



# Cape Vulture (*Gyps coprotheres*) - Captive-Breeding Protocols



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## BREEDING PROGRAMME PARTNER



*This document is designed to guide the development of conservation breeding protocols for Cape Vultures (*Gyps coprotheres*). While the headings provided may not apply to every species, using this template as a reference will help create protocols that enhance the reader's understanding of various documents. Please note that this is a living document that can be reviewed and updated as necessary.*

## 1. Introduction

The Cape Vulture (*Gyps coprotheres*) is the only vulture species endemic to southern Africa. With only about 4,500 breeding pairs remaining, it is a species of high conservation priority. Over the past 40 years, the Cape Vulture has experienced a steady decline throughout its range, prompting its classification as a Threatened and Protected Species (ToPS) nationally and as a CITES I (Convention on International Trade in Endangered Species of Wild Fauna and Flora) species internationally, as well as being listed as vulnerable by the IUCN (The International Union for Conservation of Nature). Historically, the Cape Vulture bred in most parts of southern Africa, including Namibia, Zimbabwe, Swaziland, South Africa, Lesotho and Botswana. However, they now only breed in areas of South Africa, Lesotho, and Botswana.

Vulture populations are continuing to decline due to a variety of threats. These include the loss of habitat due to expanding human development, collisions and electrocution caused by power lines, collisions with wind farms, direct and indirect poisoning, and a lack of safe and accessible food. Additional challenges include



disturbances at roosting, breeding, and feeding sites, capture for belief-based practices, ignorance about the species, and drowning in concrete dams.

In response to the ongoing threat to vulture populations across much of southern Africa, Vulpro launched its captive breeding programme in 2011. The objectives of this programme are to provide healthy chicks for population supplementation and restocking, as well as to reintroduce certain species into areas and countries where they historically bred but no longer do, or where their populations have declined to unsustainable levels.

This document outlines Vulpro's captive-breeding protocols based on our experiences. It is a living document that will be continuously updated as we gain more knowledge. Please note that it does not represent a universal solution for all species, but is specifically based on our work with Cape Vultures for the time being.

## 2. Objectives of the Breeding programme

- Maintain or increase genetic diversity.
- Support reintroduction programmes.
- Establish captive assurance populations.
- Contribute research on species-specific reproductive biology.
- Contribute to the development of husbandry and veterinary protocols.

## 3. Institutional and Legal Framework – funding / institutional security and stability

- Legislation and Legal requirements (CITES regulations, national wildlife laws).
- Relevant Permits
- Institutions involved (e.g., zoological collections, trusts, conservation organizations).
- Agreements between institutions (e.g., MOUs, animal loan agreements, ownership terms). *Full versions can be attached in the appendices if necessary.*
- Threatened or Protected Species (TOPS)
- Studbooks
- Contingency planning, including succession planning, winding down at completion, and an exit strategy.
  - *When a breeding programme goes to plan it is important to plan ahead for how and when to draw the project to an end and how to pass the project on to new leaders/different institutions should things change.*
  - *Not all breeding programmes or releases proceed according to plan. There will be a point at which investing further resources is no longer justified, despite any prior management adjustments. The decision to discontinue is defensible if the breeding programme design includes indicators of lack of success and the tolerable limits of their duration, or if undesired and unacceptable consequences have occurred. An exit strategy should be an integral part of any plan. Having a strategy in place allows an orderly and justifiable exit.*



## 4. Species-Specific Information

The Cape Vulture is a monogamous scavenger that breeds in large colonies on cliffs in Southern Africa, foraging in open habitats such as grasslands. This social species relies on its keen eyesight to locate carcasses, which it consumes, playing a crucial role in disease prevention.



Figure 1: Cape Vulture

### **Biology & behaviour**

- **Appearance:** Large, social vultures with bald heads and necks, which are adaptations to keep clean while feeding on carrion.
- **Diet:** Obligate scavengers primarily feed on the soft muscles and organ tissues of carcasses, using their keen eyesight to spot food from a distance.
- **Social Structure:** They are monogamous and mate for life, nesting in large colonies.
- **Breeding:** Nesting takes place on high cliff faces, where females lay one egg. Both parents participate in incubation and raising the chick, with the entire breeding cycle lasting up to a year before the chick fledges.

### **Ecology**

- **Habitat:** They breed on cliffs but forage widely in open, non-forested habitats like grasslands, savannas, and communal grazing areas.
- **Distribution:** They occur in Southern Africa, breeding in Botswana, Lesotho, Mozambique, and South Africa, though they may be found as vagrants in other southern African countries.
- **Ecological Role:** By consuming decaying meat, Cape Vultures act as crucial ecological engineers, preventing the spread of disease in the environment.
- **Foraging:** They travel long distances from their breeding colonies, with juveniles dispersing further than adults, to find food.

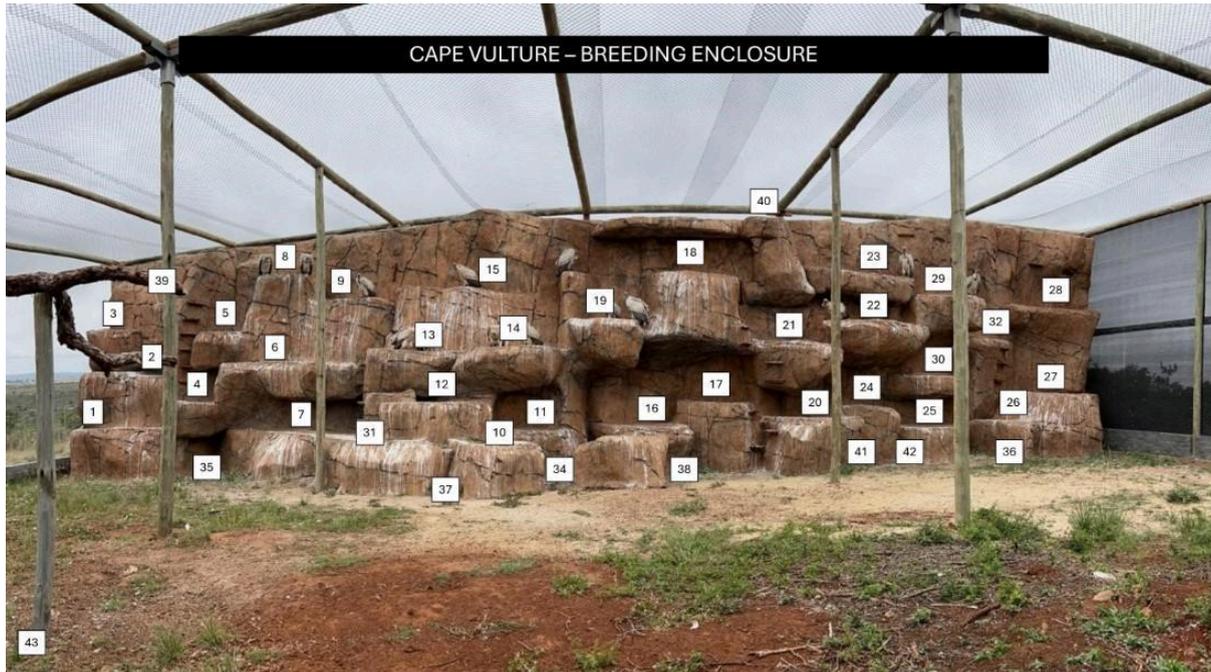
### Captive Breeding History:

