Chapter Two
The Injured Raptor

2.1 Source of Birds for Rehabilitation

2.1.1 Overview

Raptors may require rehabilitation for many reasons. For example, a fledgling might be injured in a fall from the nest, or a bird may be wounded during an escape from a predator. Some birds will not have developed the skills to effectively compete and as a result may become weak from starvation and therefore susceptible to infection. Other injuries, however, are the direct result of increased urbanization and agricultural development. Many birds are injured on roads, by fences, by power lines, or by other hazards that are part of an urban or suburban environment.

Some species are more predisposed to this type of "unnatural" injury than others. Raptors classified as attackers, such as bird-eating falcons and accipiters, are more likely to suffer from direct collisions with fences, windows, and power lines. Larger raptors that soar or sit around farmland are more likely to be shot by people defending their livestock.

Those species of raptors classified as searchers are more likely to be struck by vehicles. They expose themselves to injury as they forage along major roads, highways, or quiet country lanes, having been attracted by the insects and small rodents in the grassy verges. The incidence of road-strikes has increased with the placement of fence and power posts that serve as convenient perches. Finally, there are always fledglings that are found orphaned, or juveniles found starving, or young birds that have become caught in chicken coops or pigeon lofts. These injured or rescued raptors are regularly handed over to rehabilitation centers, local zoos, or falconers.

2.1.2 Rescuing the injured raptor

Any bird of prey which can be picked up or handled freely has a problem. It is either injured or starving, or both, unless of course it has been hand-reared. Always assume injury until a full physical examination has proven otherwise. If a bird is healthy, any attempt to restrain it will normally produce an escape

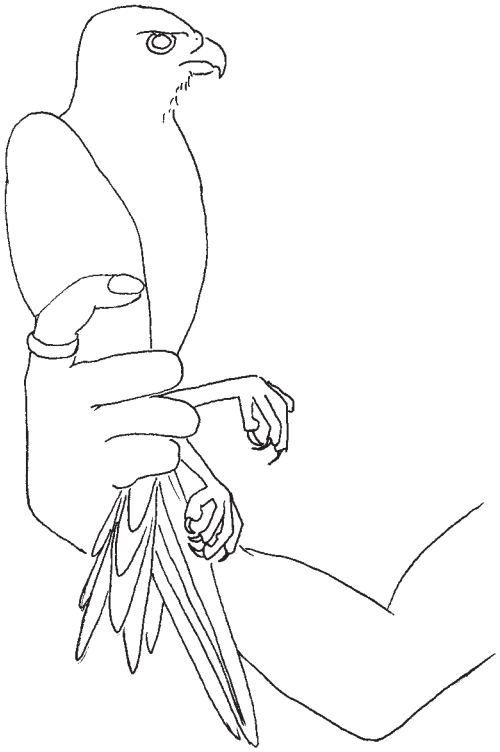

Figure 2.1.2a Restraining a small falcon.

Figure 2.1.2b Restraining a large falcon.

response. Often, an effective response is prevented by an injury which is subtle and difficult to detect, such as a fracture in the shoulder. If the bird is seriously damaged, there may be no response at all. For these reasons, all birds of prey which are presented for rehabilitation must be taken to a veterinarian for evaluation. There should be no exceptions to this rule.

Many of the problems associated with raptor rescue and the bird's recovery revolve around inexperience. We see many birds which have been held for periods ranging from a week up to a month by amateur but well-meaning care-givers who simply do not realize the extent of the bird's injuries. When these birds are finally presented to the rehabilitation center, the fractured bones have often healed abnormally, or a damaged piece of soft tissue has become infected. What may have been a treatable problem initially is now totally unsalvageable. Re-breaking old fractures and attempting to repair them is not possible in birds due to the brittle nature of their bones. Often the only remaining option is euthanasia.

Immobilizing the bird should be the first priority, as injured raptors are invariably frightened and will defend themselves in any way they can. Throwing a towel or blanket over the bird will help, for even if the raptor is a large eagle, such a covering will give the rescuer enough time to restrain the legs and wings. Raptors can inflict painful bites, but their talons can do more damage, so make sure the feet are properly restrained.

Initial examination should take place as soon as possible. It is vital that the extent of the injury be ascertained quickly, although there will be occasions when the bird will need time to settle down before being subjected to the extra stress of being put under a general anaesthetic. Experienced rescuers may be able to assess an injured raptor's future at the point of capture. Severe fractures which are

irreparable or which will ultimately inhibit normal flight can be diagnosed and appropriate action, such as euthanasia, taken.

2.1.3 Transportation of injured raptors

Injured wild birds of prey are likely to be stressed, and conceivably in shock. They should be handled as little as possible, and kept in a warm, quiet, dark area while transportation is being organized.

Transport containers must be secure and clean. Custom-made boxes designed for transporting birds of prey are obviously ideal, but failing that, one can use a pet-carrier or even a heavy-duty cardboard box. The bird should not be transported in a bag or hessian sack as this will ruin its feathers. Care must be taken to ensure that feathers are not damaged, as this could result in an unnecessary delay in the scheduled release date of the bird, possibly by as much as twelve months or more if a molt is required to replace the damaged feathers. The bird should be kept quiet during transportation. It should never be left unattended in a vehicle or placed in the trunk of a car.

No food should be offered prior to examination by the veterinarian, as it is likely that he or she will anaesthetize the bird in order to assess its condition and the extent of its injuries. A crop full of food may be regurgitated during anaesthesia, resulting in possible asphyxiation. Water can be offered in a bowl which cannot be tipped over; small dog water bowls are ideal for this purpose.

If transportation to a veterinarian is delayed, a preliminary check for obvious injuries can be made.

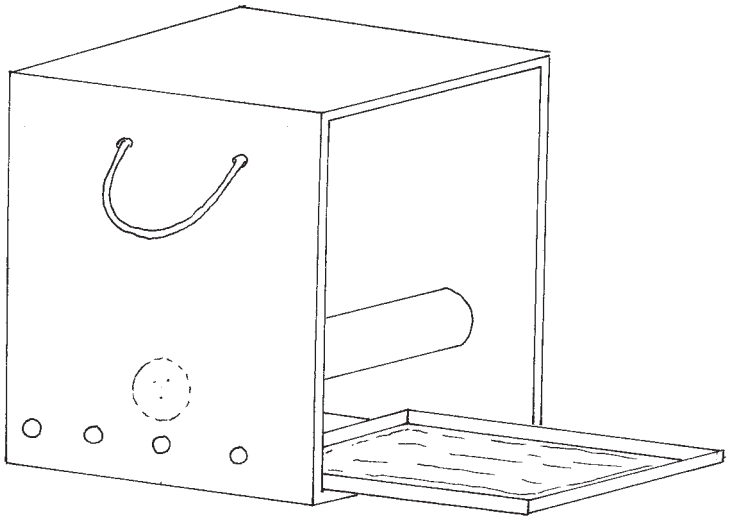

Figure 2.1.3a Transport box.

Figure 2.1.3b Transport box with perch for gripping — suitable for small raptors.

2.1.4 Checking for obvious injuries

- ❑ A. The first step is to locate the injury. If no injury is visible, take into account where the bird was when found. An injured bird found along a highway was probably struck by an automobile. A bird found beneath a window may have flown into the glass.
- ❑ B. Ascertain and record the species, sex, and age of the bird.
- ❑ C. Assess and record the bird's general condition. The body weight and the condition of the sternum will prove useful in this regard. A very pronounced breast bone will indicate malnourishment. Having confirmed the bird's sex and species will further assist you in gauging its condition.
- ❑ D. Seek veterinary help as soon as possible if the initial examination was not performed by a qualified veterinarian or technician.

2.1.5 What should one look for?

- ❑ A. Fractures of any bone and/or dislocations of any joint.
- ❑ B. Foot infection, such as bumblefoot.
- ❑ C. Infections in the mouth.
- ❑ D. Imperfect vision.
- ❑ E. Broken feathers.
- ❑ F. Signs of emaciation.

After the bird has been removed from the transport box, the next step is to establish the nature and severity of its injury. If the bird has been taken to a vet, the examination can be carried out under general anaesthetic. If the relevant details have been recorded prior to the examination, the veterinarian will have valuable information with which to work.

2.1.6 The proper procedure for examining the injured raptor

- ❑ A. Restrain the bird. Hold its wings together and restrain its feet.
- ❑ B. Hold it down on a cushion.
- ❑ C. Examine both wings, one at a time, by gently extending them. Feel the joints and check for swelling, particularly in the shoulders, elbows, and carpal joints.
- ❑ D. Check for feather damage on each wing and the tail.
- ❑ E. Check the feet and legs for swelling, abrasions, or abscesses.
- ❑ F. Check the bird's head, mouth, and eyes. Examine the beak for cracks. Look for blood in the mouth and obstructions in the throat, or any signs of ulcerations or lesions.

The results of this initial examination will dictate the next course of action. Loose limbs or protruding bones are easily diagnosed. If the bird seems uncoordinated, it is likely that some head trauma exists. At this point, the area where the bird was found may provide a clue toward confirmation of the diagnosis. Collision with vehicles or windows is a common occurrence with some species. Severe bleeding can be controlled by applying digital pressure to the site, or by using a temporary bandage. Sticky bandages such as Elastoplast must not be used, as the glue will damage the feathers. A self-adhering bandage such as Vetrap, which uses a similar principle to velcro, is ideal. A severely drooping wing can be temporarily bandaged to the body to prevent further damage to the internal musculature and bones, the wings, or the feathers. Disinfectants such as Mercurochrome should not be used, as they will make examination more difficult, damage the feathers, and if used in large amounts, may chill the bird and possibly exacerbate any existing shock.

2.1.7 Establishing sex, age, and species

Determining the species, sex, and age of a bird is also important, as it will be impossible to properly assess the bird's general condition unless one knows precisely what species he is dealing with. In raptors, males are generally smaller than females, and juveniles have a different plumage. A good field guide will be of great assistance when trying to establish which species of raptor has been presented for rehabilitation.

2.1.8 Ascertaining body condition

The sternum or breast bone will be pronounced if the raptor is malnourished, a fact which will be confirmed when the patient is weighed and checked against the correct weight range for its species, sex, and age. However, one must be very careful about using weight charts from field guides, as one never knows the condition of the birds that were weighed, and even falconers who trap birds rarely record their exact condition, e.g., one has a variation in weights which can range from 490–710 grams for male Australian peregrine falcons.

