



# VETERINARY PROTOCOL FOR GRIFFON VULTURE RESCUE AND REHABILITATION IN CASES OF POISONING

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*LIFE WITH VULTURES: SAVING GRIFFON VULTURES IN CYPRUS  
THROUGH CONCRETE CONSERVATION ACTIONS  
(LIFE18 NAT/CY/001018)*

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**February 2020**

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## Recommended citation for the report

Antoniou, C., Azmanis, P., Makridou, Z. (2021). Veterinary protocol for griffon vulture rescue and rehabilitation in cases of poisoning. LIFE with Vultures CY, LIFE18 NAT/CY/001018. Game and Fauna Service, Nicosia, Cyprus.

## About the project

LIFE with Vultures is a targeted conservation project for the protection of the Griffon Vulture in Cyprus. In this four-year endeavor (2019-2023), BirdLife Cyprus, the Game and Fauna Service, Terra Cypria – The Cyprus Conservation Foundation and the Vulture Conservation Foundation have joined forces to tackle the main threats facing the Griffon Vulture and prevent Cyprus' most threatened bird of prey from going extinct. The project has a €1,375,861 budget and is co-funded (60%) by the EU's LIFE programme. Find out more at: [www.lifewithvultures.eu](http://www.lifewithvultures.eu)

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## SUMMARY

The following text is addressed to wildlife specialists, game wardens, veterinarians and volunteers. It is written accordingly, and it aims to explain the procedures required to maximize the chances of survival of vultures found in unfortunate poisoning situations. The protocol will cover everything from basic handling techniques to medication dosages and clinical management of vultures, in order to be saved and successfully reintroduced back to the wild. Successful reintroduction of each specimen of such an endangered species is crucial and the success of it is defined in the details that will be highlighted further below.

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## INTRODUCTION

With 14 out of 23 vulture species around the world threatened with extinction imminently <sup>(1)</sup>, Europe's population in a free fall and with reports from Asia alone indicating a decrease of 95% in their numbers <sup>(2)</sup>, saving each and every vulture is critical. While the main cause of mortality is by far intoxication, either intended, in cases of deliberate poisoning of wildlife, or unintended, in cases of consumption of livestock treated with non-steroid anti-inflammatory drugs (NSAIDs) such as ketoprofen, ibuprofen, diclofenac, being able to save vultures from situations like this is more than a conservation task, it's a matter of responsibility.

Vultures have a vital role in the ecosystem, providing their services free of charge, they are essential scavengers that maintain a fragile balance of healthy ecosystems as well as human communities by controlling the availability of animal carcasses responsible for the spread of diseases and pathogens. Loosing these irreplaceable creatures will destabilize whole ecosystems and could increase the probabilities of disease on large mammals around the globe.

Their unique adaptations of extremely acidic (low pH) stomach and their tolerance for bacterial and pathogenic load on meat, makes them ideal for the Project Partners:

job of converting dead animals to energy. No other living organism can possibly take their niche that took many millions of years to perfect, so losing many of them within our lifetime is not an option. The following protocol will be devoted to prevent further vulture losses due to one of the most common anthropogenic threats, wildlife poisoning.

## COLLECTION AND RESCUE FROM THE FIELD

When called on site to capture a vulture, the authorized personnel should be fully trained, experienced, properly equipped and confident. Lack in any of the above can cause further harm to the bird and may put its life at risk. The most important aspect is to first assess **IF** the vulture should be captured. A juvenile bird which is a poor flyer can easily be mistaken for a sick individual to the inexperience eye, so the authorized personnel should be able to tell the difference and make a correct decision with all given information. Other indications for capture can be lack of alertness, weak/fluffed up posture, neck-dropping behavior, prolonged sitting on the group in vulnerable spot, inability to take off, lowered or abnormal wing/leg posture etc.

One of the most important tasks of the personnel called on site is to always collect the complete history from the

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people who alerted the authorities. The amount of time that the bird is spending on a specific spot and its recent behavior, can give you an idea of how it will react when approached. Any evidence collected can also aid the set-up of a treatment protocol later on if the substance consumed can be identified in cases of poisoning.

While the history of the bird can be indicative if the bird will try to escape, several other factors are also crucial. The position of the bird and its surroundings can help you predict to which direction the bird will bail to escape, thus helping you to make a quick and correct decision of how to capture it. Vultures are heavy and have large wingspan, thus they require several steps forward to gain momentum and 2-3 wingbeats to get enough lift from the ground. In dense vegetation the vultures are in disadvantage so they will go for the open ground and against the wind, to gain height faster. If the vultures are standing to a point with a height advantage such as a small cliff, trying to capture them will be much more difficult as they will get airborne much easier, just with a leap and a wingbeat.

When approaching the vulture, one should be equipped with a heavy duty “large bird catching net” with a handle of at least 1.5m and the net’s circumference should be able to fit the

vulture in with closed wings comfortably. Nets made of thick plastic material are preferred so that the vultures won’t tear through, soft clothed nets are also an option if they are durable enough. The circumference of the loop can be coated with soft material to minimize any impact in case it comes in contact with the vulture with force, in an attempt to catch it. The authorized personnel can also protect itself by wearing long thick trousers, long sleeved shirts, rubber boots and specialized gloves that will protect from biting and scratching, leather gloves are ideal for the purpose. Plastic goggles or sunglasses should be worn to protect further eye injuries.



