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Guidelines for the Rehabilitation and Release of Vervet Monkeys

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Abstract: In South Africa, conflict between humans and vervet monkeys (*Chlorocebus aethiops*) has led to large numbers of the species coming into care in rehabilitation centers. An accumulation of displaced vervet monkeys in such centers has necessitated the process of troop formation and release. To date, the quality of methods used has been variable, as have the outcomes of rehabilitation and release efforts. Here we present proposed guidelines for the rehabilitation and release of vervet monkeys based on studies of vervet monkey rehabilitation, behavior and biology, in conjunction with existing guidelines for nonhuman primate reintroductions produced by the International Union for Conservation of Nature (IUCN). The aim of these guidelines is to facilitate improved rehabilitation, release, and post-release monitoring and assessment, with the ultimate goal of improving release outcomes.

Key words: *Chlorocebus aethiops*, primate, rehabilitation, reintroduction, wildlife management

Introduction

Rehabilitation involves the treatment of medical or physical disabilities, active teaching of animals to develop latent or lost skills necessary for independent survival in the wild (for example, foraging, rearing behavior and anti-predator behavior) and weaning from human contact (Masataka 1983; Cowlishaw and Dunbar 2000; Beck *et al.* 2007). There are two main types of rehabilitation projects. The first type releases animals for the purpose of conservation and in some cases is associated with zoo-based breeding projects. The second, more common form, is the rehabilitation and release of confiscated pets, orphans and animals displaced by logging, habitat destruction (Cowlishaw and Dunbar 2000) and other human influences. These welfare-based release projects address issues of illegal trade and welfare in captivity by rescuing, rehabilitating and releasing confiscated illegal pets and orphans (Cheyne 2006).

Although the International Union for Conservation of Nature (IUCN) has created rigorous, well researched guidelines for primates, they focus on conservation rather than welfare, and are generalized to either all primates (Baker 2002), or great apes (Beck *et al*. 2007). We have developed a flow chart for primate rehabilitation (Guy *et al*. in press) and a decision tree for rehabilitation of mammals in general (Guy *et al*. 2013). With the exception of gibbons (Cheyne *et al*. 2012), however, there seems to be a general lack of species-specific guidelines for primate rehabilitation.

In South Africa, vervet monkeys are frequently kept as pets or otherwise treated as vermin (Grobler *et al*. 2006). Both situations often result in vervet monkeys coming into care in rehabilitation centers due to problems such as unwanted or confiscated pets, shooting, poisoning, attacks by domestic pets, and motor vehicle accidents (Smit 2010). These problems are considerable; over 300 individuals were rescued in KwaZulu-Natal, South Africa, by the "Monkey Helpline" organization in the first six months of 2010 (Smit 2010). Many of them ended up in the care of one of 20 registered primate rehabilitation centers in South Africa (Wimberger *et al*. 2010a). Displaced monkeys accumulate in rehabilitation centers as a result of high-quality care provided by specialized orphan-care centers (for example, The Hamptons Wildlife Rescue Centre, pers. obs.) along with a reluctance to euthanize displaced primates except where severe injury or disease is involved (Guy *et al*. 2013).

As a result of these issues, a number of vervet monkey rehabilitation centers have begun building and releasing troops back to the wild in an attempt to improve their welfare. Some have been relatively successful (for example, Wimberger *et al*. 2010b; Guy *et al*. 2011; Guy 2013), while others have experienced considerable problems, including poor release-outcomes as a result of inappropriate rehabilitation and release systems, poor choice of release sites, and inadequate post-release monitoring (Wimberger *et al*. 2010b; Guy *et al*. 2012a).

Vervet monkeys (*Chlorocebus aethiops*) are classified as 'Least Concern' on the IUCN Red List (IUCN 2012) and, as such, their rehabilitation and release is motivated by welfare considerations rather than conservation. Although they have different primary objectives, both conservation and welfare re-introductions should adhere to the best practice guidelines set out by the IUCN (Beck *et al.* 2007). Beck *et al.* (2007) also recommended that taxon specific protocols be developed with customized guidelines.

