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WILDLIFE HEALTH

Rehabilitation guide for raptors

Department of Conservation
Te Papa Atawhai

New Zealand Government

Cover: Ruru chicks. *Photo: Annemieke Kregting.*

New Zealand Wildlife Rehabilitation Fact Sheets are occasional publications produced to describe best practice for rehabilitation of New Zealand native species. They are available from the Department of Conservation website (www.doc.govt.nz) in pdf form.

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In the interest of forest conservation, we support paperless electronic publishing.

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Rehabilitation guide for raptors

This guide describes the appropriate food, housing and husbandry requirements for New Zealand raptors (Fig. 1) when they are held in captivity for rehabilitation and it should be considered a reference for minimum standards of care. This guide does not cover specifics of veterinary care.

1. Species

Kārearea / New Zealand falcon (*Falco novaeseelandiae*)	Endemic	NZTCS[1] status: At Risk
Kāhu / swamp harrier (*Circus approximans*)	Native	NZTCS status: Not Threatened
Ruru / morepork (*Ninox novaeseelandiae*)	Native	NZTCS status: Not Threatened
Little owl (*Athene noctua*)	Introduced	NZTCS status: Partially Protected
Australian barn owl (*Tyto alba deliculata*)	Native	NZTCS status: Coloniser

A Wildlife Act Authority (DOC Permit) is required to Hold in Captivity. Go to: https://www.doc.govt.nz/get-involved/apply-for-permits/interacting-with-wildlife/holding-wildlife-for-rehabilitation/

Figure 1. Images of New Zealand raptors addressed in this guide. A. – kārearea / New Zealand falcon. *Photo: Janice McKenna*. B. – Australasian harrier. *Photo: A.G. Hall*. C. – Australian barn owl. *Photo: Leslie Feasey*. D. – ruru / morepork. *Photo: Sharon Gamble*. E. – little owl. *Photo: J.L. Kendrick*.

[1] NZTCS New Zealand Threat Classification System, for more information visit http://www.doc.govt.nz/nature/conservation-status/

2. First aid

First aid is provided when the bird arrives for treatment to stabilise it and minimise pain.

This includes:

- Oral fluid therapy to manage dehydration.
- A source of warmth such as heat pads or hot water bottles wrapped in a towel or placing the bird in an incubator or warm room (set at 28–30°C). If the bird is alert and eating it may not need heat supplementation and can be kept at room temperatures (20–25°C).
- Holding the bird in a quiet area away from people and pets.
- Stabilising broken bones using a bandage.

For details on oral fluid therapy and bandaging, go to Modules 3 & 7 of the DOC online wildlife health course at: https://www.doc.govt.nz/wildlife-health-course

3. Why and when do raptors require health care?

3.1 The most common causes of harm are:

- Collision with vehicles on the open road and on agricultural land.
- Collision (with a solid object or the ground).
- Attack from a predator.
- Bullet wounds.
- Poisoning.
- Starvation
- Parent birds abandoning a chick.
- The effects of inadequate supplementary food.
- Complications of long-term captive care and medications for rehabilitation.

3.2 The most common types of injury and illness seen in raptors are:

- Fractures to bones in the wings and legs.
- Fractures or dislocations to the coracoid, a bone in the shoulder girdle.
- Head injuries and concussion.
- Signs of spinal injuries, such as partial or full paralysis of the legs and tail. Incontinence or failure to defecate are symptoms of a spinal injury.
- Penetrating tooth wounds and extensive internal fractures.
- Oral and intestinal infections – trichomoniasis, capillariasis (parasite infections) and candidiasis (yeast infection) are common, as well as bacterial or viral infections.
- Signs of lead poisoning – clenched feet, low body weight, neurological signs. Harriers will inadvertently eat lead shot from wounded or deceased waterfowl.
- Botulism – flaccid paralysis and weakness is seen in harriers after scavenging on waterfowl infected with *Clostridium botulinum*.
- Eye injuries, such as traumatic ulceration and infection; penetrating injuries; bacterial conjunctivitis. These injuries most commonly occur in owls.
- Infestation by external parasites – lice, mites, ticks.
- Infestation by internal parasites – roundworms, protozoa.

4. Veterinary care

A veterinary consultation is required for any bird that displays symptoms consistent with any of the conditions listed above or which is not improving as expected during care (within 1–3 days of arrival). X-rays (radiographs) are usually required to determine the best treatment for broken bones. Medications such as pain relief and antibiotics require a veterinary prescription to ensure the correct drugs and doses are used.

