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Pets and pests: vervet monkey intake at a specialist South African rehabilitation centre

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Abstract

*Vervet monkeys (*Chlorocebus pygerythrus*) encounter a plethora of anthropogenic risks as a result of their ability to exploit human-altered environments. A systematic assessment of these risks has not been carried out to date. Here, we aim to begin addressing this gap in our understanding of human-vervet conflict in South Africa. We present a descriptive analysis of the intake of the Vervet Monkey Foundation (VMF) — a specialist vervet monkey rehabilitation centre and sanctuary in the Limpopo Province. Between October 2003 and March 2012 almost 200 vervet monkeys arrived at the VMF. At least 161 infants arrived with a steady decrease in annual intake over time, most probably due to the increasing number of other centres in the province. Detailed data for all age classes were available from March 2009 to March 2012. Of the 50 monkeys that arrived during this period, more young monkeys (infants and juveniles) than adults arrived and more infants than juveniles. Intake of injured and uninjured monkeys was equal. The majority of injuries were caused by cars and the majority of uninjured arrivals were ex-pets handed over voluntarily. A distinct temporal pattern of arrival, peaking in the austral summer, coincides with the birthing season of vervet monkeys in South Africa. The merits of publishing such records and the welfare implications of the perceptions of and objections to these 'pest' primates are discussed.*

Keywords: *animal welfare,* Chlorocebus/Cercopithecus*, human-wildlife conflict, pest primates, primate rehabilitation, vervet monkey*

Introduction

There have been a number of studies of the rehabilitation and sanctuary of several primate taxa including pygmy slow lorises (*Nycticebus pygmaeus*) (Streicher 2004), Guianan brown capuchins (*Cebus paella*) (Suarez *et al* 2001), black howler monkeys (*Alouatta pigra*) (Horwich *et al* 1993), vervet monkeys (*Chlorocebus pygerythrus*) (Rhind & Lawes 1998; Grobler *et al* 2006; Wimberger *et al* 2010; Guy *et al* 2011, 2012), yellow baboons (*Papio cynocephalus*) (Gruesen 2007), various gibbon species (*Hylobates* spp) (Cheyne *et al* 2012), including Müller's Bornean gibbon (*Hylobates muelleri*) (Bennett 1992) and the silvery Javan gibbon (*Hylobates moloch*) (Ware 2001), gorillas (*Gorilla* spp) (Farmer & Courage 2008; King *et al* in press), and chimpanzees (*Pan troglodytes*) (Humle *et al* 2010; Ongman *et al* 2013). These studies have covered topics including the evaluation of release and reintroduction success and methods, survivorship, and post-release monitoring protocol (Horwich *et al* 1993; Rhind & Lawes 1998; Suarez *et al* 2001; Streicher 2004; Gruesen 2007; Humle *et al* 2010; Wimberger *et al* 2010; Guy *et al* 2013; King *et al* in press); welfare implications of release (Guy *et al* 2011, 2012); rehabilitation methods (Cheyne *et al* 2012; Guy *et al* 2013; Ongman *et al* 2013); and the role of rehabilitation and reintroduction as a conservation tool (Bennett 1992; Ware 2001; Farmer & Courage 2008).

Studies of admittance data from sanctuary and rehabilitation centre populations have been less common despite growing anthropogenic pressures and the increase in rehabilitation and sanctuary programmes in welfare and conservation strategies. What studies there have been have focused on rare and endangered taxa such as the African great apes (Farmer 2002; Ghobrial *et al* 2010; Faust *et al* 2011; Hughes *et al* 2011). Vervet monkeys are a more common species admitted to such centres yet the history and composition of these rescue/rehabilitation centre populations have not been studied to date. Studies of the release of rehabilitated vervet monkeys have discussed some individual histories in the context of suitability for release (Rhind & Lawes 1998; Wimberger *et al* 2010; Guy *et al* 2011, 2012). However, as the cause of admittance of the study populations was not the focus of these studies, the composition of these rehabilitation centre populations was not described and the anthropogenic threats faced by this conflict species remain unreported in the academic literature.