Our aim here is to present guidelines for the rehabilitation and release of vervet monkeys, based on studies of vervet monkey rehabilitation, behavior and biology, and incorporating existing guidelines for nonhuman primate reintroductions (Baker 2002). Our primary goal is to improve rehabilitation methods in order to maximize opportunities for positive outcomes in future releases.

Recommendations for a Best-Practice Model

Arrival

A history should be collected for each animal upon arrival. This should include information such as the reason for the monkey coming into care, the circumstances and location where found, its approximate age, and, if a pet, how long it was kept for and how and what it was fed. This information can help to determine the kind of initial care needed and whether or not the individual is likely to be suitable for release. For example, an orphan that has been cared for by an inexperienced person may be malnourished and/or dehydrated, a monkey that has been hit by a car may be stressed and injured, while an adult vervet that has been kept as a pet for an extended period of time will be habituated to humans and is unlikely to be suitable for release (see, for example, Guy *et al*. 2011).

Following initial assessment, the monkey should be quarantined and undergo medical assessment and treatment. A minimum quarantine of 31 days is recommended by the IUCN, with 90 days being ideal (Baker 2002). This ensures that each monkey is healthy and helps to avoid transmission of any diseases to other animals at the center. Although there are costs involved, this is a vital step. Like many primates, vervet monkeys are susceptible to human diseases and so should be examined by a veterinarian after transfer from a carer or another center. Some infectious diseases known to affect South African vervets include foamy viruses, tick-bite fever (*Rickettsia conori*) and chikungunya virus (Kaschula 1978). The new arrival should also undergo a behavioral assessment. Many confiscated pets will have been socially isolated when very young, and this can have profound effects on their behavior (Suomi *et al*. 1976; Mason *et al*. 2007) and their ability to be socially integrated.

Conspecific re-socialization

Once an initial assessment has been made and the vervet monkey is deemed healthy, they may then move into the group formation stage of rehabilitation. Due to the staggered arrival of new animals and the existence of established groupings at the center, a social group is rarely formed from scratch. An individual is likely to be introduced to an existing group or to just a few other animals to start a new group. Introductions are best made gradually, particularly in the case of young orphaned primates that have been hand-raised and have had limited or no previous contact with conspecifics.

The use of adjacent enclosures—the main one housing an existing group, the smaller one acting as an introduction enclosure for the new arrival—has been successful (Du Toit 2009). In addition, the Vervet Monkey Foundation (Du Toit 2009) and the Wild Animal Trauma Centre and Haven (WATCH) have made use of safe areas at the edge of enclosures for small, milk/formula-dependent orphans to allow feeding without interference from larger monkeys in a group. Adult females in existing groups are sometimes able to foster young orphans, facilitating their introduction to the group (Du Toit 2009). Anecdotal evidence suggests that this is particularly beneficial for adult females that have recently lost their infant (Bruce and Sandi Cronk, pers. comm.).

A number of things need to be considered when forming groups for release. The geographic origin of the monkey must be determined so as to avoid mixing distinct populations. Individuals of unknown geographic origin should not be considered for release (Baker 2002). No significant genetic differences between populations of South African vervet monkeys have been identified, however (Grobler and Matlala 2002), and this means that mixing vervets from different parts of South Africa is unlikely to pose problems for local populations. Government restrictions that prevent the movement of animals between provinces, however, may mean that they will be managed separately anyway (Ezemvelo KZN Wildlife 2008). Moreover, published genetic studies for vervet monkeys are still few, and future work might identify geographic patterning or the presence of subpopulations not currently recognized, as has occurred recently with chacma baboons (for example, Sithaldeen *et al*. 2009).

Dominance relationships need to be monitored, as a lack of a clear dominance hierarchy can lead to heightened aggression in groups (Guy and Curnoe 2011). Animal compatibility can also be a problem, as has been noted for lar gibbons (*Hylobates lar*) and capuchin monkeys (*Sapajus apella*) (de Veer and van den Bos 2000; Suárez *et al*. 2001). Although aggression during the introduction of adult or older juveniles to an existing group is relatively common (A. J. Guy, pers. obs.), prolonged physical aggression may indicate a need to rearrange groups.

