Raptor Husbandry, common Medical and Parasitic conditions of Captive Raptors.

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Risk Assessment Through the Life Time of a Raptor

Whilst most raptors live a healthy life from start to end, realisation of the potential risks by the keeper can hopefully increase awareness, and allow the keeper to avoid or minimise the potential risks, at the same time assisting the veterinary surgeon by indicating common problems at different stages. The following paper, starts at the beginning of the bird's life, and follows through, commenting on the main risks at the different life stages.

Egg Health & Viability: the health and viability of the egg is dependent on the health of the parents (in particular the hen), the hygiene and safety of the nest ledge, and the handling, storage, and incubation of the egg. Careful records of dates when eggs were laid, fertility of different clutches, hatchability and stage of death if this occurred. In the case of 'dead in shells' these should be investigated, by your veterinary surgeon, so that the stage of death, the presence of infection, etc. can be detected. By proper investigation it is hoped that future losses can be minimised.

In naturally incubated, dead in shells, the commonest causes of loss, (ignoring interupted incubation due to disturbance), are usually infection. Infection may arise at any one of three different times. Firstly if the hen is infected with a bacterial infection eg. *Salmonella enteridis*, then this infection may pass direct from the bird's ovary, into the yolk, prior to the egg even being laid. Secondly, when an egg is actually laid, it is warm, and in the cooling process air is drawn into the egg via the pores in the shell. If on laying the egg is deposited in an unhygienic environment, bacteria may be drawn in through the pores in the shell. It has been shown that within 3 minutes of laying, the inside of an egg may be contaminated with bacteria such as *E. coli*. Attempted removal of eggs immediately after laying will not prevent this, but instead simply upset the female. Thirdly the egg may become contaminated during incubation, in particular if it is in a nest or incubator with an infected egg. The risk of this can be minimised by candling eggs during incubation and removing any non fertile or non viable eggs as early as possible. Incubators should be fumigated or cleaned in some other effective manner prior to their use. One should employ an all in all out policy, ie once a batch of eggs have been incubated, the incubator is emptied, and recleaned prior to a new batch.

If broody hens (eg. bantams) are used for incubation, these should not be kept past their second season, in view of the risk of avian tuberculosis which they might then subsequently pass mycobacteria to their foster eggs/chicks.

Other important causes of chick loss relate to handling and potential storage of eggs, lethal genes and temperature and humidity control during incubation. If eggs are to be pulled, (to encourage recycling), improved hatch rates can be achieved by pulling eggs at day 10 rather than earlier.

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Eggs should be very carefully handled with no sudden movements or jarring. They should be collected by cleansed (or preferably sterile gloved hands), and placed in a clean soft padded vessel, for safe immediate transport to the incubator. Although many poultry text books discuss storage of eggs prior to incubation, this is generally not practised or indicated in raptors. It is only ever done for convenience, it can only be done with totally un-incubated eggs, and generally leads to a 10% reduction in hatchability for each week stored, (even in ideal conditions). Incubation is in itself a specialised topic, which cannot be fully covered in this paper. However one of the commonest errors made by inexperienced breeders is to try to incubate eggs of different sizes in the same incubator at the same time. Eggs of varying surface area will lose water (and hence weight), at different rates, hence the correct control of weight loss is at best hit and miss, or at worse totally impossible. If a pair of birds keeps having dead in shell chicks in successive years, whilst those around them are breeding successfully, the main possibilities are a 'lethal gene' ie a genetic abnormality which prevents the chick from surviving to hatch, or infection in one or both birds. Dead chicks must be investigated, in order to pin point the cause.

Hatching:- the assistance of chicks during hatching is again a subject in its own right. The main point to emphasise is that it is normal for a chick to take 48 - 56 hours from pip to hatch, the temptation for many breeders is to try and interfere too quickly, often with disastrous results. The shut down of egg membrane blood vessels, and the reabsorption of the yolk, are critical and time-consuming processes, and if rushed are likely to lead to significant haemorrhage, yolk sac rupture or infection.

Neonatal Care:-

Lethal genes: close inbreeding should be avoided, as even if chicks hatch they may fade or die suddenly during development, due to circulatory or metabolic complications.

Infection: when chicks are born they benefit from few antibodies from their parents, their guts in particular are considered to be 'immune incompetent' ie. they are not used to bacteria and have no defense against them. The guts must colonise with bacteria, and generally speaking it is a question of 'first come first housed'. The use of probiotics for the first 10-14 days of life (if hand rearing) may assist in filling the gut with non pathogenic organisms, so as to avoid pathogenic over growths. The author has been able to demonstrate improved chick growth rates, reduced incidence of enteritis and potentially fatal septicaemias.

Imprinting the author is in favour of flying '**social imprint'** birds, such that the stress of training is reduced, and so that the bird can be flown at a higher weight. Imprinting should only be under taken after considerable study and discussion with fellow falconers experienced in the various techniques.

Temperature: artificial chick accommodation should have a temperature gradient, such that chicks can select their own preference.

Fluid: chicks will generally receive all their required fluid intake in their food. If however they are in a very warm environment, or in sun light, dehydration can rapidly occur. The chicks will appear sleepy, and have wrinkled skin, resembling 'little old men', if this is noticed, additional fluid should be added to their food or administered by crop tube.
Food consumption: some inexperienced breeders do not appear content unless the chick perpetually has a bulging crop. It is important that the crop does empty fully before the next feed. Although chicks of some species may sometime need some encouragement to feed initially, once

stimulated they should be eager to feed. Chicks which are slow or impossible to feed are either unwell, or already satisfied. It is preferable to give a 'half' to 'three quarter crop', more often, then a completely full crop less often.

Nest Substrate: If artificially rearing chicks the nest conformation and substrate is particularly important. The nest should have a 'bowl' shape. This can be achieved by placing clean sand (it may be sterilised by preheating in an oven), in a plastic bowl, making a cup shape indentation in the sand, then placing a clean section of kitchen roll paper in the center. The idea is that the chick's legs should be encouraged to go in under the chick's body rather than to splay out to each side. It chicks do suffer from splay leg, these are best corrected by placing them in a firm 'cupped' structure eg. a section of PVC gutter. Strapping the legs together using micropore tape should only be used as a last resort.

Some breeders have used peat, wood shavings, sawdust, vermiculite, etc as nest substrate. Such substances should not be used as they will from time to time be ingested by the chicks, who being unable to cast them, will then suffer impactions of the proventriculus (stomach).

Trauma in the nest: It is crucial that full observation of developing chicks in the nest is possible. All too often it is not apparent to the breeder that a chick has suffered some injury such as a broken leg, until long after the event, simply because the chick continued to feed well, all was thought to be in order.

Cainism: eagles in particular will normally practice cainism, in other words if more than one chick hatches, the stronger larger chick will push the other one out of the nest. Evidence of cainism should be watched for.

