EXPEDITION REPORT

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Report published: July 2012

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BEST VOLUNTEERING ORGANISATION UK

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Author:
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Matthias Hammer (editor)
Biosphere Expeditions

Abstract

This research project started in 2010 and was based on Ongos game farm, situated 15 km Northwest of Windhoek, in the Khomas Hochland region of central Namibia. This report covers the survey work conducted during the periods of September - December 2010, January - March 2011 and August - December 2011. The key study species was the leopard (*Panthera pardus*). Leopards are protected animals and listed as "near threatened" by the IUCN (International Union for Conservation of Nature). However, the conservation of leopards outside of protected areas in Namibia is not assured. Their "problem predator" image, high trophy value, habitat loss, habitat fragmentation, and local outbreaks of wildlife diseases are the main threats. These threats and the lack of scientific data on this species living on commercial farmland result in the need for research for improved conflict-mitigation.

The basic questions that this study addressed were: What is the behaviour and ecology of leopards living on commercial farmland, particularly game farms? Are there any differences to leopards found in protected areas and national parks?

To provide reliable data on leopard ecology and to answer these questions active and passive methods were used. Passive methods included camera traps, spoor counts, and faeces collection. Active methods included GPS/GSM and VHF telemetry.

Data collected during the study periods did not shown marked differences in the ecology of leopards living on farmland and in protected areas. Home range sizes were slightly smaller and activity profiles similar to leopards living in protected areas. The camera trap surveys yielded a density of 2.7 individuals / 100 km^2, which is also similar to the 2.5 – 3.8 individuals / 100 km^2 reported for protected areas. The camera trap surveys also revealed some interspecific behaviour showing that different predator species avoid each other and therefore direct competition and conflict.

Interviews with local people in the Katutura township bordering onto the Ongos study site showed that leopards or other predators do not roam in or near human settlements. The reverse is not true and domestic pets were detected in the study site and with them the possibility of disease transfers from unvaccinated pets to wildlife. Vaccination and education campaigns are suggested ways to mitigate this threat.

Leopard feeding ecology from Namibian farmland was missing before this report and this aspect of the study yielded the most interesting results by showing that leopards living on Namibian farmland naturally prey on small-sized game species, particularly common duiker and springbok (no livestock was found in any leopard scat analysed). The 55-day "life story" of a GPS-collared male leopard shows that leopards are likely to become problem animals if presented with easy options to make a kill. Such easy options are inexperienced, weak and essentially defenceless large antelope as well as livestock juveniles. Therefore and in order to protect valuable game species and livestock from leopard depredation, farm managers should ensure that (1) their farm is well-stocked with low-value "cannon fodder" species, particularly common duiker and springbok. Leopards are likely to then concentrate on these preferred easy target species and stay away from larger, more valuable species, (2) during the calving period, livestock is protected at all times. Protection strategies are guard dogs, the use of donkeys or herding. In addition, herds can be kept inside kraals overnight or animals can wear bells. Keeping animals close to human settlements also offers protection. None of these strategies used for cattle are practical in protecting game species from depredation. Instead this is where the "cannon fodder" approach should come in.

Zusammenfassung

Im Jahr 2010 startete dieses Forschungsprojekt auf einer Wildtierfarm, 15 km nordwestlich von Windhuk, in der Khomas Hochlandregion in Zentral-Namibia. Der vorliegende Bericht befasst sich mit Untersuchungen, die in den Zeiträumen September - Dezember 2010, Januar - März 2011 und August bis Dezember 2011 durchgeführt wurden. Alle Untersuchungen bezogen sich auf den Leopard (*Panthera pardus*). Der Leopard ist eine geschützte Art und als "potenziell gefährdet" von der IUCN (International Union for Conservation of Nature) eingestuft. Ein Großteil der namibischen Leopardenpopulation lebt auf kommerziell genutztem Farmland und somit außerhalb geschützter Gebiete. Dadurch ist die Erhaltung dieser Art in Namibia nicht gesichert. Ihr "Problem-Raubtier"-Status, ein hoher Trophäenwert, Verlust und Zerstückleung von Lebensräumen, sowie lokale Ausbrüche von Wildtierkrankheiten sind seine stärksten Bedrohungen. Diese Bedrohungen und der Mangel an wissenschaftlichen Daten zeigt die Notwendigkeit auf, diese Spezies im Lebensraum „Farmland“ besser zu erforschen, um so vorhandene Konflikte zu minimieren.