Record the color of the injured or orphaned bird's feces. This is another good indication of its general condition. Green fecal matter is a sure sign that the gut is totally empty and an absence of fecal matter is even worse—there is nothing in the gut to pass as waste material.

If one is new to dealing with raptors, with limited experience in the falconry, rehabilitation, or demonstration fields, then finding a good veterinarian who is familiar with raptors is an essential starting point. Getting in touch with raptor breeders, falconers, and other experienced rehabilitators is equally vital.

2.2 Housing the injured raptor

2.2.1 Overview

Any sick or injured animal is potentially carrying a disease that is transmissible to other captive stock, so quarantine protocols must be established and strictly followed, even in a small rehabilitation center, such as a backyard operation. Every effort must be taken to prevent the possibility of infecting additional animals with some obscure parasite or disease.

Ideally, one should have three basic enclosure types, each catering to a specific period in the injured raptor's recovery. The dimensions of each enclosure vary from institute to institute, and the measurements provided in table 2.2.5 represent a combination from various sources. The initial confinement enclosure should facilitate easy capture or restraint of the patient and allow heating if necessary. Extremely sick birds can be kept in smaller boxes until their condition has stabilized. In most cases, I use the following three enclosure types described.

2.2.2 Initial care enclosures

Commercially made, heavy-duty plastic boxes are easily cleaned and disinfected, and can be moved around with the minimum of work. These boxes are not suitable, however, for large species such as eagles or large kites,

falcons, and hawks, as the doors are too small. Custom-made wooden boxes that have been surface-sealed to make them waterproof are ideal. Hygiene is vital and the water-proofed wooden boxes can be washed and disinfected with no detrimental effects to the wood.

When is it safe to move the raptor into a bigger enclosure?

- When injuries have stabilized.
- When the bird is feeding voluntarily and is gaining weight.
- When, after suffering from head trauma, the bird has regained its coordination.

In most instances, a confinement of one to five days in the initial care enclosure is sufficient to see the bird through the critical period.

2.2.3 Secondary care enclosures

These are larger enclosures with a window at one end to provide natural light. The floors should be of cleanable, sealed concrete covered with astroturf carpets to prevent the possibility of further injury to the bird.

The placement, number, and type of perches will depend upon the individual occupant and its mobility. Traditionally, flat blocks are used for falcons and branches for other birds of prey, but both types could be provided. Smooth branches should not be used for perches, as these invariably cause calluses and foot sores. Perches must be covered with astroturf, hemp rope, or a similar rough material to provide a textured surface. The bird's talons should never be able to completely encircle the perch or branch. Insufficient perch diameter places pressure on the ball of the foot, which may lead to other complications. The sharp talons can puncture the foot resulting in infection. It is important to remember that while in the wild the bird can choose where to perch, in the enclosure it can only use what has been provided. It is also necessary for the bird to have access to water. This type of sealed enclosure is ideal for nervous species, such as goshawks. In situations where the injury to the raptor has been minor, release can be facilitated from this type of enclosure as long as the bird has met all the pre-release requirements (see section 2.4).

2.2.4 Tertiary care enclosures

The bigger these enclosures are, the better. They must offer the raptor the opportunity of self-exercise in an environment that is not

Table 2.2.4 Enclosure dimensions in meters

Species	Initial	Secondary	Tertiary
Eagles	1 x 1 x 1	2 x 2 x 2	25 x 5 x 5
Vultures	1 x 1 x 1	2 x 3 x 2	25 x 5 x 5
Large falcons	1 x 1 x 1	2 x 2 x 2	25 x 5 x 5
Small falcons	.5 x .5 x .5	2 x 2 x 2	25 x 5 x 5
Small hawks	.5 x .5 x .5	2 x 2 x 2	25 x 5 x 5
Large hawks	1 x 1 x 1	2 x 2 x 2	25 x 5 x 5
Buzzards	1 x 1 x 1	2 x 2 x 2	25 x 5 x 5
Small owls	1 x 1 x 1	2 x 2 x 2	10 x 4 x 3
Large owls	1 x 1 x 1	2 x 2 x 2	25 x 5 x 5

stressful. Open plan flight aviaries constructed from loosely hung nylon mesh are preferable to wire mesh enclosures. Many organizations use vertical slatted enclosures, with a partially sealed roof. For the wildlife rescuer who is self-funded, this type of enclosure can be expensive, particularly if the recommended dimensions are followed. Nylon mesh is cheaper and serves the same purpose, but care must be taken to make the lower part of the enclosure predator proof.

If vegetation is to be added to the enclosure, make sure that fast-growing trees are kept pruned and flight paths within the aviary kept clear. I feel that this type of enclosure is perfect for the rehabilitation of a wide range of species–it can be planted to create secluded areas and shelter from rain, wind, and sun. A heavy mulch substrate will attract invertebrate life, providing small raptor species like kestrels an opportunity to forage naturally.

2.2.5 Perches

The odd log in an aviary is not necessarily the ideal perching arrangement. Factors such as the bird's size, the size of its feet, and its ability to fly competently should determine the number of perches and the height at which they are placed. Natural branches are obviously ideal, but it is equally as important to offer the bird a variety of perches with different surface textures and diameters, similar to those found in its wild environment. Covering even the natural perches with strips of cocofiber matting from old door mats, or with astroturf, and ensuring that the bird's talons cannot encircle the perch, will prevent the development of foot complaints.

Newly introduced raptors that are still unable to fly comfortably will not be able to reach high perches unless "runners" are placed up to them. Even in these situations it is wise not to place the perches too high off the ground. An eagle that has just been introduced to a large enclosure and is still a bit stiff, can land very badly and possibly sustain further injury if it takes off from a height. High perches are always sought after the birds have recovered sufficiently to use them, so make these comfortable and sheltered from the elements.

2.2.6 Water access

Raptors do drink and bathe, so it is important to supply a pond for this purpose. A dish with steep sides is not always suitable. A fiberglass pool or a permanent concrete pond of no more than 12 in. (300 mm) deep at the deepest point would suit a variety of raptors. The bird should be able to wade in to a depth where it feels comfortable–about 4 in. (100 mm) of water for small falcons, but as eagles and vultures require more, make the pond versatile by using a design that has a varying depth of 4–12 in. (100–300 mm).

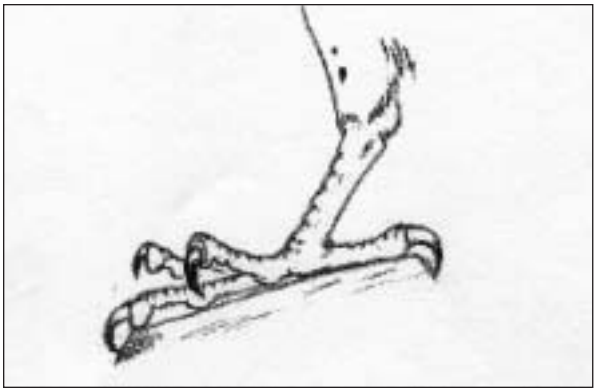

Figure 2.2.5a A flat surface for a perch is not healthy during long periods of inactivity.

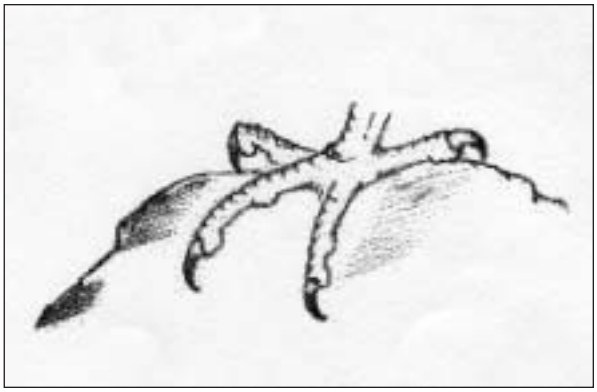

Figure 2.2.5b A perch surface that has a variable texture is by far more comfortable.

2.3 Enclosure Construction

2.3.1 Materials

Using wire mesh in the construction of any rehabilitation aviary is a recipe for disaster. Nervous, fast-flying hawks, if placed in an aviary made from wire mesh, will quickly damage feathers and ceres. Additionally, existing problems such as a lack of basic flight competence will be exacerbated. In short, wire mesh can kill raptors.

The options in terms of what to use when building a flight aviary are limited. Loosely hung nylon mesh, or wooden slats placed vertically, will limit or eliminate any potential damage to the bird within the aviary. It is possible to construct large, 160 ft. (50 m) aviaries using 1 in. (24 mm) nylon mesh, and then build or place shelters within the enclosure.

2.3.2 Predator proofing

Raptors are not immune to attack by other predators. Cats, dogs, coyotes, raccoons, genets, baboons, and large reptiles will not pass up the chance to eat a raptor that is obviously confined. Other raptors, such as the large owls, will also kill and eat smaller captive raptors. Having secure and sheltered areas in the aviary will assist in keeping the cage-bound bird out of reach from marauding eagle-owls or great horned owls, which is another reason for not placing the perches too close to a mesh roof or sides.

For protection against mammalian predators, it is important to secure the perimeter of the flight enclosure with a wire mesh fence, and to bury at least 24 in. (600 mm) of mesh under the ground. This really should be done even if the aviary is made up of vertical slats. Uneaten food left in an aviary will attract other carnivores, therefore careful attention to basic cleanliness is of the utmost importance.

2.3.3 Wind breaks

There can be nothing more miserable for the captive raptor than being left in an aviary open to the elements, without shelter. Wild raptors can choose either to seek shelter when desired, or sit in the rain. Captive raptors should be provided with the same options, allowing them to perch in or out of the rain or sun. Constructing shelters within the aviary is one solution; building half or a quarter of the aviary in the form of a semi-enclosed and roofed-over pen is another. One should take into account the prevailing wind, and situate the aviary in such a position that at least some of the pen is sheltered. The same applies to sunlight. The midday sun in some parts of the world is ruthless–providing shade, and the option of seeking shade, is not only wise but humane.

