Raptor Medicine and Case Management

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Abstract: The emphasis of this master class will be on the capture, handling, treatment, and captive care of birds of prey. Language and techniques that are unique to the case management of raptors in falconry, zoological collection, and wildlife rehabilitation settings will be discussed. The goal is to provide veterinarians with practical information and techniques that they can use to improve the medical outcomes of their raptor patients and enhance the quality of their veterinary-client-patient relationship.

Introduction

Man's fascination with raptors dates from the times recorded history first began. More recently, man's relationship with raptors has expanded into more specialized captive management of raptors for conservation, public educational programs, and for treatment and release of injured wild birds. Though all keeping of raptors essentially owes its roots to falconry, the specialized environments and goals of zoological and wildlife rehabilitation settings have added new techniques, language, and performance expectations into the world of captive raptor management.

Raptor Rehabilitation (Ford)

Overview

In the wildlife rehabilitation setting, the ultimate objective is to release injured birds back into the wild. If that cannot be accomplished, then humane euthanasia or placement in a constructive captive setting are the secondary outcomes. Accomplishing these goals in a manner consistent with the natural behaviors and habits for the species is also important as is use of the opportunities afforded to obtain scientific knowledge about the birds and to document the problems that cause them to require human assistance.

Trends in rehabilitation

The raptor rehabilitation setting is unique from falconry and zoological settings. Many rehabilitators also maintain captive, non-releasable birds of prey for presentation to the public. Often these birds are non-flighted and performance demands are not high, though some will have birds that are used in flighted demonstrations. Some rehabilitators also practice falconry or cooperate with falconers for the flight conditioning of birds prior to release. Because these 2 areas of rehabilitator activity are very similar to those in the zoological or falconry setting, the reader is directed to those areas of this manuscript.

Among the raptor rehabilitation community, there has been steady change in attitudes and practices. In North America, there has been a shift from multitudes of small, private wildlife centers towards fewer, larger, more

publicly-interactive centers. Wildlife rehabilitation ethics have also trended towards decreased human-animal interaction and this message has also been more clearly related to the public. There has also been increased humane euthanasia of non-releasable or non-native animals, particularly during high patient volumes or when there is question of quality of life for the animal in captivity. Captive habitat enrichment and more awareness to the psychological, social, and nutritional needs of patients have also increased. Some organizations will, as an alternative to euthanizing non-native wild birds, "farm" them out to volunteers with particular talents or interests in those species (eg, pigeon rescuers, persons keeping pet starlings, etc). Increasingly, the desire is to save as many as animals as possible without sacrificing high quality and while maintaining the animals as "wild." Much of this change is due to an increase in the general knowledge level of rehabilitators and better appreciation for the detrimental effects of anthropomorphization. Emerging networks such as the International Wildlife Rehabilitators Council (IWRC), National Wildlife Rehabilitators Association (NWRA), and many other regional and state-level organizations have played a vital role in "raising the bar." These organizations offer conferences, publications, training seminars, and certification programs and participate in changes in government regulations. The trend is towards a tiered certification system which may one day be a requirement for rehabilitation licensure in some states. Already, state and federal governments have simplified portions of their regulatory codes by simply referring to minimum standards documents produced by the IWRC and NWRA.[1]

Regulations

Federal and state permits are required for long-term care of wild birds. Most of the time, the rehabilitator will be more familiar with the regulations than the veterinarian and their input on medical decisions will be very important. It also behooves the veterinarian to have a copy of regulations on-hand to refer to. Federal regulations CFR50 Parts 17, 21, and 22 cover rehabilitation activities and possession of migratory birds. The following are some helpful internet links concerning the most recent regulations for wildlife rehabilitation:

Regulations Library (access to all United States Fish and Wildlife Service [USFWS] regulations):
http://www.access.gpo.gov/cgi-bin/cfrassemble.cgi?title=199850

2003 Regulation Amendments (specific to migratory bird permits, including rehabilitation):
http://www.fws.gov/policy/library/03-26823.pdf

General Application Information:
http://www.fws.gov/pacific/migratorybirds/special_purpose_rehabilitation_permits.htm

Federal Offices Directory:
http://offices.fws.gov

State Wildlife Trustee Offices:
http://www.fws.gov/offices/statelinks.html

In gaining licensure for wildlife rehabilitation, a state permit is sought first because the federal Special Use Rehabilitation Permit application requires letters of reference from state wildlife trustees. State permits often require testing of the individual's knowledge as well as inspection of facilities. *There are exceptions to federal regulations specifically for veterinarians so that temporary care does not require a permit* (50CFR 21.12(d)). As of 2003, veterinarians can possess wild birds, including endangered or migratory birds, for treatment but must transfer them to a rehabilitator within 24 hours after considered stable. The possession of endangered or threatened migratory birds must be reported to a regional USFWS Ecological Services Office within 24 hours. Also, if a rehabilitator cannot be located, the veterinarian must contact a Regional Bird Permit Office within 24 hours. The

rules allow for euthanasia as deemed necessary by the veterinarian. Records must be kept of any deaths (euthanized or spontaneous) of *all* migratory birds for up to 5 years.