In dieser Studie wurden folgende, grundlegende Fragen angesprochen: Wie ist das Verhalten und die Ökologie von Leoparden, die auf kommerziellem Farmland vorkommen? Gibt es Unterschiede zu Leoparden in Schutzgebieten und Nationalparks?

Um aussagekräftige Ergebnisse zu erhalten, wurden passive Methoden, wie Kamerafallenuntersuchungen, Analyse von Fährten und Kotproben eingesetzt, sowie aktiven Methoden, wie GPS/GSM-und VHF-Telemetrie eingesetzt
.
Die gesammelten Daten der vorliegenden Studie zeigten keine deutlichen Unterschiede in der Ökologie von Leoparden in und außerhalb von geschützen Bereichen auf. Leoparden im farmländischen Untersuchungsgebiet nutzen kleinere Lebensräume, als Tiere in geschützten Gebieten. Unterschiede in der Aktivität konnten nicht ermittelt werden. Die Kamerafallenstudie ergab eine Dichte von 2.7 Individuen pro 100 km^2 und weist somit eine hohe Leopardendichte auf. Unterschiedliche Raubtierarten kommen im Untersuchungsgebiet vor, meiden sich aber, um direkte Auseinandersetzungen und Konflikte zu minimieren (interspezifisches Verhalten).

Befragungen der lokalen Bevölkerung, die in der Nähe des Studiengebietes leben, wiesen keine Anhaltspunkte auf, dass Leoparden oder andere große Raubtiere das an das Studiengebiet angrenzende Armenviertel Katutura durchstreifen. Jedoch wurden Haustiere aus Katutura, die fast durchweg ungeimpft sind und Krankheiten aufweisen, im Studiengebiet gesichtet. Dies stellt eine Gefahr der Übertragung von Krankheiten an Wildtiere dar. Impf- und Aufklärungskampagnen sollten durchgeführt werden, um diese Gefahr zu mildern.

Diese Studie liefert wichtige neue Erkenntnisse über die Nahrungsökologie der Leoparden. Leoparden jagen bevorzugt kleinere Wildtierarten, insbesondere Kronenducker und Springböcke (es gab keine Hinweise auf konsumierte Nutztiere im Kot). GPS-Daten eines männlichen Leoparden zeigten, dass dieser Kälber auf der Nachbarfarm gerissen hatte und somit zum Problemtier wurde. Im Gegensatz zu ausgewachsenen Antilopen, sind deren Jungtiere und Kälber (Ziegen & Schafe) eine leichte Beute für Leoparden.

Aus diesen Erkenntnissen sollten Farmmanager ihre Farmen, um Leopardenangriffe auf Vieh oder teure Antilopen zu minimieren, (1) mit sogenannten "Kanonenfutter" – kleinwüchsigen Antilopenarten, insbesondere Springböcken, bestücken. Denn damit erhöht sich die Wahrscheinlichkeit, dass sich Leoparden bevorzugt auf diese Zielarten konzentrieren, anstatt größere, wertvolle Arten zu reißen. Kälber sollten (2) bis zu einer gewissen Zeit geschützt in Kraals (Dornenbuschverschlag) oder in der Nähe von menschlicher Siedlung, vor allem in der Nacht, untergebracht werden. Unter anderem können Wachhunde oder Esel als Abwehr gegen Raubtiere dienen. Keine dieser Strategien für Nutztiere kann für den Schutz von Wildarten eingesetzt werden, deswegen sollte die „Kanonenfutter"-Strategie verstärkt verfolgt werden.

