

THE VULTURE CAPTIVE BREEDING AND RESTORATION PROJECT IN PAKISTAN

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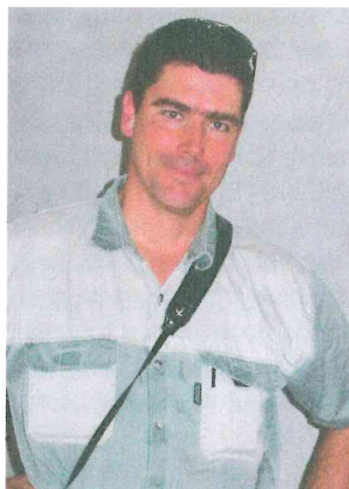
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SUMMARY

The rapid population declines of three *Gyps* vulture species in south Asia since the early 1990s has necessitated the development of captive management facilities and conservation breeding programs to protect core populations of the affected species. In 2004, WWF-Pakistan launched the Gyps Vulture Restoration Project, which will maintain a viable population of Oriental White-backed Vultures *Gyps bengalensis* in captivity and eventually produce vultures for release back to the wild. The captive breeding facility is located in Changa Manga forest, near Lahore, in the Punjab Province of Pakistan. Captive vultures have certain idiosyncrasies in their needs, and we discuss these in relation to their breeding and husbandry. In June 2007, the captive population at the facility comprised 11 birds (7.3.1). Additional vultures will join the project in 2007/2008, which has a target of up to 15 breeding pairs in addition to non-breeding juveniles and sub-adults. Herein, we describe the facility, husbandry regime, veterinary aspects and future plans for the project.

INTRODUCTION

The unprecedented decline of *Gyps* vultures in south Asia since the 1990s has seen the introduction of a range of conservation initiatives. Significant among these has been the establishment of conservation breeding centres for the three species affected: Oriental White-backed Vulture *Gyps bengalensis*, Long-billed Vulture *G. indicus* and Slender-billed Vulture *G. tenuirostris*. The primary aim of these centres is to hold safely a core population of the species affected. Once the environment is safe for vultures, they will act as a source population for reintroductions or as supplementation to wild populations. However, removing from the environment the primary cause of the vulture declines, veterinary Diclofenac, is a significant task.



Despite the drug having been banned in three of the range countries (India, Pakistan and Nepal), it is unlikely to be removed quickly from the environment. Diclofenac has been used widely in Pakistan (Oakes et al 2004; Ahmed & Khan 2005) and India (Risebrough 2004), with recent unpub-

lished reports confirming that it is still available - at least in remote areas where regulatory enforcement is low.

Even if Diclofenac is removed from circulation within the next five years, estimated mortality rates are currently up to 50% each year, suggesting that extinction, at least across most the range for these species, is considered likely (Green et al 2004; Shultz et al 2004). The task facing these conservation centres is therefore considerable. When compared to the size of the population declines, and the fact the declines are continuing, it appears immense. However, their importance cannot be underestimated. It is imperative that these centres manage their captive stock well, and have prolonged breeding success over many years, perhaps decades. Without such success, the prognosis for species survival is poor. The long term husbandry of the captive vultures, breeding success and the preparation of vultures for release requires involvement from a wide range of organisations and people. Their commitment for the duration and continued liaison with researchers working on wild populations is an essential part of the international conservation effort for south Asian *Gyps* vultures. This paper provides information on the captive management and breeding of *Gyps* vultures, particularly the Oriental White-backed Vulture *Gyps bengalensis*. We also describe Pakistan's first vulture breeding centre, recently established at Changa Manga in the Punjab Province of Pakistan. We outline the development and current status of the facility, and provide details of future plans for the *Gyps* vulture restoration project.

Captive Management of Vultures

Regardless of the species in question, there are many principles of captive management that apply. We do

not intend to discuss these, but to highlight aspects of captive management relevant to gregarious vultures, particularly *Gyps* vultures.

Vultures are intelligent birds that learn quickly and dislike surprises, so routine and consistency are key elements of successful management. Owing to their exceptional eyesight, attention to detail and long memory, vultures quickly recognise individual keepers, regardless of what they are wearing. However, the use of a 'uniform' by keepers is important, but not from the perspective of trying to conceal the identity of an individual person, as this is misguided. A staff uniform can consist simply of a certain hat or colour shirt, with the key element being that the birds learn that when a keeper wearing the 'uniform' enters the enclosure, they do so only for feeding or maintenance work. Attempting any capturing, restraint or other activity that unsettles the vultures (such as veterinary procedures) whilst wearing the 'uniform' is an abuse of trust that can lead to vultures becoming permanently unsettled when anyone enters the enclosure. The opposite situation and what is desirable, is that the vultures will recognise keepers involved in routine tasks (such as feeding or pool cleaning) and be comfortable with them entering the enclosure at any time.

