

Leopards of the Cape: conservation and conservation concerns

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The leopard (*Panthera pardus*) is the apex predator in the Western Cape, South Africa. It has until recently been regarded as vermin by farmers and conservation officials and been highly persecuted for over 350 years. It is now restricted to the more inaccessible mountains, such as the Cederberg. We have initiated several projects to highlight conservation concerns and needs of this elusive felid. One of these, a conservation genetics study, examines the extent of the genetic isolation of this population from leopards elsewhere in Southern Africa, as Western Cape leopards appear to be significantly smaller than their northern counterparts. Apart from being almost half the mass, they also utilize far greater home ranges than previously recorded. Furthermore, a leopard density study, as determined by camera trap mark-recapture techniques, indicates that these elusive felids occur in low numbers in this region. We recommend further research on leopard ecology, farmer education in animal husbandry techniques as well as a revision of present 'problem animal' legislation in order to assist in the future conservation of this threatened large predator.

Keywords: Cederberg; South Africa; Leopard; *Panthera pardus*; Conservation genetics; Home range

Introduction

The first written records of the leopard, *Panthera pardus*, in southern Africa originate from the Cape, dating to over 400 years ago. At the time, leopards were sympatric with African elephant *Loxodonta africana*, African buffalo *Syncerus caffer*, hippopotamus *Hippopotamus amphibius*, black rhinoceros *Diceros bicornis*, spotted hyena *Crocuta crocuta* and lion *Panthera leo* [1]. Today, all these species except for the leopard have been extirpated in the southern and western Cape. Historical evidence suggests that leopards disappeared from the Cape Peninsula in the mid-1800s and can now only be found in the surrounding mountain regions [1–3]. Despite extensive habitat loss and reduction in prey, the leopard has managed to persist in these mountains, and now fills the role of the apex predator in the Western Cape ecosystem. Additionally, a key threat to the leopard's continued existence in mountainous regions of the Western Cape is direct persecution as a result of conflict between leopard and farmers. Preliminary research in the Cederberg Mountains indicates that previous leopard population densities were overestimated. This, together with morphological differences

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between the Cape population and populations of leopards further north, could result in a need for special conservation management strategies for the species.

Current research (Martins and Martins, work in progress) on leopards in the Cape will provide a comprehensive understanding of the conservation status and needs of the leopard in the Cape. Aims to alleviate leopard-farmer conflict complement this move to conserve the species. Furthermore, data on leopard removals (lethal and non-lethal) and 'problem animal' situations in the Cederberg will assist in a better understanding of these problems.

Leopards as 'problem animals' in the Cape

Leopards have long been considered 'problem animals' or 'vermin' by farmers and provincial administration alike. Jan van Riebeeck in the 1650s declared the first bounties on these cats, along with other predators, that posed threats or perceived threats to the livelihood of Dutch farmers. This practice continued well into the late 20th century, with bounties on leopard still obtainable in the 1960s. Leopards were still considered 'vermin' by the Administration of the Cape Province as detailed in the Cape Problem Animal Ordinance No. 26 of 1957 and it was considered an offence for farmers not to exterminate them. This act encouraged 'hunt clubs' to pursue and exterminate leopards responsible for stock losses. In 1968 the leopard was removed from the 'vermin' list in the Cape Province and in 1974 was declared a 'protected wild animal' [3]; a permit was then required to trap and kill leopard (Nature Conservation Ordinance No.19 of 1974).

Despite this legislation, records of leopards killed in the Western Cape Province show this practice continued until the present. However, after the 1974 Act was passed, action was taken to minimize leopards killed and considerable research was undertaken into the ecology of the species [2,3].

The study area

The Cederberg Mountains, Western Cape, South Africa, 32° 27' S; 19° 25' E, lie some 200 km north of Cape Town and encompass approximately 200,000 hectares (2000 km²) of rugged mountainous terrain, stretching from the Pakhuis Pass in the north to Grootrivier in the south, and including the Cederberg Wilderness area, as well as the Matjiesrivier Nature Reserve.

The Cederberg occurs entirely within the Cape Floral Kingdom, the smallest of the six Floral Kingdoms in the world. Within this area, there occur two Biomes; the Fynbos Biome (comprising two separate classifications, Fynbos vegetation and Renosterveld vegetation) and the Karoo Biome [4]. The Cederberg is interspersed with open valleys and densely wooded ravines (or 'kloofs'). It has been declared a World Heritage Site and is now also part of the Greater Cederberg Biodiversity Corridor (GCBC).

Conservation and aims of the project

Current research

i) Conservation genetics

Leopards located in the Cape Fold Mountains appear physically different from leopards further north. Their average weight, for example, may be only half that of the more northerly leopards

[5,6]. A current study of leopards is focused on estimating gene flow, genetic variability and genetic relatedness among South African leopard populations (N. Martins, work in progress). A key aim of this study is to determine whether the leopards of the Cape region should be considered as a unique genetic unit. The results may have important implications for the conservation status of the Cape population and for future management and translocation policies.