2.3.4 Other considerations and complications

Not all injuries require long term captive management. The less time a raptor spends in captivity the better, for no matter how well one manages injured birds, there is always the risk of causing additional damage. Some raptors do not cope well at all with being confined, and will inevitably damage or break feathers, which will ultimately inhibit flight, especially in the large direct attacking falcons. They are difficult to condition to pen life, and alternative housing and conditioning through falconry techniques are often required. Severe feather damage will make the raptor totally unreleasable until a full molt has taken place. Certain injuries that involve a joint, or joints, in the wing often end up with the wing becoming permanently shortened. This type of complication or extension deficit will affect fast-flying, high wing-loaded birds more than those with a low wing-loading, and this has

much to do with hunting and flight style.

The decision to retain a raptor in captivity for rehabilitation will depend upon the time it has to spend recovering from injuries.

a) If a raptor has spent a recovery time for minor injuries of less than 21 days in captivity and has within that time fully recovered from any injury, it can be released immediately, provided it has met all the pre-release checks (section 2.4.9).
b) If a raptor has spent more than 21 days in captivity, but less than 30 days, and has recovered from any injuries, it can be liberated, but care should be taken when making this decision. Factors which should be taken into account include the bird's age and species, its foraging experience, and its ability to perform the pertinent hunting strategies.
c) If a raptor has spent more than 30 days in captivity, its flight ability should be assessed in an aviary. Flight training may be necessary.

2.4 Choosing the Right Rehabilitation Method

Choosing the correct method of rehabilitation is crucial for any rehabilitator. In order to make the proper decision, the rehabilitator should understand the foraging and attacking strategies of individual species of raptors. Refer to earlier tables 1.1.2 and 1.1.3 in Chapter 1.

In some cases it is vital that the bird undergoing rehabilitation be allowed to carry out a range of natural foraging strategies. The raptor may need to learn how to forage, and, although assisting a hawk or falcon to kill its prey is acceptable, too much assistance in the search component can be counter-productive. Techniques whereby the hawk is allowed and encouraged to perform the attack component can be misleading as a method of establishing overall foraging competence, unless careful attention is also paid to foraging ability.

Ultimately, the bird should always be assessed on its ability to forage using its own repertoire of techniques; for example a large falcon undergoing rehabilitation may have been successful at still-hunting before it was injured, therefore, it should not be considered deficient, or forced into finding its prey by using one particular strategy, such as a stoop. Once again, let me stress the importance of considering the specific raptor, its species, inate characteristics, sex, age, past life experiences, and the nature of its injury, and then planning a rehabilitation strategy that will achieve the goal of survival.

2.4.1 The small falcons

The small bird-eating falcons can be rehabilitated from an aviary, in much the same way as small falcons that have a more generalist approach to foraging. Large flight pens around 80 ft. (25 m) in length are good for rehabilitation. If the injury is not serious and the falcon has recovered fully within twenty-one days, then immediate release is possible.

There are exceptions to this rule. Some small falcons, such as the merlin, the Australian little falcon, or the red-necked falcon, that have been injured before attaining a reasonable level of foraging proficiency, should be offered a chance to prove their proficiency, either by tame hacking or free flight

under controlled conditions. This will allow the rehabilitator to assess both flight competence and total foraging ability, as well as allowing the bird to gain additional experience. Of course, the rehabilitator needs to consider the amount of time he has available and the number of birds he has in care, as well as his access to flying areas, and any local wildlife regulations that might apply. Sometimes aviary exercise, either forced or encouraged, is the only option available.

The loss of an eye will affect the typical attackers more than it will the typical searchers, and critical evaluation will be necessary if the small falcon is one of the former. Remember that the loss of an eye will eliminate all binocular vision. In familiar surroundings this may not be clearly apparent, but in novel hunting situations the bird will be handicapped. Tame hacking or flight training will provide an opportunity to evaluate the bird's performance in unfamiliar surroundings. Kestrels that typically perch and search will be much less handicapped, and their proficiency can be evaluated within a large enclosure. If the enclosure substrate consists of leaf litter or a heavy mulch and is partially open to the elements, kestrels can forage for insects that have been introduced or that occur naturally within the substrate.

Orphans should be hacked in groups. A single orphan may be tame hacked, but ideally it should be passed on to another rehabilitator with birds of a similar age. Traditional hacking is the ideal method of reintroducing uninjured orphans to their natural habitat, i.e., orphans that do not require rehabilitation.

2.4.2 Large falcons

Large falcons are more problematic in terms of choosing viable and effective rehabilitation methods:

a) Juveniles, no history of independence: Tame hack.
b) Juveniles, proven history of independence, recovery within three weeks: Release immediately.
c) Adults, recovery within three weeks: Release immediately.
d) Juveniles, history of independence, long-term injury, compromised flight: Flight training.
e) Adults, history of independence, long-term injury, compromised flight: Flight training or extensive aviary exercise.

Many of the large falcons (weighing between 600–2000 grams) are typical attackers. They have some searching tendencies, particularly within their first year, when they have longer and more pliable primary and tail feathers. Even so, this should not diminish the importance of overall foraging and flight competence.

One of the biggest factors influencing the method of rehabilitation for large, heavy-bodied falcons is time and space. The average peregrine needs a great deal of air space in which to exercise and hunt, a sports oval being the minimum requirement. If, in addition, the bird needs a chance to prove foraging efficiency, then the availability of suitable prey species is another complication. Adult falcons and juveniles that have proven foraging ability can be rehabilitated from a large enclosure and then simply released in the appropriate area at the right time, always taking into account the time of year and whether or not the bird is on passage (migrating).

Falcons or other raptors that are injured during migration, and then subsequently held up because of injury, will be in a difficult position if released six weeks later. In this case it is often worth contacting rehabilitators at the other end of the falcon's migration route and then shipping the bird there for rehabilitation or release. Alternatively, the bird can be held over and then released the following season, but this is generally not a desirable option as

the bird will then be out of condition. Any large falcon that is injured and forced to rest for four to five weeks, or longer, ideally should be actively flown using traditional falconry methods or variations thereof. As mentioned previously, time and space can be limiting factors; those who cannot manage the task should give the bird to someone who is willing and capable.

It is also vital to look at the injury and its effects on the bird, and determine what is needed to bring the bird back to normal physical health. The loss of an eye is a serious problem for any large falcon. It is possible to allow some latitude for adult females, but for adult males who are placed under incredible hunting pressures during the breeding season, there can be no latitude when considering release.

Wing extension deficits, or the shortening of a wing as a result of an injury or inadequate treatment, will make release impossible. Missing toes, particularly the hind toe on one or both feet, will also limit hunting efficiency, but this can be evaluated through periods of tame hack. When evaluating a juvenile's hunting proficiency, one must always remember to take into account its age, as it may fail to kill through inexperience, which can be exacerbated by the loss of a digit.

Traditional hacking in the case of orphan sibling groups is a good way of reintroduction to the wild, but the area for hacking must be chosen carefully.

2.4.3 The owls

Owls are comparatively easy to rehabilitate, the only method available being aviary exercise. The large eagle-owls will need to be assessed for full flight capabilities either by forced flight within an enclosure or by using a creance. It is not worth spending time trying to condition owls that are parent-reared. Any form of falconry method or basic positive reinforcement techniques will fail. Aviary exercise is the only option for owls, large or small. Traditional hacking for sibling groups (orphans) is the best method of reintroduction.

2.4.4 The harriers

Harriers are typical searchers and, as their methods are not physically taxing, aviary exercise or creance work will be sufficient for all harrier species. Creance flying is a good method of ascertaining flight competence, but care needs to be taken because harriers have long legs; sudden jerks to halt a flying harrier can result in broken legs.

Any eye damage will need to be assessed, as a missing eye will handicap even a harrier, although not to the same extent as it would a goshawk or a large falcon. Loss of wing extension is also a less severe handicap in the harriers. Due to their low wing-loading, any loss of extension, within reason, can be compensated for rather easily.

Most harriers do not do well in large open aviaries; they tend to avoid perches, preferring to sit on the ground. For this reason it is advisable to ensure that any flight enclosure provides some cover, such as tussocks of grass. Some harriers are migratory, so if any bird is held over for treatment during migration, it should not be released out of season. Sibling groups can be traditionally hacked using a domed wire cage placed on the ground in the appropriate area. The dome can be removed just prior to fledging, and food placed near the artificial nest on a daily basis.

2.4.5 The true hawks

Accipiters are problematic in a captive situation. They are often thought of as being nervous, highly strung, neurotic, and generally unmanageable. Much of their behavior stems from their foraging methods. They are ambush specialists and often spend their days in dense or closed canopy woodlands; being exposed invariably makes them uncomfortable. They have a quick reaction time and will

respond to any visual or audio stimulus with a flurry of activity, leading to the assumption that they are nervous and highly strung.

True hawks are sprint specialists and their attack strategies, while appearing to be simple and straightforward, are extremely complicated. The sprint from a perch is triggered either by a movement below or ahead of them, or by watching prey species feeding close by. Search strategies are also complex. Waiting in ambush relies upon a good likelihood that prey will appear, and the site selection for an ambush is far from random, particularly with adult goshawks.

The injured hawk, either juvenile or adult, will need special care in all the treatment phases. Let me stress that any repeated capture and restraint, such as is required when using a forced exercise regime, will invariably result in well-established fear responses. This will make the use of any flight training or falconry methods virtually impossible in the future. The true hawk that needs overall rehabilitation to improve flight ability or fitness is best left in a large "sealed" enclosure, such as a room equipped with shelf perches or wall-mounted bow perches to which the bird is tethered. Flight conditioning along a corridor proves of little value with a hawk, as it will take a long time to condition the bird to repeat the desired behavior. Accipiters do not do well in large, exposed aviaries.

The choices for rehabilitation are simple and should follow the rules set for large falcons:

a) Juveniles, no history of independence: Tame hack.
b) Juveniles, proven history of independence, recovery within three weeks: Release immediately.
c) Adults, recovery within three weeks: Release immediately.
d) Juveniles, history of independence, long-term injury, compromised flight: Flight training.
e) Adults, history of independence, long-term injury, compromised flight: Flight training or extensive aviary exercise.

If the rehabilitator selects flight training/falconry methods and the hawk needs to be assessed for a range of abilities, additional care must be taken. One should make sure that flight training sets out to achieve certain objectives. If the bird needs fitness enhancement, then develop fitness by means of vertical flights or a dragged lure. If the hawk needs time to experiment with foraging, then fly it in an area where there is a good prey base that offers a variety of situations and opportunities. It is vital to observe the bird and then assess its progress. Success is based upon the raptor's ability to forage competently without undue assistance from the rehabilitator. Traditional hacking can also be used with the true hawks, but once again, choose the correct habitat for the placement of the hack box.