- Previous successes and challenges.
- Known protocols and data from similar programmes.

## 5. Enclosure and Husbandry Requirements

### **The flightable breeding Cape Vulture enclosure: (See Pg 18)**

- The enclosure measures 30 meters wide, 60 meters long, and 6 meters high.
- The breeding ledge covers the entire south-facing width of 30 metres and extends from top to bottom, with the highest breeding roosting platform (not breeding ledge) at 5,5 metres high (Fig. 11). Roosting ledges must be spaced closely together but with enough room for personnel to safely access each nest site.
- The enclosure contains two separate lines of 9-metre-long framework poles placed from north to south. Each line is spaced 9 metres apart, and within each line, the poles are placed 10 metres apart. This setup reduces the number of poles in the center of the enclosure.
- At the bottom of the 60-meter enclosure, markers indicate the end of the enclosure to prevent vultures from flying into the mesh and injuring themselves.
- There is a large gate wide enough for vehicles, but we prefer using wheelbarrows to transport food in and out.
- There is a large pond measuring 3 meters by 3 meters and is 20 centimeters (8 inches) deep at its deepest part, with gradual slopes made of river sand to prevent the cement from becoming slippery.
- One-fourth of this enclosure is covered for shade and protection from the weather elements. This covered area should not include the nest sight.
- The enclosure's floor is composed of natural materials, such as sand, grass, and bushes, to create an environment as natural as possible. But grass is kept short to reduce tick activity and to avoid tripping up the vultures.



*Figure 2: Enclosure with numbered ledges for monitoring activities of flightless Cape Vulture*

### **The Open-Top flightless breeding Cape Vulture enclosure: (See Pg 18)**

- The enclosure measures 60 meters wide, 80 meters long, and 1.8 meters high.
- Adding breeding cliffs is not feasible because the vultures cannot access them. Instead, wooden roosting platforms are provided on the ground, allowing the flightless vultures to build their nests off the ground. The standard size for these wooden roosting platforms is a minimum of 1 meter by 1 meter, with the platform positioned approximately 60 cm above the ground (Fig. 12). Roosting ledges must be spaced closely together but with enough room for personnel to safely access each nest site.
- Note that the roosting platform must still be south-facing.
- There is a large gate wide enough for vehicles, but we prefer using wheelbarrows to transport food in and out.
- There is a large pond measuring 3 meters by 3 meters and is 20 centimeters (8 inches) deep at its deepest part, with gradual slopes made of river sand to prevent the cement from becoming slippery.
- One-fourth of this enclosure is covered with a roof for shade and protection from the weather elements.
- The enclosure's floor is composed of natural materials, such as sand, grass, and bushes, to create an environment as natural as possible. But grass is kept short to reduce tick activity and to avoid tripping up the vultures.



*Figure 3: Open-top enclosure with numbered ledges for monitoring activities.*

A natural soft substance should be present beneath the breeding platforms and raked after each breeding season. If there is no soft surface material naturally occurring then river sand can be used as it does not compact over time. If river sand is used, a yearly replacement of river sand on the ledge floor is recommended.

Enclosures must be carefully designed to maximise breeding success, comfort, and ease of management, while also offering protection from extreme weather conditions such as excessive heat, heavy rain, hail, and strong winds. Enclosures must be spacious enough to accommodate breeding pairs and equipped with ample stepped cliff ledges or breeding platforms, tailored to the natural requirements of each species.

Cape Vultures, being social cliff-nesting vultures, require large artificial cliff structures designed to replicate natural colonies. These must provide multiple individual breeding ledges in a safe, accessible, and social layout, ensuring that both disabled and flight-capable vultures can comfortably reach their chosen sites.

In all enclosure designs, it is crucial to provide more ledges than breeding pairs, ensuring vultures have freedom of choice and reducing competition. Orientation must also be considered: for example, Cape Vultures prefer south-facing cliffs in the southern hemisphere that allow sunlight to reach their nests in the morning to warm them up but are shaded in the heat of the afternoon. It is crucial to allow chicks to gain vitamin D from direct sunlight and not to shade the ledges.

There are some sights that are north or west facing so in a captive setting it would be possible to have a non south facing cliff structure if you are able to manage sun and temperature levels at appropriate times of day. Attention to prevailing wind and weather patterns is essential to prevent breeding failures caused by adverse conditions.



*Figure 4: Shelter structure in Cape Vulture flightless enclosure*

While these designs have proven effective, we have encountered **drainage challenges** on the artificial breeding cliffs. To address this, we recommend incorporating **large drainage holes** to allow excess water to run off during periods of heavy rainfall. We have intentionally avoided using downward-sloping ledges, as these can compromise nest stability and increase the risk of eggs rolling out of the nest. However, without the sloping angle, water tends to accumulate on the ledges and therefore requires careful management through proper drainage solutions.