Enclosure Design and Construction

Compared to many captive avian species, vultures are large birds. They are generally long-lived and resilient. Despite the fact that the dimensions of enclosures is an area where opinion differs greatly, the size and weight of vultures dictates several recommended design parameters.

Height is important and should be a minimum of three meters. Overall dimensions for a pair of birds can be in the range of eight to ten meters long and six to eight meters wide, although larger enclosures are recommended for groups. Enclosures must have a mixture of covered and uncovered areas, as birds will often deliberately sit unprotected in the rain and will actively 'sunbathe' with wings outstretched. Enclosure materials should be robust with consideration given to potential for injury. Thin gauge wire is totally unacceptable. Welded mesh is a superior enclosure medium, and should be of sufficient gauge and mesh size (10gauge; 40-50mm) to avoid abrasion. Enclosure substrate can vary between sand, pea gravel, grass or a combination of these. Wood chips should be avoided, particularly in enclosed or confined areas due to risk of Aspergillosis. Vultures do not appear overly prone to geosedimentation problems when housed on sand

and do not appear to deliberately eat stones.

Perch sizes should be variable. Although vultures can land and sit on surprisingly narrow perches, an enclosure should contain a number of perches 10-15cm in diameter sufficient for the number of birds accommodated. Care is required to ensure perch positions do not allow faeces to reach water baths or feeding areas. Large vultures kept on small, hard perches are more prone to bumblefoot (a chronic degenerative foot condition) - as are those where a significant part of the flooring is concrete. AstroTurf™ or similar artificial material can aid weight dispersal on perches, although some vultures will destroy this material rapidly, particularly wild vultures. Rope wound around perches is also effective. Bathing, preening, drying and loafing around water are essential behaviours for vultures, and constitute a significant proportion of their daily activity. Interaction between individuals occurs at these times, and it can be a highly social activity. Fresh water is therefore essential and should be available in a bath at least one meter wide and 10-15cm deep. Vultures will often only bathe in or drink water that is changed virtually every day.

Feeding

The gregarious feeding behaviour of vultures must be taken into account for successful captive management. Interaction between birds during feeding is important for general social development, the establishment of a colony 'pecking order' and possibly pair formation. Food type and presentation is important, and ideally consists of large animal parts (e.g. jointed beef) or small to medium sized mammals (e.g. rat, rabbit). It is important that bone is given and that large bones are smashed to enable swallowing. An effective method of ensuring bone consumption is to sprinkle smashed bone pieces over meat. Nutritional osteodystrophy has been recorded in these birds when fed meat alone or when given bone in a form they cannot ingest. Calcium supplementation is also recommended for breeding/growing birds in the form of a calcium/vitamin D3 powder (eg. Nutrobal: Vetark, Winchester, UK). Feeding regimes should attempt to mimic wild conditions. At least one fasting day per week is recommended, and should follow a sizeable feed the previous day. It is not unusual for vultures to still exhibit a protruding crop more than 24 hours after a large feed. Within reason, carcass remains should be left in enclosures for the day. Scavenging and picking around carcass remains and the consumption of small food pieces around a feeding area is an important behavioural

Table 1
NORMAL BLOOD VALUES FROM CAPTIVE *GYP S BENGALENSIS*

Parameter	Units	N	Mean	Range
Haemoglobin	g/dl	7	16.21	14.6-18.5
Packed Cell Volume	%	7	49	40-55
Red Blood Cells	$\times 10^{12}/l$	7	2.74	1.86-4.15
Mean Cellular Volume	fl	7	190	96-258
Mean Cellular Haemoglobin Concentration	g/dl	7	33.2	31.4-36.5
Mean Cellular Haemoglobin	pg	7	62.7	35.2-81.7
White Blood Cells	$\times 10^9/l$	7	12.97	9.5-18.3
Heterophils	$\% \times 10^9/l$	77	7910.21	72-867.49-14.64
Lymphocytes	$\% \times 10^9/l$	77	141.89	4-190.38-3.33
Monocytes	$\% \times 10^9/l$	77	50.59	1-100.18-1.04
Eosinophils	$\% \times 10^9/l$	77	00	00
Basophils	$\% \times 10^9/l$	77	20.28	0-60-1.1
Calcium; ionised	mmol/l	3	1.11	1.00-1.18
Calcium; total	mmol/l	8	2.56	2.31-3.09
Total Protein	g/l	8	54.9	50.3-63.1
Albumin	g/l	8	17.0	15.9-17.9
Globulin	g/l	8	38.0	33.0-46.2
Alpha Amylase	IU/l	3	1342	1125-1535
Aspartate Transaminase	IU/l	8	842	319-2550
Creatinine Kinase	IU/l	8	320	165-659
Sodium	mmol/l	3	151	144-156
Potassium	mmol/l	3	5.4	4.9-6.2
Bile Acids	umol/l	3	51.79	40.3-74.2
Uric Acid	umol/l	8	997.9	181.06-1298.0