2.4.6 The buzzards, or broad-winged hawks

The buzzards comprise a varied group of raptors, extending from the Americas to Asia. They are all searchers, have a varied prey base, and as a result they are quite common and therefore frequently admitted as patients to raptor rehabilitation centers. All methods of rehabilitation work well with the buzzards. They can be flown using falconry methods, but they can also be rehabilitated from large aviaries or conditioned to fly set exercise courses along a corridor. Orphans can be hacked efficiently in sibling groups. The red-tailed hawk, or buzzard, often used by falconers, is a frequent patient at many bird of prey centers. Therefore, if one ends up with a single orphan, it often isn't difficult to find someone who has a group, or at least a falconer who could assist in tame hacking or even flying the bird for the first few months

before it is released. Migratory species are more difficult, but once again, it is wise to follow simple rules regarding when and where to release.

2.4.7 The large and small eagles

The golden eagle is probably the best known of the large eagles in Europe, and also occurs in North America, where the bald eagle is better-known and more frequently encountered. Injuries to eagles vary from gunshot wounds to fractures caused by collision, trap wounds, and many more obscure ailments. Poisoning is another comparatively common problem. In Australia, the wedge-tailed eagle is a frequent patient at many small rehabilitation centers. The steppe eagle, tawny eagle, and Wahlberg's eagle are commonly encountered in Africa and Europe. The hawk-eagles (small eagles) are less frequently admitted for treatment or care, but they should be treated like an eagle, even though some small species behave like true hawks.

Most eagles are searchers that are capable of killing large prey items; some are also opportunistic feeders, especially when they are juveniles or sub-adults, or if they live in colder climates, and will scavenge for carrion which provides a good source of food. Bald eagles prefer to feed on the carcasses of fish, game, or cattle, and many golden eagles will feed upon dead deer. Invariably there will be times when carrion is scarce or not available, so competition for food is fierce. Tawny eagles in Africa have to contend with five species of vulture, and at certain times of the year they have to compete with a number of migrant eagles, such as the steppe eagle, small spotted eagle, greater spotted eagle, and the bateleur. An eagle should never be released with the expectation that it can survive on carrion—it must be able to hunt its prey successfully. The exception here are juvenile bald eagles that only gain adequate flying and hunting skills after a season of haggling over fish carcasses. they must be released at times of abundant food such as fish spawns.

Injuries need to be assessed critically and all factors, such as the bird's age, sex, and the nature of the injury, need to be taken into account before setting and implementing rehabilitation strategies. Eagles are best left in large enclosures, either slatted or constructed from nylon mesh. An eagle needs at least 160 ft. (50 m) of aviary length to fly properly; this is vital if the injury has caused major loss of wing mobility. A bird with minor injuries that have not caused any major loss of fitness or basic flying ability can be left in a smaller enclosure, then flown on a creance for assessment. Flight training eagles is difficult and flight training using falconry methods is time-consuming, but if it is warranted, and one has the time and is dealing with a single eagle or a small number of patients, then by all means these techniques should be employed.

Single orphans (most orphaned eagles are single) are very difficult indeed. Eagles have a long dependency period and tame hacking an orphaned eagle is a long process, as the hack area can only be used for that one bird. Fostering to a wild nest is an option, particularly if the wild pair has a similar aged chick or failed to produce offspring. Traditional hacking is another option, but the effectiveness is often reduced because of the long period of dependency. Tame hacking, despite its drawbacks in terms of time and effort, is by far the best option for orphaned eagles. This method has been widely used in North America to reestablish the bald eagle. However, great care must be taken to ensure that the young eagles do not become accustomed to man and later seek out humans for food.

2.4.8 The vultures

The vultures are the easiest raptors to rehabilitate. Flight competence is the most important

requirement for an injured vulture. For this reason, large enclosures are important. Orphaned vultures can be fostered or hacked. Some vultures have a complex social structure and assimilation into wild groups is important for natural development. Hack sites should be placed near areas where wild vultures roost.

2.4.9 Release requirements

Before being returned to the wild, the rehabilitated raptor must meet the following requirements:

a) The bird should be in perfect feather condition, with no broken or missing feathers other than those that have been naturally molted out.
b) The bird should be able to negotiate the full length of the flight pen in level flight regularly without becoming exhausted.
c) The bird must be able to use both legs, and must have perfect vision.
d) The bird must be physically fit and at maximum weight for its species and sex.
e) The bird should not display any behavioral problems, imbalances, shaking, fits, etc.

2.5 Rehabilitation techniques

What can one do to rehabilitate a raptor and yet take into account the rehabilitator's personal restrictions, such as time, space and expertise?

Common sense and a knowledge of what is required of the raptor in the wild should answer this question. If one does not have proper facilities available for the bird he is holding, or is for any reason unable to devote the time and energy required to provide adequate care, then the bird in question should be passed on to someone who has the appropriate housing and can make the necessary commitment to its full recovery.

Rehabilitation methods or techniques should be chosen that take into account the bird's sex, age, and species, as well as type of injury and any additional problems that may have ensued. There are dozens of scenarios that could face the rehabilitator, but a logical approach is the best. If one takes a moment to reflect on what he can and cannot do in terms of preparation for release, he will be in a position to make informed decisions before taking action.

Rehabilitation entails more than the basic care and treatment of injuries, followed by release; it implies, and requires, the proper conditioning and preparation of the bird for release after it has been restored to health. One should never forget that a predator must be able to both find and hunt its food efficiently. Life in the wild involves constant risk, and the raptor must be adequately prepared if it is to survive after release. The rehabilitator needs to assess each bird's situation and adopt the most suitable rehabilitation techniques. The following categories may serve as a guide.

2.5.1 Juveniles — dependent

Juveniles that have never reached independence, including nestlings and fledglings that have been injured or orphaned do not have full flight competence and its development will be retarded. On full recovery from an injury, the orphaned raptor will still have to contend with a lack of fitness, lack of total flight ability, and lack of foraging competence.

Objectives: a) Develop flight competence.
b) Develop foraging strategies and hunting technique competence.
c) Develop physical fitness.

2.5.2 Juveniles — some experience

Juveniles that have a history of independence, but due to injury have lost all fitness and flight ability.

Objectives: a) Improve physical fitness.
b) Improve flight competence.
c) Assess foraging ability in the areas of search and attack.

2.5.3 Adults — experienced

Adults that have suffered an injury and have lost basic fitness and flight competence already understand their search and attack strategies.

Objectives: a) Improve physical fitness.
b) Improve flight competence.

2.6 Review of injuries, consequences, and options

Many injuries, if left untreated, will result in the raptor becoming unreleasable; even untreated minor injuries can lead to major complications later. In order to put the rehabilitation process into perspective, it is worth listing all the variables that can complicate the process. In tables 2.6.1 and 2.6.2, some simple injuries and their resultant consequences are outlined. With each injury there is the possibility of complications that can exacerbate the original problem.

Table 2.6.1 Injuries and their consequences (Richard Naisbitt)

Species	Injury/other	Recovery time	Loss of fitness	Loss of flight ability	Rehab Method
Large (bird-eating) falcon					
	Head trauma	10 days	No	No	Aviary exercise
	Soft tissue damage	10 - 21 days	No	Yes	Aviary exercise
	Leg fracture	3 - 6 weeks	Yes	No	Aviary exercise/ Flight training
	Wing fracture	3 - 6 weeks	Yes	Yes	Aviary exercise/ Flight training
	Coracoid fracture	3 - 6 weeks	Yes	Yes	Aviary exercise/ Flight training
	Gross featherdamage	3 - 12 months			Aviary exercise/ Flight training
	Starvation	21 days	No	No	Aviary exercise/ Flight training
	Orphaned	N/A			Hacking/Tame hacking/Fostering

Species	Injury/other	Recovery time	Loss of fitness	Loss of flight ability	Rehab Method
Small (bird eating) falcon					
	Head trauma	10 days	No	No	Aviary exercise
	Soft tissue damage	10 - 21 days	No	No	Aviary exercise
	Leg fracture	3 - 6 weeks	Yes	No	Aviary exercise/ Flight training
	Wing fracture	3 - 6 weeks	Yes	Yes	Aviary exercise/ Flight training
	Gross feather damage	3 - 12 months	Yes	Yes	Aviary exercise/ Flight training
	Starvation	21 days	No	No	Aviary exercise/ Flight training
	Orphaned	N/A	N/A	N/A	Hacking/Tame hacking/Fostering
Small (insect eating) falcon					
	Head trauma	10 days	No	No	Aviary exercise
	Soft tissue damage	10 - 21 days	No	No	Aviary exercise
	Leg fracture	3 - 6 weeks	Yes	No	Aviary exercise
	Wing fracture	3 - 6 weeks	Yes	Yes	Aviary exercise
	Gross feather damage	3 - 12 months	Yes	Yes	Aviary exercise
	Starvation	21 days	No	No	Aviary exercise
	Orphaned	N/A	N/A	N/A	Hacking/Tame hacking/Fostering
True hawks (Goshawks and sparrow hawks)					
	Head trauma	10 days	No	No	Aviary exercise
	Soft tissue damage	10 - 21 days	Marginal	Yes	Aviary exercise
	Leg fracture	3 - 6 weeks	Yes	No	Aviary exercise/ Flight training
	Wing fracture	3 - 6 weeks	Yes	Yes	Aviary exercise/ Flight training
	Coracoid fracture	3 - 6 weeks	Yes	Yes	Aviary exercise/ Flight training
	Gross feather damage	3 - 12 months	Yes	Yes	Aviary exercise/ Flight training
	Starvation	21 days	No	No	Aviary exercise/ Flight training
	Orphaned	N/A	No	No	Hacking/Tame hacking/ Fostering
Buzzards/Harriers (Large and small)					
	Head trauma	10 days	No	No	Aviary exercise
	Soft tissue damage	10 - 21 days	No	No	Aviary exercise
	Leg fracture	3 - 6 weeks	Yes	No	Aviary exercise
	Wing fracture	3 - 6 weeks	Yes	Yes	Aviary exercise/ Flight training
	Gross feather damage	3 - 12 months	Yes	Yes	Aviary exercise/ Flight training
	Starvation	21 days	No	No	Aviary exercise
	Orphaned	N/A	N/A	N/A	Hacking/Tame hacking/Fostering