Group sizes, and age and sex ratios should be as similar to wild groups as possible (Baker 2002) in order to maximize survival and improve the chances of forming a cohesive group that will remain together after release. The average wild group size for vervet monkeys is 25, with a range of 11–47 (Willems and Hill 2009). Groups of between 24 and 31 are recommended, based on group sizes in successful releases as assessed in Guy *et al*. (unpublished). Ideally, studies of wild groups close to the desired release site would be

undertaken to indicate the natural group size for that area as this is influenced by a number of factors such as the size of available territories (Jackson and Gartlan 1965), food quality and quantity, environmental temperature, and predation risk (Cowlishaw and Dunbar 2000). Detailed published wild studies of vervet monkeys largely focus on Kenya, and the average group composition in the Amboseli reserve is *c.*11% adult males, *c.*23% adult females, *c.*8% sub-adult males, *c.*4% sub-adult females, *c.*49% juveniles and *c.*6% infants (Struhsaker 1967b). As full group composition data are only available for two wild groups studied in South Africa (Cambefort 1981; Willems 2007), we recommend the following approximate proportions: *c.*10% adult males and *c.*25% adult females, providing an adult sex ratio of 1:2.5, close to 10% sub-adult males, *c.*5% sub-adult females, *c.*50% juveniles and *c.*5% infants. This may be altered if reliable studies of wild groups are carried out in the region of the planned release providing composition data for specific regions. Published studies from South Africa yield an average adult sex ratio of approximately 1:2 (males:females), ranging from 1:0.9 to 1:4 (n = 5, Table 1).

Housing, training, and preparation

Social groups should be housed in naturalistic enclosures to promote shelter seeking (some form of shelter should be provided, see, for example, Fig. 1) and moving on natural substrates through complex environments. The typical habitat of vervet monkeys is gallery forest (Tappen 1960), so provision of trees or large branches in the enclosure would assist in developing natural climbing behavior. Objects such as ropes, tyres and smaller branches can be used to add complexity and allow for regular changes to be made to the enclosure (see Fig. 1).

Vervet monkeys forage on the ground and in trees (Tappen 1960). To encourage development of foraging behavior, particularly for younger monkeys or ex-pets, natural foods should be provided in a way that encourages both behaviors. Natural foods help the animals to learn what is palatable and safe to eat in their release habitat. Vervets have a diet that includes fruit, flowers, seeds, grass, leaves, bark, resin, gum, bulbs, roots, insects, eggs and small mammals (Whittsit 1997). Food items taken from the intended release site are desirable. For example, the red currant (*Rhus chirindensis*) and strangler fig (*Ficus* sp.) are common in some parts of Kwa-Zulu Natal in South Africa (Department of Water Affairs and Forestry 1992) and are eaten by vervet monkeys (Harrison 1984; Venter and Venter 2005). If it is not feasible to do this long term, a balanced diet of fresh fruit and vegetables with added protein (for example, nuts and seeds) is recommended (as employed at WATCH: Bruce and Sandi Cronk, pers. comm.), with natural foodstuffs such as fruit, leaves and insects from the release site introduced in the months leading up to release.

Environmental (for example, altering enclosure to increase complexity as described above) and feeding (for example, food puzzles) enrichment can be used to assist the development of natural behaviors. Fruit can be attached to poles, for example, and invertebrates can be placed in boxes of organic material to encourage natural foraging behaviour (Suárez *et al*. 2001). Vervet monkeys tend to have preferred sleeping trees (Struhsaker 1967a), so suitable sleeping sites such as trees, branches, hanging baskets or boxes (Fig. 2) and nets should be provided. Loose objects such as cardboard boxes, balls and paper can be used to encourage exploration of the environment (Cheyne *et al*. 2012).