Federal and state regulations contain some treatment limits. For instance, amputation of a foot or of a wing proximal to the elbow is generally not allowed and euthanasia is mandated for those birds. Exceptions can be arranged with regional permit offices but require a good reason and pre-arrangement of a permanent placement situation.

State permits will vary but the USFWS provides 4 different types of permits to rehabilitators. In 2003, the need for additional federal migratory/endangered bird permits or for special eagle permits was eliminated. Permits are generally issued to a specific person versus an organization.

Special Purpose Rehabilitation: This USFWS permit allows capture and possession of injured or ill wildlife for medical treatment, physical conditioning, and release. The permit may stipulate specific species, numbers of individual animals, and varying special permissions (eg, permission for postmortem examination or keeping live birds longer than usually allowed). Sub-permittees, such as volunteers, are allowed so that the primary rehabilitator does not always have to be present. Such persons should have a copy of the permit when performing activities away from the rehabilitation facility (eg, rescues or trips to the veterinarian). Three veterinarians are listed on the permit, including a primary and two secondary veterinarians. Some veterinarians may wish to be listed as either a veterinarian on the permit or as a subpermittee and should have a copy of the rehabilitator's permit on hand.

Special Purpose - Education and Possession (Live): This USFWS permit allows the keeping of wildlife for static display or performance for the public in efforts of wildlife education. The permit generally lists the individual animals.

Special Purpose - Education and Possession (Dead): This USFWS permit covers the possession of dead birds or artifacts (eg, skulls, feathers, eggs, nests) for educational uses.

Special Purpose Salvage: This USFWS permit allows the salvage of parts of birds for education or medical purposes (such as collection of feathers for imping).

Other permits: Some organizations will need health certificates if they travel with their birds out of state. In addition to a health certificate, many destination states also require an importation permit for wildlife. The state veterinarian or wildlife trustee agency (eg, department of fish and game) of the destination can assist in determining if this is necessary.

Code of ethics for treatment

In addition to understanding regulatory limitations, it is important for a veterinarian participating with a rehabilitation organization to understand the group's internal code of ethics. For instance, some organizations may not allow treatment of non-native species and will opt to euthanize birds such as starlings (*Sturnus vulgaris*), English sparrows (*Passer domesticus*), or common pigeons (*Columba livia*). In addition, some organizations have ethical codes which exceed federal and state mandates. An example is that some do not favor the keeping of non-releasable birds at all. For example, instead of opting for a metacarpal amputation, which would render most birds unreleasable but still able to live well in captivity, some organizations require euthanasia.

Stress/behavior

Minimization of stress is extremely important for wild raptors in captivity. Stress can be expressed in different ways by different species. Stress in some species, such as an accipiter, will be more obvious as they jump or flap repetitively in their cage. Other species, such as many owls, may appear to be sleepy or stoic in response.

Raptors under stress may refuse to eat. Variations are probably due to lifestyle (eg, owls tend to blend into their habitat during the day rather than immediately flee), so a good knowledge of the normal haunts and habits of the birds being treated is helpful. Consider the following priorities in managing stress:

Limit vision: Raptors are extremely vision-oriented. Unlike the case in parrots, covering the eyes of a raptor is very calming. Likewise, the front of a cage can be covered with a sheet or towel to eliminate visual threats or irresistible escape routes. A hood is extremely useful and can be purchased complete or as a kit from a falconry supply company (eg, www.northwoodsfalconry.com). A towel, sock, or self-adherent bandage material (Vetrap, 3M, St. Paul, MN, USA) may also suffice. Make sure that the bird can open its mouth to pant or cast if necessary.

Captive raptors should be kept in a quiet, predator-free area: Sounds and sites of perceived predators, including people, should not be a part of their environment. This is a challenge in typical veterinary clinics that attend to dogs and cats.[2] Isolation wards or storage rooms may be appropriate. Even if a wild bird is not visibly reacting to noise, it can still be stressed.

Length of confinement should be limited: Close confinement can be beneficial during transport and the most critical phases of initial treatment. However, prolonged inactivity or hyperactivity can result in bumblefoot, carpal abrasions, and cere abrasions. Captive stress is also recognized as a predisposing factor for aspergillosis, particularly in certain higher-risk species of raptors such as gyrfalcons (*Falco rusticolus*), golden eagles (*Aquila chrysaetos*), osprey (*Pandion haliaetus*), goshawks (*Accipiter gentilis*), rough-legged hawks (*Buteo lagopus*) and red-tailed hawks (*Buteo jamaicensis*).[3] For most veterinary situations where raptor-appropriate housing is not available, it will be best to contact a rehabilitator as soon as possible for transfer.

This author has a somewhat arbitrary system for classifying degrees of stress, which can be useful for training staff or volunteers. This is presented in Table 1.

Table 1. Stress levels in captive raptors during human encounters.