E.Karatzia, VCF

As soon as the vulture is contained within the net it should be immobilized while **IN** the net. Firstly, the head, with a firm grip at the base of the skull and the neck from behind with one hand, holding it stable with our thumb under the mandible,

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**NOT** the throat. The second hand goes to the legs at the level of the featherless part, while keeping the wings tucked closed under our armpit “hugging” and securing them for the bird’s protection. . Following that, the net should be flipped inside out while maintaining the same grips on the bird’s head and legs. One person is more than enough to restrain a vulture. If a net is not available, one should go directly for the head, as vultures cannot cause serious damage with their talons. The bird **should be always be restrained in an upright position** and **NOT** on its back or side as soon as possible, since that can severely impact its breathing.



E.Karatzia VCF

## TRANSPORTATION

Vultures might be intimidating creatures, but they do get stressed from human presence and contact. Stress can have a real physical impact on them, therefore during transport any exposure to the human environment and humans themselves should be minimized.

Vultures are stimulated mainly by vision, more than any other of the senses they possess, so we should try to keep their stimulation to the minimum. The ideal environment for transporting a vulture is a dark and well-ventilated environment, large enough to fit them in standing and turning around, but small enough to keep their wings closed to protect them and prevent them from jumping and potentially injuring themselves. Any mesh should be avoided, if possible, to protect their feather tips. In all instances of transport, tail feathers should be protected during transport with the placement of a “tail guard”. The tail feathers should be foiled supported by a simple carton piece of adequate dimensions and stabilised with a flexible bandage on the vent with a sticky tape allowing the cloaca to be free.

Depending on your country’s climate whatever you use should be maintained cool to prevent overheating. Wooden box is an ideal mean of transportation, specifications for such boxes can be found in IATA website where these boxes are the “gold” standard for shipping large birds worldwide. For warm countries, these boxes can be used but they should never come in contact with direct sunlight and should be well ventilated. A more expensive but safer option would be to have these boxes modified by adding a ventilation air-

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conditioning system. Suitable dimensions for Griffon vultures would be 80cm long x 75cm high x 46cm wide minimum.

An alternative for warmer countries is dog crates. They are well ventilated but the openings for visual contact are large, so some birds might find them very distressing, in these cases we can cover the openings with a cloth sheet from the outside, while the mesh on the door can be sealed from the inside with tape or any other material to prevent feather damage. They are very robust, lightweight and easy to transport. Again, direct contact with sunlight should be avoided even if they are well ventilated.



S. Rusmigo

Cardboard boxes can be used only as a last resort method of transport. These boxes although ideal for smaller birds, can be very weak to hold a vulture's weight so its base might be prone to opening, also if the vulture starts tearing through the ventilation holes we have

created, it can be out in minutes. Transportation of sick or poisoned-affected birds, should be directly from the point of collection to the place of veterinary assistance without any delay. Time is very critical in these cases.



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## FIRST AID

It should be highlighted that the **best first aid for a poisoned vulture**, which will increase its chances of survival, **is the fastest possible transport to an experienced avian vet** or an adequate veterinary/rehab facility. In poisoning cases time is counter-clocking, so permitting specialized veterinary personnel undertake **quick and possibly invasive decisions could make the difference between life and death.**

Birds in need of medical assistance in cases of poisoning should receive first a quick physical examination/ assessment, first aid and treatment suitable to support them and reverse the poison's effect in their bodies. Thus, in each case

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the care that the bird receives depends on the poisoning agent it has consumed.

The following text is addressed strictly to Veterinary doctors or medically trained personnel. According to the E.C. regulations it is **ILLEGAL** to administer injections and drugs if you are not a licenced veterinarian, vet nurse or paramedic. First aid can be exceptionally administered **IF** the admission to a vet is expected to take more than half an hour. This can be done in two ways (a) under the telephone guidance of a veterinarian or (b) by a person that has previously received medical training to act in cases of poisoning by a veterinarian. The trained personnel should be certified that it has the mental and psychological capacity to act under stress, in order not to hurt both the bird and him/herself.

**Misinterpretation** of the instructions, overdosing or faulty administration of drugs **can easily damage a bird irreversibly or kill it** especially in critical cases such as in poisoning incidents.

Even before determining what kind of poison we are dealing with, birds in distress should receive fluid boluses to alleviate the stress on the kidneys and hydrate the animal. In such cases we should proceed with subcutaneous administration of NaCl 9% or Ringer Lactate, alternative route can be through

IV catheter if it can be placed by an experienced avian veterinarian. Up to 120ml of fluids could be administered at one time shared in two-three different locations. In Griffon vultures we can administer 40-70ml on each precrural/inguinal fold (inner side of the thighs where they attach to the body) depending on the skin elasticity without harming the bird. Another location of subcutaneous administration can be the intrascapular area, “the mantle” (the area between the wings). Larger individuals can take even more. We should repeat it several times a day until we see a noticeable change in the hydration status (see page 14, part “clinical examination and clinical care”).

