

# FALCO

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### MEFRG Objectives:

**To provide:**  
A central body for the co-ordination of research activities related to falcons and falconry.  
A common forum for the exchange of information and for promoting collaborative research programmes.

**To promote:**  
Research on health and disease in falcons, falcon moulting in the Middle East, falcon nutrition, domestic breeding, taxonomy, morphometrics, reproductive biology and behaviour.  
Improved management conditions for captive falcons through educational awareness programmes.  
Greater understanding of falconry as a part of Arab cultural heritage.

**To hold:**  
International workshops and conferences on veterinary aspects, falcon biology topics, falconry and conservation issues.

**To publish:**  
Papers on aspects of falcon conservation, falcons and falconry.  
A biannual newsletter/journal containing contributions on medical, biological and conservation topics of common interest, new developments and recent medical advances.

**Membership:**  
Membership is open to any veterinary surgeon, biologist, conservationist or falconer working in the Middle East or any other person interested and contributing in the fields of medical, biological and conservation aspects of falcons and falconry worldwide.

Falco is published biannually and contains papers, reports, letters and announcements submitted by Middle East Falcon Research Group Members. Contributions are not refereed, although every effort is made to ensure information contained within FALCO is correct; the editors cannot be held responsible for the accuracy of contributions. Opinions expressed within are those of the individual authors and are not necessarily shared by the editors.

### FALCO online

Previous issues of FALCO as well as instructions for authors can be downloaded from:  
<http://www.falcons.co.uk/default.asp?id=131>

also see Saker Conservation information portal:  
[www.savethesaker.com](http://www.savethesaker.com)



Nest of Peregrine *Falco peregrinus calurus* on Yamal Peninsula, Russia showing clutch of eggs laid in 2007 and the corpse of a dead chick from the previous year (Photo: Peter Castello)

### Photographs:

Front Cover: Sequence of photographs showing a Saker Falcon transferring prey (Pheasant Pheasant) from its feet to its bill whilst in flight (Ma Ming)

Back Cover: Cropped image from a painting entitled 'Pride of the North' by Michael Demain, courtesy of [www.michaeldemain.com](http://www.michaeldemain.com)

### Editorial

Welcome to issue 31 of Falco, the Newsletter of the Middle East Falcon Research Group (MEFRG). The objectives of the MEFRG are detailed on the opposite page. In past issues we have presented articles on health care and husbandry of falcons, on research projects undertaken on wild falcons and issues relating to trade in wild falcons. We are also conscious that one of the MEFRG objectives is to advance a greater understanding of falconry as part of Arab cultural heritage. To this end we would like to appeal to falconers for articles relating to this subject for future issues of Falco. As the UAE submission behalf of 'Falconry' under UNESCO's Convention for the Safeguarding of the Intangible Cultural Heritage progresses, we shall also be able to report on developments for Falco.

As reported in the previous issue the UAE was a key participant in the CMS inter-governmental meeting on migratory raptors at Loch Lomond in Scotland. The follow up meeting will be held in Abu Dhabi later this year (see News & Announcements section). We intend to produce a special issue of Falco for this meeting detailing research work on migratory raptors, especially falcons and ways in which captive-bred and veterinary care has contributed to the conservation of wild falcons.

The field biology articles in this issue include two studies of urban-dwelling falcons. The adoption of urban wintering areas by Saker Falcons is a little-recorded and probably recent phenomenon that has followed the burgeoning feral pigeon populations in modern cities. Whilst Sakers are relative newcomers to the urban landscape, Peregrines have been long established in many cities across the world, not just as wintering birds but also as breeding birds. Recent diet studies of the urban Peregrines have revealed that a wide range of prey species are taken, shattering the preconceived notions that these birds subsist almost entirely on feral pigeons. At the other extreme, Travis Booms, describes how he has used sophisticated recording equipment to record the diet of Gyrfalcons in very remote areas.

Two articles one from Adrian Lombard and the other from Siochpane Ostrowski *et al.*, discuss issues surrounding the 'harvesting' of wild falcon for falconry. Whilst the IUCN has a Policy Statement on Sustainable Use of Wild Living Resources, there are still many people who oppose the extractive use of wild species on ethical and moral grounds. Conservationists can fall into both camps and discussions of sustainable use are often polarised. These two articles provide interesting reading in relation to the issue of sustainable use of wild falcons for falconry.

The IUCN Policy Statement is an important document and concludes that:

- D. The use of wild living resources, if sustainable, is an important conservation tool because the social and economic benefits derived from such use provide incentives for people to conserve them:
- When using wild living resources, people should seek to minimize losses of biological diversity;
- Enhancing the sustainability of uses of wild living resources involves an ongoing process of improved management of those resources;
- Such management should be adaptive, incorporating monitoring and the ability to modify management to take account of risk and uncertainty.

In the Middle East the full spectrum of sustainable to unsustainable utilization of raptors can be found ranging from birds produced by local captive breeding projects to wild falcons smuggled from Russia and Central Asia into the region through a network of trappers and middlemen and purchased locally as live consumer products. Four of the five main falconry countries in the Middle East are signatories to CITES, but trade regulations still need to be enforced more rigorously, not only to uphold international obligations to CITES, but to maintain biosecurity and prevent the introduction of avian diseases into the region.

Is it realistic to expect falconers in the region to change cultural and behaviour patterns concerning the use of wild falcons that are generations old? There is certainly need for active falconers clubs in the region who promote a more sustainable value system. There is also need for places where falconers and conservationists can interact. There is potential for common ground and the MEFRG can fulfil this role in order for us all to develop a better understanding of Arabic falconry and the conservation concerns for wild falconry species.

The veterinary articles in this issue include contributions on nutrition, electrophoresis and aspergillosis therapy. It is surprising how little is known about the nutritional requirements of birds of prey in captivity and an article by Guio Conzu describes the benefits of nutritional supplements in captive raptors, that are often fed deficient diets. A letter by John Chitty offers a contrarian view, that before we dole out the supplements we should ask questions including diet quality and the bird's requirements.

Maya Kunnrow *et al* present results of a protein electrophoresis (SPE) study in which the authors conclude that SPE is a valuable accessory diagnostic tool if performed with high resolution agarose gels.

Volter Schmidt *et al* describe their work using the new antifungal drug voriconazole and demonstrate that injecting this drug in meat provides a therapeutic alternative to other antifungal drugs used to treat mycosis caused by *Aspergillus* spp that are resistant to currently available therapies.

### Contributions can be sent to the Editors of FALCO: Dr Andrew Dixon and Dr Tom Bailey

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## Recent occurrence of Saker Falcons in an urban environment in Hungary

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### Summary

In recent years Saker Falcons have regularly been observed hunting over the city of Debrecen in eastern Hungary. Saker Falcons utilise the urban environment mainly in winter, between November and March, when they hunt the Domestic Pigeons that are resident in the city. Several individual birds, including both adults and juveniles, have been observed in the urban environment and a juvenile bird has been observed roosting on a tall water tower in the city.



Photo 1. Adult Saker Falcon wintering in Debrecen. Photo: Istvan Balázs.

### Introduction

There are numerous accounts of raptors living, breeding and hunting in urban environments (e.g. Bird et al., 1996). Sparrowhawks (*Accipiter nisus*), Goshawks (*Accipiter gentilis*), Peregrine Falcons (*Falco peregrinus*), Hobby (Falco substateus), Lesser Kestrel (*Falco naumanni*) and Common Kestrel (*Falco tinnunculus*) have successfully adapted to the urban environment, breeding and/or wintering in many towns and cities across Europe and in other parts of the World. Specific studies on urban dwelling Peregrines and Common Kestrels have been made in Hungary (Prommer, 2005; Morandini, 2005). It is interesting to note that many of the raptors that have successfully adapted to urban environments in Europe feed predominantly on other birds and/or aerial insects. However, to date there is little information in the ornithological literature about the presence of Saker Falcons (*Falco cherrug*) in urban environments. In this short article I

present information on the occurrence and behaviour of Saker Falcons in urban habitats of Hungary.

### Results

#### Occurrence of Saker Falcons in Hungarian cities

The first observation of Saker Falcons in an urban environment in Hungary was made in the early 1990's at Miskolc, the biggest city in the foothills of the Bükk mountains (L. Losonci & J. Beres). Following the initial report on the 15<sup>th</sup> December 1991 of a possible juvenile bird, records continued until the winter of 1992/93. The next two observations were in Debrecen, the biggest eastern Hungarian city, not during the winter season but in April and June in 1995 and 1997 respectively (I. Fimlba). Following the next single observation, which came from Eger in the southern area of the Bükk mountains on the 15<sup>th</sup> December 1999 (A. Szabó), all but one of the subsequent observations originate from Debrecen, the exception being a single observation from Budapest on the 2<sup>nd</sup> February 2003 where a juvenile male followed a pigeon into a ventilating system where it became trapped (Bágyura, 2004).

#### Recent records of Saker Falcons in Debrecen, eastern Hungary

In the late 1990's, Gabor Papp observed Sakers in the close vicinity of Debrecen, the most populous eastern Hungarian city, but not in the centre of the town. The first observation of a Saker Falcon in the centre of the town was made on the 3<sup>rd</sup> December 2000 (A. Kovács). From this date the species has been regularly recorded in the city especially between early November and early March (Table 1). The increase in records in recent years is a least partly due to increased observer effort and in 2007 we found the regular perching and feeding sites of the Saker Falcons in the city centre.



Photo 2. Juvenile Saker Falcon wintering in Debrecen. Photo: Istvan Balázs.

| Year | I  | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | Total |
|------|----|----|-----|----|---|----|-----|------|----|---|----|-----|-------|
| 2000 |    |    |     |    |   |    |     |      |    |   |    | 2   | 2     |
| 2001 | 2  |    |     |    |   |    |     |      |    |   |    |     | 2     |
| 2003 | 4  | 1  |     |    |   |    |     |      |    |   |    |     | 5     |
| 2004 |    |    |     |    |   | 1  |     |      |    |   | 1  | 1   | 3     |
| 2005 | 4  | 4  | 1   | 1  |   |    |     |      |    |   |    | 3   | 12    |
| 2006 | 10 | 7  | 1   |    |   |    |     |      |    |   |    |     | 20    |
| 2007 | 4  | 2  |     |    |   |    |     |      |    |   | 10 | 25  | 41    |

Table 1. Monthly Saker Falcon records in Debrecen in the 21<sup>st</sup> Century. No data available for 2002.

A recently discovered feeding site is on one of the highest residential buildings in the town (ca. 61-70 m high), where an adult bird periodically perches and feeds, with nine observations from this site to date. I have collected the remains of 23 Domestic Pigeons (*Columba livia*) from the roof and beneath this building. The adult bird usually feeds for 30-40 minutes and then leaves the town soon after. Furthermore, Gabor Papp and I have discovered another locality in the city where a juvenile Saker and an adult Peregrine share a water tower as a roosting site. The two species usually use roosting ledges on opposite sides of the water tower, though the Peregrine is more aggressive towards the young Saker than vice versa. The juvenile Saker also uses this same water tower as a feeding and perching site too. The distance between the two sites is 1700 m.



Photo 3. Juvenile Saker Falcon hunting Domestic Pigeons over Debrecen. Photo: Istvan Balázs.

The observations of Saker Falcons in Debrecen involve several different individuals, in 2006 at least two individuals were observed, whilst in 2007, Gabor Papp and I have distinguished at least four different individuals in the city: two adult birds and two juveniles (I have seen three birds over the city at the same time). We have observed a pair hunting pigeons together and they left the city after a successful hunt. From the frequency of observations it is clear that the Saker Falcons use the centre of the city for hunting in winter. Prey remains and pellets from the breeding season diet of Saker Falcons comprised mainly pigeons (species not determined), and made up 61% of prey items analysed (Bágyura, 2005). Throughout the year, but especially in

winter, Domestic Pigeons are the most abundant pigeon species in Hungary (400 000-500 000 pairs; Eszedi 2004) and alternative prey densities in the countryside are probably lower than in the summer. There is a high density of Domestic Pigeons in Debrecen with up to 8.5 individuals/ha (Harsanyi, 1998), which attracts the Saker and is the main food source that they exploit in the urban environment. A similar situation has been described in North America, where Gyrfalcons (*Falco rusticolus*) and Prairie Falcons (*Falco mexicanus*) hunted Domestic Pigeons during the winter over the city of Edmonton in Canada (Dekker & Lange, 2011).

