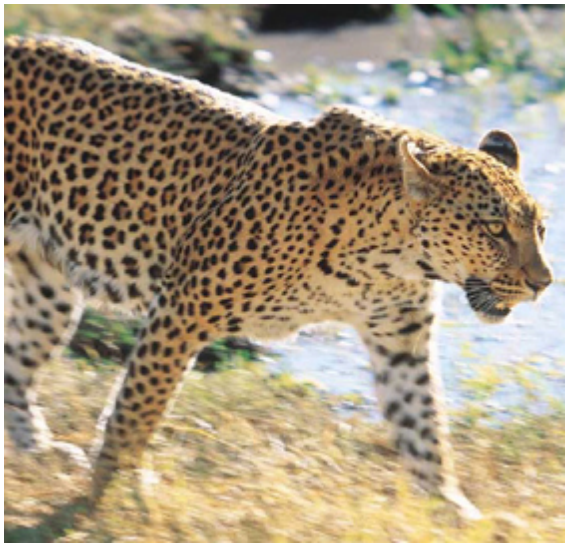
Cat Project of the Month - November 2005

The IUCN/SSC Cat Specialist Group's website (www.catsg.org) presents each month a different cat conservation project.
Members of the Cat Specialist Group are encouraged to submit a short description of interesting projects
*For application use this **standardised form** (an editable word document)*

Conservation biology of leopards (*Panthera pardus*) in a fragmented landscape; spatial ecology, population biology and human threats



The Mun-Ya-Wana Leopard Project was established in April 2002 to investigate the impacts of legal and illegal persecution of leopards in northern Kwa Zulu-Natal, South Africa, and to assess the long-term sustainability of this population under increasing human pressure.

Guy Balme

Guy Balme (photo) is a research assistant in the project since 2003, and a MSc student since 2005. The project is supervised by Luke Hunter (WCS) and Rob Slotow (University of Nata, Durban). Luke Hunter has been a member of the Cat Specialist Group since 1996.

guybalme@hotmail.com
submitted: 18/11/2005


Photo: L. Hunter

Conservation problems

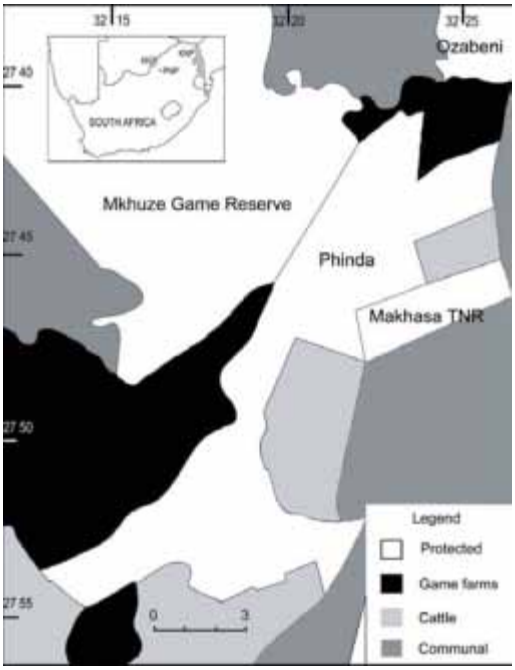
The leopard *Panthera pardus* is now the most persecuted large cat species in the world. Although resilient in the face of human pressure, leopards have been eradicated from vast tracts of their former range, due mainly to loss of habitat (Nowell & Jackson, 1996), depletion of natural prey (Henschel, 2001) and direct human persecution (Stander & Hanssen, 2001). Despite this, leopards are often assumed to warrant low conservation priority. Their legendary tenacity and ability to persist in regions where other large carnivores have become extinct has led to the supposition that their conservation status is assured. They are classified on the IUCN Red List as Least Concern and conservation evaluations at the sub-species and population level were last made in 1996 (Nowell, 2002). Since 2003, the annual quota of trophy hunting permits issued by CITES (Convention for the International Trade in Endangered Species of flora and fauna) has doubled for Tanzania, Namibia and South Africa. Compounding this is an ever-increasing number of leopards that are being destroyed by farmers, pastoralists and illegal hunters.Yet, while numerous studies have been executed on the ecology and behaviour of leopards, the conservation needs of the species have never been addressed. Accordingly, and as a result of increased hunting in the region, the Mun-Ya-Wana Leopard Project was initiated in April 2002 to investigate the landscape ecology and long-term sustainability of leopards in northern Kwa Zulu-Natal, South Africa, across a mosaic of different land-uses and persecution levels.