Inexperienced or disturbed parents: it is not uncommon for young inexperienced parents, or those who are suffering disturbance, to fail to feed, or to eat their offspring. Careful observation will hopefully pick this up at an early stage before the situation is critical. Often the best solution is to remove the chicks and allow a more experienced pair to foster rear them, replacing them if possible with a less valuable or important chick to practice rearing. If this can be achieved then usually by the subsequent year, they will successfully rear their own chicks.

Nest ledge security: the nest ledge should be rebuilt annually, to ensure that it is clean, it will withstand the weight of the nest material and clutch. The nest ledge should be sheltered from any possible inclement or extreme weather, as well as from vermin or predators.

Neonatal Nutrition: see raptor nutrition paper.

Casting for chicks: casting should not be given to any chicks under 12 days of age, for some species (in particular merlins), casting should not be offered until they are over 20 days. This recommendation applies in particular to hard casting such as rodent fur. Young chicks are often unable to cast such material, it leads to a build up of casting in the stomach, casing a blockage, and typically death of the chick..

Choice of Breeder: do not simply rush to the first or the cheapest breeder. Ask to see the breeding records of the parent's birds. Check that the parents are not themselves inbred, ie that they are not brother / sister or father / daughter etc..
Check which clutch bird you would be buying, first clutch birds are generally superior.
Check how they have been reared, (with respect to imprinting).

Be certain that the breeder is genuine, and that the birds are legitimate. If in doubt ask for a signed declaration that the birds are legally bred by his / her birds and state the parent bird's identity, preferably stating an identichip reading rather than a cable tie which might be altered.
Confirm an understanding with the breeder, (preferably in writing), that you may take the bird to an experienced avian veterinarian within a given period (3 - 7 days), to have it checked, (perhaps including a blood sample), and that you may return it to the breeder within that period, if it is found to be defective in any respect.

Planning for the home coming: prior to going to inspect any potential new bird, you must be certain that the accommodation, furniture, perches, travelling box, food supply and veterinary surgeon have all been arranged. Most importantly if you are a novice, you must appreciate that you cannot learn falconry out of a book or off a video, you must attend a recognised course run by a reputable falconry establishment. Preferably join a good falconry club, go and attend some meetings, and find an experienced member of the club who can guide you in choice of course, breeder, species as well as aviary design. Remember each and every falconer has his or her own opinions, do not rely just on one person, talk to as many others as you can, and supplement that with a good course, books and videos.

If you have an existing aviary, ensure that it is in a good state of repair and thoroughly clean. If timber treatment, or parasite control is required in the aviary, make sure this is done with a safe product at least 10 days before the bird will enter the aviary. Ensure you have a fresh supply of good quality food (see later). Before actually bringing a new bird home, check with the breeder what food the bird is used to and ensure that you have similar food to offer, once you get the bird home.

The travelling box: most falconers use a travelling box infrequently. The remainder of the time, the box is typically left to go mouldy in the garage or shed. A good travelling box, will be large enough for the bird to stand up in and turn around, but not much larger, or the bird will tend to be thrown around the box, whilst in transit. The box should be of sound construction, and be capable of being thoroughly disinfected. There must be a slip proof floor (eg, a section of carpet tile), which can be discarded after use, or taken out and washed. Ventilation holes are be provided at the bottom of the sides, so that there is not too much light at head height. If you want an inspection panel at head height, have a shutter over the outside of this (eg. a flap of wood), so that the bird is in darkness except whilst being inspected, the shutter may be opened to inspect the bird, and then closed again. The box should be designed so that the ventilation holes cannot be covered up, it the box is placed against another, or the side of the vehicle.

When not in use the box must be stored in a clean dry place, so that it does not become mouldy.

There is nothing worse for a bird than placing it in an enclosed mouldy box (full of fungal spores ie. *Aspergillus* spp,), stressing it during transport and moving it to new accommodation. Such a bird is highly likely to suffer from aspergillosis, a condition which is most commonly fatal.

Prior to getting a bird all keepers should be have checked on the details of one or preferably two veterinary surgeons who would be willing and suitably experienced to check over their new bird or to treat their bird should the need arise. All veterinary surgeons operate a 24 hour service, however it is common to find only one veterinarian within a practice who is experienced in treating raptors. In the event of this veterinarian being away when the dilemma arises, you may need to call upon the assistance of another veterinarian. If in doubt as to where to find an experienced avian veterinarian, contact members of a local falconry club, and ask who their members use.

Inspection of the bird: where possible ask to see the bird in the aviary before it is caught up. Watch its flight, its movement and its reaction to its surroundings and what is going on around it. Aviaries should be designed, and equipment available (eg, a long handled fisherman's landing net with a padded rim), with the safe catching of birds in mind. Watch your bird being caught, so that you can be certain that no injury was caused during catching. If your bird has been caught up prior to you arriving, at least make sure you have the opportunity to check the bird over well before parting with your cash. Always ask for a receipt for your money. It is illegal both to sell and to purchase a raptor without a closed ring (unless there is an exemption license), so it is important to check for the presence of such a ring.

Furniture: once the bird has been caught, for the sake of safety during transport, it is generally best to fit a new set of safe and suitable jessies, swivel and leash. Once the bird is boxed, the end of the leash should be tied firmly to the outside of the box. In this way, even in the unfortunate circumstance of another car driving into the back of your vehicle on the way home, such that the box is broken, the bird will not be able to escape.

Preparation for travelling: birds should not have been fed for at least 12 hours before travelling, and should certainly not have any food in the crop. Equally the bird should not have been starved for more than 24 hours. The bird should not have had any casting at that last feed, so that there will be no casting yet to be regurgitated. If the bird did still have casting inside, there would be the chance that the bird might cast during transit and choke on the casting. When travelling goshawks in particular, it may be better to have reduced the bird's weight over the previous 2 weeks slightly, and perhaps manned it a little as this will help it cope better with the stress of boxing and travelling. There may also be some benefit in giving goshawks a calcium and vitamin D3 supplement the day before travelling.
Those birds which are particularly susceptible to aspergillosis (eg. Gyr falcons *Falco rusticolus*,), should receive prophylactic treatment for aspergillosis for 7 days before and 14 days after any particularly stressful procedure (eg. travelling, quarantine, training etc).

Position of the travelling box: the new keeper must be certain that the travelling box is placed in a safe position. Be certain that the exhaust system is in good repair, and that there is no chance of carbon monoxide poisoning to the bird, where it is travelling. Be aware of other potential fumes or noxious substances. Beware of the effects of sunlight. For you driving at the front of the vehicle, with the air conditioning on, the temperature may be very different to that experienced by the bird travelling in the back of an estate car, with the sun pouring down on the box, and in the total absence of any air circulation around the bird's immediate environment.

Arrival at home: most owners of new birds want to immediately tether the new bird on the front lawn so that they can admire it. This temptation should be resisted. In most situations the correct line of action is to place the bird loose in an aviary, and allow it to settle after its journey and adjust to the new surroundings. All these events, and particularly training cause stress to the bird, the effect of each stress is additive, such events should if possible be separated so that the stress is never excessive at any one time.