#### Observations from other European countries

The occurrence of Saker Falcons in urban environments has been reported in other European countries. Saker Falcons have been observed in Serbia above Belgrade in the 1990's and hunting Domestic Pigeons over Novi Sad in ca. 2005 (S. Marinković, M. Ruzić and S. Puzović, EFC-CT mailing list). Elsewhere, urban Saker Falcons have been reported from the city of Oradea in Romania (A. Nagy in lit.).

#### Acknowledgements

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## Urban-dwelling Peregrines in Britain

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### Summary

Peregrines *Falco peregrinus* have been rapidly spreading into towns and cities all across Britain. The Peregrine use tall office blocks, cathedrals and churches (Drewhit & Dixon 2008). Their close proximity to people is creating huge interest and not just from the birdwatchers. It is also allowing opportunities to closely study the species, in particular their diet and breeding cycle.



Photo 1. Urban-dwelling Female Peregrine. Photo: I. Salloway

### Introduction

Until 2008, very little had been published on the diet of urban-dwelling Peregrines in the UK. In February 2008, a paper summarising ten years of data from three sites was published in the journal *British Birds* by myself and Nick Dixon (Drewhit & Dixon 2008). The study is ongoing and the results below extend beyond the dates of the paper.

### Results

Between four sites in England, Bristol, Bath, Exeter and Derby, over 6200 individual prey items have been collected from 99 different species of bird and 3 species of mammal. Just under 50% of the diet in

England comprises pigeons and doves while the rest includes species ranging from the smallest such as Wasps *Vespa velutina* and Goldenrobes *Regulus regulus* to thrushes, finches, woodpeckers, wagtails, kingfishers and swallows. The city locations allow regular and thorough searches for feathers, wings, skulls and corpses.



Photo 2. Prey remains of a Woodcock at a feeding point on a city centre cathedral. Photo: N. Moyes.

### Discussion

Some of the species eaten seem very surprising at first – they include birds that are shy and rarely fly during the day such as Woodcock *Scotopus rusticola*, Little Grebes *Tachybaptus ruficollis*, Black-necked Grebes *Podiceps nigricollis*, Cormorants *Phalacrocorax*, Water Rails *Rallus aquaticus*, Jack Snipe *Lymnospertes minimus* and Common Quails *Coturnix coturnix*. However, they do fly at night when on migration or moving between habitats (Wernham et al. 2002). Observations in England and at other sites of the world have confirmed that Peregrines are catching these birds on a regular basis at night. The falcons are using the light from city street lamps to see the pale bellies of these birds as they are flying overhead (Verbeulen 2007; Drewhit & Dixon 2008). Common Coot *Fulica atra* despite migrating in large numbers in the surrounding areas of Bath and Bristol never feature in the diet despite also being nocturnal fliers. Their darker bellies may keep them more hidden. Some of these species mentioned are attracted to the city lights and therefore expose themselves more than if the lights didn't exist (Drewhit & Dixon 2008).

The Peregrines are also revealing interesting flight movements of other species of bird not normally found inland. Wilding birds such as Knot *Calidris canutus* and terns *Sterna* sp. are normally found on estuaries and coastlines. However, they are also found in the diet of the Peregrines at inland sites both in cities and the countryside revealing that they are flying overland to reach their destinations (Drewhit & Dixon 2008;

Andrew Dixon Pers. Comm.). These findings are also supported by ringing data (Wernham et al. 2002).

### Public Engagement

Across Britain, the public's fascination, awe and wonder with birds of prey in particular the Peregrine has seen web cameras and viewpoints put in place to show people wild peregrines. One of the most successful has been that at Derby Cathedral, Bixi Midlands, England. It can be found at: [www.derby.gov.uk/pererines](http://www.derby.gov.uk/pererines)

In its first year it attracted over 240,000 hits! Many cities in Britain have public viewing points with volunteers and staff from organisations such as the Derbyshire Wildlife Trust and RSPB showing the public the birds through telescopes and binoculars it's also an opportunity to raise money and membership for conservation. The RSPB heard their viewing points with 'Arco's Birds Brilliant' to engage the public who maybe wouldn't normally stop and look. See more information at: <http://www.rspb.org.uk/birdbrilliant/>

Photo 3. Watch-points in cities give many people their first experience at observing wild Peregrine Falcons. Photo: N. Brown.

Peregrines are popular birds in the UK – their presence in towns and cities is helping to raise their profile and interest from a wide range of people. The recent paper in *British Birds* received national coverage in newspapers, TV and radio and was one of the most popular papers for this journal in many years – a tribute to the popularity and interest Peregrines create.

### Acknowledgements

Many thanks to Nick Dixon, Linnée Hærfell, Nick Brown, Nick Moyes and the Hart's Owl Trust for their continued commitment and help with studying urban-dwelling Peregrines.

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## Saker Falcons Rearing an Upland Buzzard Chick

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### Summary

We describe a nest of a Saker Falcon on an artificial platform of an electricity pole in central Mongolia in 2007, which on initial discovery held three chicks of Saker Falcon and a single Upland Buzzard chick. The nest was monitored and the development of the brood recorded. Two young Saker Falcons died shortly after fledging, whilst the Upland Buzzard chick and one Saker Falcon chick probably fledged successfully from the nest. It is believed that the Saker Falcon usurped the nest of an Upland Buzzard after an egg had been laid by the original occupant and that this egg was incubated and hatched along with the falcon eggs that were laid subsequently. Similarity in the diet between Upland Buzzards and Saker Falcons in the steppe zone of central Mongolia enabled the Upland Buzzard chick to develop within the Saker Falcon brood.

### Results

On the 24<sup>th</sup> May 2007 at a site in flat steppe habitat in central Mongolia, we inspected a nest built on an artificial platform that was attached to a wooden electricity pole. The rudimentary nest of wire and sticks lined with rags and other items of trash had been built by an Upland Buzzard (*Buteo hemilasius*) but had been usurped by Saker Falcons (*Falco cherrug*). The nest held three young Saker Falcons, judged to be ca. 15 days old, and a single chick of an Upland Buzzard. All four chicks appeared to be healthy and in and around the nest there were the remains of Brambling Voles (*Microtus branderi*) and passerine birds. The electricity distribution line ran parallel with a railway line, which was some 25 m away.

The nest was revisited two weeks later on the 7<sup>th</sup> June when we found two Saker chicks and an Upland Buzzard chick in the nest and a third Saker chick alive on the ground below, which we returned to the nest. Interestingly, the three Saker chicks had scabs on their down which could be caused by avipox virus, bacterial dermatitis or insectoectoparasitic bites, whereas the Upland Buzzard chick was unaffected (Photo 1).



Photo 1. Upland Buzzard chick (left) with downy crown and Saker chick (right) with scabby crown. Photo: N. Baltayer.



Photo 2. Three Saker Falcons and an Upland Buzzard chick at a nest in central Mongolia on 7 June 2007. Photo: A. Dixon.

On this second visit we found an Upland Buzzard nest on the ground ca. 200 m away, which held four chicks, two of which were well feathered, one of which was at a similar stage of development as the chick in the Saker nest and a fourth was still completely covered with down. Asymmetric hatching and development is commonly observed in Upland Buzzard broods in central Mongolia. The proximity of this ground nest to the nest on the artificial platform suggests that it belonged to the pair that was displaced by the Saker Falcons.

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Sites 24 hours a day and at most sites, recorded most or nearly all of the 45 day nesting period.



Photo 2. View of the small camera glued to the rock wall at an eyrie.



Photo 3. The solar panel array, battery bank (in black action packer), and recording system (gray pelican case covered by camouflage tarp) located at the top of a nesting cliff.

#### Success

Image resolution and system reliability proved very good, even in the harsh Arctic environmental conditions. Over two years, we recorded about 2,700 hours of video from four nests, documenting 921 prey deliveries. And though the recording systems were somewhat expensive to purchase originally (\$5,000 USD), operational costs are low and the system has been used in subsequent field studies of other raptor species. Unlike observational studies from a blind, the video system provides a permanent record that can be reviewed endlessly and used in the future to study other behavioral topics.

Since this field study was completed, time-lapse video monitoring technologies have improved greatly. Video from multiple cameras can be relayed remotely to a central receiving unit, eliminating constraints of chord lengths and greatly improving logistical and financial efficiency. Image quality capabilities have improved, particularly with the advance of digital recording units.

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The nest was visited a third time on the 22<sup>nd</sup> June, when only the Upland Buzzard chick remained, fully feathered and close to fledging. No food or prey remains were found at the nest, but we saw a female Saker with a vole sitting ca. 50 m away. The three Saker Falcon chicks were displaced from the nest. The first chick was perched on pole, the second chick was found at the base of another pole (in the shade), both about 100 m away from the nest and the third chick was found sitting on ground in the shade of fence pole ca. 10 m away, near the railway line. This chick had a badly mutilated right leg (dangling on its tendon) and large scabs on its crown. The Upland Buzzard nest on the ground nearby was also checked; there were two nearly fledged chicks and one dead chick on the nest. Another dead chick was found near the nest (ca. 10 m away).

The next visit was on July 7<sup>th</sup>, when we found two dead Saker Falcon chicks, one inside the railroad fence about 20 m away and the chick with mutilated leg was found dead 30 m away from the nest pole. We could not locate the third chick nor was any adult bird seen near the nest. When we checked the nearby Upland Buzzard nest, no chicks were found, but we saw a recently fledged Upland Buzzard chick flying not far from the nest. The last time we visited the Saker Falcon nest was on August 4<sup>th</sup>. We saw a live Upland Buzzard chick perched on an electric pole and there was an adult flying in the area. Also we found a dead Upland Buzzard chick near the railway line; it had probably been hit by train. However, we don't know whether this was the chick fledged from the Saker Falcon brood or if it came from the nearby Upland Buzzard nest.

#### Discussion

We believe that the Upland Buzzard chick hatched from an egg that was laid in the nest and was not deliberately put there by someone. The likely scenario is that the Saker Falcons took over the nest with a single, fresh Upland Buzzard egg and they did not remove it before laying their own eggs. In Mongolia, we have seen mixed clutches containing eggs of both Upland Buzzard and Saker Falcon in the same nest previously but this is the first time we have seen a mixed brood of chicks.

The diet of Saker Falcons and Upland Buzzards in the steppes of central Mongolia is broadly similar, in that both species exploit high density populations of small mammals, although the diet of Saker Falcons typically comprises a greater proportion of avian prey. Consequently, nesting Upland Buzzards can develop quite normally on the food provided by adult Saker Falcons.



## Studying the Diet of Large Falcons in Remote Areas - Challenges and Successes

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### Summary

Food is one of the primary tenets around which organisms develop, evolve, and adapt. Because of its importance, we were interested in assessing diet in breeding wild Gyrfalcons in Greenland in more detail than traditional techniques such as prey remains and pellets provided. Hence, we conducted a detailed study of diet using a solar-powered, time-lapse video recording unit placed at Gyrfalcon nest sites during the breeding season. The technique proved highly effective and captured 2,700 hours of detailed footage of prey deliveries and feedings. This technique should work well for others interested in studying diet of large falcons in other remote locations.



Photo 1. Travis Booms in one of the video-monitored Gyrfalcon eyries; camera is visible just above his head.