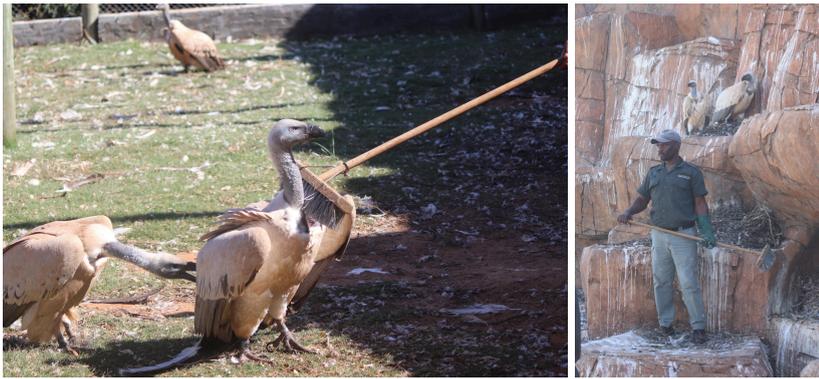


*Figure 5: Cape Vulture nests and roosting platform*

Whichever design is chosen for breeding ledges or artificial cliffs, it is essential to ensure that staff can **safely and easily access nests** for effective egg and chick management. Vulpro uses ladders to safely reach nests.



*Figure 6: Cape Vulture nests are reached safely by climbing ledges or ladders*



*Figure 7: A soft bristled broom can be used to keep vultures at bay*

In addition to the design and management of breeding ledges, attention must also be given to the **furnishings within the enclosures** to ensure a safe, healthy environment and reliable access to clean drinking and bathing water.

For perching, we provide **natural branches of varying dimensions, shapes, and sizes**, all with intact bark to help prevent bumblefoot (pressure sores and infections). Perches must accommodate both semi-flighted and non-flighted vultures and be long enough for multiple vultures to perch together safely, as these are social species that naturally rest in groups. Placement of perches should avoid areas where vultures could injure themselves, get trapped, or get stuck. Perches must also be easy to replace regularly. When securing perches together, care should be taken to eliminate risks such as loose wires or loops where talons could become caught.



*Figure 8: Cape Vulture perches*

Water sources are equally important. **Ponds must be large enough** to allow multiple vultures to drink and bathe simultaneously, reflecting their social behaviour. The pond should be positioned in a safe location where vultures cannot fall in accidentally or defecate excessively in the water. It must also be easy to clean and designed to prevent flooding of the enclosure during maintenance.

### **Safe Food Provisioning**

We provide safe, fresh whole carcasses (from livestock and game), rather than small meat pieces. We are fortunate to have support from companies, farmers, and individuals who donate safe carcasses. Vultures obtain all their nutritional needs



Figure 9: Cape Vulture enclosure pond

from whole carcasses, and having these carcasses available allows them to exhibit their natural feeding behaviours.

During the non-breeding season, we feed the vultures every three to five days. However, when chicks are present—up to about 3.5 months old—we increase feeding to once every day or every other day.

***It is an absolute MUST that the carcasses are free from veterinary drugs, including pain medications, antibiotics, anesthetics used in darting, and drugs used for euthanasia.***

***Additionally, lead bullets should not be used to kill the animals, as lead fragments in the meat can cause lead poisoning (Cade 2007; Grund 2010). Always know and trust the source of your carcasses, and be aware of any prior treatments they may have received.***

### **Calcium Supplementation**

Thin eggshells, bone deformities, and broken wings in chicks have been reported both in the wild (Mundy 1992), in other Gyps vulture captive-breeding programmes (van de Meer, online, accessed 14 May 2014), and within our own captive breeding efforts. To mitigate these problems, bone chips no larger than 10 cm (Fig.1) are provided in the breeding enclosure throughout the year. When small chicks are present, smaller bone fragments are supplied.

Observations confirm that the adult vultures readily consume these bone chips and feed them to their chicks.

A purpose-built bone-crushing machine is used to process the bones into small, manageable pieces, similar in appearance to sawmill wood shavings.

Only bones from adult carcasses are used as bones from subadult carcasses lack the calcium density required for healthy development in the crucial early stages of a chick's life. Bones are collected from remains within the enclosures or at vulture feeding sites.



Figure 10: Bone chips provided are no bigger than 10cm

Supplementation consists of vertebrae, ribs, crania, and scapulae, as these are more easily crushed than long bones.



## 6. Pairing and Breeding Management

### **Adult Health Management**

To maintain a mentally and physically healthy captive population of Cape Vultures, several aspects of their behaviour must be addressed. This document highlights a few key points, but it is not comprehensive.

Adults must be individually marked for monitoring purposes, as many management decisions rely on our understanding of individual and pair behaviours. We mark each vulture with a colored leg band and SAFRING metal rings.

### **Pair formation and enclosure density**

Cape Vultures are selective when it comes to choosing a mate. In our experience, simply placing any male and female together does not guarantee that they will form a pair over time. Adult vultures require multiple potential partners to make a choice, and some may never decide to pair at all. It is essential to identify the sexes of the vultures in the enclosure, as having a heavily skewed sex ratio can result in same-sex pairings, which can be misleading and confusing.

Our adult captive populations are always changing. Each year, we introduce additional vultures to our breeding groups, providing unpaired individuals the chance to find a mate.

We have also observed that some existing pairs may separate over time and choose new partners if they continue to be unsuccessful in breeding. The process of forming pairs can take anywhere from a few days to several years. We closely monitor the behaviours of all individuals and record any potential pair formations.

When conducting translocations, we take into account the vultures' behaviours and the time of year. For example, we refrain from adding or removing any individuals from the breeding enclosure once nests begin to form, as aggression and nest site defense typically increase around early April in Southern Africa.

### **Disturbance**

Vulpro's captive breeding programme aims to produce healthy individuals for release into the wild. During the breeding season, and especially when chicks are present, staff enter the breeding enclosure only to clean the water pool and provide food and nesting material at the entrance. All other interactions are kept to an absolute minimum and occur solely to safeguard the health and well-being of both chicks and adult vultures.