Vervet monkeys are ecologically flexible primates that range throughout eastern and southern Africa (Whittaker 2013). They can exploit various habitats from dry savannah to gallery forest, thrive in disturbed growth habitat, and exploit human-altered environments such as tourist parks, agricultural land and urban residential areas (Whittaker

2013). As per the genus, they can vary foraging strategies, territoriality, ranging patterns, fecundity, and activity levels, depending on resource quality and seasonal fluctuations in conditions (Kavanagh 1981; Harrison 1985; Whittaker 2013). Limited only by the availability of water and appropriate sleeping trees (Wrangham 1981; McDougall *et al* 2010), they have an ecological advantage over more specialist taxa that require protected closed-canopy forest for survival. They have few major threats and are widespread and relatively abundant, informing their Least Concern threat status on the IUCN Red List of Threatened Species (Kingdon *et al* 2008).

It is this very flexibility that brings vervet monkeys into conflict with humans. They frequently come to share human-dominated landscapes as increased urbanisation forces them into closer proximity with humans (Henzi 1979). To farmers in rural areas throughout the entire (*Chlorocebus*) range (occurring patchily throughout sub-Saharan Africa), these monkeys are notorious crop raiders. This conflict is relatively well documented with raiding events reported as well as several studies reporting the rank of vervet monkeys as pests according to farmers (Cameroon: Kavanagh 1980; Ethiopia: Quirin 2005; Admassu 2007; Kenya: Nampindo & Plumptre 2004; Hartter 2009; Kivai 2010; Wallace & Hill 2012; Tanzania: Masunzu 1998; Uganda: Saj *et al* 2001). In South Africa, vervet monkeys rank second only to baboons as crop-raiders and pests (Estes 1992). Suburban conflict is less well documented (but see King & Lee 1987 for Malawi) but does occur. One publication from South Africa reported that people in KwaZulu-Natal responded to vervet monkeys in gardens and houses by shooting monkeys with pellet guns, throwing stones and poisoning (Guy *et al* 2011).

In South Africa, vervet monkeys were subject to the South African Problem Animal Control Ordinance ('Ordinance 26, 1957') which allowed them to be destroyed as vermin. They were removed from this list in 2005 but, for many people, retain their reputation as pests. Complaints from residents about monkeys near and on their property and various incidents of monkey injuries and killings are reported on local news sites (eg www.looklocal.co.za). To keep a non-human primate as a pet is an illegal practice in South Africa that results in confiscation if detected (Grobler *et al* 2006). Nevertheless, though poorly documented, pet vervet monkeys are sometimes kept (Fuentes 2006; Grobler *et al* 2006). As a result of this human-monkey conflict many South African rescue centres, rehabilitation centres and sanctuaries take in injured, orphaned and ex-pet vervet monkeys (Wimberger & Downs 2010; AH unpublished data).

Rhind and Lawes (1998) reported an annual intake of 70 vervet monkeys to the Centre for the Rehabilitation of Wildlife in Durban. Over a decade later Wimberger and Downs (2010) reported that vervet monkeys were the most common mammalian species to be admitted to that same centre, where 365 arrived over four years. Monkey Helpline, KwaZulu-Natal, rescued 326 monkeys in the first 6 months of 2010 (Guy *et al* 2011). Grobler and colleagues (2006) estimated a sanctuary population of approximately 3,000. When the VMF was established in 1989 it was the only centre for vervet monkeys in the Limpopo Province. There are now four more in Limpopo and at least six in neighbouring KwaZulu-Natal (Dave du Toit, VMF Director, personal communication 2011). There are now at least 23 rescue centres in South Africa that take in vervet monkeys (AH unpublished data) and long-established networks to facilitate communication between centres (eg African Primates). Yet, despite being aware of the issue, intake at these centres, and the prevalent human-monkey conflict in South Africa, have not been documented in the academic literature. The aim of this report is to begin to fill this gap.