### The Challenge

Food is one of the primary tenets around which organisms develop, evolve, and adapt. This is a statement of the obvious, but even for large falcons that are revered throughout the world, some of their basic biology such as diet has largely gone unstudied. Most detailed raptor diet studies have relied on the traditional pellet and prey remains analysis, often because other techniques are either not available, cost prohibitive, or logistically not feasible. However, though pellet and prey remains analysis is a cornerstone of raptor biology, we know these analyses often provide over-simplified, biased views of diet.

Collaborators and I faced this dilemma while designing a study of Gyrfalcons in Western Greenland. The most important potential topic to study was fairly obvious – little was known about the species' diet in this area other than assuming it relied heavily on ptarmigan, as it does in most of the regions it inhabits. But to what extent, what alternative prey species it relied on, and what seasonal differences might occur in the Gyrfalcon's diet in West Greenland was unknown. Answering such questions has important implications to understanding population dynamics and Gyrfalcon ecology.

### The Technique

We set-out to develop a study to identify, in detail, Gyrfalcon diet and feeding ecology. Though pellet and prey remains would be an essential component of the research project, we desired a more detailed and accurate measure of diet. Conducting direct observations at nest sites was an option and would provide the type of data we were interested in. However, building a close-range observation blind was not feasible at most nest cliffs, and we were unsure how the birds would react to a new structure close to their nest. Hence, we turned our thoughts to a remote video system which was becoming a more commonly used tool in ornithology. After the requisite investigations into remote power systems, resolution, reliability, price, digital vs. analog, and too many other topics, we settled on a solar-powered Sentinal All-Weather Video Surveillance Systems produced by Sandpiper Technologies, USA. I continued a small, silently operating camera at the end of a 75 m chord, to which a time-lapse VHS VCR was attached. Collaborators and I installed the camera at nest locations by gluing the camera base directly to the rock cliff within 1 meter of the nests using two part epoxy.

The camera location provided exceptional, close-range views of prey items as they were carried into the nest by adults and fed to young. Because the nests were in remote locations far from roads or cities, we constructed a solar-panel array that charged a battery bank that provided continual power to the recording units. Hence, we were able to record video at nest

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## The Harvest of Wild Raptors by Falconers: A Practical Exercise in Sustainable Use to Encourage Conservation

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### Summary

Traditionally, falconers have relied on the procurement of wild raptors to supply their needs for hunting birds. This situation has persisted until developments in breeding technology allowing the ready availability of captive bred birds over the past thirty years. There are about 150 active falconers in South Africa, who will fly one or, occasionally two birds at a time. Our wild harvest is limited, annually, to a total of some 30 birds of a variety of species. Criticism of this harvest appears to be based on (i) aesthetics and (ii) conservation considerations. The Peregrine Falcon is listed as endangered in South Africa, though there are now more peregrines in South Africa than ever previously. A similar population increase has occurred with Black Sparrowhawks, African Goshawks and Rufous-Chested Sparrowhawks. In most provinces falconers are permitted a limited wild harvest of suitable raptors which is entirely sustainable. Falconers are very jealous of this significant privilege which has positive benefits. The principle of a sustainable harvest of wild creatures is widely accepted in Nature Conservation and is enshrined in the principles of the Convention on Biodiversity.



Photo 1. Black Sparrowhawk, a popular falconry bird in South Africa.

### Introduction

Traditionally, falconers have relied on the procurement of wild raptors to supply their needs for hunting birds. Indeed, this situation has persisted until developments in breeding technology allowing the ready availability of captive bred birds over the past thirty years. The development of this technology was sparked by the dramatic crash in peregrine falcon populations, primarily in the northern hemisphere, linked to the use of organochlorine pesticides. The epidemiology of the peregrine population decline was initially, poorly understood and, erroneously, over-harvesting by falconers to supply a presumed lucrative and illegal black market in the Middle East was deemed to be the cause. This was not the case and little evidence was ever produced to support the allegation.

Falconers have been in the forefront of the effort to restore the population of peregrines and other raptors decimated by pesticides. Most dramatic were the efforts of the Peregrine Fund in North America, started by falconers and using falconry birds as the initial brood stock. Here thousands of captive bred falcons were released back to the wild in an effort which has proved so successful that the North American Falconers are once again, permitted a wild harvest. This effort was mirrored, but less lauded, in other parts of the world. These efforts would include the restoration of the Northern Goshawk in Britain where it was extinct and attempts to re-establish the population of tree-nesting peregrine falcons in Germany and Poland.

Falconers were the first in Britain to notice the dramatic decline in the breeding successes of wild peregrines and this is recorded in articles in "The Falconer", journal of the British Falconry Club, in the late 50s. At that time, falconers were granted licenses to take wild peregrines by special dispensation. The falconers in Britain took an ethical decision to relinquish their wild harvest and not take up their permits until normal breeding was restored. Evidence exists to show that the population of Peregrine Falcons in Britain is currently better than ever in the past. Similarly the Northern Goshawk is again considered to be a threat to pheasant stocks and is being shot by gamekeepers. Despite the evidence, falconers in Britain, unlike their counterparts in diverse countries such as the USA, Ireland Germany and, indeed, South Africa are not permitted a wild take, principally through fear of a "green" outcry; Privileges once lost are seldom recovered.

One could possibly consider hawks to be among the oldest domesticated animals, along with dogs and horses, although they continued to breed in the wild. The Saker Falcon has been used by falconers for well over 2 thousand years, making this one of the oldest relationships between man and wild animal. In the

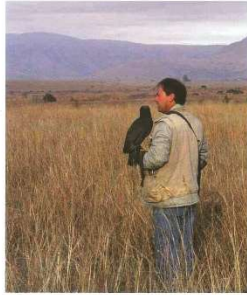
For detailed information regarding this work, please see the following publications:

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Middle East, Sakers have been trapped, traditionally, when south-bound on their autumn migration. They are then used by Arabic falconers to hunt through the winter and are released in spring to travel north with the migration once again. These traditions have been altered with the oil wealth of recent history. Sakers may now be retained through the summer in air-conditioned pens. On the other hand, captive breeding has given the modern Arab falconer the choice of exotic and hybrid falcons which are more exciting than the wild-taken Sakers. A dramatic decline in Saker Falcon has been noted in recent years. Once again, falconers find themselves in the forefront of the list of suspected causes. Some blame may be apportioned to possible over-harvesting and disturbance in the central Asian breeding grounds. While not attempting to defend the excesses of modern Arab falconers, I believe that it is serious to discuss if facile explanations were accepted to placate "green" critics and other very real potential causes for this decline were to remain uninvestigated. The serious impact of the environmental degradation of the Saker breeding grounds, the loss of their quarry base in these breeding grounds, as well as the impact of electrocutions by hazardous power-lines through the flat and treeless expanse of central Asia, all needs urgent consideration.



A falconer handling with a Black Sparrowhawk in South Africa.

#### South African wild harvest of falcons

With this background of international concerns, the falconry fraternity in South Africa also faces criticism of their wild harvest. There are about 150 active falconers in South Africa, who will fly one or, occasionally two birds at a time. Our wild harvest is limited, normally 12

to a total of some 30 birds of a variety of species. The criticism would appear to be based on two grounds:

1. **Aesthetics.** There is a perception that, because raptors are special and admirable creatures, they should not be subject to the same conservation considerations as other forms of life. While falconers will hardly quibble with the respect or reverence afforded the birds of prey, we would deny that special ethical consideration differentiates them from other forms of life. A limited and sustainable harvest is acceptable, particularly as we do not seek to kill these creatures and our intervention probably allows more to live.
2. **Conservation Considerations.** There is a prevailing belief that all raptors and, following the DDT scare, particularly the peregrine falcon are rare and endangered to the extent that any sort of harvest may turn the tide and tip their populations toward extinction. As apex predators it is prudent to be concerned about their conservation status and monitor their populations. While it is certainly true that some species of raptors are in danger of extinction, this does not apply to those raptors that are popular falconry birds. Indeed agricultural practices which have resulted in a burgeoning population of pigeons and doves have produced a dramatically increased food supply for these birds.

The Peregrine falcon, in South Africa, is listed as endangered as a result of the devastating reduction in population numbers, globally, some 40 years ago. While they were probably less affected in Southern Africa, than elsewhere and there are now more peregrines in South Africa than ever previously. This is well documented and can be readily observed as not only are the traditional cliff nesting sites occupied, but they are also to be found nesting on high-rise buildings in cities and on the walls of quarries.

A similar population increase has occurred with Black Sparrowhawks which use exotic Gum and Pine plantations for nesting and this is particularly noticeable in the Western Cape where there has been a significant extension of the range of these magnificent birds.

Habitat change with exotic trees and an increase in the prey supply has similarly benefited African Goshawks and Rufous-Chested Sparrowhawks.

South African Falconers have bred Peregrine falcons for many years and, indeed produce a surplus which is released to the wild. Black Sparrowhawks, Rufous-Chested Sparrowhawks, Gabar Goshawks, African

Goshawks, Red-necked falcons, Lanner falcons and jackal Buzzards have all been bred in captivity.

Nevertheless, in most provinces, falconers are still permitted a limited wild harvest of suitable raptors which is entirely sustainable. Falconers are very jealous of this significant privilege which has positive benefits. These include:

1. The wild harvest encourages falconers to be active participants in the conservation effort and contribute in a variety of ways to the conservation of raptors and also to the conservation of gamebirds and to the preservation of the environment.
2. The accessibility of wild birds for falconry keeps the sport within the reach of younger and less affluent falconers as captive bred birds are not inexpensive and so would risk seeing this activity becoming the preserve of the wealthy to the detriment of both the sport and the conservation effort.
3. Controls which are applied to members by falconry clubs to ensure that good standards of husbandry and good ethical standards are maintained become more difficult if birds are privately owned.

There are also a number of negative effects which would result from the loss of this wild harvest.

1. Captive breeding encourages the trading in birds of prey and this is an area which we have striven to limit and discourage for obvious reason.
2. Loss of the wild harvest would not only reduce the incentive for falconers to contribute to the conservation effort but would also actively inhibit them as it has in other countries where the wild take is prohibited. For example, activity by falconers at nest sites in this situation would lay them open to accusations of nest-robbing and laundering of birds through breeding operations.
3. The use of exotic and hybrid raptors for falconry in South Africa is very limited and of negligible impact on the environment. Experience elsewhere in the world has shown that the use of these birds dramatically increases when the wild harvest is not permitted.
4. If all falconry birds were to be captive bred there would have to be a large increase in the number of breeding birds held in breeding pens. What is seldom appreciated is that the ultimate fate of a falconry bird is release back to the wild. For example, Lanner falcons are normally trapped as "passage" or immature birds; they are flown for

one or two seasons and released. We see the wild harvest, in essence, as the borrowing of birds from nature and their ultimate release, in fine hunting condition, is a highly satisfactory outcome.

#### Concluding remarks

Experience in the captive breeding of raptors is laudable and availability of captive bred birds is an asset to the falconry community in South Africa. While the threat of the loss of our wild harvest persists, captive breeding is here to stay. Nonetheless, the principle of a sustainable harvest of wild creatures is widely accepted in Nature Conservation and is enshrined in the principles of the Convention on Biodiversity. I would plead with reasonable people who are concerned with the conservation of our wildlife to look with sympathy on the falconers' limited wild harvest and, in so doing, encourage the continuance of our art and the conservation of South Africa's raptors. For more information, please visit our website at [www.safalconry.co.za](http://www.safalconry.co.za).

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#### THE SOUTH AFRICAN FALCONRY ASSOCIATION INTERNATIONAL FIELD MEET 2008.

The South African Falconry Association is proud to announce that it will host an International Field Meet, in conjunction with the IAF AGM in July 2008. The Meet is open to all falconers from around the world who may wish to experience African falconry and meet with falconers from South Africa and Zimbabwe.