The fluid should be warmed up, up to 38-40°C and administered at a rate of 10ml/kg (100ml gradually over 5 minutes for an adult Griffon Vulture of 10 kg BW) at admission, repeated after 2 hours, then repeated every 3 hours over the first 24 hours after admission. Maintenance fluid rate is 50-60ml/kg/day. For an adult Griffon Vulture (10 kg BW) with 10% dehydration the following fluid volume should be reconstituted gradually; Day 1 =1000 ml, Day 2= 750 ml, Day 3 = 750 ml. These can be given in a combination of oral administration and subcutaneous injections. The fluid therapy should be adjusted to the individual bird and

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reduced as the bird recovers in order to avoid excessive handling stress.

In very exhausted birds some dextrose 5% solution can be added but only given orally (or intravenously) as it can be extremely painful to the skin area and can interfere with absorption of the main fluid volumes. Oral absorption is rapid from the gastrointestinal tract and less invasive <sup>(3)</sup>.



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### ORGANOPHOSPHATE (OP) AND CARBAMATE POISONING

Although a very broad category of chemicals, certain organophosphates (OPs) and carbamates are widely used in agriculture as pesticides and insecticides. Therefore, they are produced and distributed on a large scale. The most commonly encountered chemicals involved in animal poisoning incidents, are primarily carbofuran which is a carbamate, the category also includes aldicarb and methomyl. While organophosphates include chlorpyrifos,

diazinon, dursban, fenthion, malathion, and parathion.

In the case of organophosphate and carbamate poisoning we can draw suspicions from the displayed symptoms or direct identification of the consumed substance at the scene.

Symptoms of ingestion of the above agents include acute mortality of individuals, acute neurological symptoms (e.g torticollis), hyper salivation, emesis, open-beak breathing, greenish diarrhea, cyanotic coloration of exposed skin, curled/clenched toe paralysis, squatting on sternum and in some birds, mild to severe corneal opacity <sup>(3)</sup>.

In most field cases the differentiation between carbamate and OP poisoning is impossible or only possible by experienced avian veterinarians by clinical signs or if the poisonous substance can be identified on site (i.e typical color like blue for strychnine or evidence of the package). In these unidentified cases the following treatment should be administered.

Atropine at 0.25 mg/kg plus 2-PAM (Pralidoxime Chloride) at 50 mg/kg, repeated as necessary (i.e. if clinical signs improve then deteriorate again). Usually, treatment is required every 2-4 hours. If the poisoning is organophosphate and

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treatment has not started within 24 hours, therapy may make clinical signs worse. In this event PAM treatment should be stopped but Atropine maintained.

If the poisonous substance is identified the treatment is differentiated. For OP poisoning, if not treated correctly within 24-48 hours, therapy is often ineffective. Treatment consists of 2-PAM injections, at 100 mg/kg once intravenously, repeated after 6 hours if necessary, then every 24 hours as required. For Carbamate poisoning the treatment consist of Atropine 0.50 mg/kg by intramuscular, or better still, intravenous injection. If the bird responds and later deteriorates, treatments can be repeated as often as necessary. Maintain treatment until post-treatment deteriorations cease <sup>(3)</sup>.

Birds with moderate symptoms will respond within 24 hours. Signs of recovery will include gaining consciousness and alertness, standing position, reduction of emesis, diminished salivation, and disappearance cyanotic changes of exposed skin (respiratory distress, hypoxia) <sup>(3)</sup>.

Gradual improvement is expected within the following week and birds with moderate symptoms that respond have good prognosis for reintroduction.

## LEAD POISONING

Ingestion of lead particles is the leading cause of lead poisoning in vultures. This occurs when carrion consumed has been previously shot, which is not uncommon worldwide especially fragments from rifle bullets used for big game hunting, or rodent shooting <sup>(4)</sup>. In Cyprus, the most prevalent risk comes from shot canines or livestock, while where lead shotgun ammunition is used for waterfowl and upland game, wounded birds carrying lead pellets have increased mortality risk from raptors and other predators. For some species, predation on wounded (by lead shot) game birds is a common route of exposure <sup>(4)</sup>.

Symptoms in vultures will include ataxia, imbalance, neurological signs and weakness. Diagnosis of lead poisoning solely from visual inspection is almost impossible. In the last few years though, there are several available kits (e.g., LeadCare1; ESA Biosciences, Chelmsford, CT, USA) <sup>(5)</sup> for field evaluation of the birds that are using blood samples to determine the quantitative and qualitative effect of lead poisoning on vultures being captured with this suspicion.

Once ingested, lead can remain in the body for days, weeks, or longer <sup>(4)</sup>. In the acidic environment of the stomach, lead is worn down by the muscular action of

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the ventriculus, solubilized, and actively absorbed through a calcium transport mechanism <sup>(4)</sup>. Lead poisoning can cause lethargy, gastrointestinal stasis, anorexia, vomiting, anemia, disturbance of cellular function, and neurologic injury potentially leading to blindness, seizures, weakness and death <sup>(4)</sup>.