Source: Chitty & Murn (2004)

characteristic, and is an important activity for young or subordinate birds held within a colony. Care should be taken that birds do not become obese. Under usual conditions, if vultures do not feed almost immediately the food is presented, then overfeeding should be suspected and body condition monitored.

Behavioural Characteristics and Breeding

Their gregarious nature means that, unless requiring veterinary attention, it is important to avoid keeping vultures in isolation. Such birds can become 'depressed' (lethargic, loss of appetite) and will fail to thrive. Despite the need for routine and stability, captive vultures are almost invariably interested in novel items. Given the opportunity, they will also invest significant amounts of time and energy in destructive behaviour. These tendencies are useful additions to management. Although feeding and bathing are important activities, the development of methods to keep captive vultures occupied requires additional time and thought. Enclosures should contain sufficient horizontal perches, in addition to post perches. Long horizontal perches are important for social behaviour and pair formation because they reduce conflict over single perch positions and allow birds to approach one another quietly by walking along the perch.

This is particularly the case for potential breeding pairs. In the wild, courtship behaviour often consists of close mutual soaring. In captivity, however, courtship can be subdued or not easily observed. Consideration of perch type and position, in addition to an experimental approach in this regard will yield results. Separate breeding enclosures are an essential part of management. Although wild Oriental White-backed Vultures breed in colonies, difficulties can arise when captive breeding pairs are in the same enclosure as non-breeding birds. To avoid these difficulties, an important technique is the availability of a large communal enclosure, which provides a venue for breeding pairs to form. Once established, breeding pairs require separate enclosures to avoid disturbance from unpaired birds during the breeding season. Females generally take main responsibility for nest building, although males will also bring material and add to the nest. Mating takes place either in the nest or on a preferred perch nearby. Copulation can be prolonged (compared with other avian species) and lasts between 10 and 30 seconds. The male will often bite the nape of the female's neck during copulation.

Veterinary Aspects

For veterinary treatment purposes, the regular capture and restraint of a vulture should be a last resort. Due to their vomiting reaction, birds will lose condition quickly if captured regularly. During restraint, care must be taken not to throttle the bird. A vulture that is aware of the fact it is to be captured will usually vomit, and this reaction is likely to continue during restraint. Care must be taken that the bird does not aspirate regurgitated food resulting in choking or inhalation pneumonia. Treatment regimes should be as non-invasive as possible and the bird should be isolated for as short a time as possible. Vultures should be anaesthetised using isoflurane with induction by restraint and open mask. Breath holding is common making stabilisation difficult on occasions. They should therefore be intubated and placed on mechanical ventilation as soon as possible after induction. Trained veterinary personnel may take blood samples relatively easily by jugular or ulnar venipuncture. The following table outlines 'normal' blood values obtained from captive *Gyps bengalensis* at The Hawk Conservancy Trust, as part of a health screening program (Table 1). Adult birds (mixed males and females) were kept unfed for 12-24 hours before blood was taken. Heparinised samples were posted and analysed the next day. In general, drugs used in other raptors appear safe in vultures and they can be given by the same routes and methods. However, it should be noted that vultures are generally excellent at recognising drugs hidden in meat and rejecting them. It should also be noted that if on a course of oral drugs, birds should be handled and examined/treated before drugs are given in food. Otherwise regurgitation and loss of the drug may result.

The *Gyps* Vulture Restoration Project in Pakistan

In 2004 WWF-Pakistan launched the *Gyps* Vulture Restoration Project in Pakistan. The immediate project objective is to conserve a viable population of *Gyps bengalensis* in a safe and secure environment. Once secured, the breeding potential of the captive population must be realised.