Stress level:	Mild	Moderate	Severe[a]
Situations:	Human Presence	Capture/Restraint	Prolonged Capture/Restraint
Behavioral responses:	• Vocalizations, beak clicking, hissing • Erect feathers (defensive) or depressed feathers (fear)[b] • Defecation • Postural changes (putting both feet on perch, turning to face you)	• Quick head movements • Bobbing or swinging the head with eyes fixed on a perch or window, as if gauging range: implies preparation for flight • Flying or running • Dilated pupils	• Frantic fighting or fleeing, crashing directly into walls, perches, and people. • Dilated pupils
Physiologic consequences:	• Imperceptably increased vital signs	• Increased heart rate and ventilation rate • Hyperthermia (panting, hot face and feet, drooling)	• Extreme tachycardia and tachypnea with panting • Capture myopathy (exertional rhabdomyelitis) is possible with prolonged severe stress
Appropriate action:	• Prepare everything before entering enclosure • Move slowly and smoothly during capture • Avoid direct eye contact • Avoid noise and heat in enclosure	• Limit vision • Check comfort and fit of hood • Eliminate noise • Cool bird (ventilation, mist face/feet) • Finish work quickly	• Stop capture attempt or restraint and let bird calm down in the enclosure

[a] Extreme or prolonged severe stress can lead to arrhythmias, seizures, overheating, and death.
[b] HINT: This can be an important cue as to how the bird may respond to your capture attempts.

Housing and furniture

Specific criteria for wildlife enclosures are available in Minimum Standards for Wildlife Rehabilitation.[1] Raptor enclosures should have smooth walls to prevent wing abrasion, a shock-absorbent inorganic substrate on the floor, and furniture that does not have any sharp corners or projections. In addition, if towels are used as substrate, the towels must not have any loose threads as some birds can become entangled to the point of injury. Any enclosures must have excellent ventilation to prevent respiratory disease. Ease of cleaning helps immensely. In some situations, furniture and flooring can be switched out quickly and cleaned outside of the enclosure to minimize stress to the patient.

For short-term treatment (eg, less than a week), there are 2 types of enclosures to consider having for wildlife treatment. First, a critical care enclosure will be necessary for moribund patients. Intensive care unit cages made for small animals work well, but a large plastic or rubber storage box can suffice. Holes should be drilled in the sides and lid for ventilation. These boxes are inexpensive and can be thoroughly and easily cleaned between patients. The box can be placed on a heating pad or warm-water blanket or placed in a warm isolation room. Care should be taken to ensure that there are no portions of the box that reach extreme temperatures, which could result in burns or overheating.

The second type of enclosure is big enough to allow perching and some movement for eating, preening, and stretching, but not enough room for flight. Pet travel carriers generally work well for this. Windows in the sides, front, and back will need to be covered. Newspaper, Astroturf, or, for patients that are still not standing, a thick layer of shredded paper can be used for substrate. Wood chips or straw should not be used as bedding due to the tendency for fungal growth.

For prolonged convalescent care (longer than a week), it is desirable to have a small mew that will accommodate a block or bow perch on the ground and allow access to a bathing pan and food. The bird should be able to extend its wings completely in any direction. The sides cannot be made of wire or mesh and must be smooth and forgiving to prevent injuries to feathers and carpi. The floor should be shock-absorbent to prevent injuries to talons and feet if the bird repeatedly jumps and strikes the floor. Dog runs are generally not suitable if they have concrete floors and chain-link doors or walls. Pea-gravel or outdoor carpeting make good substrates. Walls can be covered in sheets of lightweight plastic board (eg, Corrugated plastic, Coraplast, Dallas, TX, USA), roof membrane (eg, Carlisle SynTec, Carlisle, PA, USA), or other slick, non-porous material. For large birds, the author has found that roof membrane hung on stand-offs from the top of the wall (eg, so that it hangs like a curtain 1–2 inches from the wall) makes an excellent padded wall that is easy to clean.

Furniture should not have sharp corners. Perch types and coverings will vary from species to species. Generally, falcons should be provided with blocks or ledges with highly textured coverings (eg, long-leaf Astroturf, Astroturf, Dalton, GA, USA). Most other raptors should have round perches covered with rope, outdoor carpeting, Astroturf, Vetrap, or natural branches. Usually, higher texturing is preferred but in situations where multiple perches are provided, a variety of textures and diameters is ultimately preferable. In critical care cages, there may be no perching provided and the birds will perch on towels or Astroturf. In small recovery cages, a single perch may be provided. This may be a perch attached across the bottom of a kennel or, for small falcons, a block perch. In convalescent cages, a single perch is usually provided. For falcons, this will be a block perch and for others it will be an appropriately sized bow perch. For birds that may have difficulty perching (such as those with bandaged feet), a large block perch, such as a short log stood on-end and covered in Astroturf, may be provided instead. For longer stays, it is good to have perches of varying diameter and texture which can be switched out on alternate days. For raptors that cannot exercise regularly, it is critical to provide varied textures and diameters of perches and to ensure that the perches are dry and clean.

Tethering is sometimes used for captive raptors. It can be particularly useful for weathering. This author does not recommend this practice unless the caretaker has received training and is very familiar with its use (eg, is a falconer). There are many potential complications with tethering and its use is beyond the scope of this section of this master class.