5. Handling raptors

Correct handling of birds minimises the risk of harm to both birds and handlers. Before handling a bird, identify its most dangerous features and gain control of these first. The main defence mechanism of raptors is their talons. Birds that appear to be calm can strike without warning and aggressive raptors can flip onto their backs and strike out with their feet. Falcons often make sudden attempts to escape and ruru (moreporks) can inflict painful scratches.

To pick up a raptor from a cage or box, start by draping a towel over the bird when it is facing away from you. Then gently push the bird to the ground and grasp the legs from behind and beneath the tail. Care must be taken not to squeeze the legs together. When the legs are under control, lean the bird's back against your abdomen, with your other hand free to restrain the head if required. Keeping the head covered with a towel will help to calm it. The towel can be used to wrap around the bird's wings in a swaddling wrap while it is being handled. When handling birds, always ensure that any restraint around the chest is loose enough that the bird can still easily move it to breath. A novice handler will require a second person to assist when handling raptors.

For a demonstration on handling raptors go to Module 1 of the DOC online wildlife health course at http://www.doc.govt.nz/wildlife-health-course.

6. Hospital cages

Cages used for housing critically sick and debilitated birds are referred to as 'hospital cages'. They securely hold birds and encourage them to rest quietly whilst allowing effective monitoring and treatment.

- All large raptors should have a tail wrap (Fig. 2) to protect their tail feathers from damage in hospital cages. Insert the tail into a suitably sized clear plastic bag and staple the bag to hold the tail in place. Do not staple the central shaft (rachis) of the feathers and ensure the vent (where the bird defecates from) is excluded from the wrap. Remove the wrap when the bird is transferred to an aviary.
- Cages should allow for provision of supplementary heat via a warm room, heat pad or hot water bottle wrapped in a towel.

Figure 2. Ruru with tail wrap. *Photo: Kate McInnes.*

- Ensure the size of the cage is sufficiently large that the bird can easily turn around and stretch its wings, but not so large that it can fly or elude capture. Recommended dimensions are 90 cm (W) x 60 cm (H) x 60 cm (D) for a harrier and 45 cm (W) x 60 cm (H) x 60 cm (D) for a ruru or falcon.
- Provide suitable substrate on the floor of the cage to prevent foot abrasions. Towels or easily cleaned soft rubber matting are good options (Fig. 3). Newspaper can be quite slippery for raptors and can only be used along with towels, perches or matting. Avoid use of materials with rips, frayed edges or holes, which may entangle feet.

Figure 3. Falcon with tail wrap on towel substrate. *Photo: Lisa Argilla.*

- Perches for small raptors should be a suitable diameter (approx. 25–35 mm) for their talons. Harriers do not require a perch. Free-standing or hanging perches must be secure, stable and covered with towels, artificial turf, rubber, foam or disposable bandage (3M Vetrap™). Perches should be approximately 40–50 mm above the floor, which allows the bird to hop up easily and avoids the tail dragging on the floor when perching.
- Cover transparent doors or whole wire cages with towels or cloth to give some privacy and to prevent attempts to escape which may incur further injury. Allow some natural light to enter the cage to encourage feeding.
- Place food and water bowls on the floor of the cage, close to the door for ease of access.

7. Diet

7.1 Natural diet

Harriers eat carrion and live prey. Animals killed on roads form a good proportion of their diet, especially for juvenile birds. They will also catch and eat rodents, rabbits, insects, lizards, frogs and small- to medium-sized birds. New Zealand falcons usually hunt on the wing and will eat small- to large-sized birds, mammals such as rabbits and insects such as cicadas and huhu beetles (*Prionoplus reticularis*). Ruru eat large insects such as huhu beetles, wētā, cicadas and large moths. They also eat small birds including silvereyes (*Zosterops lateralis*) and small mammals such as mice.

Wild raptors eat the whole carcass including bone, fur/feathers and gut contents. All healthy raptors expel indigestible material as a pellet via regurgitation from the stomach, usually once a day.

7.2 Convalescent diet

Note: there is a high risk of raptors imprinting on humans when they are in captivity and being provided with food. Raptors should not be hand fed by inexperienced people. See ‘Potential complications’ below.

Tinned cat food, cat biscuits mixed with water, shredded fresh red meat or a mixture of insects and meat, are suitable foods to provide in a short-term emergency situation (e.g. 1–3 days only). Hill’s® Prescription Diet® a/d® is a suitable convalescent diet for raptors. It can be diluted with a small amount of water to make a slurry which can be fed via a silicon feeding tube or a metal ‘crop needle’. For ruru, add Wombaroo Insectivore Rearing Mix™ to Hill’s® Prescription Diet® a/d® to make a slurry for crop feeding.