Minimizing contact with humans is also important so as to avoid excessive habituation that may lead some released animals to seek out human company post-release (see, for example, Guy *et al*. 2011). We recommend methods similar to those used in the rehabilitation of brown capuchin monkeys (*Sapajus apella*) (Suárez *et al*. 2001). To avoid association of humans and food, visual isolation was achieved by covering the mesh of the enclosure with synthetic material, with food provided through a window (Suárez *et al*. 2001). We recommend that just one or two walls be covered for this purpose rather than the entire enclosure, as complete visual isolation may reduce effective acclimatization to the area. Feeding times should be varied so as to reduce predictability (Suárez *et al*. 2001).

Training for predator awareness is an important part of the rehabilitation process (Griffin *et al*. 2000). Animals that have lived in captivity from a young age are likely to have been isolated from predators and may not express normal

Table 1. Adult sex ratios of wild troops of vervet monkeys (*Chlorocebus aethiops*) studied in South Africa.

Number of adult males	Number of adult females	Approximate ratio	Reference
5	8	1:1.6	Barrett (2005)
2	8	1:4	Willems (2007)
7	6	1:0.9	Cambefort (1981)
9	14	1:1.5	Harrison and Byrne (2000)
4	8	1:2	Baldellou and Adan (1997)

Figure 1. A naturalistic enclosure at the Wild Animal Trauma Centre and Haven in Vryheid, KwaZulu-Natal, South Africa. Note the vervet monkeys using the shelter provided on the left and enrichment items including trees, tyres, poles and ropes. Photo by A. J. Guy.

Figure 2. Hanging sleeping baskets (circled, upper right of photograph) at "Vervet Haven" in Durban, South Africa. Photo by A. J. Guy.

predator-avoidance behavior. This can greatly reduce their chances of survival when released. Predator-avoidance behavior functions to reduce the risk of an animal or its relatives being killed. Vervet monkeys have a number of predator alarm calls and associated responses including: running up into the trees in response to a leopard alarm call, looking up and running into the bushes for eagle alarm calls, and standing and looking down for snake calls (Cheney and Seyfarth 1981). These behaviors need to be functional the first time that a predator is encountered if an animal is to survive, but responses will also improve with group experience (Griffin *et al*. 2000). Housing vervets in an area where they will come into contact with predators such as snakes and eagles can increase their pre-release awareness of them (see, for example, Guy *et al*. 2011, 2012b). Providing thick bushes or artificial hiding places may also act to promote natural predator avoidance behavior for birds of prey.

In addition, studies of other mammals have shown that the presence of wild-caught experienced individuals in a group can improve responses to predators (Shier and Owings 2007). If the location of the rehabilitation center prevents pre-release exposure to predators, some form of training may be required. This can include intentional direct exposure to the predators themselves (Shier and Owings 2007), or use of substitutes such as related species (McLean *et al*. 2000), silhouettes (Brown *et al*. 1992) or stuffed or model predators (Arnold *et al*. 2008). In cases where monkeys have not been exposed to predator species or had opportunity to observe or demonstrate appropriate anti-predator behavior, an extended period of acclimatization at the release site is recommended to increase the chances of the group encountering predators from a protected environment (within an enclosure) prior to release. In this case, it would be necessary to provide an appropriately large enclosure so as to limit stress and to avoid increased aggression that sometimes occurs when vervets are moved to a smaller enclosure (Clarke and Mayeaux 1992).

Pre-release assessment

Further assessment should be carried out prior to release. An important part of this is a pre-release medical check by a qualified veterinarian. Animals kept in captivity are susceptible to infection with parasites that may be foreign to the species (Cunningham 1996). In addition, many primates, including vervet monkeys, are susceptible to human diseases. As such, human contact should be minimized and any animals for release need to be screened for common diseases. It is vital that animals for release be healthy. Failing to carry out pre-release medical checks can result in disease transmission to wild populations, both conspecifics and other species (Viggers *et al*. 1993), mortality of released animals as a result of pathogens and ectoparasites causing disease triggered by the stress of transport and release, and zoonotic diseases (for example, tuberculosis, influenza, viral hepatitis, and measles [Heuschele 1991]) being transmitted to the local human population (Viggers *et al*. 1993).