Objectives

The specific aims of the study are:

1. to determine the population status of the leopard in northern KwaZulu-Natal and evaluate the effectiveness of a number of techniques commonly used to census large, solitary carnivores
2. to determine ranging patterns and habitat use by leopards across land-types that are extremely variable with respect to their human uses,
3. to assess the mortality rate and the factors contributing to mortality of leopards occupying different land-types and under varying persecution levels,
4. to establish the reproductive parameters (especially the number of surviving cubs) in protected and hunted populations,
5. to investigate the genetic characteristics of the population,
6. to investigate the feeding ecology of leopards in the region, specifically establishing the extent of livestock depredation by leopards.
7. to establish a unified accord between landowners on the consumptive and non-consumptive use of leopards in the region, while still ensuring that a viable population of leopards persist to ensure their long-term survival.


A female leopard, walking the boundary fence of Phinda; leopards freely cross fences between various protected and non-protected areas. The area is dominated by mixed Acacia-Terminalia woodlands and open grassland clearings (Photo L. Hunter).



Phinda Private Game Reserve forms the core of the study area and leopards are offered full protection within the reserve. They are also fully protected in the Mkhuze Game Reserve abutting Phinda's western boundary. The land to the south and east of Phinda, however, comprises a composite of local Zulu communities, livestock farms and private game farms where leopards are generally viewed as problem animals or as targets for legal trophy hunts. Leopards are not constrained by the surrounding boundary fences and move freely between adjacent properties; the same individual may run the gamut of protected status within twenty four hours. Increased persecution in the region since 1997 raised concerns that:

1. protected areas in northern Kwa Zulu-Natal are providing a source population for hunting in adjacent areas,
2. properties engaging in hunting are not fostering resident populations of their own, but merely drawing off the surplus animals from the contiguous protected areas of Phinda and Mkhuze,
3. levels of persecution outside of protected areas may be so high that protected populations are unable to increase and may be diminishing.

The Mun-Ya-Wana Leopard Project is the first study of leopards comparing a protected population adjacent to regions where the species is heavily persecuted, and is also the first examination of leopard ecology under such widely divergent land-uses

The study site showing land-use types in the region (Inset: arrowhead indicates region shown). Leopards are legally protected in areas shown in white but the degree of protection actually offered them varies widely; Leopards are best protected in Phinda and Mkhuze Game Reserve. Leopards are persecuted on game farms though harvest rates depend on individual landowners. The MunYaWana area is now contiguous with Phinda and although Leopards are occasionally hunted there, this is likely to diminish or cease entirely. Cattle areas are indicated where livestock is present though these areas also have significant game populations; these areas are hostile to Leopards. Leopards appear to be killed rarely on communal land though these areas have insufficient habitat and prey for permanent occupation.

Methods

32 leopards have been captured and collared since the inception of the project in April 2002. Leopards are caught using three methods:

a) free-darting over a bait or kill,
b) using baited cage traps and
c) soft-hold foot snares.