Although the symptoms may vary, the most typical of them all are the neurological signs which are exhibited in most cases. While neurological signs may be typical in lead poisoning, they are not specific for this type of poisoning, these signs are very common in several diseases of birds affecting the brain such as West Nile virus, nutritional deficiencies and toxicities. Therefore, the only way to determine if this is a case of lead poisoning is to test the blood for lead levels.

When interpreting blood lead concentration in the field, separating blood lead concentration into 4 categories is recommended: <20 µg/dL (background exposure), 20-59µg/dL (subclinical exposure), 60-99µg/dL (clinical exposure) and >100 µg/dL (acute exposure) <sup>(6)</sup>. If the birds are found to demonstrate any symptoms of neurological discoordination, then they should be taken to the rehabilitation center regardless of the lead levels. If they bear a low concentration most of

the times it will be subclinical (10-20µg/dL), thus no symptoms and the bird should be left in the wild. In case of elevated lead levels, the evaluation of whether the bird should be rehabilitated, is done in accordance to the presence of symptoms and their severity. So, if a vulture has elevated levels but doesn't exhibit any signs it can be taken only preventively. A bird with neurological signs and an elevated or toxic level of lead should be treated immediately. According to recent data from swans, birds with lead blood levels 21-40 µg/dL had a higher collision incidence while captive vultures with levels 50-100 µg/dL had reproductive disorders without any symptoms. As such it is recommended that vultures with levels above 21 µg/dL to receive chelation therapy under medical supervision.

If radiographs indicate metal objects within the gastrointestinal tract, initial therapy should consist of removing them to prevent ongoing exposure, with an order of most to least frequently applied, gastric lavage under general anesthesia, emollient laxatives, cathartics, endoscopy, or proventriculotomy <sup>(5)</sup>. **These are complicated, dangerous and invasive procedures and should be only performed by experienced avian veterinarians.** Following the decontamination and preventing any following exposure one should proceed

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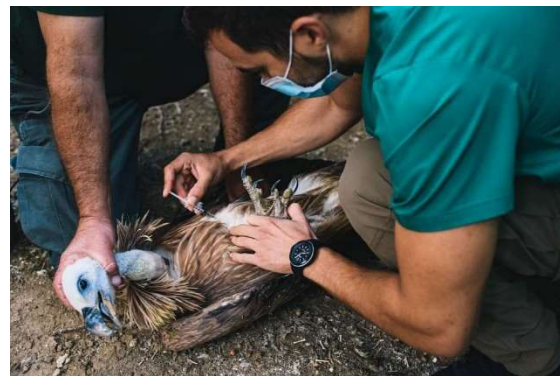
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with administration of chelating agents which is the “gold” standard for avian lead poisoning <sup>(5)</sup>. Calcium EDTA as well as DTPA is most commonly used to treat heavy metal toxicity; In humans it can be administered intravenously, intramuscularly, or subcutaneously, and is effective at binding lead in soft tissues. In birds there are no studies of the efficacy and possible side effects if administered intravenously, therefore it is avoided. In human/mammals it is known to cause kidney failure (nephrosis). Dosing protocols vary, but CaEDTA is typically given at 35mg/kg every 12 hours for 5 days to 10 days or longer if needed <sup>(7,8)</sup>. Five-day courses of CaEDTA can be repeated for individual patients as necessary to return blood lead levels to <20mg/dL. Every time we measure the lead levels should be at the end of each 5-day treatment course (better after 7 days) as the chelating agents can interfere with our results. One should choose to end the treatment when the levels have returned to the favorable <20µg/dL and the clinical symptoms (neurological symptoms) have been resolved. In severe cases, if administered intravenously, CaEDTA empirical dose is 20-70 mg/kg diluted in 1:4 with saline to avoid kidney impairment or also combined with DMSA/succimer (orally, 40 mg/kg, twice daily). A safer alternative to CaEDTA is the DTPA

(diethylenetriamine-pentaacetic acid) which lacks the side effects in the kidney function <sup>(8)</sup>.

Regardless of the method of chelation, supportive care including administration of fluids, benzodiazepine (e.g. diazepam 0.5-1mg/kg) for seizure control, antioxidants and vitamins (Vit C, Vit B Complex, Vit E-Selenium) should be always provided <sup>(3,5,8)</sup>.



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### ANTICOAGULANT POISONING

Most frequently found in readymade poison baits intended for rodents, “second-generation” anticoagulants such as brodifacoum, bromadiolone and difethiolone) are readily available to the public for anyone to use without a permit. Although Griffon vultures are rarely attracted to the prey that typically consumes this type of poisons, it is not impossible for a vulture to consume such prey. The anticoagulant that the rodent prey has already ingested is usually enough to manifest symptoms to the

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avian predator that consumed it. Anticoagulant rodenticides (ARs) interfere with blood clotting by inhibiting the enzyme vitamin K epoxide reductase, which functions to activate vitamin K. This inhibition results in the accumulation of an inactive form of vitamin K, which in turn is unable to activate the vitamin-K dependent clotting factors (II, VII, IX, and X). The depletion of these activated clotting factors causes coagulopathy and internal hemorrhage <sup>(8,9)</sup>.

