever and abdominal pain/cramps.

Prevention: Hygiene and PPE are vital in protecting against salmonellosis and include hand washing, regular disinfection of equipment and isolation of affected birds.

Avian tuberculosis

Transmission: Caused by infection with the bacterium *Mycobacterium*. There are several species of mycobacteria that can cause disease in birds (WHA 2013). Disease occurs by ingestion, inhalation, biting insects or entry via skin wounds. The organism is spread in gastrointestinal or respiratory secretions, or from infected skin lesions. Reports of disease in people are rare. Immunocompromised people are at higher risk of infection.

Signs in birds of prey: Symptoms in birds can vary as the bacteria can affect a range of tissues. Affected birds are commonly emaciated and lethargic. Some birds may have granulomas, appearing as lumps on the body (WHA 2013).

Symptoms in people: Chronic progression of symptoms including fever, weight loss, fatigue, diarrhoea, shortness of breath, abdominal pain.

Prevention: The use of appropriate PPE (gloves, mask and eye protection) when handling birds or cleaning enclosures, isolation of affected birds, hygiene and disinfection of equipment and enclosures.

Psittacosis

Transmission: Psittacosis is caused by infection with the bacterium *Chlamydia*. This bacterium is shed in faeces and respiratory secretions of birds. A person can be infected by inhaling aerosolised feather dander or faeces (Hall & Rose 2021).

Signs in birds of prey: Birds infected with chlamydia can have a broad range of symptoms, including weight loss, diarrhoea, ocular or nasal discharge and respiratory difficulty. Chlamydia should be suspected in any emaciated wild bird (Hall & Rose 2021). Infected birds can also be asymptomatic carriers, whereby they do not develop clinical signs but are still capable of shedding bacteria into the environment.

Symptoms in people: Headache, fever, chills, muscle aches, dry cough, chest pain and breathlessness (NSW Health 2018).

Prevention: Personal hygiene and the use of appropriate PPE (gloves, mask and eye protection) when handling birds or cleaning enclosures. If you are concerned you may have contracted psittacosis, it is important to inform your doctor that you work in close contact with birds.

8. Record keeping

Accurate records must be maintained to track the progress and outcomes for birds of prey in care. If the bird of prey is referred for treatment at a wildlife hospital, these records provide vital clinical information useful in determining continued treatment and outcomes. They are also a useful resource for research and government organisations.

Records to be maintained include:

- encounter details – date, circumstances, incident location, name and details of people involved
- individual identification of bird of prey – species, stage of development, sex, identification (microchip) if present
- initial physical examination findings
- daily notes – including treatments provided, progression or development of symptoms, weight, food intake, faecal output, etc. Maintain daily record sheets while the bird of prey is in care
- outcome – record the outcome for each individual coming into care; for example, whether the bird was transferred to a wildlife rehabilitator or veterinarian, if the bird was euthanased or died while in care or if the bird was released.

9. References and further reading

DPIE (Department of Planning, Industry and Environment) 2021, *Code of Practice for Injured, Sick and Orphaned Birds of Prey*, NSW Department of Planning, Industry and Environment, Sydney.

Hall J and Rose K 2021, *Common Diseases of Urban Wildlife: Birds*, Taronga Conservation Society Australia, Sydney.

Harrison GJ and Lightfoot TL 2006, *Clinical avian medicine* (vol. 2), LR Harrison (ed.), Spix Publishing, Palm Beach USA.

Hulst F 2019, 'Zoonoses', in *Current Therapy in Medicine of Australian Mammals* (eds L Vogelneust and T Portas), pp. 267–283, CSIRO Publishing, Melbourne.

Lohr MT 2018, Anticoagulant rodenticide exposure in an Australian predatory bird increases with proximity to developed habitat, *Science of the Total Environment*, vol.643, pp.134–144.

NSW Health 2018, *Psittacosis (Ornithosis)*, Fact sheet, NSW Ministry of Health, <https://www.health.nsw.gov.au/Infectious/factsheets/Factsheets/psittacosis.PDF>.

Scott DE 2020, *Raptor Medicine, Surgery, and Rehabilitation*, CABI.

WHA 2013, *Mycobacteriosis in Australian Birds*, Fact sheet, Wildlife Health Australia, wildlifehealthaustralia.com.au/Portals/0/Documents/FactSheets/Avian/Mycobacteriosis%20in%20Australian%20Birds.pdf (PDF 121KB).

WHA 2017, *Zoonoses of Australian wild birds*, Fact sheet, Wildlife Health Australia, wildlifehealthaustralia.com.au/Portals/0/Documents/FactSheets/Public%20health/Zoonoses%20of%20Australian%20Wild%20Birds.pdf (PDF 493KB).

10. More information

- [Emergency Animal Disease Watch Hotline](#)
- [Zoonoses – animal diseases that can infect people](#)