New Bird - Quarantine: Many keepers do not understand the essential principles of quarantine. Quarantine should not apply just to birds entering your premises from abroad, but also to all new birds that you acquire. All new birds should be isolated in separate, readily cleanable accommodation for 30 days. This allows time for veterinary checks to be carried out, and time for diseases that the bird was incubating to become apparent, prior to it mixing with your collection and infecting them. Wild injured birds should always be kept separate from your own birds.

New bird veterinary check: all new birds, even when acquired by experienced falconers should be subjected to a health check. This should certainly include a full physical examination, a faecal (mute) test for parasites and preferably a blood test. In this way if there is any under lying illness, which is not clinically evident, it can be detected and the bird returned or treated prior to the bird becoming ill. It is sensible to have the bird implanted with an identichip at this examination. If your bird were to become stolen, any thief is likely to cut off the ring (unless schedule 4) immediately. By having your bird fitted with an identichip, if you can find your bird, or if it turns up without a legitimate owner, you can prove ownership. As most bird thefts are sadly carried out by people who know us, it is good to publicise amongst one's friends that your birds are chipped. This is one good argument for having club chipping sessions, so everyone knows whose birds are chipped. Furthermore, signs should be erected on your bird's aviary (door), stating that the birds are chipped. This should act as a deterrent to theft in the first place.

Nutrition: see raptor nutrition paper

Weight Control: falconers are accustomed to controlling their bird's weight (for training and flying) by altering the daily food intake and weighing the bird same time of day each day. This may be less relevant to the rehabilitation bird, but the point is in the benefit of accurately monitoring not only the bird's weight (ie its condition), but also its metabolic efficiency (weight change in relation to its daily food intake). Such regular monitoring gives a level of control far greater than is commonly seen in any other avian group.

Water: although raptors typically acquire their daily water in take via their food, if the weather is hot, they are unwell or laying at the time, or if they are not eating sufficient food, their dietary water intake may be insufficient. All birds should have access to water on a daily basis. However water containers should be cleanable. Water should be changed regularly, especially in hot weather, as the very dangerous bacteria *Pseudomonas* sp. often grows in warm water, and can then readily infect the bird, leading to severe and often fatal infections. In hot weather it may be necessary to sanitise the drinking water with a diluted disinfectant to prevent this problem. Furthermore if the water bowls are filled from a hose or stand pipe, the water should be left to run for several minutes before it is used, as the first water from the pipe will have a significantly higher bacterial loading. Water baths should be carefully designed so as to minimise the possibility of birds drowning in the water. During the months of October to April (in the UK), birds should be prevented from bathing in the afternoon, as birds still wet at night are more prone to wing tip oedema, even when free lofted in an aviary.

Perches: when birds are first tethered (especially Harris Hawks, *Parabuteo unicinctus*) there is a significant risk of injury, and action should be taken to minimise this. Firstly the correct size perch (especially bow) should be chosen. A bow should be of a height such that the bird's tail just clears the ground and no more. The taller the perch, the longer the length of leash that will be required. When a bird bates away from its perch, the further it flies (which is determined by the length of the leash), before the jessies pull the bird up, the greater the speed it will de travelling at when the jessies pull on the legs. The faster the speed, the greater the force applied to the legs, and the more likely the bird is to suffer a broken leg. The leash length should be kept to an absolute minimum when a bird is first tethered. Moreover the perch should always be placed in a position where the bird is unlikely to become startled, (ie it should not be in a frequented area, or where there may be significant pedestrian through traffic. Tethered birds should be protected from the elements, (ie, shade and cover provided as required), as well as from predators, both of the two legged and four legged varieties.

Birds should not be kept tethered on perches during the night or on particularly cold days, from October to April, in view of the risk of wing tip oedema and dry gangrene syndrome.

Falcons in particular are prone to bumblefoot, no one perch material is suitable for all birds. Careful daily observation by the keeper is important, in order that the very early signs of this potentially crippling disease are detected, so that effective changes and treatment can be made, in order to prevent continuation of the condition.

Training: every care should be taken to minimise the stress caused to all birds, one of the most potentially stressful times is training. Species such as N Goshawks (*Accipiter gentilis*) are most likely to be effected. Training should be taken as slowly and as gently as possible. Rapid weight losses, starvation (beware possible dehydration), and rapid training for an unreceptive hawk should not be used. In any situation stress causes a release of additional levels of cortisol within the bird's system. This cortisol prepares the bird for the characteristic 'fright and flight response', ie enables it to fight or flee from the situation. However this increased level of cortisol also reduces the bird's immune system, rendering it even more susceptible to infection.

Less experienced falconers should seek advice and assistance in the initial training and assessment of the correct flying weight, from more experienced colleagues.

Free flight: furniture, apart from hunting jessies, bells and telemetry, should never be left attached to a bird when flown. Birds must be flown with at least bells, and wherever possible telemetry, in order to minimise the chance of losing the bird. Flying ground should be very carefully selected. The inherent hazards of any flying ground should be assessed prior to free flight. Electricity transformers, neighbouring gamekeepers who are anti-raptor, razor wire on the tops of perimeter security fencing, sheep fencing, methane burners on refuse tips, large rivers, railways or major roads which might prevent the falconer making in to the bird after a kill, are all factors that should be considered. When rook hawking care should be taken to ensure that the hawk is only slipped when there is a solitary rook present, for fear of attack by other birds after the hawk has bound to its quarry. Harris hawks should be deterred from flying squirrels wherever possible, in view of the high incidence of serious squirrel bites sustained. A bird should not be flown if other birds are visible (eg. on a cadge or block), occasionally the bird in flight will attack another. Birds other than Harris hawks (which naturally hunt in groups), should not be flown in a cast. Although it can lead to exhilarating flights, the chances of loss, or injury to either bird is greatly increased.

Birds should whenever possible be restricted in the size of quarry that they fly. Flying a bird at 'out size' quarry is not only unfair to the quarry, but also runs a considerable risk of damage to your bird.

Whenever hawks kill avian prey, it should if at all possible be checked (in particular the surface of the liver), prior to the hawk being allowed to feed up.

Aviary design and siting: aviaries should be so designed to prevent escape (ie secure build, support against snow or storms, and double doors to prevent escape) and to minimise the risk of theft. The bird should not be able to damage itself in the aviary. If it does the aviary must be altered in some way so as to prevent this. If damage is occurring on fencing or netting roof, then vertical bars or battens (eg. bamboo, conduit piping etc.) should be placed on all such surfaces, at sufficient space apart to allow the bird to get its head in-between, but not its body.