Here, we aim to present descriptive statistics of the intake records of one specialist vervet monkey sanctuary and rehabilitation centre in the Limpopo Province of South Africa — the Vervet Monkey Foundation (VMF) — identifying apparent trends in age, sex, season of arrival, and causes of injury and orphaning. We discuss the merits of monitoring and sharing such records as well as the important role of these centres in education efforts to reduce the numbers of vervet monkeys needing rescue. We also discuss the importance of identifying and addressing people's perceptions of and attitudes towards these 'pest' primates in an attempt to reduce the number of vervet monkeys entering these centres.

Materials and methods

The Vervet Monkey Foundation

The VMF is a non-profit organisation in the Tzaneen area of the Limpopo Province of South Africa founded to provide rehabilitation and sanctuary for vervet monkeys in the locality. It was registered as a charity in 1993 having taken in its first individual in 1989. The VMF is a member of the Pan African Sanctuary Alliance, and is verified by the Global Federation of Animal Sanctuaries. By 2008 the VMF housed over 800 vervet monkeys, comprised of orphan infants, ex-pets, injured individuals, groups taken in from other sanctuaries, one group from a biomedical research facility, and monkeys born at the VMF. Breeding occurred in social groups until 2010 when all adult males were vasectomised.

Data acquisition

Two datasets were gathered from the VMF. The first dataset focuses on infant intake from October 2003 to March 2012. AH worked as a volunteer at the VMF intermittently from June 2006 until March 2009. Through correspondence with other voluntary staff and notes kept by AH we obtained reliable data on the number of infants arriving at the VMF dating back to October 2003. The second dataset contains comprehensive data on intake of all age classes, ie infants, juveniles and adults, from March 2009 to March 2012. The VMF maintains a database of records of all monkeys and their individual histories and is complete from February 2009. A comprehensive dataset of intake of all age classes for the period of March 2009 to March 2012 was shared by the management of the VMF for the purposes of this study and was used to examine patterns between sexes and age classes. Combined, the two datasets were used to estimate the minimum total number of vervets admitted to the centre since 2003.

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Table 1 Circumstances of arrivals at the VMF during the period of March 2009 to March 2012.

Age and sex	Injured			Uninjured			
	Car	Shot	Other	PHO	FIB	Conf	Other
Adult: male; female; unsexed	1; 1; 0						
Juvenile: male; female; unsexed	3; 3; 0		1; 2; 1	4; 1; 0			0; 1; 0
Infant: male; female; unsexed	4; 2; 0	1; 2; 0	1; 2; 1	2; 4; 0	2; 4; 0	2; 1; 0	1; 3; 0

PHO: Pet hand-over; FIB: Found in bush.

Here, we define 'infants' as monkeys of six months or younger based on the age at which offspring will move independently of their mothers (Bolter & Zihlman 2003); before this age they are more likely to cling ventrally to their mothers when the troop is moving. Juveniles are seven months to three years for females and five years for males, the age at which sexual maturity is reached (Cheney *et al* 1988).

Statistical analysis

All data were entered in a database, with statistical analysis performed in SPSS Statistics 19. A linear regression test was carried out to determine the relationship between year and infant intake. A Chi-squared goodness-of-fit test was carried out to assess the evenness of distribution of arrivals across ages and sex, and to examine temporal patterns of intake. Significance was accepted when $P < 0.05$ in a two-tailed test.

Results

Between October 2003 and March 2012 at least 191 vervet monkeys arrived at the VMF. This is a conservative estimate since prior to March 2009 no admittance data were available for juvenile and adult age classes.

Orphan infant intake October 2003 to March 2012 (inclusive)

Between October 2003 and March 2012, 161 orphan infants arrived at the VMF. There has been a steady decrease in annual infant intake with a statistically significant linear relationship between year and number of infant arrivals (Infant intake = –3.22 Year + 40.41; $R^2 = 0.66$; $P = 0.008$).