(ii) Population estimates and the ecology of leopards in the Cederberg

A population estimate of 15–25 adult leopards within the Cederberg Wilderness Area (710 km²), is reported by Norton and Henley [7] and using radio-telemetry they suggested male leopards had small home ranges of 40–69 km². The accuracy of this data is hampered by small sample size ($n = 3$), the short duration of the study and their reported difficulty in capturing locality data in the rugged terrain. A subsequent study of leopard population size in the same area, derived predominantly from track counts, indicated 30–40 adults [8]. Their attempt to photograph leopards using five platform-type camera traps resulted in one leopard photograph.

A review of population estimates of Cederberg leopards is currently being conducted by the authors using camera-traps. The methodology is based on photographic capture-recapture estimates, first developed for tiger (*Panthera tigris*) monitoring in India [9–12], and subsequently widely used for recording elusive animals, particularly carnivores. Camera-trapping has proved to be an effective way to obtain estimates of the abundance of many species of felids. In the case of leopards each animal has unique spot patterns, thus making them individually identifiable from photographs [13,14]. Using this information, mark-recapture models can be applied to estimate population abundance and density estimates [14–17].

Early models of camera-traps used in the Cederberg by Stuart and Stuart [8] were problematic because of low camera numbers, poor trap sites and inadequate operating mechanisms. Modern, commercially-available camera traps are more efficient and have greater trapping success. In the present study by the authors, four times more cameras were employed in a survey area of approximately 776 km², thereby increasing trapping probabilities.

Concurrent with the camera-trap study, the authors are employing GPS collars fitted on leopards to track their movements in the whole of the Cederberg Mountain region. This has provided valuable data on the animals' home ranges and habitat usage.

Results

Leopard persecution

Data collected on leopards in the Cederberg Mountains in the Western Cape (Q. Martins, work in progress) indicate a rapid decrease in the numbers of leopard killed since the inception of

Table 1. Leopard conflict data in the Cederberg (data provided by Cape Nature)

Year	Period (yrs)	Numbers killed	Average killed/yr
1940–1949	10	29	2.9
1950–1955	5	43	8.6
1977–1982	5	34	6.8
1983–1985	3	11	3.6
1988–1990	3	21	7
2004–2006	2.5	2	0.8

leopard research projects in the area (The Cape Leopard Trust, work in progress, 2004). A collaborative effort with Cape Nature and Cape Leopard Trust researchers in educating farmers and providing alternative protection measures for livestock has been a key factor in minimizing leopard removals. The number of leopard killed for the period 1940–2006 in the Cederberg region is detailed in table 1 but these numbers are likely to be conservative as not all leopard kills are reported [18].

Leopard densities

To date, two territorial adult male leopards have been collared providing seven months of data on one (846 GPS fixes), and 10 weeks of data on the second (324 GPS fixes). Their estimated home ranges thus far are between 235 km² and 600 km² respectively – far larger than suggested by earlier studies

Results from the one year camera-trapping survey indicates that the survey area is too small to obtain sufficient recaptures, making it difficult to employ suitable statistical analysis. But the survey has provided the identification of 12 individual leopards in the survey area. Five of these are either juveniles or sub-adults, five adult females and two adult males, one of which only borders on the survey area and was seldom photographed.

Figure 1 demonstrates a one year sampling effort. Trap hours were calculated per camera-trap station, that is, 24 (hrs/day) × no. of stations × 40 days × 6 survey periods.

Discussion

Current conservation concerns

Effective conservation of leopards depends largely on the protective measures that can be implemented outside existing conservation areas [14]. The long-term persistence of leopard populations pivots, however, on their densities within protected areas or ‘source’ populations. Persecution of leopards in marginal areas or land surrounding these core protected