The aviary must be able to be thoroughly cleaned. Although the beginner may want to keep the design simple, there is no substitute for a sloped concrete floor covered with soil or pea gravel. In this way if it is ever found that there is significant infection in the aviary, (eg, *Capillaria* sp. worms, coccidiosis, avian tuberculosis, salmonellosis etc.), then the substrate can be cleaned back to the concrete, pressure cleaned, disinfected and refilled. If the aviary is earthen floored it should be taken down and reconstructed elsewhere. The bottom of the aviary walls should also be solid. In this way, the chances of rodents, slugs, snails, worms etc, ie the intermediate hosts for most of the avian parasites gaining access to the aviary are reduced, which will reduce the chance of your bird suffering infection with such parasites.

When choosing the site for the aviary, the potential consequences of flood, fire or tempest should be considered, as well as toxic pollution (carbon monoxide from car exhaust or pesticides or other noxious substances from adjoining land).

Routine checks: however careful you are, your bird will be at risk of infection or injury from time to time. The keeper should be diligent in their daily careful observation of the bird, and receptive to slight changes from normality. It is also sensible to have at least faecal parasite tests carried out twice yearly (at the end of the flying season, and again when taking the bird up again), and preferably a full examination and a blood test once a year.

Parasites of Raptors

Any parasite relies on survival of the animal in which it lives in order to survive itself. It is therefore not normal for a parasite to lead to the death of the host in which it lives. Under normal circumstances parasite and host will live in a balanced harmony. The exception arises when the normal host's resistance against the parasite, which usually keeps its infestation under some semblance of control, is reduced allowing the parasite to gain the upper hand. Such situations arise when wild birds are short of food, following migration, accident, injury or during extended periods of inclement weather. For the falconer's bird training, chilling, accident, or other causes of stress may trigger off the same situation. There are exceptions to this rule, where even a small number of parasites can cause disease, this arises where the parasite only needs to live in that host for a short period, in order to complete a life cycle, this done he does not mind if the host becomes diseased and dies. Recently parasitic diseases have been increasing in incidence in captive bred birds, this is as a consequence of increased levels of exposure to the parasite, as a consequence of increased contamination of the aviary by the parents.

External Parasites

A large ectoparasite infestation on a bird is typically a sign of the bird being ill for other reasons, as any fit bird will usually control its own parasites. So rather than treating the parasite alone, one should always look for a further cause of illness.

Hippoboscids (keds or flat flies) are perhaps the commonest parasites of raptors. They are blood suckers, although they rarely cause any significant blood loss. There is however now evidence to suggest that they can and do carry blood borne parasites between one bird and another. In particular the blood parasites *Leucocytozoon*, *Plasmodium*, *Sarcocystis* as well as other blood born infections. In the United Kingdom such blood borne parasites are rare, however in warmer climates such as USA diseases such as malaria are highly significant. After the warmer summers of 1994/95, the incidence has increased, affecting birds aged 3 - 5 months, to date owls (especially snowy), harris hawks and gyr falcons have been affected. In one case, the affected bird had caught

a magpie only 9 days earlier, which had a heavy infestation of hippoboscids, in time it became evident that these had carried a blood parasite infestation, which caused a dramatic and fatal infection of the harris hawk in a very short time.

Lice are also a common ectoparasite of raptors. Lice feed off skin debris and feathers, they do not however survive off the host for long, and hence treatment with routine insecticide preparations is relatively easy.

Conversely *Dermanyssus gallinae* the 'Red Poultry Mite', does survive off the host for considerable periods. This mite lives in crevices in the wood work and usually only comes out at night to feed, as such a feather plucking bird may appear free of parasites when examined during the day, whilst the same bird is crawling with them at night.

Any ecto parasite which actually sucks its host's blood can be easily and readily controlled by use of ivermectin ('Ivomec' Merial), however this will need to be diluted, in propylene glycol or water. Fipronil (Frontline : Merial) has proved highly efficaceous and safe on over 3000 birds of varying species from 30g to 6kg in weight. Other ecto parasites are best controlled by the use of insecticides, however great care must be taken that only safe preparations are used. Some sprays contain either active ingredients or propellants which can lead to toxicity or irritation to the air sacs.

Haematozoa in raptors

A common infestation which is considered to be generally benign. Clinical disease is commonest in young birds being raised by chronically infested adult birds. Clinical signs in affected birds include weight loss, weakness, malaise and anaemia. The species most commonly affected are snowy owls (*Ncytea scandica*), great horned owls (*Bubo virginianus*) and less frequently harris hawks (*Parabuteo uncintus*).

Young birds typically show weakness, reduced appetite, loss of condition, extreme pallor from 50 days of age. At post mortem, that have pale carcases, with white streaks in the muscle, splenomegaly and hepatomegaly and commonly are concurrently suffering from salmonellosis and aspergillosis. Schizonts may be found in the liver, spleen, lung, skeletal muscle, heart and brain.

Parent birds show chronic, possibly lifelong infection with frequent recrudescences
Transmission to young newly hatched birds during the spring when vector (ectoparasite) numbers increase and adults have relapsing infections due to the stress of breeding or consequent to hormonal changes.

Treatment: various treatments including chloroquine, chloroquine + primaquine, mefloquine, treatment of secondary infections eg *Aspergillus* spp and *Salmonella*
Spp. Treatment is generally not effective.
Prevention and control of the condition is the recommended option. Vectors should be controlled or excluded. During the breeding season birds should be treated with a safe and efficaceous ectoparsiticide (eg Fipronil, Frontline: Merial) one amonthly basis. The environment may also be treated with pyripoxyfen and permethrin (*Protect-A-Home Premises Flea Spray* - Virbac (Australia) Pty Limited). Adult birds may be blood screened prior to the breeding season (although positive birds may be difficult to confirm on individual tests. Infected adult birds should either not be used for breeding, or their offspring should be reared by other non parasitised individuals.

Internal Parasites

Many bird keepers, falconers and rehabilitators simply worm their birds annually or when they are handled and believe that all is then well. This concept is seriously flawed, and can on occasions lead to serious repercussions.

Fluke: fluke are a relatively common although usually non pathogenic parasite of raptors. They may inhabit the small intestine or the bile ducts. Diagnosis is made only on faecal examination, and although usually non pathogenic, when found treatment should be given. The drug which is most commonly used is rafoxanide at a dose of 10mg/kg, or praziquantel (droncit) 5 - 10mg/kg daily 14 days or chlorsulon (Curatrem) 20mg/kg by mouth 3x at 2 week intervals. Both the diagnosis, advice on treatment and the drug will be available from your veterinarian.

Tapeworms: tapeworms are a relatively common parasite, but are rarely pathogenic. Clinical illness will only occur in situations in which there is very heavy infestation, which can lead to an obstruction of the small intestine. Treatment is by the use of Praziquantel (Droncit, Bayer), which is available in injection or tablet form, and birds should be dosed at 5 - 10mg/kg or chlorsulon as above.