Methods used to reduce these risks include: quarantine (as described in the 'arrival' section), clinical examination by a veterinarian (Viggers *et al*. 1993), fecal examination for parasite eggs and larvae (services may be provided by veterinary laboratories) (Viggers *et al*. 1993), hematology and serum biochemistry profiles to aid disease detection based on comparison with normal blood values for the species, serological testing to detect infectious diseases (Viggers *et al*. 1993), microbial culture to isolate and identify the cause of the disease, and vaccination for some common diseases where there is a specific risk (Viggers *et al*. 1993). Animals that die in captivity should undergo a full post-mortem examination to determine the cause of death. Wherever possible, this should also be done for animals that die post-release so as to identify any problems with the health of rehabilitated animals.

Primates can carry tuberculosis, which can be transmitted to humans and domestic animals (Viggers *et al*. 1993). A common way to test for tuberculosis is the skin-testing procedure involving an intradermal injection, with a positive reaction being detected after three days (Viggers *et al*. 1993). This should be carried out by a qualified veterinarian.

Behavioral assessment should be carried out to confirm suitability for release. Direct comparisons of the behavior of wild and captive animals can help to determine which animals are ready for release. Individuals that show significant deviation from wild behavioral patterns are less likely to survive

post-release, while slight deviations are most likely due to captive conditions and are not a huge concern (Mathews *et al*. 2005). Monkeys ready for release should not seek human contact. Stereotypic behaviors may develop during captivity and animals should be monitored in order to identify any abnormal behavior that may affect their suitability for release.

Release site selection

One of the most important steps in a release project is the selection and assessment of the release site. This can be quite complex and a number of factors that should be assessed for any primate release have been outlined in the IUCN guidelines for non-human primate re-introductions (Baker 2002). These include availability of food and water and their seasonality, protection of the site, if conspecifics are absent and the reason for their absence, and human influence. A release site should provide appropriate habitat and ideally be free from human disturbance (for example, hunting and introduced, feral or domestic animals) (Dodd and Seigel 1991). Habitats should be chosen to minimize edge effects and should not have an unusually high concentration of predators (Dodd and Seigel 1991).

Vervet monkeys rely on riparian habitat with permanent water sources. A lack of available water increases mortality (Dunbar 1988), so the dry season should be avoided for releases, and at least one permanent water source should be located close to the release site. Release should be timed to coincide with the wet season when availability of resources would be highest (Wimberger *et al*. 2010b; Guy *et al*. 2012b). Vervets adapt well to human disturbance and are prone to raiding crops (Saj *et al*. 2001). This is a significant cause of human-monkey conflict, and often results in trapping and killing of vervets (Saj *et al*. 2001). Furthermore, hunting has been identified as a considerable cause of mortality in released vervet monkey groups (Guy *et al*. 2011, 2012b; Guy 2013). Strategies to combat this include release into areas as isolated from human settlement as possible, release habitats that contain numerous fruiting trees, and the provision of supplementary food (use of soft release procedures) for a period after release until the vervets can effectively feed themselves.

Habitat features that appear to be related to successful releases of vervet monkeys include high altitude and rainfall, a high proportion of tree or forest cover, and a minimal or zero percentage of land cover in the area being composed of dams, bare sand, grassland/bush clumps mix and bushland (Guy *et al*., unpublished). Privately owned land with supportive landholders has also been associated with positive release outcomes (Guy *et al*., unpublished), so agreement and co-operation of landholders in the desired release area must be obtained before release. Human disturbance of land, urban settlement, and other human activities are associated with poor release-outcomes (Guy *et al*., unpublished) and so should be avoided.

The size of the release site is important, particularly with regard to assessing impacts on the released group from humans. The average home range for wild vervet monkeys is 0.725 km², with an average day range length of about 1 km (Willems and Hill 2009). However, released vervet monkeys have been known to have home ranges of up to 6.98 km² (Guy *et al*. 2011), regularly travelling more than 2 km from the release site (Guy *et al*. 2011). Thus our recommendation is to select a release area that can allow for the expansion of the groups' range up to 7 km², with little or no human activity within a 3 km radius of the release site.