Intake of all age classes from March 2009 to March 2012 (inclusive)

Age, sex and circumstances of arrival

Between March 2009 and March 2012 there was a total intake of 50 vervet monkeys at the VMF, namely two adults (one male, one female), 16 juveniles (8 male, 7 female, one unsexed) and 32 infants (13 male, 18 female, one unsexed). There was no significant difference in intake apparent between sexes. There is a significant difference in intake apparent across age classes ($\chi^2 = 26.62$, df = 2; $P < 0.0001$) with significantly more young (juvenile and infant) monkeys arriving than adults ($\chi^2 = 42.32$, df = 1; $P < 0.0001$), and significantly more infant intake than juvenile ($\chi^2 = 5.33$, df = 1; $P = 0.02$).

Six vervet monkeys were euthanised upon arrival due to the severity of their injuries; one individual died of its injuries shortly after arrival. Six monkeys were released (one adult, four juveniles, one infant) following a brief period of recovery from their injuries, since the locations of their troops were known and they were judged behaviourally and physically fit. In the case of the infant release, a wild female of the identified natal group was observed by staff upon release approaching the infant and carrying it back to the troop. All others remained at the VMF for rehabilitation until eventual release.

There was an equal intake of injured and uninjured monkeys (Table 1). The most common cause of injury was vehicle collision (56%). Other causes of injury included shooting by farmers (12%), attack by dogs, some injuries of unknown causes and one case of electrocution by power lines. One injured infant found alone in the bush was presumed to be injured in an inter-troop encounter. Injured infants listed under 'Car' and 'Shot' were injured when their mothers were killed. We found no statistically significant difference between the proportion of injured males to injured females ($\chi^2 = 0.43$, df = 1; $P = 0.83$). Infants were no more likely to be injured than juveniles ($\chi^2 = 0.39$, df = 1; $P = 0.53$).

The majority of uninjured monkeys were ex-pets handed over voluntarily to the VMF (44%). The length of time monkeys were kept as pets as described by owners, ranged from two weeks to four years. Three uninjured infants were confiscated; one by Nature Conservation, one by a veterinarian when the monkey's owner brought him in wearing a nappy, and the third by the director of the VMF when she was seen in a man's arms in the local supermarket. Six uninjured infants were reported to have been 'found alone in the bush'. Uninjured infants under the 'Other' category arrived through a variety of circumstances. One was found on the side of the road with a chain around its waist, thought to be intended for sale. One was brought into a house uninjured by a family's pet dog. Another was handed into a pet shop and the VMF notified by shop staff. How the people who made the hand-over came to be in possession of the monkey is unknown. One other infant was uninjured but orphaned when its mother was shot by a farmer. The one uninjured juvenile in the 'Other' category came from another rescue centre.

Temporal intake patterns

Between March 2009 and March 2012 monkeys arrived in all months but July and September. It should also be noted that the VMF was under quarantine from April to September of 2009 and so no animals were accepted during this period, accounting for the absence of arrivals in these months. There is a clear peak in admittance in the months of November and December (ten arrivals in total in both months). Seventy-eight percent of arrivals (39 monkeys) arrived between the months of October and March, significantly more than the number of arrivals during the second half of the year ($\chi^2 = 15.68$, df = 1; $P < 0.0001$).

Discussion

Here, we presented data on the admittance of a total of 191 vervet monkeys to a specialist vervet monkey rehabilitation centre in South Africa between October 2003 and March 2012. These data can go some way towards providing insight into the anthropogenic threats faced by vervet monkeys in South Africa and to informing recommendations for conflict mitigation between humans and the problem animals with whom they share their environment.