**Dates:** 14<sup>th</sup> to 20<sup>th</sup> July 2008.

**Venue:** Thabo Nchu, East of Bloemfontein in the Free State Province of South Africa.

For details, see our web site: [www.safalconry.org.za](http://www.safalconry.org.za) or contact Adrian Lombard on [lombarda@msb.co.za](mailto:lombarda@msb.co.za). If attending please complete the booking notification and fax it to Adrian Lombard on +27 0865188912.

We look forward to welcoming you to South Africa and sharing the fellowship of falconry with you.

#### An Assessment of the Raptor Trade in Afghanistan: A Short Visit to Mazar-e-Sharif

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#### Introduction

Since July 2006, WCS Ecosystem Health Team members have conducted regular surveys in the Ka Parushi bird market in Kabul (Ostrowski 2006a, b), and in other wildlife markets in Afghanistan, to understand wildlife trade patterns in the country. Trade in wildlife is of special concern to our team since it plays a major role in the spread of infectious diseases and may directly threaten wildlife populations (Bailey *et al.*, 2001; Kurash, 2005). In late August 2007, while travelling to Wakhan, team members visited shortly Mazar-e-Sharif in Balkh Province, which we had been told is an important hub for raptor trade in Afghanistan. Hawks and falcons are apparently traded in the region to be sold to middlemen and falconers, often from Gulf States<sup>1</sup>. This trade is illegal and approaching the actors of this cryptic business is difficult. Our investigation was voluntarily brief and as little intrusive as possible.

#### Background

The Arabs have been pursuing falconry since ancient times. In the past, the Bedou typically trapped falcons as they passed through the Gulf during their autumn migration from Eurasia to their wintering grounds in Africa. Few then for one season, and they released them. They used falcons to catch prey, such as the Common Quail (*Coturnix coturnix*), the Eurasian Stone Curlew (*Burhinus oedemnes*), and occasionally the Asian Houbara Bustard (*Chlamydotis macqueenii*), the ultimate quarry of Arab falconers, to supplement their otherwise frugal diet (Allen, 1986). Nowadays, falconry is no longer practiced out of necessity but it remains an integral part of the Arab life style and has become an important sporting activity in the Gulf States (Upton, 2002), especially with the development in the 1980s of an enriched middle class keen on upholding its tribal heritage. At that time, demand for falcons surged and could no longer be satisfied by the local trapping of migrating birds. As a consequence, capture of raptors (trapping and nest robbing) developed in Asian breeding grounds, contributing to a decline in their numbers.

<sup>1</sup> The name of the body of water separating the Arabian Peninsula from Iran is still controversial in the region. To automate the diffusion of this report in all the concerned countries, we will use the name "Gulf" in this report.

All falcons are not equally desirable to the Arab falconers and some birds are more in demand than others. Due to their larger size and, therefore, greater success at hunting the Hoabara Bustard, most sought-after birds are females of Saker falcons (*Falco cherrug*), the classic bird of Arab falconry, Peregrine falcons (*Falco peregrinus*) and Gyrfalcons (*Falco rusticolus*) (Cade, 1982; Burton, 2000, 2002). All three species are on the IUCN Red List of Threatened Species (IUCN, 2006) and they are listed in Appendix I or II of CITES (Table 1), which means their commercial trade is either not allowed or allowed only with CITES permit, respectively.

The case of the Saker Falcon is especially worrying. Biologists from the Environmental Research and Wildlife Development Agency (ERWDA) in Abu Dhabi (now Environment Agency, EAD), mandated to address the impact of falconry on Saker Falcon populations, have documented a very rapid population decline, particularly in Central Asian breeding grounds, mostly caused by inadequately controlled off takes for the falconry trade. Annual consumption of Saker falcons for Saudi Arabia, Qatar, Bahrain, Kuwait and United Arab Emirates (UAE) has been estimated at 6,825-8,400, mainly juveniles (77%) and adult (19%) females, potentially creating a major bias in the wild population (ERWDA, 2003). This species is now categorized as Endangered by the IUCN.

In the 1990s, high demand coupled with increasing rarity in the wild made the falcon trade very profitable for middlemen and dealers, and provided the incentive for local communities to trap falcons. At the end of the chain, market prices commonly reached an astonishing 20,000–40,000 \$US for an adult female Saker in Riyadh or Dubai, even sometimes hundreds of thousands of dollars for exceptional specimens of the more favoured types<sup>2</sup>. During the same decade, the falcon 'harvest' increased considerably and coupled with an increased availability of captive bred birds progressively saturated the market in Gulf countries<sup>3</sup>. Thus, between 1999 and 2001, market prices for wild falcons fell by at least 50% (Fox, 2001). This, coupled with the trade ban imposed on UAE by CITES in 2002,

<sup>2</sup> The Arab system of classification identifies over 11 'types' of Saker falcons based on the bird morphology, which are not equally favoured by Arab falconers. Preferred falcon types are not associated with specific breeding grounds but occur and sometimes region (e.g. Altai) seem to provide a large number of excellent specimens and Saker population may be more at risk there (Fasi *et al.*, 2002).

<sup>3</sup> Whether captive-breeding has been instrumental in the drop in market prices for falcons is debatable. Certain authors such as Fox (2001) support this opinion. However, whether the majority of falconing birds were from wild or captive-bred origins is unfortunately difficult to assess with precision. Captive-bred falcons are often traded by parents, who consider them poor harvesters compared to wild-born adults.

Table 1. Saker, Peregrine and Gyrfalcons: current categorization in IUCN red list and listing in CITES appendices.

| Common name      | Scientific name         | IUCN Red List Category | Listed in CITES Appendix |
|------------------|-------------------------|------------------------|--------------------------|
| Saker Falcon     | <i>Falco cherrug</i>    | EN                     | I                        |
| Peregrine Falcon | <i>Falco peregrinus</i> | LC                     | I                        |
| Gyrfalcon        | <i>Falco rusticolus</i> | LC                     | II                       |

EN: endangered species; LC: least concern species

the implementation of a CITES passport to monitor the captive falcon population, affected the unregulated market there (Fox, 2002; ERWDA, 2003). However, local communities in falcon breeding grounds are poor and even reduced prices and reinforced regulations don't deter people (trappers, middlemen and exporters) involved in this business. The multi-million dollar fur trade is most probably still going on but, owing to its largely clandestine nature, very difficult to document.

Afghanistan is a known breeding ground and migratory destination for several species of falcons, including the Saker Falcon, and hawks, but the occurrence and extent of raptor trade in this country is unknown.

#### Report

Through anecdotal reports of captive birds (in Kabul zoo for example) and informal discussions with sighrid traders in Ka Parushi market and falconers in Gulf countries, we learnt that Mazar-e-Sharif in Balkh Province is considered an important hub for the falcon trade in Afghanistan. We also got the name of a hotel there, whose owner is known to be a major middleman in the regional falcon trade.

On August 26, 2007, while travelling to Wakhan for a summer survey, Ecosystem Health Team members Drs Ali Madad Rajabi and Hafizullah Noon stopped in Mazar-e-Sharif to pay a visit to the hotel owner. He agreed to present two of his relatives involved in the falcon trade for an interview. One belonged to the Uzbek ethnic group, the other to the Pashto ethnic group. We asked each of them a series of nine questions and they responded cooperatively. Interviews were carried out in Dari and subsequently translated into English by Dr Rajabi.

**Question 1: Where do traded falcons come from?** Local trapping seems to provide the majority of the raptors sold in Mazar-e-Sharif. Trapping takes place in three contiguous northern provinces: around Mazar-e-Sharif (Balkh Province), and in the west around Sheberghan (Jowzjan Province) and Andkhoy (Faryab Province). A few raptors come from China, Uzbekistan and Tajikistan. The two traders also mentioned that some birds came from Tashkurgan<sup>4</sup> but it wasn't clear whether they referred to Tashkurgan in western Xinjiang, China, or to a local area in Afghanistan.

#### Question 2: What are the local mechanisms of falcon trade?

Captured raptors are quickly brought to Mazar-e-Sharif and hidden in private houses. Potential buyers stay at the hotel until the hotel owner informs them of the catches and brings them to inspect the birds. If several buyers are interested in the same bird, it is auctioned and sold to the highest bidder. Buyers are usually local traders who resell the birds to visiting traders or falconers. On several occasions in the recent past it also occurred that rich falconers from Arab countries hired the services of trappers and directly participated in captures. It happened for example in 2006 when an important Arab customer (said to be a Ministers son) hired a team of trappers and succeeded in capturing one valuable specimen.

#### Question 3: Which species of birds of prey are sold in Mazar-e-Sharif?

In descending order, the most represented bird species in the Mazar market are the Eurasian Sparrowhawk (*Accipiter nisus*), the Goshawk (*Accipiter gentilis*) and the Saker Falcon (*Falco cherrug*). Afghan traders favour Sparrowhawks and Goshawks whereas Pakistani and Arab traders are interested by Saker Falcons.

#### Question 4: What are the prices of bird of prey sold in Mazar?

All good specimens are auctioned. Average price for a good Saker Falcon would be 1000 US\$ while exceptional individuals could reach 2000–3000 US\$. On the other hand, poor quality sparrowhawks will not exceed 100 US\$. More sought-after individuals are those with very white belly feathers and very yellow eyes (here: obviously referring to sparrowhawks or goshawks).

#### Question 5: Who are the traders / buyers?

Buyers are, by descending order: Afghan traders, Pakistani traders, and Arab traders and falconers. They smuggle falcons to Pakistan or directly to 'Arabistan'. When Pakistani or Arab traders visit the area they often bear documents issued by the Afghani government allowing them to trap falcons in the country. Until 2–3 years ago significant numbers of falcons were also coming from China, Uzbekistan and Tajikistan. Nowadays falcons from Mazar-e-Sharif are essentially captured in Afghan provinces.

**Question 6:** For which reasons do Arab people buy falcons?

One of the responder said that there is in 'Arabistan' a kind of pigeon of great value, which when consumed improves longevity. Falcons are trained to capture this species. The other falconry is the use of a peculiar species of fish, living only in 'Arabistan' that bears some gold in its stomach. Arabs train falcons to catch this fish species and collect gold.

**Question 7:** When is the peak of capture operations?

Falcons and other birds of prey are captured during autumn. Trapping starts in October but the best time to capture raptors is from the end of November to mid-December.

**Question 8:** What kind of technique do you use to catch the birds?

Trappers use pigeons fitted with a 'snare harness' to trap falcons. Snare are fixed on the back of a pigeon which is either attached to the ground or has a piece of cloth attached to its legs to limit its fly performances. When a falcon is spotted in the sky, pigeons with snare are released in the air or on the ground. If a falcon attempts to catch the pigeon, its claws get trapped in the snare, and it is trapped.

**Question 9:** What is your understanding of market trends in recent years?

In recent years trapping pressure has decreased in the region. Because of the hunting ban promulgated by the Central Government, local police are now bribing trappers if they want to continue their activities. The trappers who do not have enough resources or capture opportunities stop their activities.

**Discussion**

The present report documents raptor trading activities in Mazar-e-Sharif based on the interview of two persons. Although we have been told that these two persons were intimately involved in falcon trade we have no means to verify this and their answers should be interpreted carefully. Having said that their answers corroborated what I (Dr Oronowski) already knew from falcon trading in western Asia. Indeed when discussing with falcon dealers and local falconers in Gulf countries, I was told that falcons from Afghanistan or transiting through Afghanistan were often purchased by Pakistani traders from Peshawar, smuggled to Pakistan before being further smuggled to UAE, Qatar, and Saudi Arabia. The technique described for trapping falcons is very similar to the one used by falconers along the shores of the Red Sea coast, south of Jeddah in October and November, which I have personally witnessed. It is important to understand that migrating adult birds with already good hunting techniques are far more

valued by Arab falconers than juvenile birds collected in nests before fledging or juvenile birds performing their first migration. Kabul Zoo displays a confiscated juvenile Saker highly imprinted to humans that might have been collected unheld from nest. Although of reasonably good size, such animal is of little to no value to falconers.