## 7. Nesting and Egg Management

### **Nesting Material**

Vulpro supplies nesting materials by placing them at the entrance of the breeding enclosure, allowing Cape Vultures to collect and utilize these resources according to their nesting preferences. This method not only supports natural nest-building behaviours but also serves as a form of enrichment, promoting the vultures'



instinctual activities such as gathering and constructing nests. By enabling vultures to choose, carry, and arrange materials themselves, the programme fosters both physical and mental stimulation, which is essential for their well-being and reproductive success in captivity.



*Figure 11: Rhus lancea branches*



*Figure 12: Cape vulture gathering nesting material, Rhus lancea branches, from the entrance of the enclosure.*

Nesting materials provided to Cape Vultures must be free from harmful chemicals to ensure vulture safety. At Vulpro, we primarily use branches from the fast-growing tree *Rhus lancea*, which is verified as non-toxic. Thin branches with leaves are cut to offer both flexible stems and soft foliage, allowing vultures to construct sturdy and comfortable nests. The vultures also make use of available feathers and uprooted grass from the enclosure floor for additional nest lining.

Feather cleanup is minimized during the breeding season so vultures can access this natural material. While other organic materials such as cut grass are sometimes offered for variety, vultures consistently show a preference for *Rhus lancea* branches.



*Figure 13: This nest took the pair weeks to build and reaches one meter high.*

Each breeding pair displays unique preferences in nest construction. Some pairs build substantial nests reaching up to one meter high (see Fig.4), while others create simpler structures resembling those found in the wild.

Vulpro staff meticulously record the details of each pair's nest, including its nature and location.

We offer at least a wheel barrow's worth (Or ideally as much as is available) of fresh nesting material daily starting in early March in southern Africa, or as soon as regular copulation activity is observed. This daily provisioning continues for the first two months of the breeding season, then decreases to every other day during egg incubation. Once all chicks have hatched, we reduce supply further to twice a week.

The success of a pair in incubating an egg and raising a chick depends on the quality and stability of their nest. Egg losses can occur if nests are poorly shaped, so



it is important to monitor nest shape as the egg-laying date approaches. Each nest should have a cup that is sufficiently concave to keep the egg from rolling out. Inexperienced pairs may lay eggs without building nests due to neighboring vultures stealing materials or as a result of difficulty gathering supplies. Though rare, helping these pairs build nests can allow them to practice incubation and chick rearing.

To address these issues early, consider providing more nesting materials to each ledge to reduce competition over the resource and thus aiding struggling pairs to build their own nests on the ledges with lips and drainage holes built into the artificial cliff face.

Please note: When the chicks have fledged we remove all nests and clean the ledges and platforms in order to avoid a build up of bacteria.

### **Egg Management and Incubation**

A few days before vultures lay their eggs, their behaviour changes slightly. The female becomes more lethargic and spends more time resting on her nest. This egg lethargy can be concerning for managers, as the female may appear unwell before laying. It is crucial to monitor vulture behaviour closely during this stage.

If a vulture seems unable to get up, intervention may be necessary to prevent potential issues like egg binding, which, although uncommon, can be triggered by very cold winds during the egg-laying period. Be mindful that both the male and female vultures tend to become more aggressive when they start building their nests and especially when they have an egg or chick. They may begin hissing and biting if another vulture or a human comes too close to their nest.



*Figure 14: False nest made for educational purposes, displaying a dummy egg (left), real egg shell (right), and hatched egg displaying blood vessels and inner membranes.*

Cape Vultures, like many other vulture species, typically lay a single egg. Once the egg is laid, a decision must be made about whether to leave it with the parents or to remove it for artificial incubation. Generally, Vulpro prefers to leave the eggs with experienced breeders who have demonstrated their ability to successfully incubate either dummy or real eggs. If a pair of vultures is inattentive to their egg or allows it to roll off the nest, Vulpro will promptly replace it with a dummy egg.

In general, newly paired parents often lack attention to their eggs or chicks, may not incubate properly, and might allow eggs to roll out of poorly constructed nests. However, appropriate nesting and parental behaviours tend to improve with age and experience. We recommend closely monitoring these behaviours and reviewing management decisions annually based on the evolving dynamics of each pair. Only pairs that successfully incubate a dummy egg for the entire incubation period will be allowed to incubate a real egg in the following season.



### **Double Clutching**

Depending on the specific circumstances and history of each pair, Vulpro will decide whether to 'double clutch' or remove an egg from a nest without replacing it with a dummy egg. The removal of the egg is intended to encourage copulations and nesting behaviours, which may lead to the pair producing a second fertile egg. On average, our captive Cape Vulture populations lay approximately 37 days (with a range of 24 to 69 days) after the removal of the first egg.

Some pairs have shown that they will not successfully double-clutch. In these cases, the pairs either do not copulate and lay a replacement egg, or the second egg has never been fertile. For these pairs, Vulpro will not attempt double-clutching again and will only replace the egg with a dummy egg or fertile egg if the pair has shown success in incubating dummy or real eggs in past breeding seasons. In such cases, a pair can incubate a fertile egg from another pair and raise the resulting chick.

If any eggs are found to be infertile, we will remove the egg from the pair to initiate double clutching, allowing the possibility of producing a fertile egg on a second attempt.

It is essential to keep thorough records of each chick's parentage, particularly in programmes that aim to retain chicks within the breeding initiative. Our goal is to ensure that every pair capable of raising a chick incubates either a real or a dummy egg, as a pair will not accept a chick unless they have been incubating an egg.

### **Swapping the egg**

During the egg-swapping process, vultures can be very aggressive, and some pairs exhibit more aggression than others. Typically, we only need two staff members to collect the eggs, although multiple staff members may be required to safely monitor the area and manage aggressive vultures.



*Figure 15: Labelled egg with direction marker for determining degrees for manual rotation.*

It's important to operate quickly to minimize disturbance, so aim to be in and out of the enclosure as swiftly as possible. A third person should remain outside the enclosure to watch for safety concerns and assist with opening and closing the gate.

Staff members must wear a full-face shield, especially in enclosures like the step-style cliff, where vultures are present at eye level. A soft-bristled broom can often be used to gently prod the incubating parent vulture off the nest.