Species	Injury/other	Recovery time	Loss of fitness	Loss of flight ability	Rehab Method
Large eagles (Including fishing and snake eagles)					
	Head trauma	10 - 21 days	No	No	Aviary exercise
	Soft tissue damage	10 - 21 days	No	No	Aviary exercise
	Leg fracture	3 - 6 weeks	Yes	No	Aviary exercise/ Flight training*
	Wing fracture	3 - 6 weeks	Yes	Yes	Aviary exercise/ Flight training
	Gross feather damage	3 - 12 months	Yes	Yes	Aviary exercise/ Flight training
	Starvation	21 days	No	No	Aviary exercise
	Orphaned	N/A	N/A	N/A	Hacking/Tame hacking/Fostering
Small eagles (Hawk eagles and booted eagles)					
	Head trauma	10 days	No	No	Aviary exercise/ assessment/release
	Soft tissue damage	10 - 21 days	No	Yes	Aviary exercise and release
	Leg fracture	3 - 6 weeks	Yes	No	Aviary exercise/ Flight training
	Wing fracture	3 - 6 weeks	Yes	Yes	Aviary exercise/ Flight training
	Gross feather damage	3 - 12 months	Yes	Yes	Aviary exercise/ Flight training
	Starvation	21 days	No	No	Aviary exercise/ Flight training
	Orphaned	N/A	N/A	N/A	Hacking/Tame hacking/Fostering
Vultures (New and old world)					
	Head trauma	10 days	No	No	Aviary exercise
	Soft tissue damage	10 - 21 days	No	No	Aviary exercise
	Leg fracture	3 - 6 weeks	Yes	No	Aviary exercise
	Wing fracture	3 - 6 weeks	Yes	Yes	Aviary exercise
	Gross feather damage	3 - 12 months	Yes	Yes	Aviary exercise
	Starvation	21 days	No	No	Aviary exercise
	Orphaned	N/A	N/A	N/A	Hacking
Large and small owls (Horned to Scops owls)					
	Head trauma	10 days	No	No	Release post aviary assessment
	Soft tissue damage	10 - 21 days	No	Yes	Aviary exercise and release
	Leg fracture	3 - 6 weeks	Yes	No	
	Wing fracture	3 - 6 weeks	Yes	Yes	Aviary exercise and release
	Gross feather damage	3 - 12 months	Yes	Yes	Aviary exercise and release
	Starvation	21 days	Yes	Yes	Aviary assessment and release
	Orphaned	N/A	N/A	N/A	Hacking/Fostering

Table 2.6.2 Primary and secondary problems

Primary Injury	Secondary complications	Release viability	Exceptions
Head trauma	Eye damage/mandible damage	Poor	None
Soft tissue damage	Feather damage/Patagium contraction	Poor	Vultures/Harriers
Leg fracture	Bumble foot/Digit loss	Poor	Vultures
Wing fracture (Ulna/Radius/Humerus)	Wing extension deficit/ Feather damage	Poor	Vultures/Harriers
Coracoid fracture	Asymmetry	Poor	Vultures/Harriers
Gross feather damage	Follicle damage	Poor	None
Starvation	-	-	
Orphaned	Imprinting	Poor	None

2.7 Aviary exercise (forced exercise)

Many rehabilitators are confined to basic rehabilitation methods, for example forced exercising of the bird within an aviary. This generally involves forcing the bird to fly up and down the length of the enclosure. Forced exercise, if conducted correctly, can achieve basic flight competence and lead to improved levels of fitness. For some species that have simple foraging strategies, this type of exercise may be adequate for rehabilitation.

Forced exercising must be conducted in a suitable enclosure. The larger the aviary the better, as it will be more versatile. Both large and small raptors do well in spacious aviaries. A large raptor should never be placed in a small aviary. The use of small enclosures, such as secondary care enclosures, for this purpose is not recommended, particularly for large raptors weighing over 500 grams. The length of these pens does not allow a raptor to gain enough speed to glide and thus land safely. Most of the birds forced to exercise in these enclosures run the risk of damaging feet and feathers.

From the rehabilitator's point of view, the enclosure must be large enough to be able to accurately assess the bird's fitness and flight ability. Only after making an initial assessment can an effective exercise program be developed. A well-formulated program should have targets set throughout that will assist the raptor in gradually improving its flight ability and stamina. The final goal is to have a bird that is flight competent and can maintain its fitness levels. It will then be prepared for release into the wild.

Fitness is maintained by regular exercise, and by a regular and constant food intake that is above what is required for basic body maintenance. In simple terms, if a raptor expends a certain number of calories in capturing prey, then it needs to replace those calories. If it constantly runs at a deficit, then it cannot

maintain its lifestyle and cannot build and maintain fitness. Raptors that have been forced to rest due to injury invariably become unfit, despite having a constant food intake. Such loss of fitness is caused by lack of activity and is no different to that experienced by inactive human beings, or animals in captivity which are not exercised regularly.

2.7.1 General recommendations

A. For small raptors

Phase one: Preliminary (forced) flight exercise (introduction to the flight aviary)
- Aviary size: 80 ft. (25 m) length
- Number of flights per day: 5
- Total distance flown: 400 ft. (125 m) per day
- Duration: 10 days

Phase two: Secondary flight exercise
- Aviary size: 80 ft. (25 m) length
- Number of flights per day: 10
- Total distance flown: 800 ft. (250 m) per day
- Duration: 10 days

Phase three: Tertiary flight exercise
- Aviary size: 80 ft. (25 m) length
- Number of flights per day: 20
- Total distance flown: 1600 ft. (500 m) per day
- Duration: 10 days

B. For large raptors

Phase one: Preliminary (forced) flight exercise (introduction to the flight aviary)
- Aviary size: 165 ft. (50 m) length
- Number of flights per day: 5
- Total distance flown: 825 ft. (250 m) per day
- Duration: 10 days

Phase two: Secondary flight exercise
- Aviary size: 165 ft. (50 m) length
- Number of flights per day: 10
- Total distance flown: 1650 ft. (500 m) per day
- Duration: 10 days

Phase three: Tertiary flight exercise
- Aviary size: 165 ft. (50 m) length
- Number of flights per day: 30
- Total distance flown: 4950 ft. (1500 m) per day
- Duration: 10 days

If the raptor can complete the set number of flights in phase three with ease, then release can take place immediately. However, in the majority of cases, a newly recovered raptor will be unable to complete even the lowest number of flights without obvious signs of exhaustion.

Each bird's progress should be carefully monitored and properly recorded. A bird should not be forced to fly if it cannot manage the lowest number of repetitions (phase one), as shown in Table 2.7.2. It should be kept in mind that on very hot days the raptor will not be able to complete the set number of forced flights; its inability to do so under such circumstances should not always be regarded as an indication of a flight impairment.

The bird's fitness will improve with repeated exercise. The best indications of progress are the relative ease with which it manages the exercises and the length of time it takes to recover from the exertion. Recovery after exercise can be determined by visible indicators, such as the raptor's posture, the position of its wings, and whether or not it is gaping. During hot weather all raptors will try to cool down by gular fluttering (gaping).

An indication of the progress raptors should make when put through the same flight exercises with an increase in the number of flights per day (phase two) is shown in table 2.7.3. Careful monitoring of birds during this phase of training will give some indication as to whether or not they can be moved directly to the next stage (phase three), shown in table 2.7.4.

It must be pointed out that in all these stages factors such as flight symmetry, buoyancy, and landing ability should be carefully noted.

The fact that the bird is confined by the boundaries of the aviary should be taken into account, as it may be difficult to establish the raptor's overall maneuverability.

To sum up, let me say that the forced exercising of a bird in an aviary is a good option for some species under certain circumstances. It is suitable for searchers that have a simple foraging strategy and do not need to be actively trained (conditioned) and flown. It can also be used with attackers that have had a minor injury that can be addressed using an aviary. In all cases the aviary should be the correct size and constructed with suitable, safe materials. Forced exercise is risky, if not dangerous, if the aviary is constructed from wire mesh. Collision with the mesh is inevitable, and often disastrous. In an ideal world, this type of flight would take place in a long sealed corridor with perches at both ends.

Many rehabilitators are confined to using an aviary for a variety of species and circumstances, either because of financial constraints, lack of experience with other methods, or general philosophical beliefs. In the event a rehabilitator is presented with a seriously injured attacker requiring more sophisticated rehabilitation, then flight training is a better option.

C. Species specific recommendations

Table 2.7.2 Phase one aviary exercise routines

Species*	Flights expected	Flights completed	Recovery time	Repeat
Peregrine**	5	2	20 minutes	No
Peregrine**	5	4	15 minutes	No
Peregrine **	5	5	15 minutes	No
Goshawk	5	5	17 minutes	No
Large Eagle	5	2	20 minutes	No
Kestrel	5	3	10 minutes	No
Small falcon	5	5	7 minutes	No
Small falcon	5	2	12 minutes	No

* Raptors recovered from fractured Ulna.
Recovery time — when respiration returned to normal (Lactic acid levels are also a good indicator).
** Same bird within the 10 day period

Table 2.7.3 Phase two exercise routines

Species	Flights expected	Flights completed	Recovery time	Repeat
Peregrine	10	10	10 minutes	No
Peregrine	10	10	10 minutes	No
Peregrine	10	10	10 minutes	No
Goshawk	10	9	12 minutes	No
Eagle	10	8	14 minutes	Yes
Kestrel	10	10	6 minutes	No
Small falcon	10	10	5 minutes	No

Table 2.7.4 Phase three exercise regimes for specific species.

Species	Flights expected	Flights completed	Recovery time	Repeat.
Peregrine	20	20	10 minutes	No
Peregrine	20	20	10 minutes	No
Peregrine	20	20	10 minutes	No
Brown goshawk	20	27	12 minutes	No
Wedge-tailed eagle	20	19	10 minutes	No
Australian kestrel	20	20	-*	No
Little falcon	20	20	-*	No
Little falcon	20	20	-*	No

* No recovery time noted.
** No accurate temperatures taken.