Prices mentioned by the two responders were about 30-50% of those reported from the UAE market, meaning that prices roughly double between Mazar and the UAE markets, which shows a reasonable profit for traders provided they succeed buying a cohort of birds or an individual of great value.



**Photo 1.** Confiscated Saker Falcon at Kabul Zoo.

Both responders suggested that falcon trade decreased during recent years. Although this information must be interpreted with caution, it is interesting to note the perverse mechanism triggered by the National hunting ban, which unfortunately supports indirectly police corruption.

Prior to the Afghan-Soviet war, Afghanistan had a strong tradition of falconry. It is a known breeding ground and migratory destination for several species of falcons, including the Saker Falcon, and hawks but the occurrence and extent of raptor trade in this country is unknown.

Note worthy Mazar-e-Sharif seems to be a more important marketing place for Accipitridae (sparrowhawks and goshawks) than for Falconidae (falcons). Accipitridae are valued by local people but

are only seldom sold in Gulf countries. Most falconers in these countries regarding flying 'yellow-eyed' birds as dis Honourable.

Eventually the reasons advocated by the two local dealers for Arab people putting so much money into buying falcons make sense. The 'kind of pigeon' hunted by Arabs refer most probably to the Houbara Bustard, and it is true that Arab falconers believe that calling houbaras improves longevity and is also an aphrodisiac. However the interesting observation is that both dealers did not really know about Houbara Bustard, a species breeding in southern provinces of Afghanistan but also in the north near Mazar-e-Sharif (Olivier Combreau, pers. comm.) and also victim of an intense smuggling to supply Gulf country markets (Combreau et al., 2001; Tourang et al., 2005), suggesting that both traders were not involved in Houbara Bustard trade.

We hope that this short document will improve the understanding of conservationists, often misinformed, about the current reality of capture and trade of raptors in Mazar-e-Sharif region, Afghanistan.

**Acknowledgments**

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**Nutritional Supplements used in Raptors**

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Other than some studies about serum levels of Vitamin E in various raptor species (Calle et al., 1989; Mainka et al., 1992; Mainka et al., 1994), surprisingly little is known about the nutritional requirements of birds in captivity.

Several types of food are commonly used to feed raptors, including "whole prey" such as day old chicks, quails, pigeons, rodents, and butcher's horse, beef, lamb, and chicken meat. Some small species, like Lesser Kestrel (*Falco naumanni*) and Merlin (*Falco columbarius*), can be fed on insects, while others such as Osprey (*Pandion haliaetus*), fishing eagles and sea eagles with fish.

The generally held view on raptor nutrition is that a good diet should be diverse and should include whole prey of different species, such as day old chicks, quails, rodents and pigeons (Heideneich, 1997; Fox and Barton, 2000; Forbes and Davies, 2000; Forbes and Flint, 2000), because the nutritional content of prey animals is different (Forbes and Flint, 2000; Clum et al., 1996; Cooper, 2002). In Europe, many raptor keepers feed their birds exclusively with day old chicks. Although it is reported that European Kestrels (*Falco tinnunculus*) can breed successfully for several generations on a diet consisting entirely of day old chicks (Forbes and Davies, 2000), this food is probably inadequate for other species as a sole food source. Some health problems associated with the exclusive feeding of day old chicks include atherosclerosis, metabolic bone disorders, thiamine deficiency and overgrown hooks (Fox and Barton, 2000). The yolk of day old chicks is considered by some authors to contain excess fat and if used as the sole source of nutrition may cause 'Fatty Liver/Kidney Syndrome' in Merlins (Forbes and Cooper, 1993).

Diets based solely on muscle are also inadequate (Fox and Barton, 2000; Forbes and Davies, 2000; Forbes and Flint, 2000; Cooper, 2002) and should not be used without adequate supplementation (Table 1). Even if raptors are fed an adequate diet, it may be useful to supplement their diet during times of increased physiological stresses that includes training, hunting, breeding, or moulting (Fox et al., 2000; Forbes et al., 2000; Chitty, 2007). As a precautionary measure when handling or transporting more highly strung species such as Goshawks (*Accipiter gentilis*) and

Sparrowhawks (*Accipiter nisus*), the provision of vitamin supplementation is recommended (Fox and Barton, 2000). Nutritional supplementation is necessary in sick birds because their increased metabolic requirements are often combined with anorexia and an associated loss of body condition (Fox and Barton, 2000).

**Table 1.** Suggested supplementation of raptors diet

| FEED BASED DIETS    | TYPE OF SUPPLEMENTS  | WHEN TO SUPPLEMENT   |
|---------------------|--|--|
| Butcher's meat      | Calcium and trace minerals, vitamin complex (all vitamins), amino-acids, plants extracts | Maintenance, Breeding, Moulting, Growing, Diseases, Stress |
| Day old chicks      | Calcium, vitamin complex (especially B group and E), amino-acids, plants extracts        | Maintenance, Breeding, Moulting, Growing, Diseases, Stress |
| Maturing whole prey | Vitamin complex (especially vitamin B), amino-acids, plants extracts                     | Breeding, Moulting, Growing, Diseases, Stress              |

Over supplementation can be dangerous, especially with regard to fat soluble vitamins such as vitamins A and D3—because they are stored in the liver (Fox and Barton, 2000). In comparison, water soluble vitamins can be provided to excess without being harmful (Fox and Barton, 2000).

If supplements are to be used, then those developed for raptors should be used (Chitty, 2007). Many supplements that are currently marketed for falcons have not been specifically formulated for these animals, but for pet birds. However, raptors are obligatory carnivorous, and their nutritional needs are different from psittacines or passerines. Indeed, their nutrient requirements are considered to be similar to that of Felids and other carnivorous species (McDonald, 2002).

To avoid an imbalance in Calcium and Phosphorus levels, raptors need Calcium supplementation in their diet, especially if the diet is not based on whole mature animals. It is also conceivable that as in other carnivorous species, raptors may need Thaurine and Tryptophane supplementation (McDonald, 2002).

Vitamin A is usually added to feline diets, but its supplementation is not always necessary in falcons fed with whole prey, because of the high content of this vitamin in the liver of prey animals (Forbes and Flint, 2000; McDonald, 2002). Many supplements designed

for pet birds have high levels of vitamin A to cover the deficiency of this vitamin in seed based diets, so their use in falcons is not recommended because of the potential risk of vitamin A toxicity. Furthermore, high doses of vitamin A may antagonize other fat soluble vitamins, particularly vitamin E (Forbes and Flint, 2000; McDonald, 2002).

Vitamin E plays an important role as antioxidant and its deficiency causes neuromuscular, reproductive and vascular systems disorders (McDonald, 2002). It also benefits fertility and egg hatchability (Tux et al., 2000; Forbes and Flint, 2000; McDonald, 2002) and consequently vitamin E supplementation of the diet, particularly during the breeding season, is recommended by some authors (Heideneich, 1997; Fox, 1995). The nutritional quality of food that has been frozen for a long period of time is reduced - vitamin E and water soluble vitamins are particularly susceptible to degradation during storage (Forbes and Flint, 2000). For these reasons dietary supplementation is recommended in breeding birds.

The criteria used to formulate supplements for raptors compared to most non-specific avian supplements includes:

- reducing vitamin A level,
- increasing vitamin E level,
- including Calcium,
- including Thaurine and Tryptophan.

**Table 2.** Suggested daily dosage of vitamins, amino acids and minerals of a supplement formulated for falcons undergoing training.

| Vitamins        | Dose/kg bw (mg) | Aminoacids      | Dose/kg bw (mg) | Minerals          | Dose/kg bw (mg) |
|-----------------|-----------------|-----------------|-----------------|-------------------|-----------------|
| Vitamin A       | 2,000 IU        | L-arginine      | 3,0             | Calcium gluconate | 4,0             |
| Vitamin D3      | 5 IU            | L-lysine        | 3,0             | Copper            | 0,06            |
| Vitamin B1      | 12 IU           | L-colline       | 1,3             | Iron              | 1,0             |
| Vitamin K       | 0,8             | L-methionine    | 1,5             | Zinc              | 0,5             |
| Vitamin B1      | 1,0             | L-istidine      | 0,7             | Selenium          | 0,01            |
| Vitamin B2      | 1,6             | L-leucine       | 1,5             | Manganese         | 0,1             |
| Vitamin B6      | 1,6             | L-isoleucine    | 0,6             | Magnesium         | 0,9             |
| Vitamin B12     | 0,006           | L-phenilalanine | 0,9             | Cobalt            | 0,04            |
| Vitamin C       | 1,5             | L-threonine     | 2,0             | Iodine            | 0,1             |
| Biotin          | 0,04            | L-cystine       | 1,0             |                   |                 |
| Panhotenic acid | 3,0             | L-valine        | 0,9             |                   |                 |
| Folic acid      | 0,4             | L-tryptophane   | 0,7             |                   |                 |
|                 |                 | L-thaurine      | 2,0             |                   |                 |
|                 |                 | L-tyrosine      | 2,0             |                   |                 |

reported (Wulff-Tilford and Tilford, 1999; Waide, 2004; Capasso and Grandolini, 2003; Fiorentinzi, 2003).

Alfa alfa extract contains proteins, trace minerals, vitamins (A, B1, B12, C, D, E, K) and uncharacterised growth factors (Wulff-Tilford and Tilford, 1999; Capasso and Grandolini, 2003; Fiorentinzi, 2003). On the basis of my personal experience with avian nutrition Alfa alfa extract, in combination with anabolic factors from Fenugreek extract, appears to improve chick growth and feather replacement in young and adult raptors (Conzo, unpublished data).

The above mentioned plants extracts are a few examples of the beneficial effects of phytotherapeutic agents in falcon nutrition.

Powder formulated nutritional supplements can be dosed (Table 2) on the basis of falcon's body weight, including them inside whole prey or other food. If properly used, nutritional supplements represent important tools to keep raptors in good health, supporting a healthy immune system and contributing to a faster recovery from illness.

Table 3. Some herbal extracts useful for animal nutrition

| EXTRACT      | BENEFIT IN OTHER SPECIES   | REFERENCE   |
|--------------|--|---|
| Spirulina    | B complex vitamins, $\beta$ carotene, $\gamma$ -linolenic acid, Calcium, Iron, Magnesium, Manganese, Potassium, Selenium, Zinc and bioflavonoids | McDonald, 2004  |
| Milk thistle | Silymarin (liver protector)  | Wulff-Tilford and Tilford, 1999; Waide, 2004; Capasso and Grandolini, 2003; Fiorentinzi, 2003 |
| Echinacea    | Immune system stimulation; antimicrobial activity  | Capasso and Grandolini, 2003; Fiorentinzi, 2003   |
| Alfa alfa    | Vitamins (A, B1, B12, C, D, E, K) and uncharacterised growth factors   | Wulff-Tilford and Tilford, 1999; Waide, 2004; Capasso and Grandolini, 2003; Fiorentinzi, 2003 |

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Some Observations on Nutritional Supplementation and Raptor Diets

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Introduction

As in other species, proper balanced nutrition is fundamental to the correct husbandry and performance of the captive raptor. They therefore require a diet balanced in terms of quality, quantity and affordability that should reflect their requirements in terms of macronutrients (water, carbohydrate, protein, fat) as well as micronutrients – vitamins and minerals.

In simplistic form, raptors eat meat. However, simple provision of meat is not sufficient.

Raptors are whole carcass feeders!

Failure to provide whole carcasses of prey of an appropriate size for the raptor will result in selective feeding and nutritional imbalance.

This is all very well, but the natural diet of the bird is unlikely to be available all the time and commercially available carcasses do vary from the natural – they are often fatter and certainly they may be issues regarding changes caused by freezing.