Contents

1. Expedition review

1.1. Background

Biosphere Expeditions runs wildlife conservation research expeditions to all corners of the Earth. Our projects are not tours, photographic safaris or excursions, but genuine research expeditions placing ordinary people with no research experience alongside scientists who are at the forefront of conservation work. Our expeditions are open to all and there are no special skills (scientific or otherwise) required to join. Our expedition team members are people from all walks of life, of all ages, looking for an adventure with a conscience and a sense of purpose. More information about Biosphere Expeditions and its research expeditions can be found at www.biosphere-expeditions.org.

This expedition report deals with three expeditions to Namibia, one that ran from 12 September to 17 December 2010, and two in 2011, from 30 January to 11 March and from 7 August to 11 November. The expeditions were part of a long-term research project and assisted the local scientist in ascertaining the status of the African leopard (*Panthera pardus* - Linnaeus, 1758) living in parts of mountainous game farmland in the Khomas Hochland region of Namibia. The expeditions' emphases were on capture activities, radio- and GPS-tracking, searching for leopard' signs such as counting tracks and collecting scats, identifying individuals with the help of camera trap surveys, and on recording prey animals by hide-based observations at water points and on game study drives and walks.

Namibia is one of a few African countries that support six species of large carnivores. Lions, spotted hyaenas and wild dogs are mainly restricted to protected areas, but cheetahs, leopards and brown hyaenas still occur on areas with intensive livestock and/or game farming. The leopard is currently not listed as an IUCN endangered species in Namibia. However, we believe that high trophy take-off together with "problem predator" take-off combined with habitat loss and fragmentation as well as the risk of local disease outbreaks may put the local leopard population under threat. There is thus an urgent need to gain a better scientific insight into both leopard demographics as well as ecology outside protected areas in Namibia.

A good knowledge of leopard ecology living on Namibian game farmland will help to conserve and protect the predator. No effective population density estimates exist, while removal through human conflict is poorly monitored and hunting quotas are set without reliable scientific basis. The Ministry of Environment and Tourism started a leopard study covering the whole of Namibia in 2011. Data gathered during this expedition will support this study.

1.2. Research area

At 825,418 km^2 Namibia is the world's thirty-fourth largest country. However, after Mongolia, Namibia is also the least densely populated country in the world (2.5 inhabitants per km^2). About 40% of the total area in Namibia is used for commercial livestock farming, communal areas comprise another 40% with national parks and restricted areas (Berry 1990) making up the remaining 20%. It is estimated that commercial farmland hosts about 80% of the commercially useable larger game species (Brown 1992) and also represents most important habitat types.

Figure 1.2a. Location of Namibia and study site.

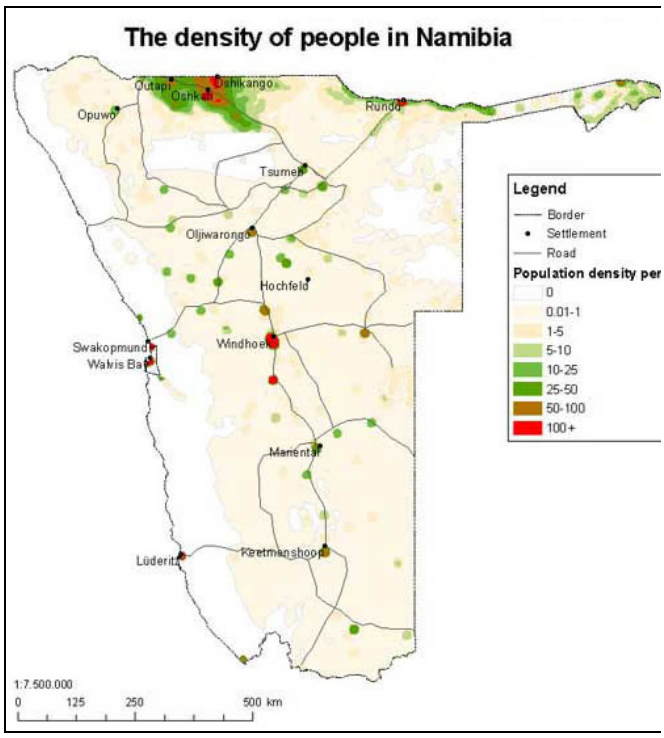

Figure 1.2b. Density of people in Namibia.
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The study area was centred on Ongos game ranch, and surrounding farms, all in the central Khomas Hochland (Figure 1.2c). The Khomas Hochland region spans 36,804 km² and, due to the inclusion of Windhoek, Namibia's capital, has the highest human population of any region in Namibia (Figure 1.2b; Mendelsohn 2009).