Criteria for movement of a bird into a larger mew or into a flight enclosure will vary from species to species and with the injuries being treated. As a general rule, once a raptor is standing well, eating without assistance, perching well, and does not need to be captured frequently for treatments, it is probably ready to go into a larger enclosure. As an intermediate step, a mew with low perching can be utilized if height restriction is required (eg,

birds in the early stages of orthopedic healing) or if frequent capture is still necessary. As the patient demonstrates increased activity and a desire and ability to reach higher perches, perching can be added or the bird can be moved into a flight enclosure. Ambulation and flight, access to natural light, opportunities for bathing, and the ability to gain a higher viewpoint are probably very helpful in diminishing stress and improving well-being for a raptor. In addition to addressing stress, movement is also important for maintaining the integrity of the skin of the feet and flexibility of joints and condition of muscles.

Diet

Logically, the type of meat offered in captivity should simulate the diet in the wild. For falcons, this will generally be bird meat such as quail, chicks, or duck. Because of the lack of calcification in the bones of chicks, it is not recommended to feed them exclusively for long periods of time. For birds in very small enclosures (eg, kennels or hospital caging) or with bandages on one or both feet, it is advisable to remove the skin and feathers/fur from prey, and to provide it in easily manipulated chunks. Buteos and accipiters should be offered a variety of avian and mammalian prey such as quail, chicks, rats, mice, and rabbit. Bald eagles can also be offered fish. Ospreys are almost exclusively piscivorous. Supplementation with a daily vitamin supplement, (Vitahawk, D.B. Scientific, Oakley, CA, USA) is advisable, particularly when feeding gutted or de-boned prey or when feeding thawed frozen fish. Sedentary birds of prey at indoor temperatures can quickly become obese, which will increase the potential for bumblefoot and other complications. Likewise, increased activity level, the commencement of molt, or movement of the bird to a colder ambient temperature will increase metabolic demands and cause body weight to decrease more rapidly, so be aware that a diet adjustment may be required.

Husbandry

Raptors produce an abundance of urates because their diet is high in protein. In addition, feces tend to be very pasty and sticky and hawks and eagles tend to forcefully eject their droppings horizontally. Add to that the bits of entrails and other portions of prey and you quickly have a husbandry challenge. As mentioned earlier, the ability to remove furniture and floor covering can minimize patient stress and also allows more thorough daily cleaning. It is not advisable to apply chlorinated bleach products directly to quantities of urates as this will produce a very noxious fume (essentially, an ammonia-compound and bleach chemical interaction). Washing with a detergent such as dish soap, Simple Green, or a quaternary ammonia product will yield good results. Items should be rinsed and dried thoroughly before reintroduction into the enclosure.

Dehydration/inanition

Often, admitted birds of prey are dehydrated and emaciated, depending upon how quickly they are rescued. Careful restoration of fluids and initiation of alimentation are important during their first 24–48 hours in veterinary care. Crop stasis and autointoxication can occur if hydration is not restored before high demands are placed upon the gastrointestinal tract. In this syndrome, the crop and stomach contents move too slowly (or not at all) and anaerobic bacterial flora proliferate. At the extreme, endotoxins production and metabolic acidosis occurs and results in death. There are many excellent writings on the subject of critical care and the reader is directed to these.[2,4–11] In general, parenteral fluids are given at the rate of half the deficit plus maintenance fluids for the first 24 hours, the remainder of the deficit plus daily maintenance for the following 48 hours. An estimate of 10% dehydration usually suffices for most situations though this should be increased for birds in extremely poor condition. Subcutaneous is the most frequently used route, but this may not be adequate in emaciated birds whose osmotic pressure is too low (eg, a total serum solids less then 2.0 mg/dl). In those cases, intravenous or intraosseous administration should be considered and use of whole blood transfusions, polymerized hemoglobin products (Oxyglobin [hemoglobin glutamer-200, bovine)], Biopur, Cambridge, MA, USA), or colloids such as hetastarch

should be considered. This author generally uses hetastarch in the face of hypoproteinemia when anemia is not present and prefers to use blood transfusions when anemia is present and a same-genus donor is available. Blood transfusion is described by Huckabee.[2]

During the first 12–24 hours, an easily-digested high protein, high-fat liquid diet is gavaged. There are numerous recipes for these diets (and rehabilitators often have their favorite), involving vitamin powders, clean meat, and electrolyte solutions blended to a slurry. There are also commercial alternatives such as Oxbow Carnivore Care (Oxbow Enterprises, Murdock, NE, USA). Over-the-counter non-caffeinated human nutritional drinks can be utilized in the absence of other veterinary alternatives (eg, Ensure, Abbot Laboratories, North Chicago, IL, USA). Once gastrointestinal tract function is confirmed, small amounts of clean meat are introduced and increased gradually. Finally, the transition is made to chunked and whole prey. For birds that refuse to eat, B-vitamin at 10 mg/kg may be useful but often reduction of stress and presentation of the food in a familiar manner is sufficient (eg, floating fresh, whole, small fish in water for piscivorous species).[12]