Therefore, supplementation seems a good idea – should you do it?

In spite of these arguments it is fair to say that supplementation of vitamins and minerals should not be required in the adult non-breeding bird. These areas should be addressed in the basic diet – if the diet is fundamentally poor then the addition of various micronutrients is unlikely to address the main problem and definitely won't improve the state of the macro-nutrients – ie as long as the quality is good enough (food from a reputable source, proper storage and defrosting) the diet should be adequate for the bird that does not have a specific "catch" need.

If the food isn't stored properly or is altered (eg de-yolking of chicks, feeding of pure "meat") then addition of a vitamin powder may help a little but certainly won't address the fundamental problems in that diet.

However, there are times when the diet does need to be supplemented. In the wild when the bird has certain

specific needs (eg breeding) it can redirect its hunting and feeding activities and modify its own diet. Naturally these opportunities for "free choice" are not available in captivity so the falconer must anticipate extra needs and help out.

Supplements, when used, should be directed specifically toward specific requirements at specific times, eg:

- Growth and rearing. Addition of a calcium/ Vitamin D3/ fat-soluble vitamin mix
- Breeding. Female birds lay down calcium stores approximately a month before breeding. Addition of a calcium/ Vitamin D3 supplement is recommended during this period
- Moulting. Use of an essential amino-acid/ fat-soluble vitamin mix during the moulting period may assist in feather growth and in speeding-up moult. This is very important in the captive raptor as it may be required to moult its entire plumage in a much shorter time period than in the wild. Please note that no supplement in my experience has reliably stimulated the start of moult. The actual induction of moult depends on many factors (including diet) and is fairly poorly understood in many species.

During all these periods, basic feeding should be increased with particular attention to protein content and quality

If supplements are to be used, then those recommended and developed for raptors should be used. These should be balanced and heavy doses of single fat-soluble vitamins should be avoided. This is because all the fat soluble vitamins (A,D,E and K) are absorbed using the same mechanism – saturating this with one will result in less capacity for the others; eg, large doses of Vitamin E may aid fertility, but will not help if their suppress absorption of Vitamin D resulting bone deformities!

All supplements should always be used precisely as per manufacturers' instructions!

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Plasma Concentrations of Voriconazole in Falcons

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Introduction

Aspergillus infections remain a significant cause of morbidity and mortality in animals and humans, despite advances in medicine and the emergence of new antifungal agents. One of these drugs is voriconazole (vfen®; Heinrich Mack Nachf. GmbH & Co. KG, a subsidiary of the Pfizer Group, Ulm/issen, Germany), a triazole antifungal. The primary mode of action of voriconazole is the inhibition of fungal cytochrome P-450-mediated 14 alpha-lanosterol demethylation, an essential step in fungal ergosterol biosynthesis (Anton, 2006).



In falcons the clinical efficacy could be demonstrated in the form of a complete clinical resolution of aspergilliosis in 19 out of 25 falcons with aspergilliosis (Di Somma et al., 2006). Results of a pharmacokinetic study in chickens might indicate that an effective treatment of aspergilliosis with a dosage regime of 10 mg/kg q24h PO in birds is not possible (Scope et al., 2005). However, voriconazole is used in clinical practice to treat aspergilliosis in falcons at a dose of 12.5 mg/kg in Dubai Falcon Hospital in the UAE with good response (Di Somma et al., 2004). The following study was performed to investigate the bioavailability of voriconazole in falcons.

Material and Methods

Six adult falcons, 3 Saker falcons (*Falco cherrug*), 2 Gyrfalcon x Peregrine Falcon hybrids (*F. peregrin* x *F. peregrinus*) and 1 Gyrfalcon (*F. rusticolus*) were used in the trial. Five birds were female. None of the 6 birds had a clinical history of aspergilliosis, they were clinically healthy, free of endoparasites and had no signs of aspergilliosis on radiography.



Before start of the experimental part, a blood sample of each falcon was taken to obtain zero points of voriconazole levels and individual baseline levels for haematology and clinical chemistry. In the following experimental part 12.5 mg voriconazole (vfen®)/kg body weight (BW) q12h was administered orally for 2 weeks. The tablets were crushed into a fine powder and mixed with sterile water (200 mg tablet in 80 ml sterile water) and given by crop gavage 1 h before feeding. The application volume was 5 ml/kg BW. Falcons were weighed every day before medication was given. At day 1, 2, 3, 7 and 14 blood samples for determination of plasma levels of voriconazole were collected directly before (defined as trough values) and 1 h after (defined as peak values) the second application. The post-experimental period commenced after the last application on day 14. Blood samples were collected at 24, 36, 48, 60 and 72 h after the last application. All blood samples were collected under anaesthesia to minimize stress. Blood was collected in lithium heparin tubes. The tubes were centrifuged and plasma was stored at -80°C until analysis after 6 months. Each bird was observed daily for adverse effects.

Voriconazole plasma levels were measured in one additional Gyrfalcon x Peregrine Falcon hybrid (*F. rusticolus* x *F. peregrin*) after application of 12.5 mg voriconazole (vfen®)/kg BW q12h PO via injection of the solution in meat. Medication of voriconazole via meat would be a desirable form of application because it is does not cause additional stress to the animal. The age of this female bird was 11 months. The bird had no clinical history of aspergilliosis, was clinically healthy,

and had mild *Caryospora megalocanis* infestation and no signs of aspergilliosis on X-ray. The experimental part of this trial was 1 week. The tablets were crushed into a fine powder and mixed with sterile water (200 mg tablet in 20 ml sterile water) and given via injection of the solution in eviscerated quail meat. The application volume was 1.25 ml/kg BW. Body weight was measured before each application. Collection of blood samples were carried out under the same conditions as described above.



Furthermore trough values of 3 falcons that hospitalized for aspergilliosis treatment with voriconazole were examined. Diagnosis of aspergilliosis was confirmed by endoscopy and cytology and culture of aspergilliosis from biopsy samples collected from the lower respiratory tract. The 3 adult female falcons consisted of two Saker falcons (*F. cherrug*) and one Gyrfalcon x Peregrine Falcon hybrid (*F. rusticolus* x *F. peregrinus*). The dosage regime was the same as described above for voriconazole application via meat. Plasma samples were collected under the same conditions described previously to monitor trough values on day 56 in one bird and day 91 in two birds.

Determination of voriconazole in plasma was done using a liquid-liquid extraction method followed by reversed-phase HPLC with UV detection at 255 nm (Gage and Stupker, 1998).

Results

Values were not normally distributed (Table 1). In the experimental part of the study median trough values (12 h after voriconazole application) were between 0 (below the limit of quantification) and 0.2 µg/ml. Significantly (P<0.05) higher voriconazole plasma values could be detected 12 h after the last application on day 15 (median 1.4 µg/ml). Median peak voriconazole plasma values (1 h after application) were between 1.9 and 2.4 µg/ml, except for day 14, where the median peak voriconazole plasma value was significantly (P<0.05) higher (median 7.5 µg/ml) than the days before. The falcon which was given voriconazole in the meat showed the highest value on day 2 (peak value 1.7 µg/ml). The other measured voriconazole plasma values 1 h after application were between 0.2 and 0.7 µg/ml. The voriconazole plasma levels directly before drug administration (12 h after the last dose was administered) were between 0 (below the limit of quantification) and 0.1 µg/ml except for day 2 again, trough value on this day was 1.1 µg/ml. Furthermore, a high voriconazole plasma value could be found in the diseased falcon on day 56 (trough value 1.5 µg/ml). Values measured in diseased falcons on day 91 were 0 (below the limit of quantification) and 0.9 µg/ml, respectively.

Discussion

The aim of this study was to evaluate an effective dosage regime for voriconazole in falcons. Following the results with dosage regime of 12.5 mg voriconazole/kg BW q12h a median plasma concentration between 1.9 and 2.4 µg/ml was attained 1 h after application. This is in contrast to the study on chickens, where  $C_{ss}$  of only 0.4 ± 0.1 µg/ml with a voriconazole dosage of 10 mg/kg could be reached (Scope et al., 2005). An

| Falcon ID | [D0] | [D1] | [D2] | [D3] | [D7] | [D14] | [D15] | [D16] | [D17] | a.   |      | b.   |      |      |     |   |
|-----------|------|------|------|------|------|-------|-------|-------|-------|------|------|------|------|------|-----|---|
|           |      |      |      |      |      |       |       |       |       | 24 h | 36 h | 48 h | 60 h | 72 h |     |   |
| 461       | 0    | 0.1  | 0    | 5.3  | 0.9  | 2.0   | 2.1   | 2.8   | 7.1   | 22.7 | 10.7 | 3.3  | 0    | 0    | 0   |   |
| 3145      | 0.2  | 0.2  | 2.2  | 2.5  | 0.1  | 1.9   | 0.4   | 2.8   | 0.1   | 8.8  | 3.0  | 0.2  | 0    | 0    | 0   |   |
| 3042      | 0    | 0    | 2.9  | 0.4  | 2.7  | 0.3   | 3.2   | 0.3   | 1.8   | 0    | 6.2  | 0.8  | 0    | 0    | 0   |   |
| 743       | 0.1  | 0    | 1.4  | 0    | 2.3  | 0.4   | 1.7   | 0     | 1.8   | 0    | 3.6  | 0.1  | 0    | 0    | 0   |   |
| 3144      | 0    | 0.7  | 2.3  | 0.2  | 1.2  | 0     | 1.5   | 0     | 1.9   | 0    | 12.4 | 0.6  | 0    | 0    | 0.1 |   |
| 3140      | 0.1  | 0.1  | 1.9  | 0    | 2.3  | 0     | 2.5   | 0.1   | 1.7   | 0    | 3.3  | 1.9  | 0.1  | 0    | 0.1 | 0 |

Table 1. Voriconazole plasma trough (T) and peak (P) values in µg/ml on the different days (D) and after (a, b) different hours of the last application.

important consideration regarding the therapeutic usefulness of the q12b regimen are the trough plasma levels 12 h after voriconazole application, which were between 0 (below the limit of quantification) and 0.2 µg/ml. These results were confirmed by the values obtained after application of voriconazole via meat in an experimental trial and in the birds under treatment for clinical aspergillosis. The median plasma concentration of voriconazole in these birds was 0.5 µg/ml 12 h after voriconazole application. Furthermore voriconazole plasma values were determined in diseased falcons with long term treatment on day 56 (trough value 1.5 µg/ml) and in a falcon on day 91 (0.9 µg/ml). The study confirmed that the inter-individual variability of voriconazole pharmacokinetics in falcons is high, as described for humans (Anon, 2006). When given via the meat median peak plasma concentrations were reduced by 21 to 26%, respectively. Evaluation of minimum inhibitory concentration (MIC) of aspergillus isolates from falcons in the Middle East showed that 95% of the isolates consisting out of *Aspergillus fumigatus*, *A. flavus*, *A. niger* and *A. terreus* were susceptible to voriconazole at MICs ≤ 0.38 µg/ml and 100% of the isolates at MICs ≤ 1 µg/ml (Silvanose *et al.*, 2005). According to these results a therapeutically effective voriconazole level above 0.38 µg/ml was attained using the described dosage regime in most falcons.

#### Conclusions

A dosage regime of 12.5 mg voriconazole (vfen989) kg BW q12h PO via injection of the solution in meat provides a therapeutic alternative to other antifungal drugs especially in cases of mycosis with *Aspergillus* spp that are resistant to currently available therapy.

Giving voriconazole via meat minimizes the stress to the birds.