2.7.5 Flight training (encouraged exercise)

Flight training (see chapter 6, Training methods) is perhaps an inappropriate term to use for encouraged flight exercise. The connotations of the word training, for some rehabilitators, are often shocking, for they include weight reductions, possible imprinting, and obvious taming, which could be detrimental to the ultimate survival of the raptor involved. It is, however, possible to use certain minimum conditioning processes to encourage rather than force flight.

Before looking at the training process, two types of exercise which are effective in improving overall fitness and basic flight competence are worth discussing; these are vertical flight and corridor flying. Once again, the rehabilitator should consider the bird in question and decide whether it needs extensive flight training. A raptor can take time to condition; behaviors have to be set and food consumption controlled. It may be better in some cases to use a forced exercise regime, particularly when simple flight assessment is the only requirement.

A. Vertical flight

Many falconers and rehabilitators use vertical flight as an exercise, but it is important to remember these points:

1. Raptors (particularly goshawks) can jump quite high, so the vertical flight should be a flight as opposed to a mere jump with a quick wing-flap.
2. The angle at which the bird flies to a perch or glove should not be too steep (30 degrees is good).
3. Approximately 10 ft. (3 m) from a perch to the gloved hand or to a perch with food, is a good height for this exercise.
4. The exercises should gradually be build up from a small number of flights, say ten in one session, to a higher number as the bird improves in general physical condition.

A variation of vertical flight is gradient flight. This is perhaps self-explanatory, as the raptor is encouraged to fly at a 45 degree angle to a point where the food is located. The flight down is also good exercise, as the bird really has to back beat to slow down and land. This works well for large eagles.

B. Corridor flying

Many large rehabilitation centers use this type of exercise for eagles and buzzards. The flight distance is generally about 80–160 ft. (25–50 m). The exercise takes place within an enclosed corridor with perches at both ends. The raptor is encouraged to fly from end to end for a small food reward. This can also be a forced exercise regime and may be appropriate if large numbers of birds are being dealt with, or when the injury is minor and the expected recovery time is short.

C. Creance flying

Evaluating flight can be achieved in an open field by using a creance or safety line. Jesses or anklets and a swivel are attached to the bird's tarsi. A length of nylon cord, 5 mm in diameter, at least 650 ft. (200 m) long is then tied onto the swivel or directly to the jesses. The free end of the line is tied to a piece of wood, which will act as a drag and should weigh no less than 50% of the bird's total weight. Two people are needed for this operation. One person holds the line near the drag while the other releases the bird into the wind. It is vital that the person holding the line runs as the bird flies and gently drags it down when required. The line should never be tied to a solid object.

Evaluation of the raptor's flight ability can take place on the spot, or by using a video camera. This process can be repeated a number of times, however, this method should be avoided on very hot days. It is important to undertake this process only in an open area entirely clear of trees, fences, and power lines. Sports fields are perfect for this exercise.

While both vertical flight and corridor flying can be useful in assessing a bird's basic flight competence, these exercises offer no indication of its foraging ability. In the rehabilitation context, flight competence and fitness is useless unless it exists in conjunction with foraging competence. In order to catch prey, a raptor must be physically and mentally fit. A raptor that is fit and bt has no foraging experience will be at a serious disadvantage when it is forced to compete on equal terms with raptors that have all three survival pre-requisites.

2.8 Dealing with Orphaned Raptors

Raptors are orphaned for a variety of reasons: owls that have left the nest-hollow or wandered away from the nest are often found by well-meaning passers-by and passed on to rehabilitators; nest collapse or the loss of parents is another cause for raptor chicks becoming orphaned.

The objective of artificially rearing young orphaned raptors is to see them through the development stage and then through to eventual release and final dispersal. Rearing raptors for demonstration purposes does not differ, although in this case it is often desirable to socially imprint the individuals. Creche rearing, or rearing groups of chicks together, whether siblings or otherwise, is preferable to rearing individuals in isolation. Group rearing can also be done in an aviary when broods of orphans are being dealt with. It is a good idea to house unreleasable adult and juvenile birds next door to the chicks, as this allows some social development to take place.

Very few wildlife rehabilitators have to deal with raptors that are less than ten days old.

Illustration: Elizabeth Darby

From this age onward, most young raptors can be encouraged to self-feed from a bowl of chopped meat. It is unfortunate that many hand-reared raptors become behaviorally isolated and unreleasable. Such imprinting can be avoided if care is taken, but realistically, it is virtually impossible to hand rear raptors less than ten days old in total isolation from others with a reasonable expectation of normal development unless the chick is prevented from seeing humans and only fed by a puppet.

Raptors develop in stages. From hatching to the appearance of the first down the young bird needs to be brooded by the female almost constantly to keep warm. As size increases, the second down appears and helps in self-insulation. Later in this stage the young are often too big to be brooded by the female. The second down coincides with the emergence of primary and tail feathers, referred to as "pins."

Fledging is not the first true flight, as many raptor species leave the nest well before they can fly. They simply outgrow the nest and move off into surrounding branches or rocks, depending on the type of nest site. Many species are still fully dependent on their parents well after their first flight, and only attain independence as their flight and foraging skills develop. The period from fledging to full independence can take as little as three weeks in some small species to as much as six months in the large species. Table 2.8.1 shows the development of different species of raptor chicks.

Table 2.8.1. Raptor chick development, fledging to independence.

Species	First down	Second down	First flight	Independence*	Reference
Peregrine falcon	4 days	14 days	40 days	75–90 days	1, 2
Hobby	4 days	14 days	35 days	70–80 days	1, 2
Kestrel	4 days	9 days	30 days	21 days	1, 2
Goshawk	3–4 days	12 days	26–31 days	21–35 days	1, 2
Bald eagle	0–10 days	10+ days	80–90 days	180 days	3
True eagle	10 days	21 days	70 days	180 days	1, 2
Buzzard	10 days	21 days	50–60 days	150 days	1, 2

* Days to independence after first flight.

References.

1. Handbook of Australian, New Zealand and Antarctic Birds, Vol.2.
2. Birds of prey of Southern Africa, Peter Steyn.
3. David Hancock, personal correspondence.

It is always a good idea to identify what species you are dealing with and determine the chick's age. There are various methods in practice that will allow you to ascertain the bird's age if the wing pins (feathers) are showing. These formulas were derived by measuring the wing chords (the measurement from the carpal joint to the tip of the longest primary feather) of birds of known age at various stages in their development. The measurements for certain species are shown in table 2.8.2. While this might seem totally irrelevant in terms of hand raising, it should be of great assistance when it comes to the hacking process (see this chapter). Many orphaned raptors are picked up during the second part of their development, when the primary feathers are half-developed.

Where specific comparative data is not available the raptor rehabilitator should keep such growth records and publish them for future comparisons.

Table 2.8.2 Ascertaining age in days. Specific examples.

Species	Wing chord/ age in days	Wing chord/ age in days	Wing chord/ age in days	References
Brown goshawk	11.4 cm / 17 days	17.5 cm / 25 days	25.5 cm / 37 days	1, 2, 3
Sparrowhawk	11.4 cm / 18 days	17.5 cm / 27 days	25.5 cm / 40 days	1, 2, 3
Peregrine	13.0 cm / 20 days	16.0 cm / 24 days	25.0 cm / 37 days	1, 2, 3
Australian hobby	13.0 cm / 22 days	16.0 cm / 27 days	25.0 cm / 41 days	1, 2, 3
Brown falcon	13.0 cm / 20 days	16.0 cm / 24 days	25.0 cm / 37 days	1, 2, 3
Booted eagle	13.0 cm / 24 days	16.0 cm / 29 days	25.0 cm / 43 days	1, 2, 3
Whistling kite	13.0 cm / 26 days	16.0 cm / 30 days	25.0 cm / 44 days	1, 2, 3

References 1. *Handbook of Australian, New Zealand & Antarctic Birds.*
2. Olsen, P.D. & J. Olsen. 1981. *Raptor Research* 15: 53–57.
3. Healesville Sanctuary Raptor Rehabilitation Program. *Unpublished Data.*

Raptors grow quickly. In most cases, just before they fledge they have attained, or exceeded, adult weight. During the development period, food quality is crucial and periods between feeds should be short. In the wild, young peregrine falcons up to a week old are fed, on average, once every hour. The time between feeds increases as the chicks grow. Begging actions from the chicks will evoke a feeding response from the parent; if the chick doesn't beg, the parent will not feed it. When the young are very small, the female may vocalize and try to solicit a begging response. Young falcons will sit up and beg quite loudly; on the other hand, young hawks need to be stimulated to feed and are more likely to lunge at the food. Feeding with sharp forceps is dangerous, particularly if the young hawk is a lunger. Blunting the ends of the forceps or using blunt wooden tongs will reduce the risk of eye damage to young chicks.

2.8.3 So what is needed to rear a young raptor?

1. A brooder box (a box that is thermostatically controlled).
2. A set of accurate scales (electronic with a graduation of one gram or less).
3. Blunt-ended forceps.
4. A supply of fresh food.
5. Feeder seclusion, or the use of puppets to reduce imprinting on humans.

The brooder box should be kept at a temperature of 30C (86F) for the first 10 days. This temperature can be gradually reduced as the chick starts to self-regulate its body temperature. In the wild, the second down insulates the chicks when the female cannot brood them. The chicks themselves are excellent indicators of whether or not they are too hot or too cold; if they are too warm, they will sprawl, and if too cold, they will huddle.

Each chick should be weighed before and after each feed, as this will give you an indication of 1) the weight increment, and 2) the amount of food eaten per meal.

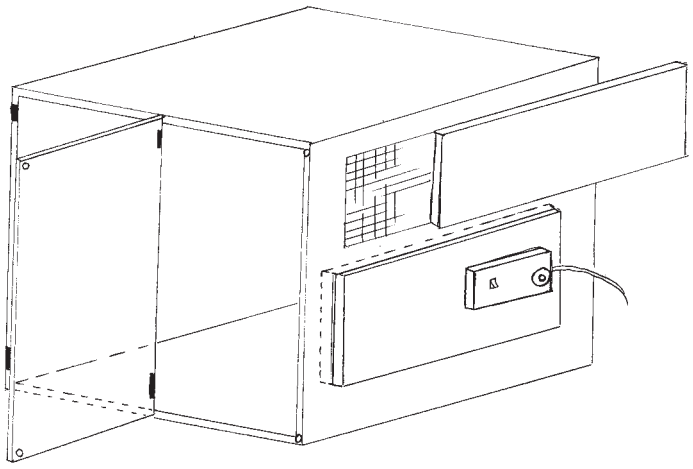

Figure 2.8.3 Brooder box.