Vultures exhibit very vague signs in these cases similar to lead intoxication with weakness being much more prevalent than neurological signs. Possible epistaxis (blood from nares) and general loss of blood might be observed but macroscopic evidence is not guaranteed. Pallor of mucus membranes has been documented in other birds of prey as well as discoloration of skin due to subcutaneous bleeding. In the cases where we suspect anticoagulant poisoning either by elimination techniques, history gathering or evidence found on the scene, we should proceed with diagnostics and treatment. Obtaining a small amount of blood can help confirm the diagnosis of AR toxicosis and differentiate this condition from straightforward trauma. Profound anemia and hypoproteinemia will be present in poisoned birds. There are no

commercially available laboratory tests for avian coagulation, and tests run with mammalian thromboplastin will provide inaccurate results. Nevertheless, the lack of clotting in these birds is usually quite evident if 0.1-0.2 ml of blood are placed in a serum collection tube and simply observed. In normal birds, signs of clot formation in the tube should be obvious within 5 minutes. In most AR poisoned birds, no signs of clotting are seen after several hours <sup>(8,9)</sup>.

The antidote for AR toxicosis is administration of vitamin K1, which should be administered at a dose of 0.2-2.2mg/kg, based on the severity of the case, intramuscularly (SC) immediately and repeated every 4-8 hours until signs of hemorrhage resolve. Once the bird's condition has stabilized, vitamin K1 can be given at 2.5 mg/kg once daily orally with food, which enhances absorption <sup>(8)</sup>. In critical cases, blood transfusions could support the bird, but the latter should be performed cautiously.

### **NON- STEROID ANTI-INFLAMMATORY DRUGS (NSAIDs) POISONING**

Vultures are known to be sensitive to various drugs such as fenbendazole and NSAIDs <sup>(10)</sup> that have caused the Indian Vulture crisis and severe decline. The following are the known NSAIDs to be toxic to vultures, but other drug groups (antibiotics, antiparasitic) cannot be

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ruled out. Diclofenac Sodium, Ketoprofen, Phenylbutazone, Flunixin, Vedaprofen, Carprofen. Vultures exhibit general signs of weakness, dropped head behavior, depressed appearance and severe dehydration. No specific treatment exists apart from supportive care that aim to conserve liver and kidney function. **The only safe painkiller/NSAID for vultures is meloxicam** <sup>(11)</sup>.

### **POLYTETRAFLUOROETHYLENE (PTFE/TEFLON) POISONING**

This rare case of poisoning can be caused by heat lamps and bulbs in the breeding or nursing facilities. The vultures are usually found dead suddenly after collapsing. If the bird is still alive it would show respiratory distress (open-beak breathing), ataxia and convulsions of the head.

Therapy consists of oxygen therapy, diuretics, NSAIDs (**only Meloxicam**) and broad-spectrum antibiotics <sup>(5)</sup>. **Corticosteroid administration (e.g dexamethasone) should be avoided.**

### **CLINICAL EXAMINATION AND CLINICAL CARE**

Vultures, like any other bird can be fragile and prone to stress, our clinical examination should be carried in the fastest and best manner possible to keep their stress level to minimum but also

correctly, in order to avoid injuries of the vulture or the personnel. The bird should be manually restrained in a vertical position as each bird in horizontal position (sternal or dorsal) will suffer 10-60% of respiratory volume capacity loss. **Overall handling/processing should NOT exceed 35 minutes.**

A competent individual examining a vulture should have the medical knowledge to assess the presence of several diseases and the skills to handle such a bird. An assistant to immobilize the bird is needed.

Starting from the body condition score (BCS) of a vulture we can tell a lot about its health. A healthy bird can possess of BCS of 5 even in the wild, although uncommon for other birds of prey, healthy vultures can present and feel (full fat) upon palpation of the sternum and pectoral muscles with the sternum buried below muscle and fatty tissue. Such vultures arriving for veterinary care with high body score condition and symptoms of weakness are good candidates for poisoning incidents.

After the amount of “reserves” has been determined on a bird, we can assess its hydration status. While in birds of prey this is commonly done at the dorsal part of the tarsometatarsal joint by pinching and lifting any exposed flexible skin on

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the legs, to see if it will regain its shape fairly fast. In vultures we have the possibility to perform such a test on the skin of its neck. The skin should react similarly to the skin of mammals upon pinching. To the experienced veterinarian's eye this can indicate the bird's hydration status and even separate dehydrations of 5% and 10% indicating their severity. In each case fluid therapy is recommended either SC, IO or IV with the doses mentioned above. For practical aspects, it should be considered that every rescued vulture has at least a 10% dehydration deficit that should be replaced. **Birds should be offered ALWAYS access to clean water, in case the bird chooses to rehydrate itself !!**

After investigating these parameters, we can proceed with closer examination of the head.