Birds of Prey in Zoological Collections (Chitty)

While there are some great similarities in the keeping of raptors, there are certain special points in relation to the zoological collection. In particular there may be differences in:

- Species being kept. In Europe, all zoos are required to demonstrate commitment to conservation, education, and research. Compare this to the falconer who keeps and flies birds based on their hunting function. For example, the secretary bird (*Sagittarius serpentarius*) or the European eagle owl (*Bubo bubo*) have little use in hunting, yet in flying demonstrations are often used to illustrate different forms of flight and hunting technique. Similarly the *Gyps* genus of Old World Vulture is equally useless for hunting, yet their captive propagation is essential for such threatened species and their presence provides an excellent educational message.

- Standards. All zoos are inspected and must come up to basic standards as laid out in the Secretary of State's Standards of Modern Zoo Practice (SSSMZP).[13] While it is unfair to criticize standards in private keeping and certainly unfair to brand all falconers the same, it is fair to say that many methods of keeping are based on tradition, and some may not bear up to public scrutiny.

- Seasonality. This is important for the collection veterinarian! In the UK, the hunting season is in the winter. Most injuries/illnesses occur when flying or when being manned/trained. Therefore hunting birds will usually be seen in the winter months, demonstration birds in the summer.

There will be many similarities in training of birds between a working/sporting falconer and an exhibition falconer. In both cases, the aim is to cue, control, and encourage natural behaviors. However, in the former case, the aim is to kill, in the latter case to educate others.

SSSMZP Guidelines

The following quotations are from the special guidance given in the SSSMZP, and the author is grateful to the Department for Environment Food and Rural Affairs (DEFRA) for permission to use them. The full document is downloadable from www.defra.gov.uk. Additional notes have been inserted by the author.

"8.7.1 Birds of Prey (Falconiformes and Strigiformes) are kept in a variety of ways and for a variety of reasons, These include:

- Aviaries, where birds enjoy relative freedom of movement, and are kept for display and or captive breeding.
- Demonstration birds, tethered or not, that are free flown regularly for the general public.
- Homing of the occasional permanently disabled wild bird, for educational or captive breeding purposes.
- Sick or injured wild birds, kept for treatment and rehabilitation.

8.7.2 Each of these categories of keeping brings with it particular requirements in terms of good management."

Aviaries and Species Selection

"8.7.3 Birds of prey kept in aviaries are generally managed in a similar way to other birds. Particular points to note are:

- Choice of species–Some species, such as accipiters, are by temperament less well suited to zoos. Their nature makes them very difficult to house and manage and they should only be kept in specialist collections."

This also affects choice of individuals–some accipiters will display well, others are fine when kept in seclusion aviaries and viewed through half-silvered mirrors. However, many are simply unsuitable.

Individuality is important in other species too–some Harris' hawks, a naturally sociable species, have proven unsuitable for demonstration flying in front of a crowd even when they have been excellent falconry birds.

Diet

"Food - Whole animal diets are needed, or meat that has been properly supplemented. No food type should be used exclusively. All birds of prey must have access to clean drinking and bathing water daily."

Some compromise may need to be made in the public viewing areas where it may be socially unacceptable for people to view the dismembering of a rodent or rabbit! In these cases, beef is much more acceptable but is, of course, not the ideal diet. Therefore limited feeding of beef is often used as the flying bird's reward with its main diet being given either behind-the-scenes or when the park is shut (in the latter case, uneaten carcasses, bones, etc must be removed prior to opening!)

"Aviary design. Enclosures should provide suitable vantage points for the species, as many raptors prefer to be up high. Perching should be appropriate for the species housed. Sizes should reflect the flying capabilities of the species. For example large vultures are unable to land lightly and so need enough space to land without causing injury. Most birds of prey are more settled in pens with at least one solid wall. Retreats may be necessary for more nervous individuals."

Again, a difference in the keeping of these birds. For a falconry bird that is being exercised regularly, it is not so important to have a large aviary. In the zoo it is a requirement that a bird must be able to "exhibit most natural behaviours." This includes flight! Also, in the zoo the public need good viewing whereas this is not such a prerequisite in a private aviary where seclusion for breeding may be more important.

"Mixing genera is rarely a good idea, and if done, should be managed with extreme care. Knowledge of the individual birds and experience in dealing with birds of prey in general is essential."

Demonstration Birds

"8.7.4 Tethering. Birds of prey kept as demonstration birds are subject to restraint by tethering for part of their lives, so that they can be free-flown for the public. Important considerations are:

- Flying–Birds that are tethered must be flown at least four times a week unless tethered for medical treatment. No bird should be tethered permanently. All birds should be given the opportunity to fly or move around freely during part of the year."

This is a major issue in UK falconry where there is a growing move away from tethering. However, some species do not appear to suffer when tethered and it is certainly easier to view and handle the bird – tethered birds are usually presented to the veterinarian in a much less advanced state of disease than the aviary bird.