2.9 Preparing the Food

Food preparation is important. Do not re-use food that has not been eaten and do not re-freeze uneaten food. Take out enough for one meal and make sure it is at room temperature before feeding. Food should be prepared as follows:

2.9.1 Chicks aged 1–10 days

A. Rat and mouse preparation.

1. Skin the rodent and remove the head, feet, tail and intestines.
2. Mince the body using a mincing machine or a mallet; make sure it is finely crushed.
3. Prepare enough food for the day.

B. Feeding regime: feed every two hours. This is a rough guide; only feed if the gut or crop is partially or totally empty.

2.9.2 Chicks aged 10–15 days

A. Rat and mouse preparation.

1. Skin the rodent, remove the head, tail and intestines.
2. Chop up the animal, not too finely.
3. Make sure the portions are not too big.

B. Feeding regime: feed every four hours. Again, this is a rough guide; only offer feed when the gut or crop is empty or partially so.

At this age the chicks should be able to feed from a bowl. Falcon chicks are easily taught to self-feed. Not only does this save time and allow them some independence, but prevents the development of any strong association between humans and food.

2.9.3 Chicks aged 15–25 days and eagle chicks to fledging

A. Whole food can be provided.

1. Skinned and gutted rodents.
2. Plucked quail, opened to expose the meat.

B. Feeding regime: feed ad-lib; preferably leave food for the whole day and replace it when necessary.

At this stage, make sure that each chick is getting its fair share of food. Offer the last feed at sunset.

2.10 Behavioral Development

The behavior of a raptor is partially innate (the black-breasted buzzard knows how to break eggs with a rock), partially imprinted, and partially learned.

Instinctive behavior includes search methods and reproductive behavior, and to some extent, the fear of certain species. As examples, falcons generally react adversely to true hawks, such as goshawks, and many raptors will react to owls.

Imprinted behavior includes identification of parents and siblings, and fear responses; young birds are also imprinted on the type of nesting site used by the species. Imprint behaviors are learned almost automatically when the developing chick is subjected to specific stimuli at specific times in its development.

Learned behavior is more complex. What sounds mean food and when to expect food through visual cues are all learned. Screaming for food is an example. In the wild state, young raptors learn how to recognize potential danger and intruders at the nest: other species of raptor, and human beings. They learn how to respond to social cues and interact with siblings. The correct combination of all these behaviors will produce the ideal bird for release; the incorrect combination will not.

Behavioral traits learned during rearing are outlined in Table 2.10.1.

Table 2.10.1. Behavioral traits learned during rearing.

Wild parent-reared	Partially human-reared	Totally human-reared	References
Has fear response.	Partial fear response.	No fear response of humans.	1, 2
Recognizes own kind.	Responds to both human and own species.	Has abnormal fear response of own kind.	1, 2
Begs from own species.	Will beg from humans and own species *	No normal begging response to own species. Solicits food from humans.*	1, 2
Not aggressive toward humans	Shows some food-associated aggression	Treats humans as siblings/potential threat to food, is defensive over food.	1, 2
Courts own species	Courts both	Courts humans only	1, 2

*Screaming for food is often associated with imprinted behavior, but prior to becoming independent, a young raptor will scream for food regardless of its rearing.

References: 1. Nick Fox, *Understanding the Bird of Prey*, 1995.
2. Personal observations.

2.10.2 Crucial periods

Young raptors first imprint onto their parents and then their siblings. They develop a fear response to things that are not a part of their daily lives, for example intruders at the nest. The reaction of their parents to intruders or to objects that cause alarm will in turn reinforce their fear response. They learn how to socialize and therefore how to select and recognize future potential sexual partners. Finally, when they are free flying, they can develop an image of where they were born and thus recognize future nesting sites.

The crucial periods of the raptor's behavioral development are as follows:

1. Day 1–20 Parental imprinting.
2. Day 10–25 Sibling recognition or imprinting.

3. Day 10–25 Development of fear responses.
4. Day 20–45 Future sexual partner recognition.
5. Day 35–independence: Nest site recognition.

In summing up this section on rearing young raptors, the development period is just as important as food and food consumption.

The following should be remembered:

1. Pay attention to the age of the raptor; confirm the species.
2. Adhere to correct feeding regimes.
3. Provide the correct diet.
4. Keep accurate records.
5. Seek expert veterinary attention if problems arise.
6. Keep the chicks isolated as much as possible from seeing humans to reduce imprinting.

2.11 Re-introducing Orphaned Raptors

2.11.1 Traditional hacking.

Broods of young raptors can be traditionally hacked in a hack box. The purpose of this method is to allow a natural fledging process to take place. Groups of chicks will generally stick together until dispersal, and in the process they can learn the appropriate search and attack behaviors and all the social graces required for future pairings and socializing. Single orphans which are hacked are at a serious disadvantage in terms of social development; by not having a sibling group to interact with, they are likely to wander off well before they are ready. As a group, the orphans will keep in contact with each other, either vocally or visually. Anyone who has ever watched wild eagles or falcons and their fledged young will understand the importance of this cohesiveness.

It is important to place the orphans in the hack box at the right time in their physical development (see Section 2.7). It is vital that the young birds are self-feeding from a bowl well before they are placed in the hack box; once they are inside, food should be placed in the box twice per day. All the precautions to prevent any food/human associations from developing must be taken.

For small raptors, the dimensions of the hack box should be 3 ft. x 3 ft. x 3 ft. (1 m x 1 m x 1 m). The front should be slatted with vertical slats and open downward, in order to serve as a ledge when open. The box must be placed high enough off the ground to reduce the risk of mammalian predators gaining

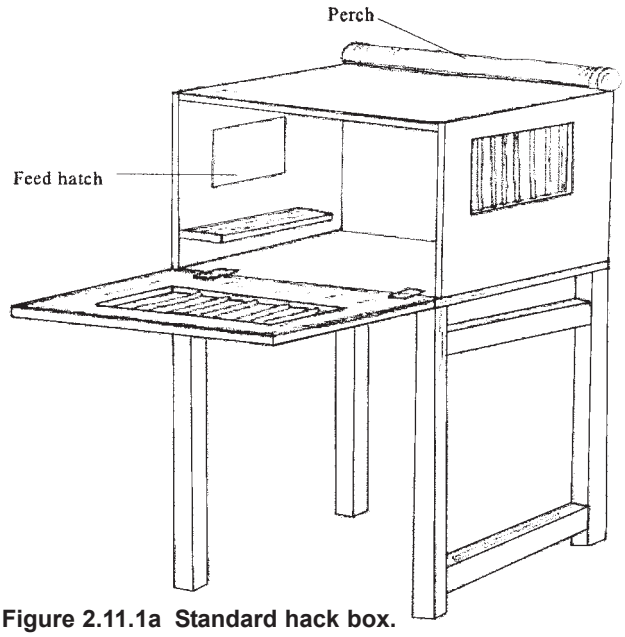

Figure 2.11.1a Standard hack box.

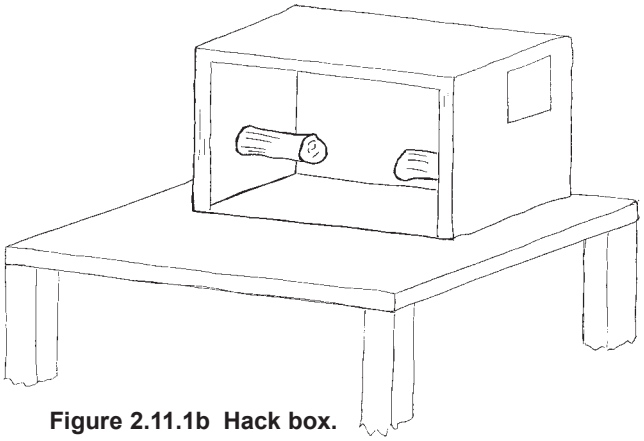

Figure 2.11.1b Hack box.

access once the door has been finally opened. The position and location must be chosen carefully for food availability and safety; it is madness to place a brood of orphaned peregrines in a hack box that is near a highway, power lines, or private pigeon lofts. Final dispersal of the birds will take place at varying times. Some species will become independent quite quickly, while others can take three months before they are totally self-sufficient.

For large raptors, the dimensions should be increased proportionally; a hack box measuring 6 ft. x 6 ft. x 6 ft. (2 m x 2 m x 2 m) should suffice.

A. Hacking from start to finish.

1. Ten day old orphaned kestrel chicks are checked for injuries; all seem fine.
2. Feeding regime is established.
3. Weight increment is steady.
4. Feathers start to appear and the orphans become more mobile.
5. The young birds are placed in the hack box and taken to the release site.
6. Enough food for all the birds is left.
7. A check is made the following morning; any food that has not been eaten is removed and new food is left.
8. Feeding and checks carry on until the chicks are close to twenty-five days old.
9. Food left in the box via a hatch and the door is opened as quietly as possible.
10. The first bird leaves the box for a quick exploratory flight; observations are kept up.
11. Two weeks have passed since the box was first opened. The chicks spend more and more time away from the box.
12. All the chicks have dispersed five weeks later.

B. What could go wrong with this process?

- If the box is not in a secure position, predators could easily gain access and kill the newly fledged raptors. Potential predators include avian, reptilian, and mammalian.
- Disturbance just after the box has been opened could result in premature fledging, with the young raptors dispersing in panic.
- If the box is placed in an area where there are other species of raptors breeding, then there is a risk of the young birds being predated upon.

To understand what traditional hacking is intended to achieve, one needs to be familiar with the whole process of fledging, and the subsequent achievement of independence and survival. Traditional hacking can only offer the chance of a natural fledge. Remember that the young birds will be dependent on supplementary food in the hack box for varying lengths of time. Large eagles and large falcons take a long time to gain independence, so the rehabilitator must be patient in waiting for their final dispersal. With traditional hacking there is no control over where the fledged raptors go, and unless they are being radio tracked with transmitters, their ultimate fate will be unknown. Traditional hacking is not recommended for single orphans; rather, such birds should be tame hacked, unless the situation arises where the rehabilitator has no other alternative.