- Ear canals should be clean of debris and the feathers surrounding them should be dry.
- The infraorbital sinuses should be symmetrical and not swollen.
- Nostrils and choana should also be clear of any debris or fluids for the same reason.
- Oral cavity should always be inspected. It's usually the only way to visually detect serious diseases such as trichomoniasis (frounce). This

disease presents itself in the form of yellow plaques attached on different surfaces of the oropharynx. It needs to be treated because it can enhance fatal results due to inability to feed. **But NOT every plaque in oral cavity is frounce!** Proper diagnostics (i.e cytology, bacterial culture e.t.c.) should be applied to differentiate frounce from other pathologies of the oral cavity (tongue, choanae, oropharynx, crop) attributed to other parasites, bacterial or fungal organisms. Oral infections of any etiology should be treated as it can interfere with feeding ability and lead to starvation and death. .

After investigating the head, crop integrity and overall the naked parts of the skin should be examined. .

In general, listening to a bird's heart (auscultation) is not indicative of its health status, although, in case of certain poisoning incidents such as with organophosphates (OP), bradycardia or arrhythmias might be present and noticeable. Counting the beats makes sense only to assess bradycardia and to evaluate possible response to therapy by the experienced vet who could link these findings linked with a type of poisoning or in general of decompensation shock and response to therapy/first aid

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Musculoskeletal system and locomotion . A vet should be knowledgeable of the normal posture, position and mobility patterns of the vulture's extremities (wings/legs) and able to recognize, upon orthopedic examination, any abnormalities . In every instance the extremities (wings and legs) can be compared with each other, to determine any limitations in normal range of motion present. In injured birds, deep pain reflex can be tested to determine innervation and sensation, temperature can be felt as well as color of skin to determine blood supply. The majority of fractures on the extremities could be palpated. If there is presence of fractures (by visual inspection or palpation)



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or suspicion of any other locomotory abnormality (i.e dislocation, muscle damage) a full body radiographic examination (or even better a computed tomographic/CT scan examination) should be performed.

Another health indicator is the cloaca. A dirty cloaca with clumped, soiled feathers around it, suggests diarrhea in birds either as a result of poisoning or many other diseases affecting the gastrointestinal tract.

The presence of stress marks and ectoparasites (lice, feather mites) as well as the health of the plumage can be of great importance for the release. Feathers especially on juveniles will demonstrate to the experienced eye any starvation periods at the stage of their growth and will determine their durability and waterproofing ability, this can be seen with horizontal thin lines of the feather even through the feather shaft, not to be confused with lice marks. Parasitic load also on juveniles can have a detrimental effect if it exceeds what the birds can handle, something that is important to deal with in cases of rehabilitation of such birds. Last but not least the shape and presence of feathers themselves can determine if the released bird will manage to fly adequately, catch and soar on thermals and fly energy efficiently. When primary feathers are broken on vultures, unless it's bilateral and limited to molting feathers, they should always be replaced with imping methods. If we fail to do so, even a perfectly healthy and fit bird will struggle to be successfully reintroduced.

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During the vulture's rehabilitation period, the health of the feet should be also frequently checked. Overweight (obese) and birds with leg problems (more time spend perching) are prone to pododermatitis (bumblefoot). While the birds are in our care, we should prevent pododermatitis by providing a variety of soft perching spots covered with artificial plastic grass (e.g. Astroturf), as well as natural logs of adequate and variable diameters, natural cliffs and platform ledges alongside, allowing as much flying as possible within our premises to keep the bird's feet healthy. Pododermatitis (bumblefoot) is a multifactorial and complex disease with its main features being decreased blood supply of the feet and increased weight bearing on certain spots of the plantar surface of the foot. This is something that can be avoided with good husbandry techniques and balanced nutrition.

## FEEDING

The diet of vultures in the wild varies when it comes to the types and parts of carrion they consume. When rehabilitating a vulture though we should provide food that is the easiest to digest and will provide enough nutrition for the vulture to recover.

In general, in rehabilitation situations, we provide food to vultures in two ways: force feeding and voluntary feeding.

## FORCE FEEDING

A vulture that has responded to treatment for poisoning needs to be fed after 24 or 48 hrs. Because most likely it will not start eating on its own immediately. Several critical care commercial formulas are recommended by the authors to be administered instead of meat at least the first few times we attempt to feed it. This is because these formulas are specifically designed to provide high nutritional and caloric load in small quantities thus making them less likely to be expelled with vomiting. Such formulas can be found on the market and are specifically designed for carnivorous birds. Small boluses of feeding should be given 2-3 times a day the first crucial days.



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A vulture's natural defense will be to vomit under stress, this works against us

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when we try to force feed because all our effort will be wasted if not done properly. When feeding we should try to do it in the vulture's already established environment without relocating the bird, administer the food as fast as possible in quantities of up to 50ml so they won't be felt in the crop triggering vomitus. When force feeding, one person should immobilize the vulture while another one is feeding it. The person administering the food should hold the head with his/her palm and the beak open with the thumb in between upper and lower beak. The catheter for feeding should be carefully advanced while the tracheal opening is within sight, bypassing the trachea and then advancing the catheter further in the crop and/or proventriculus. Food administration should be in one bolus as fast as possible and the release of the bird should follow immediately to prevent triggering vomitus.