Liquid diets should be warmed to approximately 38–40°C. Adult birds may need crop feeding. The volume fed will depend on each bird's response to feeding. As a general rule, if feeding is slowly increased until the right volume for each bird is known, feeding should always stop before food starts to well up in the mouth or regurgitation occurs. For details on crop feeding techniques go to Module 3 of the DOC online wildlife health course: http://www.doc.govt.nz/wildlife-health-course.

In most cases:

- Adult harriers can be fed 20 ml of Hill's® Prescription Diet® a/d® slurry and 20 ml of fluids twice a day.
- Adult falcons can be fed 10–20 ml per feed, twice a day. This is usually split into 10 ml Hill's® Prescription Diet® a/d® slurry and 5 ml saline.
- Ruru can be fed up to 8 ml per feed with Hill's® Prescription Diet® a/d® slurry or insectivore mix 2–3 times a day. Often additional fluids will be required either as part of the 8 ml feed or given subcutaneously to adequately re-hydrate a sick ruru.

To reach minimum fluid requirements in convalescent falcons and ruru, additional fluid therapy will often be required in the form of subcutaneous (SC), intravenous (IV) or intraosseous (IO) fluids. Maintenance fluid requirements for raptors are 50 ml/kg/day, and additional fluids are required when the bird is dehydrated or recovering from illness.

Any bird being treated for lead toxicity with Ca EDTA will require additional fluid therapy to protect the kidneys; discuss an appropriate fluid plan with your veterinarian.

The raptor should be weighed daily to monitor weight gain during the initial hospitalisation period and feeding should be adjusted accordingly. Dehydrated or sick raptors may retain casts and this may give the false impression of weight gain, so always monitor the weight and frequency of casting in raptors. If any of the raptors are not maintaining weight, further assist feeding with small cut up pieces of one day old chicks may be required and may help to encourage some birds to recognise food to feed independently. Wrap the raptor in a towel with the head left free. Gently restrain the head with a thumb and forefinger either side of the skull (on the jaw line, below the eyes) and/or carefully open the beak, approaching from behind and above the head. Then use blunt forceps or thin tipped tongs to gently place small cuts of chick or mice pinkies (captive-bred baby mice, which can be frozen and defrosted) into the mouth. Once the food is placed at the back of the mouth, let go of the head to enable the raptor to swallow or regurgitate freely without restraint. Two people may be required to assist feed while this technique is being learnt. Be careful not to dribble any fluids from the food onto the feathers around the mouth. If soiling of feathers does occur, clean them using a mist spray of water. Do not wipe the food into the feathers. When feeding, always try to keep handling time as short as possible. Darkening the room and not talking around the birds will help to reduce stress during feeding.

7.3 Self-feeder's diet

A self-feeder's diet is provided to birds that are alert and can demonstrate the ability to feed themselves. The diet must provide all the bird's nutritional requirements. A suitable diet for raptors includes whole day-old chickens (sourced from the poultry industry) (Fig. 4) and/or captive-bred mice or mice pinkies which can be frozen and defrosted as required. Ox-heart or other red meat are suitable foods to provide in a short-term emergency situation (e.g. 1–3 days only). Raw chicken necks, whole rabbit, duck or other shot or trapped prey could be used, but ensure that it does not contain lead shot, is from a healthy population and has not been euthanised with injectable agents. Food items can be chopped into small pieces, but always aim to feed out the entire carcass

Figure 4. Day-old chickens. *Photo: Kate McInnes.*

where possible, as it provides superior nutrition. In a whole carcass bones are a source of calcium, viscera provide vitamins and fur or feathers will encourage healthy casting. Raptors being fed whole bodies should be casting (regurgitating lumps of undigested bone, feathers or fur from their prey), once a day. For birds that require higher fluid rates chicks and mice can be injected with additional fluids. Carcasses should be frozen for several days before use to decrease the risk of infection from parasites (e.g. *Toxoplasma*). It is currently illegal to feed live vertebrate prey such as small lizards to captive animals. However, live insects can be offered to insect eaters such as ruru (e.g. mealworms, waxmoth larvae, large moths, crickets, cicadas). Placing a small solar garden light in the night aviary can help to attract moths and insects into the aviary. Provide slightly more food than the bird(s) consume each day. Ensure fresh water is always available.

8. Aviaries for raptors

Raptors can be moved to aviaries once they are feeding themselves and are no longer requiring handling for medical treatments. Flight aviaries are used to enable birds to regain strength and fitness prior to release and all raptors will require an assessment of fitness and ability to fly before release. Whilst some raptors are relatively easy to care for in an aviary environment (e.g. ruru), others (e.g. falcons) must be under the care of experienced falconers or raptor rehabilitators for their ongoing rehabilitation.