If necessary, you can remove and replace the egg while a tolerant parent vulture stays at the nest.

Before entering the aviary, it is important to ensure your hands are clean. The egg should be placed carefully in a clean box of cotton wool, maintaining its original



position. First, carefully take the real egg from the nest before placing the dummy egg in to avoid any damage to the real egg during the process.

Mark and number the egg with a pencil (see Fig. 8) and weigh it immediately upon arrival in the incubation room. To assist with turning the egg by hand, draw a single line on the pointed end to indicate the degrees of rotation.

### **Artificial Incubation**

We use Grumbach and Brinsea incubators set to 37.0°C and 30% relative humidity (Fig. 9). During the Cape Vulture incubation season in southern Africa (April to August), the ambient humidity is extremely low, approximately 25%. Therefore, incubator settings may need to be adjusted based on regional ambient conditions. The ideal temperature and humidity settings will vary depending on the specific situation, the type of incubator used, and the species being incubated.



*Figure 16: Incubator set to 50% RH and 37.4 C*

At the beginning of the breeding season, when copulations become more frequent around mid to late April in southern Africa, the incubator is thoroughly disinfected, connected to an uninterrupted power supply, and turned on in preparation for egg arrival. The period between copulation and laying is different for every pair so it is important to be prepared.

Vulture eggs are too large to be rotated fully with the automatic turning feature, so they need to be manually turned 180 degrees three times a day. Vulpro rotates the

eggs alternately clockwise and anti-clockwise with each rotation, without lifting them from the incubator. It is crucial never to rotate the eggs in only one direction, as this can suffocate the chick by twisting the umbilical cord.



*Figure 17: Vulture eggs in the incubators where the door remains closed to better control ambient temperature*



*Figure 18: Vulture eggs should be labeled to differentiate them from each other for better management.*

Manually turning the eggs three times a day allows for close monitoring, enabling us to detect any issues. Occasionally, an egg may show signs of infection, which may be indicated by a change in feel or smell. By turning the eggs frequently, we can regularly monitor for these signs and remove any suspect eggs promptly.

To minimize changes in the incubator's climate, we recommend keeping the door closed as much as possible. When turning and monitoring the eggs, it is important to record the current incubator settings (temperature and humidity), note the level of



distilled water, refill if necessary, and document the time along with any observations about the eggs. It is important to wash your hands before handling the eggs.

We weigh all the eggs upon their arrival at the incubator and continue to monitor mass loss every three days. This ensures that the eggs maintain the appropriate constant rate of mass loss. In our calculations, the day an egg is laid is counted as development day zero (Mundy, pers. comm.).

We have used an egg mass loss equation adapted from *Gyps fulvus* captive breeding efforts (Hoyt 1979; van der Meer accessed online, 14 May 2014) and have found it to be a useful guideline, as *G. fulvus* eggs are indistinguishable from Cape Vulture eggs (Mundy 1992). However we are now able to use the RaptorMed software to calculate acceptable mass loss ranges which guide our work.

While some eggs may display mass variation above and below expected values, our egg mass loss generally aligns closely with expected values, resulting in healthy chicks.

Note: Eggs that are naturally incubated and reared by parents are not weighed.

The mean incubation period for Cape Vulture eggs, from laying to external pipping, ranges from 52 to 56 days, with the date of egg laying counted as day zero. Vulpro's naturally incubated eggs fall within this timeframe.

For eggs incubated artificially, the average time from internal pipping to hatching is 4 to 6 days. The duration from external pipping to full hatching can take anywhere from less than 48 hours to slightly more, as some chicks hatch more quickly than others; it is not an exact science.

Cracked eggs are susceptible to infections that can lead to chick septicaemia or bacterial infections in the blood. To reduce the risk of infection, it is advised to clean the crack with F10 disinfectant (diluted to a ratio of 1 ml to 250 ml) before sealing it. The crack can be sealed using a small piece of tissue paper and craft glue, applying the glue only to the smallest necessary surface area. Ideally, a separate incubator should be set aside for cracked and compromised eggs, as keeping these eggs separate can help reduce the transmission of bacterial infections between them.

## **Candling**

We candle the eggs to check for fertility and monitor their development. This process is done every three days. Typically, signs of fertility should be observed by day eight, but they may appear as early as day six.

A fertile egg yolk should remain stable, it may get darker and more pronounced but it should not grow or develop a red ring.

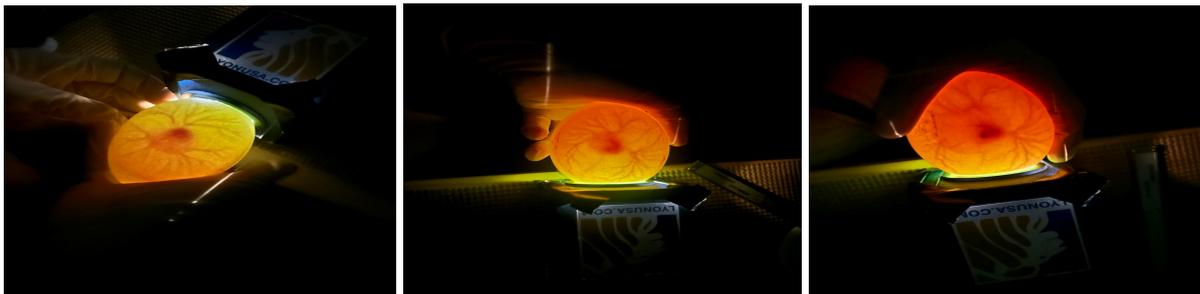
If an egg shows no signs of fertility, it should not be discarded right away. However, if it remains infertile by approximately day twenty-one, we recommend removing it from



the incubator to prevent contamination of other eggs. Having a separate incubator for these suspect eggs is very useful.

Immediately remove any eggs from the incubator if they begin to smell, if the shell changes texture, or if there are any other noticeable changes. These eggs should be discarded as they may lead to the spread of infection to otherwise healthy eggs.

Regularly candling eggs is essential, as fertile ones can still die and contaminate others. Early detection allows you to address environmental issues and prevent future problems like bacterial infections. Candling can be done frequently if handled carefully, as rough handling can harm the developing embryo.