It is important for the density of conspecifics to be lower than the carrying capacity (Cowlishaw and Dunbar 2000). Often the presence of the species in an area is used as a definitive criterion for the suitability of a release site. This simplified view fails to recognize that introducing more vervet monkey groups to an area may lead to increased competition, aggression and disease transmission. Vervet monkeys can be highly territorial and this can result in inter-group aggression, sometimes resulting in the injury of released monkeys (Wimberger *et al*. 2010b). Whether conspecifics should be present near the release site at all depends on the specific goal of the release. If the primary aim is to improve welfare of individuals through release, then it is not necessary for conspecifics to be present. If the aim is to increase numbers, however, then wild groups must be nearby as vervet populations rely on male dispersal for gene flow (Cowlishaw and Dunbar 2000). Disease risks and competitive impacts on other resident primate species must also be taken into account. Vervet monkeys share their range with a variety of primate species, ranging in IUCN Red List status (IUCN 2012) from Least concern (for example, the southern lesser galago *Galago moholi*, chacma baboon *Papio ursinus*, blue monkey *Cercopithecus mitis*, and guereza *Colobus guereza*) to Endangered (for example, Udzungwa red colobus *Procolobus gordonorum*, and chimpanzee *Pan troglodytes*).

Release

As recommended by the IUCN, a transport plan should be in place, with emphasis on minimizing stress and risk of injury (Baker 2002). All monkeys should be transported in well-ventilated, secure transport boxes (Bruce and Sandi Cronk [WATCH], pers. comm.). The hottest part of the day should be avoided, transporting either in the early morning or late afternoon. Larger monkeys, such as adult males should be placed in individual boxes to avoid injury to smaller individuals. Vulnerable individuals such as mothers with infants should, likewise, be isolated (WATCH, pers. comm.). Whenever possible, monkeys that have been known to frequently direct aggression toward each other should not be transported in the same box. If transporting a long distance, regular stops should be made to check the monkeys and to provide food and water. The group should be accompanied by experienced personnel from the rehabilitation center and, if possible, a veterinarian (Baker 2002).

A soft-release method, including an acclimatization period at the release site, is recommended to allow the animals to recover from transport, acclimatize to environmental conditions, and become familiar with their surroundings

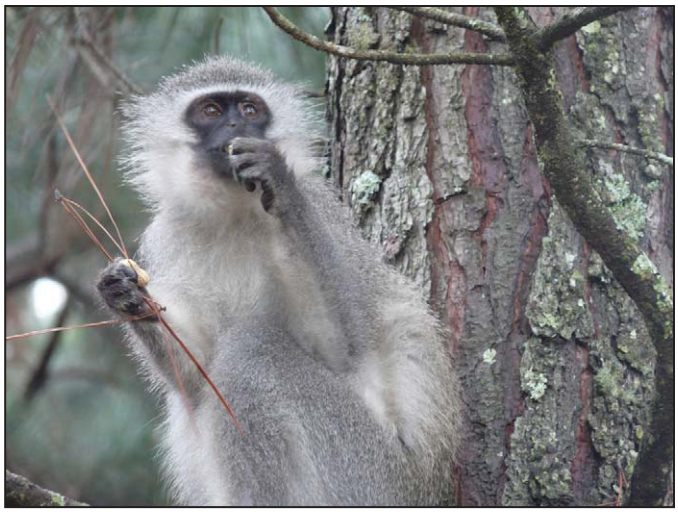

Figure 3. Small food items such as nuts can assist monitoring. Photo by A. J. Guy.

Figure 4. A released vervet monkey fitted with a radio-collar. Photo by A. J. Guy.

(Baker 2002). This site is often used as the initial location for supplementary feeding post-release (Guy *et al*. 2011, 2012a, 2012b). During acclimatization, vervets should be fed natural food, preferably taken from the surrounding area. The average time spent in the release enclosure in past vervet releases has been three days (based on Wimberger *et al*. 2010b; Guy *et al*. 2011, 2012a, 2012b). A minimum period of two weeks, as recommended for gibbons (*Hylobates* sp.) (Cheyne *et al*. 2012), however, may be more appropriate. Some experimentation may be required to determine the ideal acclimatization period and enclosure size.