We attempt to locate every radio-tagged individual at least once daily and have so far logged over 10 000 'leopard radio-transmitter days' (the total number of days combined for which all radio-tagged leopards are monitored) and over 2 000 direct observations of leopards. When animals are observable, a wide variety of ecological and behavioural data is recorded, including information on hunting, feeding ecology, mating behaviour, territorial activity, etc. Possible den sites (determined by a localisation of the mother's movements) are investigated on foot to assess litter size at the earliest possible stage. All collars are also fitted with a 'mortality switch' that activates if the animal does not move in 12 hours. This allows us to locate dead individuals promptly before decomposition is too advanced and we can accurately ascertain cause of death.

Luke Hunter recording data on sedated female (Photo G. Balme)

Remote photography surveys are being conducted in all the principal land-types (i.e. protected areas, cattle farms, community land, hunting areas) to establish relative leopard densities. This method was initially developed by Karanth and Nichols (1998) to monitor tiger *Panthera tigris* populations in India and has since been used to census jaguars (Silver *et al.,* 2004), ocelots (Trolles, 2003), snow leopards (Jackson *et al*., 2005) and rainforest leopards (Henschel, 2001). It takes advantage of distinctive individual markings through photographs taken by remote-triggered cameras and uses the theoretical framework of mark/ recapture models to estimate animal abundance.

Camera-trap photograph of F12's cub

Preliminary results

The results to date paint a bleak picture. We have recorded the deaths of 21 leopards on Phinda and adjacent properties during the three-year study period. The average annual mortality rate (AMR) of the population between April 2002 and August 2004 was 44.7%; in other words, almost half the population is dying every year (Balme & Hunter, 2004). In comparison, a study conducted on a protected leopard population in the Kruger National Park revealed an AMR under 25% (Bailey, 1993). The worst-affected segment of the population is males; 82% of independent males (resident adults and dispersing sub-adults combined) are killed each year. Males are more desirable to trophy hunters due to their larger size, and males also utilise larger home ranges (Mizutani & Jewel, 1998) and cover greater daily distances than females (Stander *et al.,* 1997), increasing their chances of moving off the reserve into areas where they are vulnerable to persecution.

Removing an excessively high number of males may produce a cascade of deleterious effects on the population. Although male leopards provide no parental care to cubs (Bailey, 1993), the presence of the sire allows mothers to raise cubs with a reduced risk of infanticide by foreign males. There are few reliable observations of infanticide in leopards (Scott & Scott, 2003; Ilany, 1986) but new males entering the population are likely to kill existing cubs. We saw this once during the study period, following the illegal killing of M5. The resulting vacancy was rapidly filled by the male M13 who killed the four-month-old cubs of F12 (which M5 probably sired). Although we observed infanticide only on this one occasion, there was limited evidence of successful reproduction in general. During the three-year study period, we recorded only seven litters (13 cubs) being born, even though we observed consorting pairs on 53 occasions involving ten different females and multiple males. Of these seven litters, only five cubs survived to independence and, of these, only three are still alive today.

Male leopard M1, killed in a territorial clash with M5 who subsequently occupied his territory. M5 in turn was illegally killed in a non-protected area adjacent to Phinda (Photo L. Hunter).