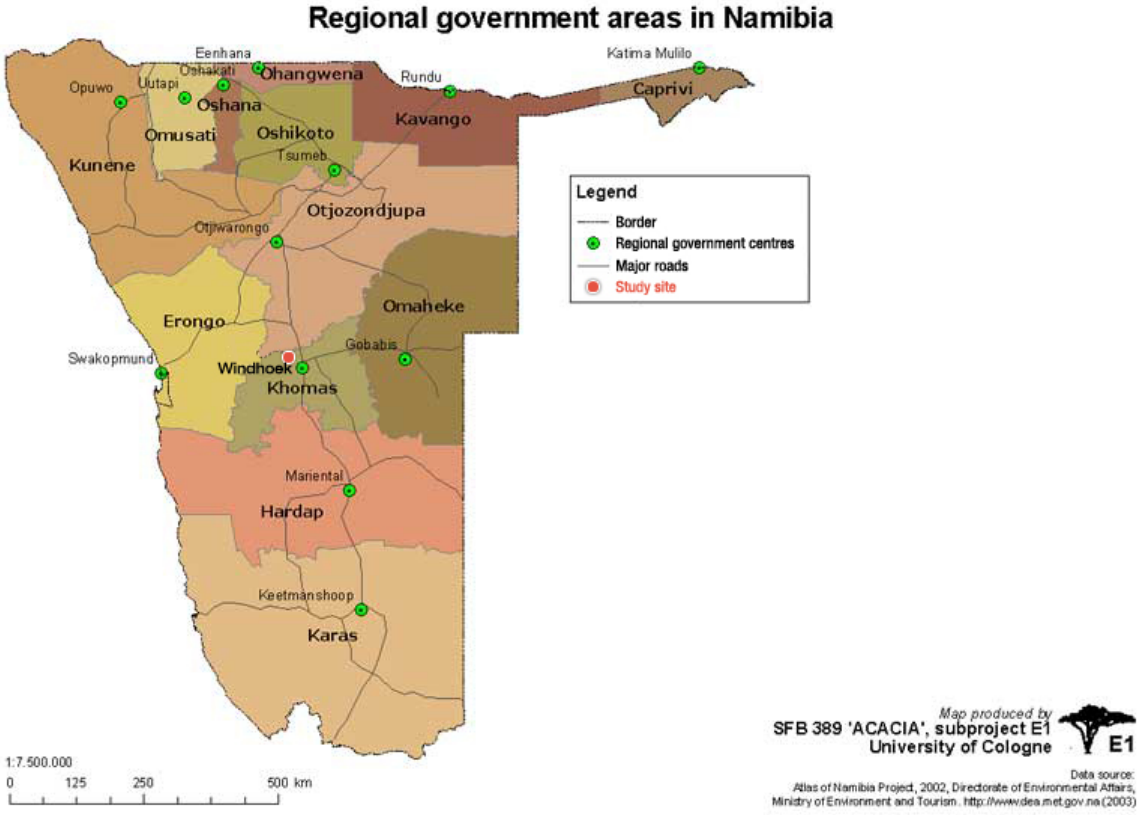

Figure 1.2c. Regional government areas and study site in Namibia.

1.3. Dates

The expedition ran over three periods totalling fifteen two-week groups.

2010: 12 - 24 September | 26 September - 8 October | 17 - 29 October | 31 October - 12 November | 21 November - 3 December | 5 - 17 December.

2011 (A): 30 January - 11 February | 13 - 25 February | 27 February - 11 March.

2011 (B): 7 - 19 August | 21 August - 2 September || 11 September - 23 September | 25 September - 7 October || 16 - 28 October | 30 October - 11 November.

All groups were composed of a team of international research assistants, guides, support personnel and an expedition leader (see below for team details).