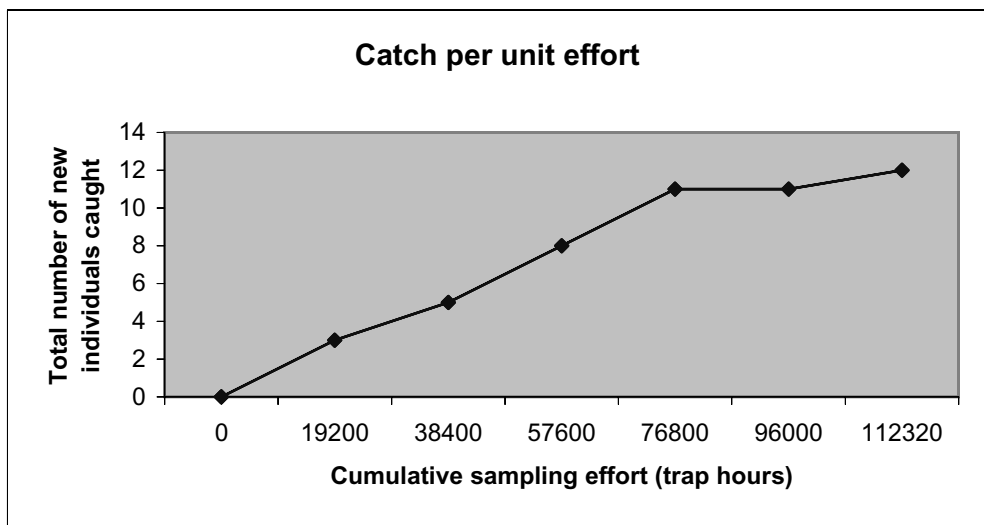


Figure 1. Plot of cumulative number of new individuals against the cumulative sampling effort.

areas, and the resulting edge effects, may result in these populations becoming ‘sinks’ or even experiencing local extinctions [19]. Reliable population estimates of large carnivores are essential for effective conservation management [20], yet the best estimates of leopard density in the Cape are extremely vague.

Martin and de Meulenaer’s [21] estimate of 714,000 leopards in sub-Saharan Africa and 23,472 in South Africa is criticized by Norton [22] as an ‘over-estimate’. He suggests this data may have negatively affected leopard populations by fostering complacency among the authorities charged with managing the species. Although the effects on large contiguous leopard populations in optimum habitat are probably negligible, the same cannot be said of small, persecuted and isolated populations such as in the Cederberg. Although the Cederberg may be viewed as part of a continuous mountain chain also known as the Cape Folded Belt, the effect of human habitation has resulted in a core protected area surrounded by a marginal inhabited area.

Present conservation management strategies, which include translocation and lethal control of ‘problem’ leopards, are based on very limited data. In terms of work conducted to date, it is evident that leopards occur in low densities in the mountains of the Western Cape. It is most likely that there are no more than five contiguous territorial males co-existing in the Cederberg. This takes into account a percentage overlap of territories, as well as unsuitable habitat inhabited by humans. We have insufficient data to estimate female population size.

A major conservation concern for leopard in these areas is due to existing legislation which makes it possible to trap caracal *Caracal caracal* and black-backed jackal *Canis mesomelas* without a permit. Often the mechanisms used for the removal of these ‘problem animals’, such as gin-traps or cages, are indiscriminate, creating a high risk of trapping leopard. Prosecution in such a case is unlikely and thus exposes flaws in existing legislation. The trapping methods for ‘problem’ leopards are unselective in that the animal caught may not be the one causing stock losses. Permits issued by the authorities for the removal of a ‘problem leopard’ may specify that cage traps or ‘gin traps’ can remain set for up to one month. In such cases there is a high probability that a non-target leopard may be injured or killed. Additionally, the injuries caused to animals by ‘gin-traps’ may result in their death. Present legislation does not condone the use of gin-traps for trapping leopards, but there is no specific legislation that outlaws their use for other problem animals.

The increasing loss of wilderness areas through farming and human habitation is a major factor in the loss of habitat for leopard prey species especially rock hyrax *Procapra capensis* and small antelope [2,23, Martins, pers. obs.]. The likelihood of leopards preying on stock for survival is thus increased. A study on the hyrax in the Cederberg has been initiated to investigate the relative health of this population, and whether it has diminished considerably over a period of time.

Possible solutions

The leopard should be highlighted as a ‘flagship’ species in the Western Cape. In particular the Cederberg should be identified as a high priority conservation area. The immediate positive effect on existing leopard populations is that it will create a ‘source’ for the dispersal of migrant animals into surrounding areas. The economic spin-offs of declaring leopards a ‘flagship’ species will come from tourism and subsequent job creation [24,25]. Leopards, considered one of the ‘Big Five’ in Africa, have proven a popular attraction for tourists. The potential of derived tourist income can provide incentives for the conservation of suitable habitats which, when sufficient in size, will act as natural corridors for the dispersal and migration of leopards. These are positive solutions for the conservation of leopards [24].

Responsible management of livestock and the encouragement of farmers to practise a more holistic approach to problem animal control need to be promoted. This includes the use of natural deterrents such as guard dogs (Anatolian shepherd dogs), electrified and predator proof fencing around 'kraals' or paddocks, the traditional use of shepherds in the field and the conservation of natural prey species for the leopard. An immediate ban should be implemented on any form of trapping mechanisms which may injure leopards when caught accidentally. The future of leopard populations in the Cape Fold Belt Mountains is precarious. An accelerated combination of research, education and legislation is needed to ensure their survival.

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