*Figure 19: Candling eggs shows signs of fertility as early as day six*

## 8. Chick Rearing

From 2011 to 2015, we returned the eggs to their parents as soon as the chick began to internally pip. However, during the 2015 breeding season, we experienced limited success, with several pairs killing the chick as it was hatching.

Now, we give the chicks back anywhere from three to five days.

Returning the chicks at an older age is crucial because they are stronger and more capable of handling potential harassment from the parents during the swap. Additionally, they will have spent the most critical time in development (hatching and newly hatched stages) under human care, which increases their overall survival rates. There are no concerns about imprinting with this species, provided the chick is returned to the parents within the specified timeframe of being younger than three weeks. However it is recommended that healthy chicks should be returned to parents as early as three to five days after hatching.

The swapping event is vital for the success of this protocol, and reactions can vary among individual vultures and pairs. Some adults may react violently within seconds of receiving the chick, leading to injury or death. For the safety of our staff, approaching the incubating pair should only be attempted with proper safety gear, such as a soft-bristled broom, face shield, and potentially multiple staff members, depending on the behaviour of the pair (refer to the 'Swapping the egg' section above).

Each situation is assessed based on parental behaviours towards each other and the egg. In some cases, only the male might stay on the nest during a swap, while in



others, both individuals may need to be flushed away before making the swap and allowing them to return. These decisions rely on understanding the vultures' behaviour and trial and error. Monitoring the adults' reactions to the chick is crucial, as aggression can lead to harm with a single bite.

Vultures have unique characters and personalities, so not every pair will tolerate human interference. Because of this variability, hand-raising the chick to three weeks old may not be possible for every pair. In such cases, we revert to our original protocol: allowing the parents to naturally incubate, hatch, and raise their chicks, or swapping a dummy egg for the real egg just after the chick internally pips. The decision on which approach to take is based on our knowledge of the individual breeding pairs and their acceptance levels. Our goal in every instance is to provide the chick with the best possible chance of survival.

Typically, it is possible to quickly determine if the reintroduction was successful. The parents will exhibit excitement, confusion, and stress. If the swap is successful, they will acknowledge the chick's presence and should begin brooding within a few minutes. It is also essential to closely monitor the situation for the first 24 to 48 hours to ensure that both parents are feeding the chick.

### **Chick to Fledgling**

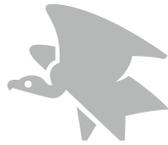
Calcium is essential for the proper development of chick bones. It is important to provide either intact small adult carcasses from which the parents can extract small bones or ready-crushed bones, so the vultures have options. We supply crushed adult ungulate bones at the entrance of the enclosure for the parents to collect and feed to the chicks. Bones from younger individuals should not be provided, as they have lower calcium content than adult bones. Bone chips are made available year-round for the adults, but when chicks are present in the enclosure, it is crucial to ensure the chips are small enough for them to consume.

From the moment of hatching until fledging, which takes approximately 4.5 months, we provide safe, fresh whole carcasses (from livestock and game), not small meat pieces, every other day for the breeding pairs to feed their chicks. Vultures obtain all their nutritional requirements from whole carcasses, and their presence helps to simulate natural feeding behaviours.

***It is an absolute MUST that the carcasses are free from veterinary drugs, including pain medications, antibiotics, anesthetics used in darting, and drugs used for euthanasia. Additionally, lead bullets should not be used to kill the animals, as lead fragments in the meat can cause lead poisoning (Cade 2007; Grund 2010). Carcasses of animals that have died of a natural disease may be good, when available, as we suspect this helps in exposing the chicks to natural elements and diseases which they will encounter in the wild; however, you must know and trust the source of your carcasses and any prior drug treatments provided.***

### **Fledglings**

Once all the chicks have successfully fledged, we reduce our carcass feeding to every third day, as vultures do not require daily feedings. We place the carcass at the



entrance of the enclosure, where all the vultures, including fledglings, can visit to feed. At this stage, the fledglings still depend on their parents for protection and sometimes for feeding.

Around 6 to 7 months of age, we separate the fledglings from their parents and move them to a large communal flight enclosure. This allows them to develop independence from their parents as well as strengthen their skills and establish dominance, which are essential for survival in the wild. This enclosure is kept out of public view, and only wild vultures being temporarily housed for rehabilitation are kept here; tame vultures are not housed in this enclosure.

All releasable captive-bred vultures are fitted with colored leg bands, a metal SAFRING ring, and a GPS tracking device. Monitoring each chick’s movements is crucial to improving our methods and gaining insight into their survival. Understanding their post-release behaviour will help us identify any problems or fatalities and the reasons behind them.

### **Monitoring Captive Breeding**

To enhance our understanding of captive breeding and inform updated management decisions, it is essential to record both habitual and noteworthy behavioural observations from the breeding enclosure. Each vulture within Vulpro’s breeding enclosure is identified by individually numbered and colored leg bands, allowing for effective monitoring of individual vultures and breeding pairs.

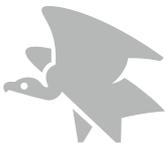
Monitoring begins when pairs start to exhibit regular copulation behaviours, typically around mid-March in Southern Africa. We track the rate of copulations to determine the need for supplementary nesting materials. As copulations become more frequent, we increase the supply of nesting materials. In South Africa, monitoring should begin at least two weeks before the expected egg-laying period, which is typically late April, coinciding with the onset of winter as temperatures drop.

Observations are recorded using a standardized data collection sheet (refer to Table 1). We recommend that monitoring takes place from a well-concealed hide or from a distance of at least 30 meters away from the breeding cliff. This distance helps avoid disturbing or habituating the breeding vultures, as well as the wild vultures that visit the adjacent vulture restaurant.