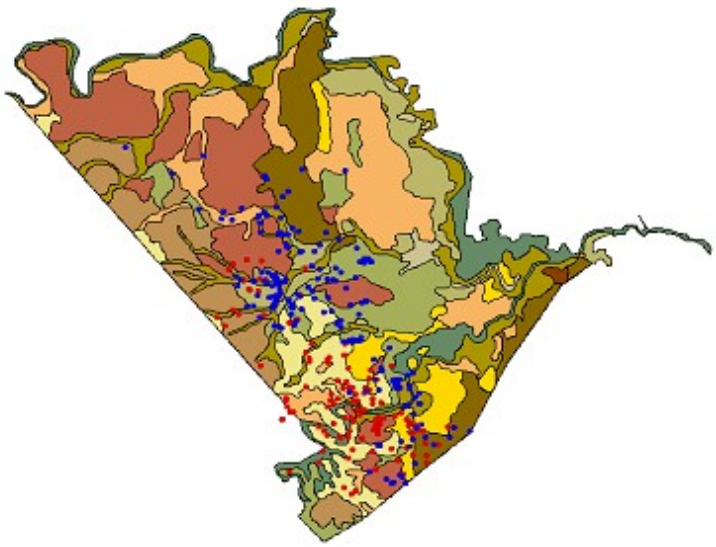
That so few cubs were produced and survived during the study may be a consequence of high turnover among males. In lions, high levels of infanticide lowers the chances of cubs surviving to independence, and may further impact reproductive output by reducing the rate at which females conceive (Packer & Pusey, 1983). Lionesses display a period of reduced fertility immediately following the take-over of a pride by a new male coalition. This presumably allows females to assess the fitness of new males and postpone conception until the males are established and the threat of another take-over is reduced. Rapid turnover of male leopards at Phinda might be driving female leopards into a similar strategy, resulting in low recruitment. In an isolated leopard population in the Judean Desert, Israel, infanticide was the chief reason that not a single individual was recruited into the adult population during a five year period (Ilany, 1986).

The remains of a 3 mo cub, killed by an infanticidal male following a territorial take-over (Photo G. Balme).

At Phinda, the ultimate cause of such a pattern may be the human persecution of males outside the reserve. Whitman *et al.* (2004) demonstrated that excessive trophy hunting of male lions under a certain age reduced the chance of population persistence because lionesses failed to raise cubs to independence. We do not yet have sufficient data to draw the same conclusion here; however there are coarse patterns that warrant concern. For a population to remain stable, birth and mortality rates need to be equivalent, and immigration and emigration rates need to be comparable (Eltringham, 1979). On Phinda, mortality rates far exceeded the number of leopards being born in the population so high levels of immigration will need to occur for densities to remain stable. Yet, even if this is taking place, it may be exacerbating social flux if it encourages constant incursions by young males.

The figure opposite provides an example of the telemetry data we have been collecting, showing point locations of two male fitted with GPS collars. M25 was captured on the 2/6/05 and fitted with a VHF radio-collar which we replaced with a GPS collar on 5/7/05. Judging from tooth wear, his age is estimated between four and six years. We have downloaded 134 locations (opposite, in red) from the collar; and he is using a home range of approximately 57km^2 (95 % Fixed Kernel Analysis). This area is dominated by the mountainous regions in the south and the west of Mkhuze GR, though he has crossed

out of the GR on at least one occasion into a neighbouring Zulu community. M26 is approximately three-years-old, weighs 55 kg, and was captured on the 24/6/05. At this age he would almost certainly still be a transient individual; ranging over a large area, avoiding adult resident males and looking for a territory in which to possibly settle. We recorded 197 fixes from the first two months of monitoring. Home range size (preliminary) is 58km^2. We have not recorded him leaving the GR.



GPS locations downloaded from collars deployed on male leopards M25 (red) and M26 (blue) in Mkhuze Game Reserve from the 24/6/05 to the 3/9/05

Next steps

Our initial data suggests that Phinda might represent a partial population sink for leopards, despite their fully protected status on the reserve. There is little reason to think that levels of killing of leopards adjacent to Phinda will decline. South Africa has recently been granted international permission to double its exports on leopard trophies to 150. At the very least, this means that legal off-take will increase in the area. Assuming that levels of illegal killing remain the same, the overall numbers of leopards removed can only increase.

Accordingly, the next crucial stage of the project is to focus intensively on the areas where leopards are most at risk- the surrounding livestock farms, game farms and communal areas. We need to produce more accurate data showing exactly where leopards are killed, how frequently they are killed and by whom. At the same time, we need to initiate activities with landowners to mitigate their problems with leopards and reduce their tendency to kill leopards.