9. Requirements for flight aviaries

- House different raptor species in separate aviaries, but some species (e.g. harriers and ruru) can have several birds to one aviary if required.
- The aviary must have sufficient space that the raptor has room to fly between perches. An aviary for small raptors requires minimum dimensions of 3 m (L) x 1.5 m (W) x 2 m (H). Harriers will require a larger aviary with minimum dimensions of 4 m (L) x 2 m (W) x 2 m (H).
- Note that raptors in captivity for longer periods will require a larger aviary to enable adequate exercise, unless they are being hacked (exercised) by experienced falconers. Experienced harrier rehabilitators in New Zealand carry out pre-release flight training in aviaries with dimensions of 12 m (L) x 6 m (W) x 4 m (H). These dimensions allow for turning whilst in flight.
- Large circular aviaries of 6–8 m diameter are a suitable design and size. Smaller raptors (e.g. ruru) will fly around the aviary in circles and build fitness.
- Most raptors prefer to use elevated perches; however, harriers will spend time on the ground.
- The aviary should be a mix of solid construction materials to provide shelter from sun, wind and rain; and open mesh to present more natural conditions and encourage natural behaviour. Allowing rain and sunshine into part of the aviary encourages birds to preen and get used to natural conditions after hospitalisation.
- Suitable construction materials include corrugated PVC or polycarbonate roofing, wood, steel or aluminium. Any galvanized materials should be scrubbed with vinegar to remove the oxidised zinc coating. Aviary sides can be constructed of vertical wood slats (Fig. 5), plaited nylon netting (for harriers) or welded wire mesh of approx. 50 mm mesh size (for falcons) and a shade cloth exterior. Plaited nylon netting/ shadecloth sides are soft and help to prevent injury if frightened or disorientated birds fly into the walls. Chicken wire mesh is not appropriate as it can cause injuries to birds.

Figure 5. Exterior of aviary for raptors. *Photo: Ron Lindsay.*

- Provide perches with a variety of diameters so birds can move around and vary their foot grips. Suitable materials include branches of various diameter or PVC piping with artificial gripping material attached (e.g. rubber, artificial grass or closed cell foam). Provide perches at each end of the enclosure to encourage birds to fly between perches. Firmly attach perches to the aviary walls or to the aviary roof by chains.
- Harriers can have wood/branch perches fixed low to the ground, e.g. 30 cm high. Falcons will perch on fixed wooden posts or platforms, which can be covered with synthetic turf or carpet to protect their feet (Fig. 6). Also, a higher perch should be provided at one end of the aviary along with a screening panel or box. Harriers could be provided with a 'house' by building three walls and a roof at one end of the aviary or by providing free-standing wooden 'houses', e.g. 2 m (L) x 2 m (H) x 1.5 m (D).

Figure 6. Interior of aviary for raptors. *Photo: Ron Lindsay.*

- Additional features (such as kōwhai branches or other native greenery) provide enrichment and hiding places, particularly for falcons and owls. (Note: some New Zealand flora species are toxic to birds; for a guide to suitable species refer to http://www.doc.govt.nz/get-involved/conservation-activities/attract-birds-to-your-garden/what-to-plant/
- Flooring substrate should either be waterproof and easily cleaned (e.g. waterproofed plywood, concrete) and/or natural materials such as sand, pea gravel or smooth stones. Soil or grass can also be used. However, all naturalistic enclosure floors are harder to keep clean and parasites will build up over time, requiring periodic removal and replacement of the top 50 mm of ground substrate. Ideally, floor substrate should be changed from every 6 months to 2 years, depending on the frequency of use and stocking density of birds in the aviary. The floor substrate should also be replaced if high and/or persistent parasite burdens occur or if there are any deaths in the aviary related to avian TB (*Mycobacterium avium*). Seek consultation with your veterinarian if there are any disease issues within your aviary. Concrete is far easier to clean and can be covered with astroturf or pine needles to help prevent foot problems for harriers. Ensure any natural substrates are dry and free of mould when collected from the environment. Sand can cause gut impaction if food is eaten from the ground. Fungal spores will grow in damp or humid conditions or when storage is inadequate. Bark chip or wood mulch is not suitable as it quickly becomes mouldy.
- Ensure aviaries are predator proof. Any predator traps set around the perimeter must be regularly checked. At the same time, the aviary walls should be examined for holes or evidence of digging at the bases of the walls. Ensure the interior of any newly constructed aviary is cleared of all mammalian pests before introducing birds.
- Capturing raptors in an aviary will require use of a hand net and some skill – particularly for falcons which are fast and nimble. Where possible, capture birds on calm days, as wind aids flight. Bird-specific, butterfly or fishing hand nets that have a soft, woven nylon bag of a very small mesh size can be used. Trout landing nets with rubber coated mesh are also practical. Harriers in smaller aviaries can be caught by slow cornering and throwing a towel (or net) over them when they turn away from you. Remove the bird from the net immediately and place into a box for transportation.