If commercial formulas are not available, meat should be used for the purpose. The pieces of meat (or minced meat) can be blended to form a liquid diet containing electrolytes, proteins and vitamins. Another option is to feed small pieces of soft internal organs (i.e. liver and kidney) which is already cut in the desired pieces of 5x2cm so they can be easily picked up and pushed down the bird's esophagus. This meat should be in

room temperature and soaked in water for at least 10-20 mins. This will ensure that the bird is receiving enough fluids and will facilitate the passing of the meat through the esophagus. As soon as a piece is pushed further down the oropharynx, one hand should drive the meat all the way down to the crop, if we fail to do so, several pieces will cause the esophagus to clump and the bird will vomit any content immediately after we release it. **Before every force-feeding attempt it should be experimented if the bird resumes voluntary feeding by offering/holding for a while some small pieces of food with forceps, close to the bird's beak.** To ensure that our feeding quantity is sufficient, daily weighing of the vulture should take place before feeding. After the first few days we can feed less frequently and give full crop to the bird.

### VOLUNTARY FEEDING

When we are providing food to vultures that are already eating by themselves, we should try to keep their diet as variable as possible. Different parts of muscle, organs such as liver and kidneys should be offered, whole heads and spinal cords with meat on from ungulates help with enrichment. Smaller pieces of bone are also a nutritious addition for calcium deprived juveniles. **Offering of avian meat (e.g. chicken, turkey etc.) should be avoided to**

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prevent the spread of diseases such as avian influenza and parasites. We should always provide fresh meat or recently defrosted meat, meat from the previous day should be removed from the aviary.

### **EVALUATION IF THE VULTURE IS FIT FOR RELEASE**

After a vulture stops displaying any symptoms, feeds voluntarily and gains weight back to its full potential, then it's time to evaluate if it is fit for release.

A vulture in order to be able to survive back in the wild should:

- Be in perfect health
- Have a full body (nutritional) score
- Be free of any parasites or other infectious disease.
- Have a perfect plumage condition (including impeded feathers).
- Be able to fly perfectly
- Exhibit natural behavior and instincts

All of the above, except the last two parameters can be determined with clinical examination. In order to be able to judge whether a vulture can fly perfectly we should have in our facilities an aviary large enough with several levels of perching posts, to allow the vulture to fly substantially and perform vertical flights which are the most physically demanding. If a vulture can lift

itself in a steep angle and land precisely on perches it ticks the box of flight capability. In weak birds, falconry training techniques could be applied to condition the vulture in the first stages.

Natural behaviors in vultures is a lengthy subject. Post treatment though, we should focus on possible abnormal behaviors such as imprinting to a human (the food provider), loss of fear towards humans, preference to human company instead of conspecifics, aggression/isolation from the other vultures and finally stereotypic behavior or neurologic deficits. More prone to imprinting are the juvenile Griffon vultures. .

In the case of imprinting, which is extremely rare in post poisoning incidents, the birds are not opted for release. Imprinting prevents birds from accepting that they belong to their own species with all the negative consequences that follow; such as isolation from the group, seeking of human company, failure in exhibiting breeding behavior towards other vultures etc. These birds can only be used in captive breeding programs or education ambassadors.

In the scenario that a certain individual has lost its fear towards humans through prolonged handling, this behavior could be reversed and desensitized if it is

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placed with a group of vultures away from human presence for a certain period of time. Therefore, it's crucial that handling and presence of humans around rehabilitation enclosures should be kept at minimum, because lack of fear for humans in the wild can put them in danger.

Reintroduction should be done after the vulture has had the possibility to spend time in a flight pen with sufficient flight time and away from human presence to regain its strength and develop the favorable human shy behavior. It is also preferable to transfer the vulture in acclimatization aviaries in the future release area, in order to familiarize to the climatic conditions and surrounding area of the future release site, reducing the stress of unknown area. A soft release, by just opening the door or roof of the acclimatization aviary reduces the release stress as well.



S. Rusmigo

## SAMPLING AND DATA

Interaction with wild vultures is rare, so our chances as a scientific community to have access to biologic material from wild vultures for research is always scarce. Such opportunities as wild vultures brought in for rehabilitation should be exploited to their full potential in order to gather information that might help the species in the long run or foresee and prevent any incoming disasters such as infectious diseases. As there is variation among laboratories and techniques, **it would be useful first to consult your local laboratory, before sampling.**

## SAMPLES TAKEN

Feathers (chest and/or back), also blood feathers and store them in paper or plastic sealable bags. Before storing, feathers should be cleaned of fresh tissue (blood, muscle) and dried.

- Oral swab – oropharynx, choana
- Cloacal swab

Insert and turn the swab in rubbing effort to obtain content. Ideally, take one swab sample per each separate purpose of analysis (bacteria, virus) to study. A dry triple swab (enter first the swab below the eyelid, then in choanae and finally in cloaca) without medium, to be analyzed for *Chlamydophila spp.* Swabs with

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Amies medium are normally used for bacteria analyses and specific medium exists for viruses. Swabs should be stored at normal fridge temperature (2-5°C) and be elaborated within 48h.