- "Rest and Moulting–All collections should allow sufficient aviary space to rest working birds and allow them to moult.

- Birds not to be tethered–Owls and vultures, particularly the New World vultures should not be kept tethered. They can easily be trained to fly from pens and this is the preferred way to house them."

Exceptions are allowed for some owls as tethering may be needed to facilitate therapy. However, it would be expected that a decision to tether would only be made after consultation with the veterinarian and/or Ethical Review Committee (a compulsory committee in any UK zoo). Vultures are slightly different and many of us would include Old World Vultures in this requirement–if for no other reason than practical ones: I have yet to see a safe tether that a vulture can't chew through!

- "Safety at Night–Tethered birds are very vulnerable to attack by other wild animals, so they should be well protected at night. Birds that are put away at night should be placed in areas that meet appropriate welfare standards under section 8 of the Wildlife & Countryside Act 1981 and should not be left shut in for unreasonably long periods. Unless ill, owls in particular should not be shut away in boxes at night.

- Flying Areas–Flying areas should be free of hazards for birds and should not be close to cages containing animals that might catch or kill a bird should it alight on or in the cage. Taking birds to and from the demonstration area should be made as safe and stress free as possible by travelling in a suitable vehicle. Flying areas should not be directly adjacent to, or in view of tethered birds.

- Staffing–Staff should be well versed in training methods, weight reduction issues, handling techniques, and maintenance of equipment and birds. They should also be capable of passing on the correct and up to date information about the birds to the watching public.

- Escape–Birds that are free-flown are always at risk of being lost. If not found, most demonstration birds will eventually die. Such incidents can be reduced by good training, experienced handlers and by ensuring that all birds being flown wear telemetry for radio tracking."

Wild Birds

Disabled Wild Birds

"8.7.5 Permanently injured wild birds of prey will sometimes come into a collection and can be useful either as an educational bird, or, with the rarer species, as a part of a captive breeding programme.

- Individual needs–The welfare and quality of life of these birds should be paramount. Badly injured birds, however rare, which are not capable of living a reasonable life should be euthanased. Birds which are too nervous to be displayed in public should not be kept on public display. Permanently disabled birds should not be tethered.

- Housing–Often these birds are either unable to fly and or land properly. Perching should reflect the ability of the bird in question.

- Pairing–When paired with non-injured birds, aggression levels will need to be monitored, as injured bird will be less able to cope.

- N.B. There are other legal requirements specific to many native species which should be adhered to."

Sick Or Injured Wild Birds

"8.7.6 Sick or injured wild birds should not, in theory, form an integral part of any zoo or collection. However, given the definition of a zoo under the Zoo Licensing Act, some establishments which tend casualties and have 7 or more public open days a year will be subject to the licensing requirements of the Act and liable to inspections. Some particular points relating to such collections are:

- Disease Control–Sick or injured birds are more prone to disease than healthy animals. Health monitoring and hygiene needs therefore need to be rigorous, in order to minimise risks to other birds, staff and visitors.

- Welfare–Most of the birds will have come in from the wild and will already be stressed. Exposure to the public will exacerbate this. It is therefore strongly recommended that save in exceptional circumstances, recovering wild birds should not be displayed to the general public.

- Accommodation–Facilities must cater for injured birds' special needs. Birds destined for release may need to be kept under conditions where they can retain their escape behaviour, gain confidence and fitness in flight and behave naturally.

8.7.8 Some birds of prey in zoos may be subject to control under several different pieces of legislation, for example the Wildlife and Countryside Act 1981 and CITES. Legislation concerning welfare, animal health, travel, and veterinary treatment may be relevant. It is important for operators to understand which legislation applies to zoos."

Many bird of prey zoos will be heavily involved in rehabilitation and this often forms a part of their conservation remit. It also assists in education of the public about native species, man's impact (sometimes literally!) on them, and their habitat requirements.

Over all, these standards are obvious ones and the main husbandry differences are a question of nuance and public perception. Nonetheless these are important in keeping species for the benefit of the public as opposed to benefit of the individual.

A Brief Overview of Falconry (Jones)

Falconry, also called hawking, is the art and sport of training, hunting and managing birds of prey. Its origins date back more than 4,000 B.C. when it was discovered that hawks, eagles, and falcons could be trained and used to acquire food.[14,15] There are many indications that the rich traditions of falconry, which is probably the ultimate form of bird watching, did not originate in one part of the world, but may have arose spontaneously in the Central Asian Plateau (region between current day Korea, Japan, and China), Persia, and the Middle East (Arabia).[14–17] In these parts of the world, falconry served a utilitarian purpose—literally to put food on the table—and is practiced in many different forms.