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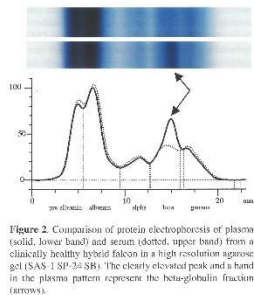
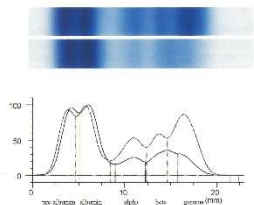


Figure 2. Comparison of protein electrophoresis of plasma (solid, lower band) and serum (dotted, upper band) from a clinically healthy hybrid falcon in a high resolution agarose gel (SAS-1 SP-24 SB). The clearly elevated peak at β and h band in the plasma pattern represent the beta-globulin fraction (arrows).



#### Discussion

Based on these results it can be concluded that protein electrophoresis is a valuable accessory diagnostic tool if performed with high resolution agarose gels in order to include the pre-albumin fraction. Reference values may vary considerably between different bird species and electrophoresis techniques.

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Figure 3. Comparison of serum protein electrophoresis patterns of a clinically healthy hybrid falcon (solid, lower band) and a gyr falcon with aspergillosis (dotted, upper band) in a high resolution agarose gel (SAS-1 SP-24 SB).

| Species, sex          | TP*           | prealbumin  | albumin      | alpha       | beta        | gamma       | A/G  |
|-----------------------|---------------|-------------|--------------|-------------|-------------|-------------|------|
| <b>Peregrine</b>      |               |             |              |             |             |             |      |
| female (n=10)         | 20.9 ± 4.90   | 5.11 ± 1.30 | 6.95 ± 1.61  | 3.01 ± 0.75 | 2.70 ± 1.0  | 3.13 ± 1.12 | 1.41 |
| male (n=8)            | 25.75 ± 3.45  | 5.66 ± 1.40 | 8.73 ± 1.48  | 3.75 ± 0.75 | 3.24 ± 1.02 | 4.29 ± 1.48 | 1.3  |
| <b>Saker</b>          |               |             |              |             |             |             |      |
| female (n=11)         | 26.73 ± 5.26  | 5.3 ± 2.70  | 10.35 ± 2.50 | 3.34 ± 0.80 | 4.49 ± 1.64 | 3.34 ± 0.80 | 1.47 |
| male (n=1)            | 20            | 5.56        | 7.9          | 1.31        | 3.88        | 1.85        | 2.06 |
| <b>Gyr falcon</b>     |               |             |              |             |             |             |      |
| female (n=10)         | 29.8 ± 6.56   | 6.69 ± 1.79 | 10.39 ± 2.01 | 3.82 ± 1.58 | 5.13 ± 1.75 | 3.77 ± 1.54 | 1.42 |
| male (n=1)            | 23            | 2.9         | 11.67        | 3.1         | 3.35        | 2.08        | 1.78 |
| <b>Hybrid falcons</b> |               |             |              |             |             |             |      |
| female (n=20)         | 25.78 ± 9.33  | 5.59 ± 2.24 | 9.20 ± 2.80  | 3.50 ± 1.92 | 3.62 ± 2.06 | 3.66 ± 2.15 | 1.51 |
| male (n=17)           | 29.29 ± 15.03 | 7.36 ± 4.07 | 10.55 ± 5.42 | 3.49 ± 1.77 | 4.49 ± 2.80 | 3.37 ± 1.93 | 1.62 |

Table 1. Reference values for serum protein electrophoresis in clinically healthy hunting falcons; mean (95% confidence interval).

## Serum Protein Electrophoresis in Healthy and *Aspergillus* sp. Infected Falcons using High Resolution Agarose Gel Electrophoresis

M. Kammrow<sup>1</sup>, C. Silvanose<sup>2</sup>, A. Di Somma<sup>2</sup>, T.A. Bailey<sup>1</sup>

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#### Summary

Serum protein electrophoresis (SPE) has gained importance in bird medicine during the last decade and it has become evident that interpretation patterns should be based on species-specific reference ranges, due to differences in fractions between different avian species. This study was performed to evaluate SPE with high resolution agarose gels for commonly used hunting falcons in the Middle East. Serum protein electrophoresis reference values are presented for clinically healthy falcons and compared to values from falcons with confirmed aspergillosis. Falcons with confirmed aspergillosis showed slightly higher total protein values and lower albumin-globulin ratios, significantly decreased prealbumin values and significantly increased alpha and gamma globulin values.

#### Introduction

Evaluation of serum protein distribution by electrophoresis (EP) allows the early detection of inflammatory and humoral responses and is a well-established aid to diagnosis of many diseases of humans and animals (Werner and Reavill 1999). Serum protein electrophoresis (SPE) has gained importance in bird medicine during the last decade and it has become evident that interpretation patterns should be based on species-specific reference ranges, due to differences in fractions between different avian species (Cray and Tatum 1998). However, lack of data for many bird species and inconsistency in methodology and interpretation make it difficult for clinicians to include EP as part of routine diagnostic procedures in birds.

The aim of this study was to validate a technique for EP in falcons for further use of SPE as diagnostic tool in routine procedures.

#### Materials and Methods

**Animals.** Serum protein electrophoresis was performed on heparinized blood samples collected from 117

falcons that were submitted to the Dubai Falcon Hospital (DHF), Dubai, United Arab Emirates) between September 2003 and March 2004. The species of falcons included gyr falcons, peregrine falcons, saker falcons, and falcon hybrids (gyrfalcon x peregrine, gyrfalcon x saker falcons). Eighty-seven falcons were considered clinically healthy following physical, radiographic, endoscopic and blood and fecal examination. Thirty falcons were diagnosed with *Aspergillus* infections by endoscopic examination of lungs and air sacs and culture of biopsies.

**Serum protein electrophoresis.** Electrophoresis was performed in a SAS 1 unit (Lena) with two applications at an electric voltage of 100 V for 18 minutes on a high resolution agarose gel (SAS-1 SP-24 SB) (Helen, Saint Lea La Forest, France). The interpretation of the peaks in the electrophoretogram was based on total protein (TP) and albumin concentrations which were determined in an automated chemistry analyzer (Mira Plus, Montpellier, France) by the Buret and bromocresol green dye binding (BCG) method, respectively.

#### Results

Table 1 shows the reference values for clinically healthy hunting falcons. There were no statistically significant differences between species (ANOVA, p>0.05) or sexes (unpaired t-test, p>0.05). Statistical differences between the healthy group and the group with confirmed aspergillosis were computed as differences between the means with confidence intervals based on pooled variance. Falcons with confirmed aspergillosis showed slightly higher total protein values and lower albumin-globulin ratios, significantly decreased prealbumin values and significantly increased alpha and gamma globulin values.

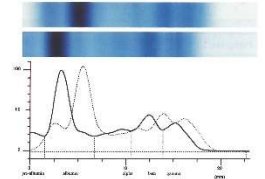


Figure 1. Comparison of serum protein electrophoresis patterns of a clinically healthy Saker falcon in high resolution agarose gel (dotted) and standard agarose gel (solid). Note the last migration and therefore incomplete running of the peak at the very left of the electrophoretogram in the standard agarose gel (solid).

## What's new in the literature

### Molecular assays for detection of falcon adenovirus.

Schneitzel M, Snoonk K, Gagneux P. *J Vet Diagn Invest.* 2007 Sep;19 (5):479-85.

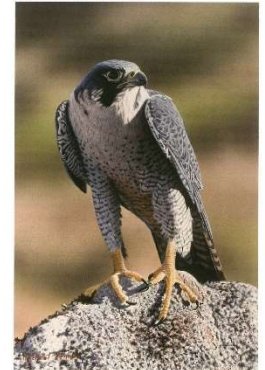
Falcon adenovirus is a newly recognized member of the family *Aviadenoviridae* and includes 2 closely related strains that are pathogenic to several species of falcons. Peregrine falcons appear to be one of the primary reservoirs, but recent outbreaks suggest that other carrier species probably exist. To allow screening of captive birds for virus shedding and investigations of disease outbreaks, conventional and real-time, quantitative polymerase chain reaction (PCR) assays and an *in situ* hybridization technique were developed. The diagnostic protocols were used on tissue and fecal samples from 7 species or subspecies of falcons infected with adenovirus as well as adenoviruses from other birds and mammals. The assays were specific for falcon adenovirus and detected both strains of virus in fecal samples from living animals or frozen and formalin-fixed, paraffinized tissues. Together with established serologic tests for falcon adenovirus, these molecular assays are valuable tools for management and conservation of falcons in captivity and the wild.

### Lethality and molecular characterization of an HPAI H5N1 virus isolated from eagles smuggled from Thailand into Europe.

Steenisels M, Van Borm S, Boschmans M, van den Berg T. *Avian Dis.* 2007 Mar;51(1 Suppl):401-7.

On October 18, 2004, two crested hawk eagles, *Spizocoen nipalensis*, smuggled into Europe from Thailand were seized at Brussels International Airport. A highly pathogenic avian influenza virus, denominated *Avicrested eagle/Belgium/01/2004*, was isolated from these birds and antigenically characterized as H5N1. Here we report on the molecular characterization of *Avicrested eagle/Belgium/01/2004* (H5N1). We completely sequenced all eight genome segments. The hemagglutinin (HA) and neuraminidase (NA) sequences clustered within the Z genotype and were closely related to strains circulating in Thailand during 2004, although some mutations in the HA were evident, notably a unique arginine (R) > lysine (K) replacement in the cleaving site. The HA cleavage site contained six basic amino acids, confirming its high pathogenicity (intravenous pathogenicity index = 2.94). The 20-amine acid deletion in the NA stalk region is consistent with its Thai Viet origin. We further discuss the assembled genetic information in the light of currently known host adaptation, virulence, and antiviral

resistance factors. Using infection experiments, we show that pathogenicity in chickens depends on breed, inoculation route (ocular/nasal vs. intramuscular), and dose. Additionally, in Muscovy ducks, pathogenicity proved to be age dependent.



Peregrine by Michael Demain ([www.michaeldemainwildlifetrack.com](http://www.michaeldemainwildlifetrack.com))

### Urinalysis as a noninvasive health screening procedure in Falconidae

Tschopp, R., Bailey, T., di Somma, A., Silvanose, C. *Journal of Avian Medicine and Surgery.* 2007; 21: 1: 8-12

Clinical signs of renal disorders in animals, including raptors, are not specific. Furthermore, serum or plasma biochemical parameters change only when 70% of kidney function is lost. In this study, reference values of urine variables were established in clinically healthy falcons. Urine samples were collected from 78 mature (>1 year) and immature (6-12 months) male and female falcons belonging to 5 species. Droppings were assessed visually for urate color and consistency and color of the liquid urine. The liquid urine was collected by aspiration into a syringe and centrifuged, and the supernatant analyzed by commercial dipstick and by a wet chemistry analysis for alkaline phosphatase, gamma glutamyl transferase, glucose, chloride, and total protein concentrations. Sex, age, and species did

not affect results of biochemical urine values (<3-Pe/ >50-105). Urine biochemical values did not differ significantly between fasted and fed birds. Total protein levels in urine samples decreased after 24-hour storage at 4 deg C. Reference ranges for clinically normal birds are reported.

**Genetic characterization of HPAI (H5N1) viruses from poultry and wild waterfowl, Burkina Faso.**

Ducatez M, Tamaglia Z, Taha MC, Sow A, de Landtsheer S, Lomdi BZ, Brown IH, Osterhaus DM, Fouchier WA, Ouedraogo JB, Miller CP. *Emerg Infect Dis*. 2007 Apr;13(4):611-3.

Genetic analysis of highly pathogenic avian influenza (HPAI) viruses from poultry and hooded vultures in Burkina Faso shows that these viruses belong to 1 of 3 sublineages initially found in Nigeria and later in other African countries. Hooded vultures could potentially be vectors or sentinels of influenza subtype H5N1, as one case and swans elsewhere.