Roundworms: these are the largest and most significant group of endo parasites. The group includes the *'Syngamus trachea'* and '*Serratospiculum* sp.', which affect the trachea, and air sacs respectively. Both will cause respiratory signs in infected birds, however in both cases it is particularly important that the diagnosis is made prior to treatment being given. In the case of *Syngamus* spp even after the worms are killed they will remain in the airways for up to six weeks slowly rotting away causing respiratory signs and occasionally pneumonia. *Serratospiculum* is most commonly found in this country in imported birds (coming from warmer countries). The worm itself does not usually cause any clinical signs, and may live in the air sacs happily for several years. However if the worm is killed it will rapidly putrefy often causing a severe air sacculitis and death. If the worm is diagnosed then the preferable treatment is to treat the bird with wormer daily for 14 days and then to surgical removal of the worm from the air sac, a more recent method is to treat the bird once with 1mg/kg of ivermectin (s/c). This single treatment alone appears to be highly efficaceous.

Cyathostoma spp are seen intermittently in the UK, this is another respiratory nematode, which is on occasions coughed into the infra orbital sinus, in which it will generate a significant reaction.

Drugs which have been used in the treatment of roundworms include piperazine, levamisole, benzimidazoles (e.g. Panacur or Mebenvet or Pyrantel) and ivermectin (Ivomec). Some of these are now old fashioned and ineffective, others have very narrow safety margin and can be dangerous, others are potentially toxic at certain times of year (especially during the moult), others are safe.

Protozoa: This group of parasites includes *'Trichomonas gallinae'* the agent which causes 'Frounce'. The most common source of infection is from pigeons. Many falconers believe that just because the pigeon looks clean, or by avoiding feeding the crop the disease can be avoided, this is not the case. Even the breast muscle can carry the infective agent. Any pigeon fed to raptors should be frozen first as this freezing kills off virtually all the organisms. The disease is seen as white plaques in the mouth, throat or crop. However the condition must be differentiated from infection with *Capillaria, Candida* or owl Herpes Virus (in owls), or vitamin A deficiency. Treatment is with Carnidazole (Spartrix) 25mg/kg once. This single treatment as opposed to the

previously recommended daily treatment for 5 days makes therapy a lot easier, particularly for young wild or captive birds still on a nest being fed by the parents.

The same group of parasites also includes coccidia, which may be present and cause or not cause disease, depending which exact species of coccidia is involved, likewise if disease does occur the clinical signs and treatment required will be different. Coccidia have been recognised as an increasing clinical problem due to a build up of infection in captive breeding aviaries. The disease affects primarily young birds, prior to their having developed any immunity of their own. The condition is treated with Toltrazuril (baycox) at 25mg/kg once weekly for 3 weeks. This condition has been subject to considerable research by the author in recent years, and the additional information is given below.

Control of Endemic *Caryospora* species Infestation of Captive Raptors

Abstract: *Caryospora* spp. infestation is a major cause of morbidity and mortality of captive bred raptors. This paper describes the results of 948 faecal examinations, before and after a series of different treatment protocols. Effective methods of controlling this coccidian parasite, which has enabled the production of parasite free offspring from endemically infected breeding facilities are described.

Introduction: The genus *Caryospora* comprise cyst forming protozoal parasites belonging to the 'true' coccidia (phylum Apicomplexa, class Sporozoa, subclass Coccidiasinia, order Eucoccidiortia, sub-order Eimeriidae).[1] *Caryospora* spp. infestation has previously been reported as causing significant morbidity and mortality in falconidae.[2] Although infestation has been demonstrated in wild raptors,[3,4,5] it has been reported to have a greater incidence in captive raptors.[2,3,6,7] There are 14 species of *Caryospora* identified and reported as affecting falcons, kites and owls, whilst three species are found exclusively in falcons.[1] It is considered that there may be as many as 150 different *Caryospora* species in raptors world wide.[4] Coccidial oocysts are a common finding in captive (12% in 461 samples in Germany in 1982,[6] 79% of 86 in Germany in 1994,[3] 26% in 1158 samples in Saudi Arabia in 1999 (Dr Jaime Samour, written communication November 1999) [the majority of which were wild caught rather than captive bred birds], 24% of 75 samples in the UK in 1997 [2]) but less common in wild (31% of 16 samples in the USA,[5] 0% of 247 in Germany in 1998[8]) birds of prey. The source of the birds and the level of infestation of their parents affect the incidence of faecal oocysts in any captive bird survey. However the age of the birds[6,7] is responsible for the greatest variance. The majority of *Caryospora* spp. infestations in captive birds are aquired directly[9] (i.e. definitive host to definitive host) as opposed to indirect routes.[10] Most clinical disease and the incidence of high levels of shedding is said to be found in birds less than 3 months of age.[3,6,7] The incidence of faecal shedding in wild birds is related to the rate of ingestion of relevant intermediate or paratenic hosts (frequently rodents[10]) by the birds sampled. Various therapeutic regimes have been previously advised for the control of clinical disease[3,6,7] but the author and others[3] have indicated poor responses to therapy. The aim of this work has been to survey the incidence of *Caryospora* spp. infestation in captive bred merlins (*Falco columbarius*) in the United Kingdom (UK), in whom the disease has been shown to be the greatest cause of juvenile deaths. To survey the incidence in wild merlins in the UK. To evaluate diagnostic techniques and to assess the efficacy of various therapeutic and control regimes. Whilst the clinical signs associated with *Caryospora* spp. infestation in most raptor species comprise abdominal cramps, lethargy, fluffed up appearance, weight loss, inappetance, vomition, brown or occasionally haemorrhagic diarrhoea, in merlins clinical disease is frequently characterised by severe diarrhoea or acute death in birds between 28 to 45 days of age.[2] It is widely accepted that coccidiosis is difficult to control due to persistence of infective oocysts in the environment. Young merlins are most likely to ingest

oocysts prior to 17 days of age, but do not to show clinical disease until after 27 days of age.[2] It has been shown that the prepatent period for *Caryospora* infestation in falcons is 9 to 13 days and that if the birds are treated in this period they will not only develop a partially or completely protective (depending on host and parasite species) immune response but that they will not shed oocysts.[3]

Materials

In 1996 and again in 1998 all merlin keepers in the UK registered (which was a legal requirement) with the Department of Transport and Regions were contacted requesting their assistance in providing regular faecal samples for analysis for the oocysts of *Caryospora* spp. Nine hundred and forty eight faecal samples were acquired from 168 captive merlins kept by 62 different keepers, in addition to this 72 samples were received from wild merlin nest, perch or roost sites. Samples varied with respect to quantity, water content as well as the relative presence of urate and non-avian organic material. Keepers were requested to despatch samples monthly, however many samples were not forth coming due to lack of commitment by keepers, fear of disturbing birds during the breeding season or other reasons. The keepers of all birds with positive samples were advised to use one of several different treatment regimes, and to submit further samples. The keepers administered all medications to their own birds.