Supplementary feeding should be provided to ensure that the released monkeys obtain adequate nutrition whilst acclimatizing to and exploring their new habitat. The average time period of supplementary feeding for vervets is approximately two months (Wimberger *et al*. 2010b; Guy *et al*. 2011, 2012a), but this may vary due to circumstances such as wild groups eating the supplied food (Guy *et al*. 2012a) or the monkeys leaving most of the supplied food and obtaining nutrition from wild sources. The amount of food may be reduced as the released monkeys increase their foraging on natural sources. Once supplementary feeding ceases, small food items such as nuts can be useful in drawing out monkeys so that their condition can be assessed (Fig. 3).

Post-release assessment

Post-release monitoring is vital, and the data collected during this time allow the success of the project to be assessed and lessons to be learned for future release efforts. The released groups should be monitored for a minimum of one year (Beck *et al*. 2007) to encompass at least one breeding season and all climatic conditions at the release site. Most released vervet monkey groups have not been monitored for this minimum period (Wimberger *et al*. 2010b; Guy *et al*. 2012a).

Tracking devices such as radio- or GPS-collars are vital to monitoring. Studies that have not used such devices have yielded very little data extending over a time frame of less than six months (Guy *et al*. 2012a). Radio-collars (Fig. 4) have been used for several releases of vervet monkeys (Wimberger *et al*. 2010b; Guy *et al*. 2011, 2012b) and at times were the only way of gathering data on the groups in inaccessible terrain (Guy *et al*. 2012b). However, data collection is also limited when collars are fitted to only a small portion (mean = 44%: Guy *et al*., unpublished) of the group. All individuals large enough to carry a monitoring device should be fitted with one so as to limit the number of missing animals and allow monitoring of all post-release. Specialized GPS collars as used, for example, by the University of Neuchâtel for wild studies (Bruce Cronk, pers. comm.) are recommended whenever finances permit as they allow remote data collection when animals cannot be physically located. There are some published primate release studies that have made use of GPS collars (Markham and Altman 2008; Pebsworth *et al*. 2012), but the collars used exceed the maximum 5% of body mass (Animal Care and Use Committee 1998) for vervet monkeys (based on an average mass of 3 kg for females and 4.3 kg for males; Dunbar and Barrett 2000).

Monitoring data should include predator densities, competitors, human impacts and population demographics (births/deaths) (Cheyne 2006). Predators of vervet monkeys include: baboons (*Papio ursinus*, *P. cynocephalus*), Verraux's eagle owl (*Bubo lacteus*), Martial eagles (*Polemaetus Bellicosus*), Crowned eagles *(Stephanoaetus coronatus*), and leopards (*Panthera pardus*) (Struhsaker 1967a). Poisonous snakes such as cobras (*Naja haje*) and puff adders (*Bitis arietans*) have the potential to kill vervet monkeys. These species evoke an alarm response from vervet monkeys, indicating that they recognize them as a threat (Struhsaker 1967a). Other carnivorous felines are potential predators, with high intensity predator responses observed for lions (*Panthera leo*) and servals (*Felis serval*) (Struhsaker 1967a). Human activities are possibly the most significant cause of mortality and care should be taken to avoid areas of human activity when selecting a release site.

Other key parameters for assessment could include animal numbers over time, sex ratios, and adult/juvenile ratios (which can be compared to existing wild populations), population changes, and continuing assessment of threatening processes (Fischer and Lindenmayer 2000).

Conclusion

Although rehabilitation and re-introduction programs have been in progress for many years, until very recently, vervet monkey rehabilitation was almost entirely lacking in the published literature. Even with recent studies, the number of releases that have been assessed thus far are relatively few. We hope that these guidelines will be the beginning of a continually developing manual for vervet monkey rehabilitation. Additional material should be incorporated based on lessons learned in future releases in order to maximize positive release outcomes.

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