**\*\*Table 1: Recommended Method for Recording Copulation behaviours of Cape Vultures\*\***

date	time	top	bottom	location	fply (sec)	fply behaviors	mnt (sec)	mnt behavior	cop (sec)	voc?	voc ID	comments
4/11/2014	15:57	B589	B675	21	20	walk in circles	19	ruff grab	5	y	B589	B564 watches as if to harrass
4/18/2014	14:54	B589	B675	21	0		13	ruff grab	11	y	B589	
4/18/2014	15:50	Yellow Ring	B399	7	0		28	ruff grab	12	y	?	
4/18/2014	15:50	B566	B415	5	0		28	ruff grab	15	y	B566	

Non-paired individuals should also be observed along with paired ones. Captive Cape Vultures often engage in extra-pair copulations (EPC) or attempts at EPC. These EPC attempts rarely occur on the cliff face, generally do not cause significant disturbance, and should not be a major concern for the management of the



enclosure. However, they should be closely monitored. If a particular individual frequently causes aggression or disturbances near the cliff face, it may be necessary to remove that individual to prevent future conflicts when eggs and chicks are present.

Our vultures demonstrate a significant number of copulation attempts outside of established pairs. While these interactions often occur off the cliff face and are not always successful, they should be taken into account. Notably, some paired males have formed relationships with individuals other than their partners. These extra-pair interactions can lead to more frequent aggressive encounters at the nest, which may negatively impact the pair's breeding success.

It is crucial to identify the individuals involved in these extra-pair copulations in order to assess the parentage of any additional eggs found in the enclosure or nests. Although we have never observed two eggs in a single nest, this phenomenon has been documented in the wild and is believed to result from multiple females laying eggs in the same nest (Mundy et al., 1992).

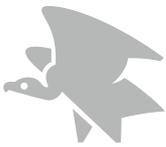
Each ledge on Vulpro's breeding cliff is assigned a unique and permanent number (see Figure 14). The nest ledge of each breeding pair should be recorded, including any changes in nesting locations and the potential reasons for these changes. For instance, when the first egg is removed from a pair, they may move to a new site to lay a second egg, possibly attributing the initial 'failure' to the original nest. Additionally, if neighboring vultures steal their nesting materials, the pair may be compelled to find an alternative ledge. All this information should be recorded, along with the date and time of each occurrence.

The frequency of copulation appears to be dependent on the mating pair. By understanding the typical behaviours of each pair, you can more easily anticipate egg laying and promptly identify any health concerns or abnormal behaviours, **allowing** for swift intervention.

Since vultures tend to vocalize during copulation, we recommend that observers familiarize themselves with the sounds associated with this behaviour, as these vocalizations can alert them to copulation activity. Furthermore, these sounds may encourage other couples and neighboring pairs to engage in copulation as well.

**Please note:**

1. ***Date and time:*** Are they copulating more often in the morning or in the afternoon, closer to dawn and dusk, or in the middle of the day?
2. ***Breeding pairs and their leg band numbers:*** Recording these details provides insight into the sex of each individual, as males typically (though not always) assume the top position during mating. Occasionally, same-sex pairs may form if there is a sex imbalance in the enclosure. These same-sex pairs behave similarly to normal pairs but will not produce fertile eggs. It's important to note the number of different pairs copulating each day and how often a particular pair mates within that time.



3. **Place in enclosure:** The majority of paired copulations occur inside the nest or nearby. If a pair copulates elsewhere frequently, it may indicate that they have changed their nest site.
  - Duration of Foreplay and Copulation is a matter of seconds. Foreplay includes any behaviour observed before mounting. These behaviours can be subtle, such as a change in body posture, and may or may not involve vocalizations. Mounting begins when one individual stands on the back of the other. Copulation starts with the initial contact between their cloacas. Successful copulation occurs when the cloacas of both vultures touch. It is important to note that a couple may mount without achieving successful copulation, as cloacal contact is never established.
4. **Comments:** Note everything before, during, or after the copulation that might be important (for example, if copulation was attempted but disturbed by a neighbouring vulture).

## 9. Genetic Management

- Maintaining a studbook or genetic database.
- Avoiding inbreeding and ensuring genetic diversity.
- Collaborate with geneticists or conservation biologists.

Do not allow related vultures to breed. For Vulpro this is made possible through meticulous record keeping and because we are constantly receiving new vultures from the wild, we do not keep captive bred vultures as part of our breeding stock.

## 10. Veterinary Care

- Pre-breeding health checks for potential pairs.
- Disease prevention and quarantine protocols.
- Emergency care for complications during breeding or chick rearing.

Health Monitoring:

- Veterinary checks and growth tracking.
- Vaccination and disease prevention protocols.

## 11. Record-Keeping

Detailed logs for:

- Pair introductions and behaviours.
- Egg data (fertility, incubation, hatching).
- Chick growth and health
- Template for management of chick growth
- Veterinary treatments and interventions.
- Use of software



- For studbooks or breeding data.

## 12. Release

- Criteria for selecting individuals for release.
- Conditioning for survival in the wild (e.g., predator awareness, foraging skills).
- Post-release monitoring and support.
  - Tracking released vultures.
  - Monitoring survival rates and reproductive success in the wild.
- Retaining some individuals as a genetic reserve.
- Captive stock Management related to offspring that are unable to be released

Release protocols are dependent on species and why you are captive breeding. Consideration for these factors should be undertaken, however it is vital that all offspring releases are tracked in some form.

Vulpro does not use wing tags, instead opting to use colored leg bands as a visual marker for researchers and citizen scientists to identify and report vultures.

## 13. Review and Adaptation

- Annual review of the breeding programme's success and challenges.
- Updates based on new research or observations.
- Feedback mechanisms for keepers, veterinarians, and researchers.
  - Long-term conservation impact assessment.
  - Consider registering research projects with the managing authority.