Methods

All samples were mixed in saturated saline solutions and left to stand for 30 minutes to allow oocyst floatation and collection under a coverslip. The coverslip was lifted and placed onto a slide for examination using 10x magnification to assess oocyst numbers. In view of variable sample volume, desiccation and levels of non-faecal material it was considered that obtaining accurate estimates of oocyst excretion in faeces was unrealistic. All samples were scored 0 (clear), 1 to 5 (light to very heavy levels of excretion). Subsequent analysis using the Mc Master method indicated that these assessments were equivalent to the following oocyst levels. Level 1 (<1000 oocysts/g), level 2 (1000 to 5000 oocysts/g), level 3 (5000 to 10000 oocysts/g), level 4 (10000 to 100000 oocysts/g) and level 5 (>100000 oocysts/g). All positive samples were then stored at 4^{o}C in 2% potassium dichromate for subsequent measuring, sporulation and identification. No cross infection tests were performed. 690 samples were collected on a single day, 186 were collected over a three day period whilst 72 were nest scrape or roost samples. The time of day of sample collection was requested and recorded where supplied. The ages of all birds involved were recorded as it is recognised that juvenile birds are most commonly affected. In the case of 10 birds with relatively low (level 1, or 2) levels of excretion, treatment was delayed and further faecal samples were collected three or more times a day for a ten day period to investigate diurnal or post prandial variations. In an extension of the initial work, a further major breeding site (producing peregrine *Falco peregrinus*, saker *Falco cherrug*, gyr *Falco rusticolus*, merlin *Falco columbarius* and hybrids there of) was investigated. This site had previously suffered a serious incidence (70% of young birds clinically affected within the first 4 months of life) of *Caryospora* spp. infestations of young birds. Adult birds were all treated with toltazuril (Baycox, Bayer, Bury St. Edmonds, UK)(25mg/kg po once 2 months prior to anticipated egg laying in an attempt to reduce oocyst contamination of the breeding aviaries). All off spring from the site were target treated with a single dose of toltazuril (Baycox, Bayer)(25mg/kg po) at 21 and 35 days of age. These birds were faecal screened for oocysts at 40 and 70 days of age. It was believed to be impossible and perhaps undesirable to eliminate *Caryospora* spp. from this collection and hence the aim was to produce healthy, parasite free young birds. At three other sites, merlin offspring from parents that had previously produced infected offspring despite being screened and treated were foster or hand reared and subsequently screened for oocyst excretion.

Therapeutics

Common therapeutics used against coccidiosis in falcons have not lead to satisfying results.[3] Previously recommended therapies for avian coccidiosis have involved sulfadimidine (Bimadine, Bimeda, Llangefni, UK) 50 -150mg/kg po or i/m sid 5 to 7 days, amprolium (Amprol Plus, Merial, Harlow, UK) for 6 days at 30mg/kg, or amprolium in combination with ethopabate (Amprolvet Super) at a dose of 0.5mg/kg sid for 5 days. More recently clazuril (Appertex, Petlife, Bury St. Edmunds, UK) 5 - 10mg/kg po sid has been recommended, as has toltazuril (Baycox, Bayer) at doses ranging from 7.5mg - 25mg/kg on one or two consecutive days. In a previous publication[2] the author reported the lack of efficacy of sulphonamides and clazuril (Appertex, Petlife) in treating *Caryospora* spp. infestation in merlins. It is recognised that thiamine deficiency may occur in birds suffering from coccidiosis due to vitamin utilisation by the parasite. Furthermore that hypovitaminosis may worsen leading to thiamine responsive fits when such birds are treated with amprolium (Amprol Plus, Merial) (in the absence of concurrent thiamine supplementation).

Treatments: In this survey the following therapeutic regimes were tested: clazuril (Appertex, Petlife) 7.5mg/kg po sid 3 days, toltazuril (Baycox, Bayer) 8mg/kg po once, toltazuril (Baycox, Bayer) 20mg/kg po once, toltazuril (Baycox, Bayer) 25mg/kg po on 2 consecutive days, toltazuril (Baycox, Bayer) 25mg/kg po once plus movement of the bird to a previously uncontaminated area, toltazuril (Baycox, Bayer) 25mg/kg po daily x 2 followed by sulphonamide for 5 days at 50mg/kg po sid, or toltazuril (Baycox, Bayer) 25mg/kg po once weekly for 3 weeks. All positive cases, irrespective of level of excretion, were assigned to different treatment regimes subsequent faecal samples were monitored on a monthly basis. Response to therapy was assessed by repeated monthly faecal analysis following treatment. Long term monitoring is essential in determining the true efficacy of treatment for *Caryospora* spp. infestations of falcons. Temporary cessation of shedding is commonly seen with a number of agents, but is typically not maintained. Treatment of falcons with *Caryospora* spp. infestation is necessary not only to prevent clinical disease but also in an attempt to reduce the level of oocyst contamination of the aviary.

Results

Seventy two samples were examined from wild merlins, none of the samples were positive. Eight hundred and seventy six samples were examined from 168 captive merlins owned by 62 different keepers. One hundred and forty six (16.7%) of samples were positive, with 56 (33%) of the birds testing positive on at least one occasion. Thirty four (55%) of the breeder sites were positive on at least one occasion during the study period. The ten birds whose treatment was delayed in order to monitor shedding rates excreted oocysts in between 10% and 80% of samples (average 45%). There was no apparent diurnal or post prandial variation in shedding. Rates of shedding were analysed for the first 18 months of life (Figure 1) demonstrating that shedding was significantly higher in the period 8 to 24 weeks of age, although previous authors[2,3,6,7] have reported higher levels in birds under 3 months of age, shedding has not previously been reported to extend to 5 months of age. Rates of shedding were analysed by season excluding birds (<6months of age) (Figure 2). These results show there is a significant increase in shedding rates of adult birds during the breeding season (egg laying is anticipated in early May), which inevitably leads to increased oocyst contamination of the rearing site. This seasonal increase in shedding was also demonstrated in non-breeding birds. Rates of oocyst shedding were analysed including juvenile birds (Figure 3), which show a higher incidence of shedding in the last eight months of the year. Oocyst shedding following the different treatment regimes were also assessed (Figure 4). The only treatment regime which demonstrated any significant efficacy was toltazuril (Baycox, Bayer) 25mg/kg once weekly for three weeks, which was significantly more efficacious than the same dose on two consecutive

days. Although it is accepted that the control of coccidiosis is dependent on good hygiene as well as medical and/or immunological control, moving birds to a clean environment 24 hours after 2 treatments with toltazuril (Baycox, Bayer) (a reportedly effective treatment regime[3]) did not improve success rates over medication alone. In the breeding collection which had suffered the 70% incidence of clinical disease in the previous breeding season, a total of 45 young birds were treated as described above. Four and a half percent of these birds did demonstrate infestation although this did not occur until 100 and 105 days respectively, by which stage they had been under their new keepers care for a period 30 days. The remaining birds demonstrated no clinical signs or faecal oocysts of *Caryospora* spp. No oocyst shedding was found in 15 young birds, foster or hand reared from infested parents that had previously produced infested offspring.