10. Cleaning and disinfection

- Food and water bowls are replaced twice a day. Used bowls are cleaned daily with detergent and rinsed with water then allowed to dry.
- Feeding equipment and crop tubes are disinfected daily by thorough rinsing with water and soaking in dilute disinfectant such as Milton™ antibacterial tablets or F10 Veterinary Disinfectant as per the manufacturer's instructions.
- Substrate materials such as towels and newspaper are changed daily.
- Cages are disinfected daily with a mild disinfectant such as dilute F10 or Avisafe™ (the bird must be removed during cleaning).
- Cages and equipment are thoroughly disinfected and rinsed in between use by different patients using a stronger disinfectant (such as bleach or SteriGENE™) at manufacturer's specifications, then left for 24 hours in a well-ventilated position.

11. Potential complications

The following are common complications birds can experience as a result of medical care, rehabilitation or prolonged captivity. In any of the following cases or if the bird is not recovering as expected, seek advice from an avian veterinarian, wildlife nurse/ technician or an experienced wildlife rehabilitator.

11.1 Imprinting

Falcons and harriers can be particularly dangerous if they become imprinted (bonding to or losing fear of humans). Chicks that are hand-reared and hand-fed by humans may become so aggressive that they are not able to be released to the wild and must be euthanised. It is essential to prevent imprinting, as it is difficult to cure. Adult birds should ideally be provided food in the dark or via a chute into the aviary/cage so that they do not see or hear humans as the food is presented. Juvenile raptors must be transferred to an experienced raptor rehabilitator or falconer.

11.2 Failure to heal

Sometimes fractures do not heal adequately or wounds deteriorate. Muscles and tendons contract following prolonged restriction of movement. These issues prevent flight and therefore prohibit release of the bird. It is essential that falcons regain perfect use of their wings or they will not be able to hunt. A veterinarian can potentially treat these problems with repeated surgeries or utilise other techniques, such as physiotherapy.

11.3 Foot lesions

Inadequate perches, inappropriate substrate or prolonged captivity can lead to pododermatitis ('bumblefoot' – scabs and deep infections of the footpads). This can be a serious and painful condition and should always be seen by a veterinarian.

11.4 Feather damage

Excessive damage to primary wing feathers or tail feathers may mean a loss of ability to fly and will require the bird to remain in captivity until they moult. Protect feathers from damage by careful handling, using appropriate-sized cages, avoiding cages that have wire mesh sides/bases and by installing elevated perches. Tail wraps help to prevent tail damage. These can be removed when the bird is moved to a larger aviary for fitness and weathering prior to release. In some cases, expert raptor rehabilitators can undertake imping (attaching a new feather to a broken feather shaft) to replace damaged feathers and this will be noted in their DOC permit.

12. Criteria for release

- Courses of medication and treatments are complete and injuries have healed properly.
- The bird is observed to be flying properly and is able to gain vertical lift.
- The bird has good body weight and body condition.
- The feathers are in good condition.
- The bird is physically and behaviourally able to forage and breed in the wild.

13. Method of release

Check your DOC permit for release requirements. Falcons should be hard released. Soft release may be suitable for harriers and moreporks in some cases.

Hard release: transport the raptor from the captive location and release them directly into native forest or a park. If it is possible and the location is safe, release the birds where they were originally found. If not, contact the local DOC office to arrange a suitable release site.

Soft release: seek advice from a raptor expert for soft release techniques.

14. Further information

'Wild City Neighbours' at: https://www.doc.govt.nz/globalassets/documents/science-and-technical/birdrehabguide.pdf

Wildlife Rehabilitators Network of New Zealand (WReNNZ): http://www.wrennz.org.nz/

Department of Conservation online wildlife health modules: http://www.doc.govt.nz/wildlife-health-course

15. Acknowledgements

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- The New Zealand Raptor Trust: https://www.facebook.com/nzraptor/
- Te Kōhanga, The Nest, Wellington Zoo: https://wellingtonzoo.com/conservation/saving-wildlife-in-the-nest-te-kohanga/

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