## 14. References and Resources

### References

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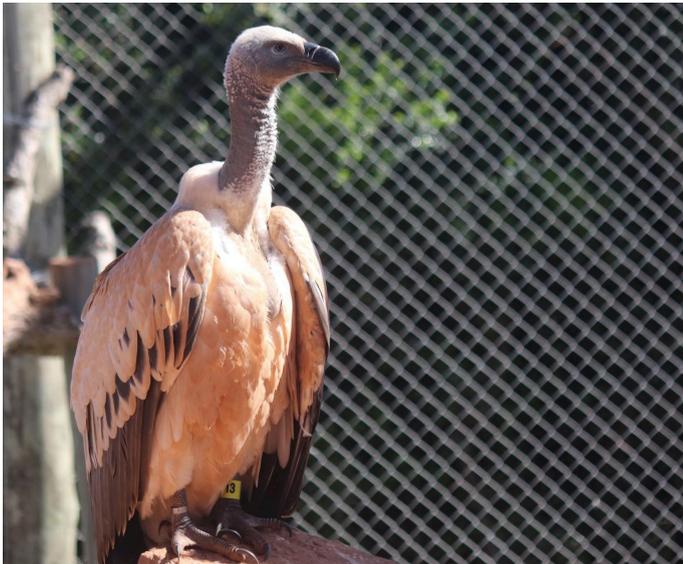


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Wolter, K., Botha, A., D. Allan, S. Krueger, M. Neethling, W. Nesor, M. Pfeiffer, S. Ronaldson, K. Shaw, K. Webster, R. Uys, J. van Wyk, and L. Venter. 2012. Cape Vulture Task Force Report 2012.  
Wolter, K., W. Nesor, K. Webster, and M.T. Hirschauer. Let Vultures Soar. 2014. Afrivet Publishing. Print.

- Manuals or guides from other successful breeding programmes.
- Contact information for partnering institutions or experts.

### **Acknowledgements**

Thanks to the entire Vulpro team for always helping to make vulture lives better. Thanks to our partner Shamwari Private Game Reserve for their support and partnership which is already showing to be successful. Lastly, to our sponsors, for their unwavering loyalty and belief in our conservation breeding work, namely, Cheyenne Mountain Zoo, Cincinnati Zoo, DHL, National vultures of Prey Trust - UK, Olsen Animal Trust and The Tusk Trust



*Figure 20: Cape Vulture*

## 15. Appendices

### **Legal or regulatory documentation:**





Figure 16 & 17 - Permit - Biodiversity Eastern Cape Province Ordinary Breed pg.1-2

C/o Hagreaves Road  
Bracon Hill  
Hockley Close  
King Williams Town  
South Africa

Province of the  
**EASTERN CAPE**  
DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND TOURISM

Private Bag X0054  
Bhisho  
South Africa  
5605

Permit No: TS-202403000005353  
Expiry Date: 2027-03-13

Issuing Office: Sarah Baartman Region (Port Elizabeth)  
Amount Paid: ZAR 1000.00

**STANDING PERMIT FOR A CAPTIVE BREEDING OPERATION**

In terms of the National Environmental Management Biodiversity Act 2004, Act 10 of 2004

**NOT TRANSFERABLE**

A permit is hereby issued to:

PERMIT HOLDER	FACILITY
ID/Passport Number: Kerri Wolter 7701210049082 Email Address: info@vulpro.com Telephone Number: 0828085113 Physical Address: Shamswai Private Game Reserve Paterson 6130 Postal Address: P.O. Box 91 Paterson 6130 Lat/Lng: /	Agent Name: Kerri Wolter Facility Name: Shamswai Private Game Facility Number: 2723/(75512) Facility Size: 20000.0 ha Physical Address: Shamswai Private Game Reserve Paterson 6130 Town: Paterson Unique Registration No:

SPECIES				
Common Name	Scientific Name	Qty	Restricted Activities	Particulars
Vulture, Cape	Gyps coprotheres	123.0	Breeding/Propagate	Non releasable
Vulture, white-backed	Gyps africanus	42.0	Breeding/Propagate	Non releasable

Signature of Approver: [Signature]  
Date Issued: 2024-03-13

Signature of Holder: [Signature]  
I acknowledge, accept and fully understand the permit conditions as set out on this permit

Permit No: TS-202403000005353 Page 1 of 2

**STANDARD CONDITIONS**

- Please do not hesitate to contact this office should you not be in agreement with any aspect of your permit.
- PLEASE NOTE THAT THIS PERMIT DOES NOT NEGATE ANY RESTRICTIONS PLACED ON THE PERMIT HOLDER BY THE CURRENT COVID-19 NATIONAL LOCK-DOWN REGULATIONS ISSUED (TO SECTION 27(2) OF THE DISASTER MANAGEMENT ACT, 2002.
- Please note too that if permits are not returned as per the conditions you are in contravention of Ordinance 19 of 1974. It may also result in the withholding of your permits and/or delay in the issuing of your permits in the future.
- The actual number of wild animals of every species which has been transported and the number of such wild animals of each species which have been unloaded alive at the destination shall be recorded.
- The permit holder must adhere to the applicable National Norms and Standards and are bound by those Norms and Standards when carrying out a restricted activity.
- The permit holder must give regard to any other applicable legislations and/or protocols.
- The species listed on this permit are deemed as adequately enclosed; the ownership of the species is therefore maintained in terms of the Game Theft Act 105 of 1991.
- The use of the Game Farm Hunting Permit Book is subject to the validity of the registration certificate and standing permit and may only be used as per the Conditions specified in the Standing Permit.
- This permit is subject to a valid CAC in terms of the Nature and Environmental Conservation Ordinance 19 of 1947.
- This permit or a certified copy thereof must always be kept at the facility or in the vehicle used when the restricted activity is carried out.
- This permit or a certified copy thereof must be shown to any authorized official upon request.
- The permit holder must take reasonable measures in ensuring that the fence is in a good state of repair which includes but is not limited to: regular fence patrols, fence repairs and maintenance which must be according to the Departmental Fencing Specifications Policy document at the time of such repairs.

**SPECIAL CONDITIONS**

Permit No: TS-202403000005353 Page 2 of 2

Version	Date	Comment
1.0	2014-09-14	Authors: Kerri Wolter, Walter Nesor, and Maggie Hirschauer Editors: Jemima Parry-Jones, Dr. Katja Koeppel
2.0	2015-12-05	Editors: Maggie Hirschauer and Kerri Wolter
3.0	2024-04-15	Editors: Kerri Wolter
4.0	2025-09-15	Editors: Nadia Opperman, Kerri Woter
5.0	2025-10-02	Editors: Jamie Venter, Kerri Wolter

For any further information or additional explanations, please contact:  
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