Discussion

This survey has not been laboratory based, but has dealt with privately owned birds maintained and medicated were necessary by their owners. Inevitably the experimentation has been hampered by the death or loss whilst flying of study birds and by the failure to maintain sample collection by some keepers. There may have been inaccuracy in administering medication by the owners, or post administration regurgitation. The number of merlins registered in captivity in the UK during the period 1990 to 2000 has remained very constant at approximately 350, with an annual fledging of some 100 young. These data indicate an average captive life expectancy of 3.5 years. All merlin keepers were asked to collect samples and 37% of the captive merlin population have been included in this survey. As the program continued additional cases were added to the program either having been presented as clinical *Caryospora* cases, or being related to other birds being studied. The overall effect may be a skewed population with the addition of a greater percentage of oocyst positive birds than would have been found in a normal captive bird population. The results of this survey do confirm that *Caryospora* spp. infestation is a common problem in the UK captive bred merlin population. As this infestation has been shown to be a common cause of death in merlins,[2] the author believed that there was merit in attempting to minimise or eradicate the infestations from captive merlins in the UK. Toltazuril (Baycox, Bayer) at 20mg/kg once weekly for 3 weeks is the only therapy which has been effective in achieving this final response, although some birds have had to be treated several times. Clazuril (Appertex, Petlife) although previously recommended[2] has proven ineffective. With this exception, all treatments led to a cessation of clinical signs and a temporary halt to oocysts shedding. However long term monitoring has proven these regimes to be non efficacious contrary to previous findings.[2,3,6,7] It is generally accepted that oocysts remain viable in the environment for a considerable period (at least 15 months),[9] and that to effect full control environmental cleansing is essential. However in this survey when a second group was treated with toltazuril (Baycox, Bayer) 25mg/kg and moved to previously uncontaminated accommodation their response to therapy was no better than the group which had been treated and left in a contaminated area. Furthermore when the same level of toltazuril is administered once a week for 3 weeks, a dramatically improved response rate is achieved. The results add weight to the view previously expressed[2] that the oocysts are resistant to this treatment at certain stages of the parasite development cycle. Although even with the most effective therapeutic regime there was a significant failure rate, it is noteworthy that the initial incidence of positive samples of 48%, had reduced to just 7% by early 2000. Other workers have demonstrated the development of variable levels of immunity and duration of patency with different *Caryospora* spp. in different *Falconidae* host species.[3,6,7] In this study oocyst shedding by juvenile birds has been maintained for longer than previously reported[3,6,7] indicating a slower or less complete development of immunity. Two birds sampled in this project demonstrated overt clinical disease, with level 3 shedding, caused by the same species of *Caryospora* within a 5 month period. This is contrary to previously published expectations.[3,6,7] This finding indicates that a solid immunity is not

maintained in all merlins for a period of five months. The finding of a high incidence in captive-bred birds is as expected.[2,3,6,7] A zero incidence in wild birds is consistent with the views of some authors[2,8] but contrary to others.[4,9,10] Although the clinical effect of coccidiosis is expected to be much greater in a confined area and less significant in a free living situation, it is considered that the loss or release of infested captive bred birds could pose a threat to an already threatened endogenous free living population. The intermittent nature of oocyst shedding by infested birds indicates that sample collection over a three day period has a greater chance of detecting positive cases. Although Kuhl[3] treated 16 kestrels (25mg/kg toltazuril, Baycox, Bayer) none demonstrated any abnormalities in general health, faecal consistency, feeding, moulting or behaviour. In this survey, a small minority of birds demonstrated reduced flight ability and general malaise, a slight croakiness and change of vocalisation for a period of up to 48 hours following a single oral administration of 25mg/kg. However no birds showed any significant or long term effects and this therapeutic agent is considered safe in this species at doses up to 25mg/kg po. In this survey infestation of breeding birds has been eradicated in many cases as judged by repeated faecal monitoring and oral therapy which enabled *Caryospora* free off spring to be produced. The use of parasite free foster parents or hand rearing has also enabled parasite free offspring to be produced. The process of allowing or creating *Caryospora* infection in young birds and treating them during the pre-patent period shows promise as a clinical technique to produce un-infested young birds with immunity against the parasite. However the current project has not proven that infection did occur or that immunity was generated. Additional research is on going to further investigate control of this parasite.

Figure 1. Rate of shedding during the first 18 months of life

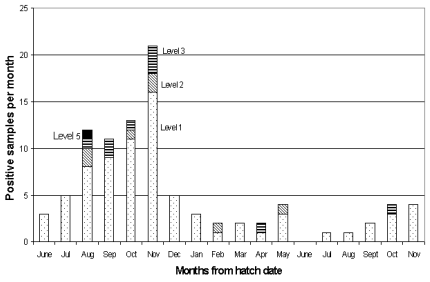

Figure 2 Monthly Oocyst Excreting incidence excluding birds <6m

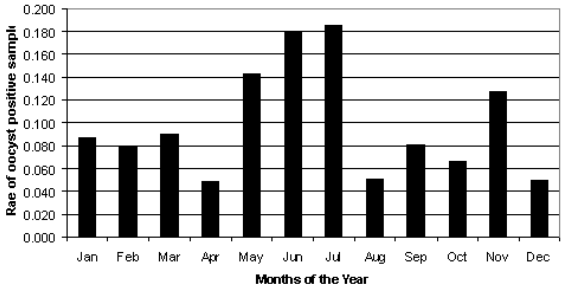

Figure 3. Rate of Oocyst positive samples by month all ages

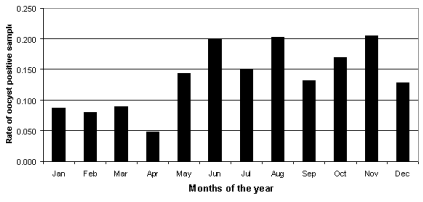

Figure 4. Therapeutic Efficacy

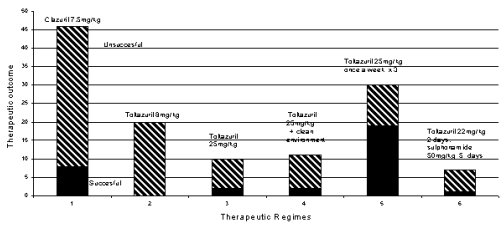

Table 2. Common Parasitic Infestations of Raptors.