- Feces

Collect fresh feces. Try to discard the urea phase (the white or yellow content). Use a sealed, sterile container.

- Blood - Up to 10% of blood volume (or 1% of total body weight in grams) from ulnar vein, jugular vein or medial metatarsal vein in various containers and kept in fridge/freezer
- Prepare at least 3 blood smears using EDTA blood and dye with Gram stain and Diff-Quick stain
- Gastric lavage content for toxicology

Collect the gastric content at the beginning of the lavage process and store in a sterile sealable container. One sample in the fridge and another one in freeze.

### DATA TAKEN

Biometric data of the vulture includes measurements of length of:

- Skull (cere to end of the head)
- Upper beak (tip of beak to cere)
- Head (tip of beak to nape/end of head)

- Rear talon length (hallux)
- Length of metatarsus
- Total wing length
- Distal compartment of the wing

Documentation includes:

- Weight
- Pictures with identification markings if possible
- Pictures of any visible pathologies or anomalies

### EQUIPMENT

Necessary equipment for the authorized person who intends to capture a potentially poisoned vulture:

- Heavy duty bird catching net of minimum 50cm diameter with strong netting such as thick nylon.
- Gloves/goggles for his/her own protection. Gloves reduce the mobility of the fingers and the ability to grab efficiently on the vulture, something that the person should bear in mind. Leather gloves can provide adequate protection from vulture bites.
- Sock or hood specifically designed for Griffon vultures. They help in maintaining the bird calm when someone has to handle it for long time or cover a lot of distance on foot to the transport box for example.

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- Tail guard from carton and bandage.



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- Transportation box already prepared. Transportation box options are:
  - Plastic dog crate XL
  - Wooden box complying with IATA regulations.
  - Cardboard box min. dimensions 80cm length x 50cm width x 80cm height.
  - Provision of food is not recommended during transport, in rare cases if vultures are dehydrated, they might attempt to drink water so it's worth trying to give them the option for some water.
  - A Transportation vehicle that can provide shade and air-conditioning is ideal, for example a Van or a pick-up truck with closed rear cabin.

Necessary equipment for veterinarian:

- First aid kit with all necessities including all drugs mentioned through the protocol, feeding tubes etc.
- Sampling tubes, syringes and swabs in order to be able to collect all samples mentioned.
- Available hospitalization crates designed for large birds of prey.
- Large flight pen designed for birds of prey.

## COMMUNICATION

Organized and predetermined cascade of communication between collaborating parties for successful rehabilitation of vultures is crucial. The need to minimize intervention time and transportation of vultures to the veterinarian is of outmost importance, while engaging only competent personnel which is key to avoid disasters.

In the event of a suspected deliberate poison case, it is critical to inform the competent authorities in order to initiate investigation of this wildlife crime and build a case. The veterinarian should inform the Game and Fauna Service promptly which in turn will notify the Cyprus Police. It is also advised to refer to the protocol "Operational Protocol for the management of poison use cases in Cyprus" which lays out the procedures for ensuring the chain of custody. The

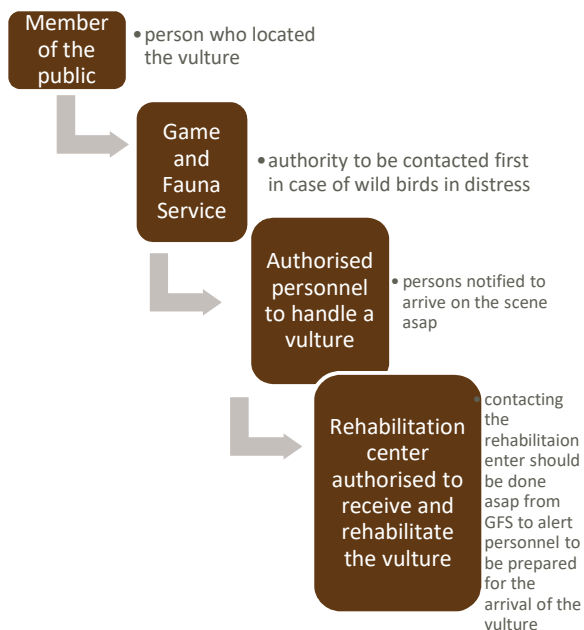
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protocol is available on the project website and on request by Game and Fauna Service and BirdLife Cyprus.



## Game and Fauna Services contact details

- Nicosia District Office: 22662428, 22664606, 99445697
- Larnaca/Famagusta District Office: 24805128, 99634325
- Limassol District Office: 25342800, 99445728, 99628338
- Pafos District Office: 26306211, 99445679

**Game and Fauna Services Headquarters**  
22867786

## COLLABORATING PARTIES

- Game and Fauna Service, Ministry of Interior
- BirdLife Cyprus
- Terra Cypria
- Vulture Conservation Foundation

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