Additional project objectives include continued monitoring of wild populations, lobbying for the complete removal of Diclofenac from the environment and to build staff capacity for the eventual release of captive-bred vultures.

Plans for Pakistan's first conservation breeding facility for vultures began in 2005. Government

approval, land allocation, facility design, fundraising and staff selection took place over the following 18 months. The project, run by WWF-Pakistan, is a partnership between WWF-Pakistan, the Punjab Wildlife and Parks Department, the Environment Agency, Abu Dhabi and the Hawk Conservancy Trust. WWF-Pakistan is the project manager and staff provider, whilst the Hawk Conservancy Trust has provided technical and training support and will contribute towards facility running costs into the future. The Environment Agency and WWF-US provided keystone funding for the facility construction.

The Facility

The vulture conservation centre is located in a secluded area of Changa Manga forest, which is approximately 80km southwest of Lahore. Government and local officials and project partners attended an official opening of the facility in April 2007. There is currently one large holding enclosure (Figure 1). It is 38m long, 6.5m high and increases in width from 14m to 27.5m. Construction materials consist of 150mm steel pole supports and welded steel frames on concrete bases. The walls and roof are chain link. The enclosure substrate is local soils and plants. Within the enclosure, perch types consist of live trees in addition to a number of artificial perches. One end of the enclosure contains a roosting/nesting ledge, which runs the width of the enclosure. This also provides shade and shelter for the birds. Additional shade cloth on the roof provides sun protection over a smaller area near the water pool. Heat stress in the vultures is evident on hot days. Head drooping is frequent at these times, and the vultures will spend increased amounts of time bathing and drying (Figure 2). Apart from environmental considerations, there are other challenges specific to the management of captive raptors and these necessitate staff training. A key component of the project is the development of staff skills through training and capacity building.

Within the enclosure, potential breeding birds have access to artificial nest sites (shallow woven baskets) and nests retrieved from the wild. These have proved popular already with the birds, and may provide an additional stimulus for courtship and/or breeding behaviour. Although a tree-nesting species in the wild, captive Oriental White-backed vultures have shown an occasional preference for nest ledges and artificial 'caves' (Chitty & Murn 2004). To accommodate this, the roosting/nesting ledge in the enclosure is fitted with partitions to provide separate areas for



Fig. 1. Vulture holding enclosure.

potential breeding pairs. There is an attached service building, storage facilities, and provision for office space (Figure 3). The facility currently has a capacity of approximately 30 vultures.

Current Population and Future Plans

In June 2007, there were eleven vultures in the facility (seven males, 3 females, one unsexed). Five were collected as chicks from nests during the 2005/2006 breeding season, with one additional bird collected during the 2006/2007 season. The remaining five vultures are older, and are the remainder of the captive population used during Diclofenac toxicity testing work by the Peregrine Fund (Oakes et al. 2004). All birds have identification rings visible from a distance and microchip implants.

Future breeding potential with this small population is limited, as there are only three confirmed females in the group. The sex of the 2007 chick is currently unknown, but even if this bird is female, breeding potential is still low.

Clearly there is a need to increase the number of vul-



Fig. 2. Vultures bathing during hot weather.

information between Pakistan and India will be of benefit to all parties that are working together on this international conservation effort.

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Fig. 3. Facility addition allowing for storage and office space.

tures at the facility. To this end, trapping of wild vultures will take place in late 2007, following the monsoon season. Small populations and available food will undoubtedly make trapping attempts difficult; however the project aims to trap between 15 and 20 sub-adult birds. Second phase building will commence in the last quarter of 2007. The plans for phase two building include four breeding enclosures, plus additional infrastructure. This will include livestock paddocks, perimeter fencing, a facility for breeding rats for supplementary feeding and freezer rooms. Solar panels are being investigated for the electricity supply.

In the longer term, the construction of additional breeding enclosures is a primary goal. Only in this respect is the time scale favourable. It is likely to be many years before the environment is safe for the release of vultures back to the wild. However, unless the facility can reach a production capacity of at least 10-15 chicks per year, there will be limited potential for any release program in the future.

CONCLUSION

The WWF *Gyps* vulture restoration project in Pakistan is part of a regional effort for the conservation of south Asian *Gyps* vultures. The project benefits from a dedicated staff team, solid governmental and partner support and a series of clear targets. Further development and the expansion of facilities will occur over future years, as there is an urgent need to increase the capacity of the facility.

There are no prospects for a rapid conclusion to the conservation of *Gyps* vultures in south Asia. Continuing the lines of communication and sharing