2.11.2 Tame hacking

Tame hacking can be used to reintroduce single orphans to the wild, particularly if there are no other viable options for release, although, ideally, single orphans should be placed with other orphans of the same age and then traditionally hacked or fostered out to wild pairs that have offspring. The single orphan will need to be reared carefully to avoid imprinting to humans. This is difficult unless one has access to birds that are unreleasable, to which the young bird can be exposed in adjacent pens (see Section 2.8).

Tame hacking is a modified version of the traditional wild hack. It allows a great deal more control over the orphan in terms of when and where it is allowed to exercise. In choosing tame hack sites, one should follow the same rules used in selecting traditional hack sites. Avoid areas where human habitation is high or where there are highways close by. Eagles should not be hacked where there is a likelihood of them encountering livestock. It is also worth while to inform all the local residents that a raptor is being rehabilitated or reintroduced in the area. I recommend using transmitters on all tame hacked raptors, as it is then possible to follow their progress closely when they are not visible or when they have left the hack site.

Only one species at a time may be tame hacked in the same area; to tame hack three or four different species of birds, a separate site must be found for each. The whole process will be time consuming for one person. When a rehabilitator is confronted with this situation and has a number of orphans of varying species, he should consider each individually. Species with a simple search and attack strategy should be traditionally hacked, and those that have a more complex hunting method should be tame hacked. Single red-tailed hawk or common buzzard orphans can be traditionally hacked. This may not be ideal, but it is better than simply throwing them out. Large falcons need to be tame hacked. Eagles also benefit from tame hacking, although this is incredibly time consuming. Golden eagles need to be hacked well away from habitation.

The raptor should be introduced to the tame hacking release site well before it can fly; it can be fed at the site from a low block on the ground. An artificial nest can be placed in a tree crotch; an old tire covered with astroturf is ideal for this purpose. Late afternoon is the best time to start the orientation. Allow about

Figure 2.11.2a
Bald eagle chick reared for tame hacking being fed using a puppet to avoid imprinting to humans.
Photo: Sutton Research Center

Figure 2.11.2b Nine-week-old bald eagle chick.
Photo: David Hancock

sixty minutes for the initial sessions. First, place the orphan on the nest and let it look around. It can be fed either on a lure or by just leaving food on the nest. If introduced early, a lure is handy for falcons and eagles. A whistle will also help, as the bird can then be called to the rehaber later on in its training.

The time that the bird is allowed to spend at the release site should increase as flight potential increases. Start with a sixty minute session, just before sunset, and gradually increase to eighty minutes, and so on, by starting earlier in the day, until finally the bird is out all day. This process can take three to five weeks, and the rehabilitator can either spend the whole day at the site or simply leave and return later to check on or retrieve the bird. Transmitters are especially handy at this time. Once the raptor is flying well and is able to find a secure roosting area, it can be left out overnight. The rehabilitator should remember, however, to first check for the threat of any large owls in the vicinity.

The whole point of a tame hack is to allow some orientation to the release site and to give the rehabilitator a chance to monitor the bird's progress and to continue to supply food well after fledging, if required. A well-fed raptor at tame hack will still try to hunt and seek independence. I have had falcons at tame hack for nine weeks, after which they were not only aloof, but efficiently feeding themselves. One falcon still remains in the same area after four years and is now breeding there with another, more recently tame hacked bird.

A tame hacked bird does not need to be tethered or fitted with permanent jesses, but it will need to be fitted with a leg-mounted transmitter until the tail has fully emerged. Once the raptor is being left out overnight, it will become more aloof. If a tail-mounted transmitter has to be attached to replace the leg-mounted unit, the bird will need to be trapped and fitted with the new transmitter, and the leg-mounted one removed. As time progresses, the raptor will become less punctual; at times, it will not be at the site when the rehabilitator arrives. When this happens, it is useful to try to locate the bird; if this is not possible, one can simply wait until the next day and try again.

Dispersal normally takes place soon after independence has been attained, and this comes with self-sufficiency in terms of finding and catching food. With species that are migratory or nomadic, there is an urge to disperse as the season progresses from summer into autumn. For this reason, some raptors that have been injured before they reach full independence will actually be racing against time, or rather the rehabilitator will be, for the raptor will leave the hack site whether you are confident of its ability to survive or not.

Tame hacking can also be applied to individuals that have been injured after their first full flight, but before becoming fully independent, or to those that have had their foraging

competence reduced by injury. This works well with juveniles, but not so efficiently with adults that have been breeding or were breeding prior to injury. These adults will invariably disperse to their breeding territories as soon as they are liberated. Therefore, one should always make sure that an adult bird is competent before its total release.

Dealing with wild-fledged raptors, as opposed to captive-fledged, in the tame hack capacity will require the use of jesses, either removable clip-ons or anklets that are more permanent. This method of tame hack requires more contact between the bird and the rehabilitator. During exercise periods in the release area it is important to watch how the bird copes. The objective is to assess its flight competence and allow this to improve. Foraging ability and ultimate proficiency will come with time and effort. The bird needs to develop a full repertoire of search and attack strategies. At times it may be appropriate to assist the bird, always remembering that the bird at tame hack is not a falconry bird and will ultimately be released, and must therefore develop strategies without human intervention. If the raptor can succeed repeatedly in difficult circumstances, this will augur well for its future in the wild.

It is a good idea to compare the search and attack strategies used by the bird one is dealing with to those that have been recorded for that particular species in the wild. The typical waiting-on flight for a peregrine, a gyrfalcon, or saker falcon might be desirable for the falconer who wants to witness a spectacular stoop, but the falcon at hack may use less classical strategies which prove to be efficient in its circumstances. The bird must be allowed to experiment and learn. This will be to its ultimate advantage, and is also reassuring to the rehabilitator who observes the process.

Goshawks are slightly different. Their attack strategies are comparatively straightforward but prey selection is more complex. A direct attack from a perch is their standard approach when pursuing prey. One of the best methods for developing hunting skills in a goshawk is to let it follow you as you walk. In Africa, the chanting-goshawks often follow livestock or their herders, and in Australia, brown goshawks sometimes follow horseback riders in the hope of catching some prey animal that has been disturbed from cover.

Eagles are more problematic, and yet in some ways they are easier to tame hack than most other species. Tawny eagles, wedge-tailed eagles, steppe eagles, and golden eagles occasionally feed upon carrion, which can be easily found in some areas, although at certain times of the year carrion will be scarce. Thus there is still a need for the eagle to develop search and attack skills. Many eagle species have a long dependency period and will therefore require an extended tame hack–they need time to learn.

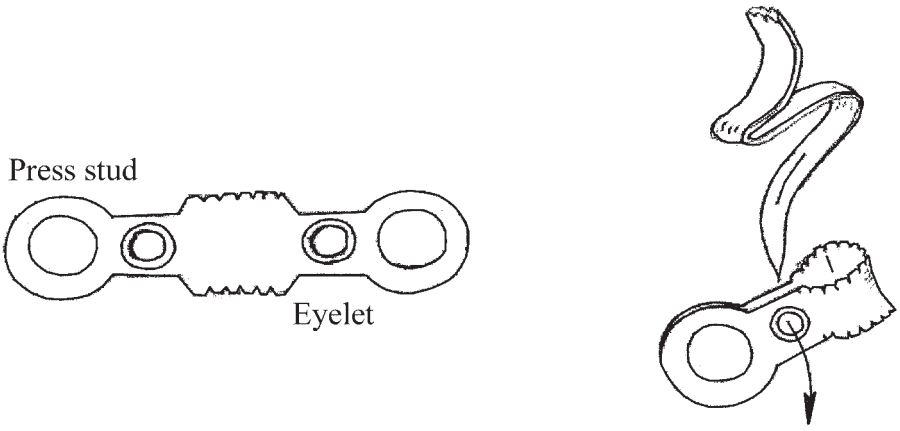

Figure 2.11.2c
Temporary anklets clipped on with a press stud.

Any species of bird can be tame hacked and many people carry out the process without really knowing or understanding what they are doing. The tame hack that involves a relative hands-off approach, as with pre-fledged raptors, will be time consuming; a more direct hands-on tame hack will be even more so. The rehabilitator must understand the whole process and think very carefully about what he is doing. If he is confined by time constraints, lack of release sites or legal restraints, then the bird should be passed on to a person who can devote both the time and energy required.

2.12 The Starving Raptor

The raptor rehabilitator is frequently confronted by the starving raptor; this could represent any species ranging from hawks and eagles to owls and falcons. The primary concern in these situations is that the raptor's general condition be improved, which can be achieved by care and feeding. Experience is a decided asset when dealing with raptors that are significantly malnourished, and it is particularly important here to have an idea of the correct weight for its sex, age, and species.

Raptors that are presented to the rehabilitator with no visible injuries, but which are severely emaciated, have had a problem either through parasite burdens or a simple inability to compete with others of the same species for a scarce food resource. A thorough examination should narrow down the cause of the starvation. A broad spectrum treatment for parasites should be administered to reduce that burden.

Winter is the time when the majority of raptors are found starving. More often than not they are juveniles facing the test of hunting on their own under difficult circumstances. Even though the bird may have been treated for parasite burdens, its inability to forage competently still remains. Adult birds, which have a wide repertoire of search and attack strategies, cope much better when their prey base is reduced; juveniles do not cope as well and often face starvation—in short, nature's adjustment of predators to fit the reduced food supply. In reality, there is a high juvenile mortality rate caused by starvation. A young goshawk or peregrine that is finding it difficult to meet its daily energy requirements will start to weaken, and the more hunting attempts it makes, the more energy it expends, until it no longer has the strength to fly. This becomes a vicious circle, inevitably ending in death if the bird is not subjected to rehabilitation.

Low prey populations pose something of a dilemma to the rehabilitator who is dealing with a starving raptor. Several options are available. The first is to feed the bird until it has attained maximum weight once again and then release it in an area where the prey base is adequate. The second option is to actively train and fly the bird, thus giving it some additional foraging experience. The third alternative is to hold it over until spring, when weather and food conditions improve, and then release it. The rehabilitator who has no experience in flight training techniques is limited to the first option, but the rehabilitator who can properly flight train a bird may choose either the second or third, depending upon the amount of time he can devote to the bird. Understanding these options is an important factor in the final decision, as it is often not practical for a rehabilitator to flight train every bird he receives.