Falconry in Arabia

Falconry has always been and still plays major part in the Arab way of life. The discovery of oil in Arabia has brought about dramatic changes to a once isolated part of the world. However, despite its incredible wealth, falconry serves to remind the Arabs of their nomadic past and rich Bedouin heritage.[17–19]

The main falconry region of Arabia is within the Arabian Gulf region extending northward into Saudi Arabia.[17] Interestingly, falconry is not practiced in Oman and Yemen.[17] Given the harsh climatic conditions, topography, available raptors species, and cultural values and traditions of the Arabian Gulf, falconry in Arabia is uniquely specialized.[18] Hunting for the Bedouin focused on supplementing nomad's diet with meat and not on the aesthetics of hunting for sport–a stark difference between the falconry practice in Arabia and that of the Western world.[17–19]

Everyone from Bedouin to wealthy Sheikhs practices falconry in Arabia. Most importantly, falconry served to knit falconers together as Arab falconry is rarely practiced alone. Again, this is in contrast to falconry in other parts of the world. A desert hunting party may involve only few men or hundreds and involve elaborate tents,[18] hunting vehicles, and even temporary hospitals to meet the medical and surgical needs of falcons used in the hunt. More traditional modes of transportation have even been replaced by airplane flight to distant hunting grounds. Unfortunately, the ease of transport to previously uninhabited hunting lands has led to overhunting and decline of previously numerous quarry in some localized populations.[18,19] For example, the Arabian hare (*Lepus capensis*) and Houbara or Macqueen's bustard (*Clamydotis undulate macqueenii)* are illegal to hunt within the United Arab Emirates and falconers travel to other countries such as Pakistan or India to hunt Houbara in their wintering grounds.

To hunt sizeable quarry such as Houbara requires large falcons. Specifically, Arab falconers tend to favor Saker falcons (*Falco cherrug*) and peregrine falcons (*Falco peregrinus*), both of which tend to be able to tolerate the harsh climate of the Arabian Gulf. With the advent of captive breeding and international sale and transport of falcons, the gyrfalcon and hybrids (ie, gyr x peregrine, gyr x saker, and other hybrids) are available to Arab falconers.

Most commonly, falcons are flown from the fist in Arab falconry. Again, this is due primarily to the topography of the land, sparseness of cover in which the quarry may hide, and the available quarry itself. In contrast, falcons in Europe and The United States are commonly flow from a high pitch from which they attempt to catch their intended quarry.

Falconry in Europe

From its origins in Asia and the Middle East, falconry spread to Europe, spurred particularly by the spread of trade between Arabia, Europe, and the Far East, and falconry was thought to have reached the Mediterranean near 400 A.D.[14] In Europe and Great Britain, falconry gained incredible popularity as a sport of nobility, yet it was practiced by all socioeconomic classes. Clergy, in particular, were noted for their fondness for falconry. Notably, Pope Leo X was considered an avid falconer.[14] Historical records indicate that the average citizen usually kept the more "common" raptors, which were thought to be less suitable for falconry and included goshawks and sparrowhawks (Table 2).[14] Larger falcons (long-winged hawks) such as gyrfalcons and peregrine falcons were reserved for nobility as they were more suitable for falconry purposes.[14]

Table 2. Falconry and social rank.[7]

Social rank	Appropriate raptor species
King	Gyrfalcon (male or female)
Prince	Peregrine falcon
Duke	Rock falcon (subspecies of peregrine falcon)
Earls	Tiercel (male) peregrine falcon
Baron	Common Buzzard (*Buteo Buteo*)
Knight[a]	Saker falcon
Squire	Lanner falcon (*Falco biarmicus*)
Ladies[a]	Merlin (*Falco columbarius*) (Female)
Yoeman	Goshawk[b] (*Accipiter gentilis* spp)
Priests	Sparrowhawk (*Accipiter nisus*) female
Holy water clerks	Sparrowhawk (male)
Knaves, servants, children	Common Kestrel (*Falco tinnunculus*)

[a]Saker and Lanner falcons were imported and expensive; perhaps too expensive for Knights and Squires.
[b]Ladies were not always allowed to practice falconry.
[c]The goshawk was used primarily to stock a larder.

The person considered by many to be the greatest falconry enthusiast of all time was Frederick II of Hohenstaufen, Holy Roman Emperor, king of Sicily and Jerusalem. He was considered to be the greatest of all historical falconry aficionados, as evidenced by his book, De Arte Venandi cum Avibus (The Art of Falconry).[14,16,21] This book, which took over 30 years to complete and, as one of the first scientific works on the anatomy of birds, also placed him as one of the founders of ornithology.

Unfortunately, with the advent of gun powder and firearms in the fourteenth century, falconry experienced a decline and the raptors used in falconry were often regarded as vermin and shot and killed.[14–16] By the eighteenth century, falconry was only practiced by a small nucleus of falconers who valued hunting style and traditions above all else. These dedicated individuals established the foundations of the western practice of falconry as we know it today—an art form where success is measured by the aesthetics of the flight and the killing of game is an outcome of a high quality, beautiful, majestic, and dramatic event.[15]

Falconry is practiced with birds being flown both from the fist as well as from a pitch. Species such as the goshawk, red-tailed hawk (*Buteo jamaicensis*), Harris' hawk (*Parabuteo unicinctus*), and even the diminutive merlin are flown from the fist. The hawks can also be encouraged to follow the falconer from tree to tree as the

search for acceptable quarry progresses. Large falcons are encouraged to wait on from a pitch of varying height. Once quarry such as ducks, pheasant, or grouse are visually marked or found with the use of a pointing doing, the falcon is released and takes a commanding pitch above the quarry. The game is then flushed and the falcon dives in an attempt to take the quarry given the advantage of height and speed generated by its pitch. Peregrine falcons have been clocked at speeds of 200 mph or more during their dive and may experience G-forces in double digits during the outrun of their dive. Species such as the golden eagle are used in Europe more commonly than in countries such as the United States and are best left for the experienced falconer, as eagles can be quite challenging given their size and temperament.