**Protection and virus shedding of falcons vaccinated against highly pathogenic avian influenza A virus (H5N1)**

Liczka M, Hafcz HM, Klopelitsch R, Luschow D, Prusac C, Teifke JP, et al. *Emerg Infect Dis*. 2007 Nov;

Because fatal infections with highly pathogenic avian influenza A (HPAI) virus subtype H5N1 have been reported in birds of prey, we sought to determine detailed information about the birds' susceptibility and protection after vaccination. Ten falcons vaccinated with an inactivated influenza virus (H5N2) vaccine seroconverted. We then challenged 5 vaccinated and 5 nonvaccinated falcons with HPAI(H5N1). All vaccinated birds survived; all unvaccinated birds died within 5 days. For the nonvaccinated birds, histopathologic examination showed tissue degeneration and necrosis, immunohistochemical techniques showed influenza virus antigen in affected tissues, and these birds shed high levels of infectious virus from the oropharynx and cloaca. Vaccinated birds showed no influenza virus antigen in tissues and shed virus at lower titers from the oropharynx only. Vaccination could protect these valuable birds and, through reduced virus shedding, reduce risk for transmission to other avian species and humans.

**Genetic structure among continental and island populations of gyrfalcons**

Johnson JA, Burnham KJ, Burnham WA, Mindell DP, Mai EC, et al. 2007 Aug;15(8):245-60.

Little is known about the possible influence that past glacial events have had on the phylogeography and population structure of avian predators in the Arctic.

and sub-Arctic. In this study, we use microsatellite and mitochondrial control region DNA variation to investigate the population genetic structure of gyrfalcons (*Falco rusticolus*) throughout a large portion of their circumpolar distribution. In most locations sampled, the mtDNA data revealed little geographic structure; however, five out of eight mtDNA haplotypes were unique to a particular geographic area (Greenland, Iceland, or Alaska) and the Iceland population differed from others based on haplotype frequency differences (FST). With the microsatellite results, significant population structure (FST), principal components analysis, and cluster analysis) was observed identifying Greenland and Iceland as separate populations, while Norway, Alaska and Canada were identified as a single population consistent with contemporary gene flow across Russia. Within Greenland, differing levels of gene flow between western and eastern sampling locations was indicated with apparent asymmetric dispersal in western Greenland from north to south. This dispersal bias is in agreement with the distribution of plumage colour variants with white gyrfalcons in much higher proportion in northern Greenland.

Lastly, because the mtDNA control region sequence differed by only one to four nucleotides from a common haplotype among all gyrfalcons, we infer that the observed microsatellite population genetic structure has developed since the last glacial maximum. This conclusion is further supported by our finding that a closely related species, the saker falcon (*Falco cherrug*), has greater genetic heterogeneity, including mtDNA haplotypes differing by 1-16 nucleotide substitutions from a common gyrfalcon haplotype. This is consistent with gyrfalcons having expanded rapidly from a single glacial-age refugium to their current circumpolar distribution. Additional sampling of gyrfalcons from Fennoscandia and Russia throughout Siberia is necessary to test putative gene flow between Norway and Alaska and Canada as suggested by this study.

**Polybrominated diphenyl ethers in birds of prey from Northern China**

Chen D, Mai B, Song J, Sun Q, Luo Y, Luo X, Zeng FY, Hale HC. *Environ Sci Technol*. 2007 Mar 15;41(6):1828-33.

Birds of prey from Northern China (Beijing area) were examined for polybrominated diphenyl ethers (PBDEs). A total of 47 specimens from eight different species were analyzed. Muscle and liver were analyzed separately for each bird. Kidneys were pooled by species. Common kestrels exhibited the highest PBDE levels (mean muscle and liver concentrations of 12300 and 12200 ng/g lipid weight, respectively), with maxima in an individual bird of 31700 in muscle and 40900 ng/g lw in liver. Congener profiles differed between some species, but were generally dominated by the more

brominated congeners (e.g., HBD-153, -209, -183, -207). BDE-209 was especially elevated compared to other published reports. Interspecies differences in congener concentrations and profiles may be due to diet, behavior, or biotransformation capacities. BDE-209 was detected in 79.4% of the samples. Common kestrels contained the highest HBD-209 levels (mean maxima of 2150/6220 in muscle and 2870/12200 ng/g lw in liver). BDE-209 was the dominant congener in tissues from some buzzards, scops owls, and long-eared owls. It was the second most abundant congener in common kestrels. The remarkable levels and dominance of BDE-209 may relate to significant production, usage, or disposal of deca-brominated products in China. These observations reinforce the growing view that organisms using terrestrial food chains may have greater exposure to BDE-209.

**Density, habitat selection and breeding success of an insular population of Barbary Falcon *Falco peregrinus peregrinoides***

Rodriguez B, Siverio M, Rodriguez A, Siverio F. *Ardea*. 2007. Vol. 95 (2) : 213-223

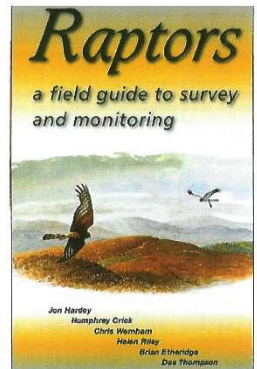
We studied density, habitat selection and reproduction of Barbary Falcons *Falco peregrinus peregrinoides* on Tencific Island during 2004 and 2005. A total of 26 breeding pairs were counted, all of them occupying natural cliffs around the island. Density observed was 1.27 pairs/100 km<sup>2</sup>, and was positively correlated with cliff availability. Mean distance between neighbouring pairs was 5869 ±338 m, ranging from 1388-13160 m; in some areas this value was as low as 2062-673 m. Tencific still shows potential for further increase regarding the observations of single females and the availability of potentially suitable but unoccupied cliffs. Falcons selected taller cliffs, more apart from roads and houses, near the coast, with lower presence of cultivated and urban areas, and associated with other cliff-nesting species. Stepwise discriminant analysis of habitat selection selected cliff height, nearest neighbour distance and distance to road, and correctly classified 71.1% of the cases. Productivity averaged 1.55 fledged young/pair and breeding success was 81.1%. No correlations were observed between habitat features and productivity. Since most territories are located in protected zones and human disturbance seems to be absent, special management measures are not necessary. However, further study into the biology of this population is required for effective and timely conservation of this species if need be.

**Raptors: a field guide to survey and monitoring**

by Hardey, J., Crick, H.L., Wernham, C., Riley, H., Elberidge, B., Thompson, D. The Stationary Office, UK ISBN: 9780114973216. Pages: 300

The guide describes survey techniques, gives tips on interpreting raptor behaviour and includes a free CD with raptor calls. This CD is an important supplement to the guide, because, rarely seen at close distance, it is the call of birds such as the golden eagle that is most frequently used in their identification and the interpretation of their behaviour.

The guide has been born out of a clear demand for detailed data on the raptor population and is written for people who watch, survey or monitor raptors. Its publication comes at a time when many raptors in Britain and Ireland are recovering from low population levels, following their near extinction, in the early 20th century through game management techniques and later through the introduction of new organochlorine pesticides. Today, the raptor population faces new challenges such as the effects of proposed windfarm developments, declining prey populations, continuing persecution, and changing climate and land management. Therefore to avoid future declines in their population, it is more essential than ever that more people become involved in their study to ensure that they are continually surveyed and monitored.



The guide describes the scientific principles behind population monitoring of raptors, and detailed descriptions of survey methods for 22 species, (including the raven), that breed regularly in Britain

and Ireland. Shorter accounts for five species that occur less regularly are also included. The species accounts draw from scientific literature, but, importantly, also the field experience of scores of raptor enthusiasts and members of Raptor Study Groups who have played a key role in collecting data on raptors in Britain and Ireland. Information on each species includes a number of "tricks of the trade" such as how to locate the nests of raptors through careful observations of behaviour; when not to approach the birds as disturbance can result in the desertion of a nest; how to estimate the ages and sex of raptor chicks in a nest which has been located; and what to record as possible evidence if it is suspected that nesting birds have been killed or disturbed.

Professor Des Thompson, Chair of the Scottish Raptor Monitoring Group and co-author of the guide, said: "Raptors are one of the best indicators of the health of the environment and it is fantastic that we now have a detailed guide to survey methods for these birds. We owe a great debt to several hundred volunteers who have devoted much of their spare time to surveying and monitoring raptors. Their efforts have provided us with some of the best indicators of how our environment is changing. As the demands for information increase, we need more people in the field to begin to fill in gaps in knowledge and to ensure that we continue to gather this important information".

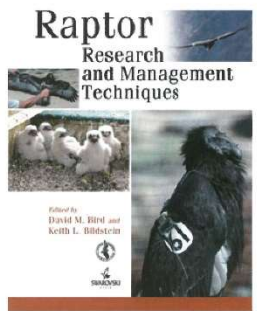
Patrick Stirling-Aird, Secretary for the Scottish Raptor Study Groups, said: "It is great to see detailed descriptions of survey methods for all of our birds of prey brought together in a single volume. This book is an invaluable resource for the Scottish Raptor Study Groups - as a teaching aid for new members and also for existing members who wish to begin work on a new species".

**Raptor Research and Management Techniques** by Bird, David M., Bilstein, Keith L. Hancock House Publishers ISBN: 0-88839-639-2. Pages: 464

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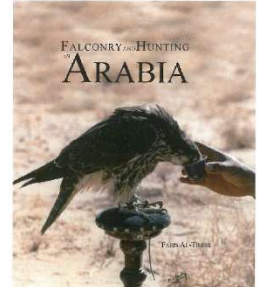
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**Falconry and Hunting in Arabia**

by Firas Al-Timimi Hancock House Publishers ISBN: 9780973883309. Pages 320.



A book that is a magnet for the eye in visual terms is one that most certainly attracts you to read within the pages, and this is just such a book. The photographic references fill every page as they expound the allure of the Saker, the ancestral hunting falcon of Arabia.

The veterinarian author, specialising in falcons, has been in the unique position to witness and catalogue the fascinating array of shape, size and colour, of the wild hunt Saker Falcon, as they came into his practice as patients but equally and importantly to witness their

performance in the field. From a falconry perspective the narrative on hawking with these large desert falcons is highly descriptive. It recounts the total passion of the Arabian falconer with his new falcon, which every Western falconer can appreciate. An historical account spanning the period from the early '80s to the present day, its core being the return to a Belouisi lifestyle, hunting the Houbara Bustard.

The falcon which is most loved and kept by Gulf Arabs are usually juveniles which are trapped in the wild. This may well be a reflection on the fact that juveniles are more easily trapped, yet immature falcons are admired for their comparative turn of speed and especially so in the case of juvenile Peregrines.

The value which is given to certain falcons that have been caught from the wild, whose hunting skill and performance is unknown, is entirely dependant on the external features of that falcon. The more attractive its colour, the better.

Falcons that have shown considerable skill in hunting the Houbara Bustard *Chlorocybys undulata*, which is the favoured quarry, will always be kept for the next seasons hunting, as successful falcons provide the meat of the Houbara which will be cooked in the evening with the rest of the food for the whole hunting group, whilst tales of the flight are recounted around the camp fire.

The status of falcons, and their place in Arabic falconry history to the present day, is recounted with fact and detail. Of the two commonly flown species the peregrine and the Saker, it is the latter which has had a prominent influence as she is the larger of the two species: "Arab falconers believe that Sakers resist sudden climatic changes and stress factors much better than peregrines plus having greater resistance to disease".

The consequence of disease are shown in the final chapters of the book and follow on from the authors' first book 'Falconry and Falconry in Qatar'. The quality of veterinary treatment has seen many significant changes for improvement in terms of expected lifespan of the falcon as well as their management and husbandry.

*Falconry and Hunting in Arabia* is a visual diary of the changing times spanning the last part of the 20th and the present. It is detailed and absorbing and written as a 'warts and all' comprehensive account, revealing a great deal about Arab falconry.

Reviewed by Diana Durrant-Walters Senior Aviculturist FWC Ltd