There has been a steady decrease in infant intake over time which could be due to several factors. It is possible that with the removal of vervet monkeys from the vermin list in 2005 there has been a genuine decrease in the need for rehabilitation and sanctuary. This is unlikely, however, as human-vervet conflict continues, and is likely to escalate with increased urbanisation. A more likely explanation is the growing number of vervet monkey sanctuaries and rehabilitation centres in the region, with four additional centres in the region since the VMF's founding and at least 23 across the country (AH unpublished data). Another possible explanation is that there are fewer resident troops in the area. However, the wild population has not been monitored. And without baseline population data or ongoing monitoring we cannot speculate as to the condition of the wild population in the area and how this would influence rescue centre intake, though it would certainly be a worthy avenue of research.

Trends in causes of injury and orphaning could go some way towards reflecting the threats to vervet monkeys in a given area and areas where these threats are highest could be identified (cf Schoene & Brend 2002; Kelly & Sleeman 2003; Harden *et al* 2006; Drake & Fraser 2008; Randall *et al* 2012; Serangeli *et al* 2012; Souza *et al* 2012; Dubois & Fraser 2013) and preventative measures could be attempted to mitigate some of these threats. For instance, Griffith and colleagues (2013) reported an increase in vehicle collisions as a cause of injury to koalas (*Phascolarctos cinereus*) in New South Wales over a 30-year period. These data supported the local authorities in their pursuit of traffic-calming measures in the area. Similar trends were analysed by Molina-Lopez and colleagues (2011) regarding the wild raptor population of Catalonia confirming both direct persecution and indirect anthropogenic threats to be the primary causes of admittance of injured birds. Though direct recommendations were not made, the deficiencies of the police investigation processes with regards the shooting of protected raptors were highlighted and the necessity for stronger legal action in these cases was suggested. An evaluation of the causes of injury and morbidity to wild birdlife in Greece (Mazaris *et al* 2008) used its findings to recommend a reduction of the hunting period and improvements in law enforcement. An ongoing initiative of the Colobus Conservation to reduce primate road deaths and injuries in Diani Beach, Kenya, involved the construction of canopy-level 'bridges' across stretches of road identified as high risk to monkeys. These have been shown to be beneficial to vervet monkeys as well as Sykes' monkeys (*Cercopithecus mitis albogularis*) and black-and-white colobus (*Colobus angolensis palliates*) (Andrea Donaldson, Colobus Conservation manager, personal communication 2013). The most common cause of injury to vervet monkeys arriving at the VMF was vehicle collision. In light of this finding, local authorities could be prevailed upon to initiate traffic-calming measures, or alternatives such as aerial 'bridges', at key areas to increase the safety of wildlife and humans alike.

There is a seasonal pattern of intake at the VMF with a clear peak during the austral summer (October–March). This is to be expected given that in regions of their range where there are clear wet and dry seasons, as in South Africa, mating generally occurs during the dry season and birthing tends to occur from the beginning of the wet season (October to March) when resources once again become plentiful (Lee 1984). Wimberger and Downs (2010) also report seasonal increases in rescue centre arrivals, linked directly to the increased abundance of juveniles and infants during the spring and summer months. In fact, an overwhelming majority of VMF admissions — 96% — were either juveniles or infants, and of those a clear majority — two-thirds — were infants, a trend also reported in Durban (Wimberger & Downs 2010). As a large portion of injured infants were brought in when their mothers were killed by vehicle collisions, addressing this could reduce this seasonal influx of infants.

Shooting is the second most common cause of injury to vervet monkeys admitted to the VMF. In the case of crop-raiding animals, farmers could be encouraged to employ non-lethal methods of crop protection. However, it is recognised that non-human primates, in particular, are more problematic to farmers than other large mammals due to their intelligence, manual dexterity, size and their often omnivorous character commonly making control techniques unsuccessful (Hill 2002). Where some other large mammals can be contained by barriers, primates can jump over and dig under fences, they learn to climb on electric insulators and can find 'dead spots' in electric fences (Strum 1994). Even killing crop-raiding primates can be ineffective in dissuading others from the behaviour as the remaining animals simply learn extreme caution and continue to raid (Kavanagh 1980). Awareness-raising programmes targeting farmers could highlight the ineffectiveness of shooting monkeys that are crop-raiding. Farmers could instead be

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encouraged to employ alternative crop-protection techniques. Educational messages could also raise awareness of the presence of suckling infants during the birthing season.