In Great Britain, there is no special license to practice falconry except that captive raptors must be registered. Unfortunately, regulations allow anyone to obtain and keep a raptor that is not used for hunting purposes. This practice is more synonymous with pet keeping than actually taking game with a trained raptor. Falconers in the UK are also allowed only captive-bred raptors since the taking of wild birds has not been allowed for quite some time.

Falconry in the United States of America

Falconry as we know it in the United States did not gain popularity until the early to mid 1900s.[15] Although there were falconers in the United States prior to WWII, they were a rare breed. While falconry is very popular in other countries it is a very unique sport in the United States. There are approximately 6000 falconers in the United States and many of them are inactive.

In the United States, falconry is the most highly regulated field sport and is legal in all states except for Hawaii and the District of Columbia. Persons interested in falconry must obtain a valid state and federal falconry license by contacting a local falconer, passing a written evaluation (by 80% or greater), and have their equipment and facilities inspected and passed by an approved state agent. Once the license is issued, the new falconer must serve a 2-year apprenticeship under a licensed general (greater than 2 years of active falconry experience) or master (greater than 7 years of active falconry experience) falconer. An apprentice falconer is only allowed to possess 1 raptor at a time and only 1 of 2 species; the American kestrel (*Falco sparverius*) or red-tailed hawk. Falconers must allow adhere to both state and federal hunting regulations/seasons.

Due to the dramatic differences in terrain across the United States, falconers attempt to choose the raptor species most suitable for the terrain and available quarry. Raptor species commonly used in the States include the popular Harris' hawk, red-tailed hawk, Cooper's hawk (*Accipiter cooperi*), goshawk, sharp-shinned hawk (*Accipiter striatus)*, Ferruginous hawk (*Buteo regalis*), peregrine falcon, gyrfalcon, prairie falcon (*Falco mexicanus),* merlin, and hybrid falcon species. Unlike falconry in the UK, falconers in the United States are able to take raptors, even peregrine falcons, in limited numbers from the wild for the purpose of falconry.

Glossary of Raptor Jargon (All Authors)

Aylmerie.	*(pronounced AL-mare-eye) pl. aylmeries* Leather bracelet attached to a bird's ankle that has a grommet for the quick application of a jess.
Cast.	*1:*(noun) The indigestible material regurgitated by birds, also called a pellet. Castings are formed in the ventriculus following digestion. They are usually comprised of hair, feathers, and other insoluble materials compressed into a dense wad. *2:* (verb) The act of regurgitating a cast. *3:* (verb) In falconry, to capture a bird off the fist of its handler using a towel.

Clean meat.	*Rehabilitation.* Meat without bones, fur, or feathers.
Creance.	*Falconry.* A long tether for exercising or training birds for free flight.
Deck.	*Falconry.* Tail feathers of a raptor. Sometimes also called the train.
Footing.	*Synonym: taloning.*The act of being grabbed by the foot and/or talons of a bird of prey.
Frounce.	*Falconry term.* Trichomoniasis.
Haggard.	*Falconry term.* Raptor that is more than 1 year old.
Hen.	*Falconry term.* Female raptor.
Jack.	*Falconry term.* Male kestrel, hobby, or, especially, merlin.
Mew.	Raptor enclosure.
Musket.	*Falconry term.*Male accipiter.
Mute.	*Falconry term.* Raptor dropping (feces, urates, and urine).
Passage bird.	*Falconry term.* Raptor that is less than 1 year old.
Pellet.	See Cast 1.
Putting over.	*(verb)* To move crop contents into the stomach, usually accomplished in a shrugging motion.
Sampo.	A heavy-duty, ball-bearing swivel with closed rings on each side used for the attachment of jesses to a tether.
Sharp.	Muscle wasting such that the keel is more prominent.
Tail guard/sheath.	A protective sheath, made of cardboard or radiography film, placed around the tail of a raptor to prevent feather trauma while in confinement.
Tarsal cuff.	A Velcro strip wrapped around the lower legs of a bird for restraint when the feet must be temporarily freed during a procedure such as weighing.
Taloning.	See footing.
Tidbit.	*Falconry term.*Small piece of meat used for positive reinforcement during training.
Tiercel.	*Falconry term.* Male raptor, especially peregrine or gyrfalcon.
Train.	Falconry term. See deck.
Weathering.	Placing a raptor outside in an enclosed yard and tethered to a perch for access to fresh air and sun or rain.
Wing bumper.	Varying types of wraps or bandages placed on the carpus to control carpal abrasion in enclosures.

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