We also need to get some idea on what is happening in the larger Mkhuze Game Reserve to the west of Phinda, as ultimately this area may be acting as a source population for the entire region. Due to its larger size, the leopard population within Mkhuze may be 'buffered' to some extent and hence may represent a more natural situation. If this area is acting as a source population, are recruitment levels sufficient to accommodate for the large number of cats being destroyed in adjacent non-protected areas? Investigating the Mkhuze leopard population will give us the necessary control to compare with data collected from Phinda and the non-protected areas. It will hopefully also give us an indication of the overall long-term sustainability of leopards in the region.

Bibliography

Bailey, T. N. 1993. *The African leopard: ecology and behaviour of a solitary felid.* Columbia University Press, New York.

Balme G.A. & Hunter, L.T.B 2004. Mortality in a protected leopard population, Phinda Private Game Reserve, South Africa: A population in decline? Ecol. Journal 6:1-6

Eltringham, S. K. 1979. The ecology and conservation of large African mammals. Macmillan, London.

Henschel, P. 2001. Untersuchung der Ernährungsweise und der Populationsdichte des Leoparden (Panthera pardus) im Lopé Reservat, Gabun, Zentralafrika. MSc-Thesis, University of Göttingen, Germany.

Ilany, G. 1986. Preliminary observations on the ecology of the leopard (*Panthera pardus jarvisi*) in the Judean Desert. In *Cats of the world: biology, conservation and management*. Ed. Miller, S. D. & Everett, D. D. National wildlife Federation, Washington D. C. pp. 199.

Jackson, RM., Roe, JD Wangchuk, R and Hunter, DO. 2005. Surveying Snow Leopard Populations with Emphasis on Camera Trapping: A Handbook. The Snow Leopard Conservancy, Sonoma, California 73pp

Karanth, K.U. & Nichols J.D. 1998. Estimation of tiger densities in India using photographic captures and recaptures. *Ecol.*79: 2852-2862.

Mizutani, F. & Jewel, P. A. 1998. Home-range and movements of leopards (*Panthera pardus*) on a livestock ranch in Kenya. *J. Zool. Lond.* 244. 269-286.

Nowell, K. & Jackson, P. 1996. *Wild Cats: Status survey and conservation action plan*. IUCN, Gland, Switzerland.
Nowell, K. 2002. Revision of the Felidae Red List of Threatened Species. *Cat News* 37:4-6.
Packer, C. & Pusey, A. E. 1983. Adaptations of female lions to infanticide of incoming males. *Amer. Natrl*. 121: 716-728.
Scott, J & Scott, A. 2003. *BBC Big Cat Dairy: Leopard*. Harper Collins Publishers, London.
Silver, S.C., Ostro, L.E.T., Marsh, L.K. Maffei, L., Noss, A.J., Kelly, M.J. Wallace, R.B., Gomez, H. & Ayala, G. 2004. The use of camera traps for estimating jaguar *Panthera onca* abundance using capture/ recapture analysis. *Oryx*, 38: 148-154.
Stander,P.E., Haden, P. J., Kaqece & Ghau.1997. The ecology of asociality in Namibian leopards. *J. Zool.,Lond.* 242: 343-364.
Stander, P. & Hanssen, L. 2001. Population ecology and long-term monitoring of free-ranging large carnivore populations in Namibia's marginal and arid environments. Ministry of Environment and Tourism, Namibia.
Trolles, M & Kery, M. 2003. Estimation of ocelot density in the Pantanal using capture recapture analysis. *J. Mamm*. 84(2):607-614.
Whitman, K., Starfield, A. M., Quadling, H. S., Packer, C. 2004. Sustainable trophy hunting of African lions. *Nature* 428 (6979): 175-178.

Duration:	2002-2008
Location (see map):	Northern KwaZulu-Natal, South Africa
Sponsor (s):	
Project address:	Luke Hunter, Wildlife Conservation Society-International, Global Carnivore Program, 2300 Southern Blvd., Bronx, NY 10460 USA
Project leader:	Luke Hunter, lhunter@wcs.org
Project website:	http://www.biolsci.monash.edu.au/research/leopards/

Download as **PDF**