In the residential context, where monkeys enter gardens, conflict could be mitigated if people could be encouraged to 'monkey proof' bins. Insect mesh or screens could be placed in front of windows if they are to be left open to prevent monkeys from entering houses. Leaving food visible and accessible should be avoided. As the majority of uninjured monkeys were ex-pets it is imperative that people are educated as to why non-human primates are not appropriate companion animals.

There is a general trend of common species living in close association with humans being those most frequently admitted to rehabilitation centres (Deem *et al* 1998), as there is an increased probability of injury and subsequent detection (du Toit 1999; Reeve & Huijser 1999; Barnett & Westcott 2001). But when it comes to problem animals it is not only proximity to humans and the resulting accidents with which we have to contend. Any proposed mitigation measures would be purely academic without concurrently addressing attitudes. A quantitative assessment of these attitudes and perceptions of vervet monkeys in South Africa is lacking, but from informal discussion with the public and those that hand over vervet monkeys it is clear that they are generally not liked or tolerated at best. Some negative terms used by members of the public when referring to vervets have included 'hate', 'nuisance', 'malicious' and 'cause too much damage'. Farmers, in addition, commented on the economic losses they incurred due to the presence of vervet monkeys, and to an absence of any benefit brought by the vervet monkeys (du Toit 2012). In July 2012, a vervet monkey was deliberately killed, dragged by a cord and tied to a post by the main gates of the VMF (du Toit 2012). Although it was not the sole piece of evidence demonstrating the attitudes of the neighbouring public towards these monkeys it was the most violent. These perceptions must be addressed. It is widely acknowledged that understanding attitudes to 'pest' primates, and other commensal species, is imperative for mitigating conflict (Else & Lee 1986; Parry & Campbell 1992; Pirta *et al* 1997; Gillingham & Lee 1999; Hill 2002; Lee & Priston 2005; Hill & Webber 2010; McLennan & Hill 2012). Informing local communities about how to successfully live with vervet monkeys could potentially reduce conflict. The VMF has become more active in its education and community outreach in recent years. Raising its profile through increased involvement with the local community will likely influence future interactions with people who live closely with vervet monkeys, could aid in improving relations between people and monkeys, and may contribute to future data collection. Awareness events as well as educational visits by school groups and by the general public to the VMF and other facilities would be an opportune time to conduct such research into the attitudes and perceptions of local people towards problem animals.

Animal welfare implications

Wildlife sanctuaries and rescue and rehabilitation centres do not use a uniform comparable recording system that would facilitate the sharing of intake records (Harden *et al* 2006). Such comparable data would be of great use both for conservation- and welfare-related research. If databases such as this one were maintained over time we could categorically identify the anthropogenic causes of harm to wildlife, in this case vervet monkeys in South Africa, enabling the development of preventative measures to reduce harm to individuals and to protect local populations (Sharwood Smith 2006). Comparisons of intake could be made between sanctuaries based on location, urbanisation, proximity to roads and other anthropogenic threats. Intake numbers at one centre could be compared over time. Records of where an individual was found would facilitate possible release, as well as identifying the locations and status of resident groups. Attitudes of local people towards problem animals could be identified and addressed through raising awareness and providing practical solutions to some problems. This is particularly important when it comes to 'pest' species as there is the problem of where to safely release rehabilitated animals. With the co-operation of rescue centres and other invested stakeholders, such as those studying human-wildlife conflict in the region, these efforts could go some way to reducing the number of vervet monkeys arriving at centres, playing an intrinsic role in improving the welfare of these wild animals living in close proximity to humans, while simultaneously contributing to conservation efforts.

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