Species and host susceptibility	Clinical signs	Treatment
Nematodes *Capillaria* spp. thread worm. Commonest nematode. Frequently responsible for clinical disease. Direct infection or by ingestion of molluscs, earthworms etc.	White necrotic oral lesions, or enteric. Head flicking, weight loss, diarrhoea.. Lemon shaped bi-operculate egg.	Ivermectin ineffective. Use benzimidazoles at the highest levels. (eg Fenbedazole, Panacur. Hoescht. 100mg/kg once or 20mg/kg daily x 5). Repeat after 10 days beware source of infection, and possible reinfestation. Levamisole 40mg/kg (narrow safety margin).
Ascaridia Relatively uncommon (more common in young birds), rarely found in high numbers.	Rare, unless high numbers. Can cause weight loss and gut impaction or rupture, especially in young birds. Typical ascarid- type egg (thick shelled); some show discrete bi-operculum, eg. Porrocaecum. Individual worms are large; found in small intestine, ventriculus and large intestine.	Ivermectin (200ug/kg p/o, s/c, ie. 0.2ml/kgof 1:11 dilution). Benzimidazole at the standard dose (10-50mg/kg daily 3-5 days or 20-100mg/kg once). Levamisole (20mg/kg) has narrow safety margin; rarely justifiable in individual raptors.
Spirurid (stomach worm). Rarely pathogenic.	Found in lumen and mucosa of ventriculus and proventriculus. Inappetance, weight loss. Thin-walled, larvated egg.	Ivermectin (200ug/kg), benzimidazole (10-50mg/kg daily 3-5 days, or 20-100mg/kg once). Benzimidazole does not appear to be toxic or cause feather abnormalities in raptors.
Syngamus spp. (gape worm) Commonest in Buzzard family and other scavengers.	Respiratory distress, cough, gaping, loss of vocalisation.	Avermectin (200ug/kg), benzimidazole (20-100mg/kg repeat after 10 days)+ antibiosis. Beware reinfestation form environment.
Serratospiculum spp. (Air sac worm). Common in warm climates, not in UK, unless imported birds.	Pathogenicity low, in healthy birds. If birds concurrently ill, then may cause air sacculitis. Killed worms in air sacs may lead to potentially fatal air sacculitis.	Mebendazole (Mebenvet, Janssen) 20mg/kg daily 5-10d, antibiosis, then remove worms, by endoscopy or ivermectin (Ivomec, Merial) at 1mg/kg s/c once.
Trematodes Rare in UK, 30% incidence in warmer countries. Usually larger single operculate ova.	Non-pathogenic unless in very large numbers (rare). Enteric or hepatic signs with respect to species of fluke.	Treat with chlorsulon (Curatrem, MSD Agvet) or praziquantel (5-10mg/kg s/c or p/o)(Droncit, Bayer) (not effective against all species).
Cestodes Rare	Rarely of any significance.	Treat with praziquantel (Droncit Bayer) 5-10mg/kg p/o or s/c once ,Chlorsulon (Curatrem. MSD Agvet)

Table 2. Common Parasitic Infestations of Raptors (continued)

Species and host susceptibility	Clinical signs	Treatment
Protozoa Coccidia		
Caryospora spp	Sudden death in juvenile birds 25 - 45 days of age. Inappetance, abdominal pain in adult birds.	Toltazuril (Baycox, Bayer) 25mg/kg once weekly po for 3 weeks.
Eimeria spp (rare) and *Isospora* spp.	Weight loss enteritis usually juvenile or weak birds affected.	Sulphonamide (75mg/kg daily 3.2.3), Clazuril or baycox (doses as above). Pyrimethamine (Daraprim. Welcome) 0.25 - 0.5 mg/kg bid p/o for 30 days.
Sarcocystis (rare)	Weakness, inappetance, lethargy, death	Pyrimethamine (dose as above)
Toxoplasma (raptors appear relatively resistant)	Conjunctivitis, blindness (retinal damage) , circling, anorexia, diarrhoea.	Metronidazole (50mg/kg p/o daily 5 days). Carnidazole (Spartrix. Janssen) 25kg/kg p/o once. Always freeze pigeon carcases, prior to feeding to raptors. Organism is temperature sensitive.
Trichomonas spp.('frounce'**)	Inappetance, dysphagia, white lesions in mouth/oesophagus/ crop.	

HOUSING and HANDLING

A number of basic principles must be considered whenever any birds are housed. Firstly birds are quieter more relaxed when kept in subdued lighting. Care should be taken during handling such that the chances of injury to the patient or the handler is minimised. If birds are kept in small sized accommodation then they may be caught by their jessies (if any are fitted), or by throwing or placing a towel over the bird, with all birds of prey, with the exception of vultures it is the talons which present a danger to the handler, these must be immediately immobilised, when the bird is caught. If the bird is in a larger area, such as an aviary, then the best method is to use a fisherman's landing or similar net. This may seem brutal but it is much quicker, easier and hence safer and less stressful to both handler and patient. Whenever holding a bird's feet a finger should be placed between the legs so that if the bird struggles, you do not cause any crushing injury to the legs in your attempt to restrain the bird. Having got the talons under control, the wings must be restrained against the bird's back so that it cannot flap about. Lastly (except in very large birds and vultures), the head should be held from behind. In the vast majority of cases, the bird will be accompanied by an experienced handler who will be only to happy to advise you, demonstrate or carry out the handling for you. Many falconer's birds are trained (or 'made') to the hood, ie they are used to wearing a hood, this pacifies the bird, making handling easier for you and the bird. Such hoods have to fit closely, and the bird should be used to wearing it. If a bird is made to the hood typically a falconer will bring his bird's hood with him.

When handling and treating any bird, it is most important that unlike many veterinary surgeon's more common patients, they only have one set of feathers each year. Their flight feathers, ie. primary and secondary feathers of the wings as well as the tail feathers are essential for full flight. Any wild injured bird cannot be released back to the wild with damaged flight feathers, any falconer will crucify you and never come back if you send his bird home with damaged plumage. Any bird kept in for hospitalisation should have a tail guard fitted, and should be able to perch such that it keeps its tail clear of the cage floor and the faeces.

WILD BIRD CASUALTIES

Most birds will arrive at the surgery in scruffy cardboard boxes or wire cages. On no account should any bird of prey be kept in a wire basket since this will inevitably cause severe feather damage and does not allow seclusion.

Choice of housing will to an extent depend on the injury or illness. Generally for a wild bird the ideal container should be clean dark quiet and warm. A solid sided cat carrying box is suitable for all species up to the size of a goshawk. (1 Kg in weight). Warmth can be supplied by a heated pad under the box. Such containers should be discarded after use to minimise the risk of cross infection between patients. Bear in mind that legally no bird may be kept in a container such that it cannot fully stretch its wings unless in is in the process of transportation, temporary display or is under veterinary treatment. So although the clinician may suggest such accommodation for certain cases, a client cannot make such a decision without referring the case to a veterinary surgeon first.

Once the bird has recovered from the initial injury, shock etc. it may be placed in more spacious accommodation. For a Kestrel or Sparrow-hawk the minimum size should be 1 metre cube. Each case should be considered individually. Whilst some individuals will appreciate more space, others will simply use it to throw themselves even harder against the sides of the container. Whenever possible birds should be kept separate from all other species and should not be able to see each other. Falconers' birds, if hospitalised, will tend to be better behaved as they are accustomed to proximity to humans. Their accommodation should be of sufficient size for them to stretch their wings fully. A number of different sized perches should be available preferably covered with different surfaces, such as carpet or 'Astroturf' (manuf) (a commercially available plastic grass substitute).

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