1.4. Local conditions & support

Expedition base

The expedition team was based at Ongos Game Farm, about 20 km northwest of Windhoek in the Khomas Hochland. The base camp (S22.44308 E16.96900) was situated close to a dry river bed, which after a heavy rainy season (2011) contained water.

Team members stayed in tents equipped with beds, mosquito nets and furniture, and en-suite bathrooms. Breakfast and all meals were prepared by the expedition cooks, who could cater for vegetarians and some other special diets. Tents had 220V mains electricity from European style sockets.

Weather

The climate is semi-arid savannah type with three distinct seasons: a hot, dry season from September to December when temperatures can reach 40º C or more during the day and plummet at night, sometimes to levels below zero. Average daily temperatures during the expedition ranged from 20 to 34º C. Daytime temperatures reached 42°C, and night-time 20°C. Second is a hot, wet season from January to April and third is a cold, dry season from May to August with warm days, which are contrasted by very cold nights, when temperatures often drop to below freezing. One expedition was conducted during the summer rainfall peak time between January and March 2011. The two other expeditions started at the end of winter in August/September 10/11. Annual rainfall was highly variable.

Field communications

Two-way radios (Motorola P030) were used for communication between teams around the study site. There was also mobile phone coverage in some areas of the study site. Regular expedition diary updates were uploaded to www.biosphere-expeditions.org/diaries for friends and family to access.

Transport & vehicles

Team members made their own way to the Windhoek assembly point. From there onwards and back to the assembly point all transport and vehicles were provided for the expedition team, for expedition support and for emergency evacuations.

Courtesy of Land Rover, and with the support of their local dealer in Windhoek, Novel Motor Company, the expedition had the use of one Defender 110 Station Wagons, two Defender 130 Double Cabs and one Defender 130 Single Cab. Team members wishing to drive the Land Rovers had to be older than 21, have a full clean driving license and a new style EU or equivalent credit card sized driving license document. Off-road driving and safety training was part of the expedition.

Medical support and insurance

The expedition leader was a trained first aider and the expedition carried a comprehensive medical kit. Namibia's healthcare system is of an excellent standard and the nearest doctor and hospital were in Windhoek. All team members were required to carry adequate travel insurance covering emergency medical evacuation and repatriation.

There was one incident that required a few stitches to a team member's finger. One visit to an eye doctor was needed for one team member who had encountered a thorny bush.

1.5. Local scientist

Kristina Killian was born in Germany and studied biology at the University of Hamburg, Germany. Her research focus lies primarily on the ecology and behaviour of mammals and their conservation. Her interest in biodiversity has increased to include domestic animals and crops and the people that share the ecosystems with them. Amongst other things, she has investigated zebra herd behaviour, red deer and whale acoustics and the endangered Darwin Fox (*Lycalopex fulvipes*) on Chiloé, Chile. She has travelled and worked in Spain, Australia, Argentina and Namibia. Her other big passion is horses and she has worked in a professional equestrian centre and travelled as a horse groom around Europe.

1.6. Expedition leaders

The 2010 expedition was led by Ronald Seipold. Ronald graduated from the University of Berlin with a Masters Degree in Business Administration and then spent several years working in different branches of industries leading organisational and IT related projects. He then decided to go for a total change of career & lifestyle and focus on his passion for travelling, wildlife and the outdoors. After a 100 day intensive training course with COLT (Canadian Outdoor Leader Training) he qualified as an outdoor leader, radio operator, sea kayak and canoeing guide, backcountry first-aider, etc.. Ronald then began leading and instructing groups in the outdoors primarily in Scandinavia and Canada as well as working for outdoor camps and lodges. Ronald joined Biosphere Expeditions in 2007. His favourite activities are mountaineering, canoeing and climbing.

Both expeditions in 2011 and two slots in 2010 were led by Jennifer Kraushaar. Jennifer qualified as a vet at the University of Giessen in Germany. As part of her training, she spent time at various wildlife clinics in Australia and Canada. Her work as a vet also took her to Asia where she spent some months working with injured elephants. Jennifer has also completed a one-year course in safari field guiding in South Africa. Her field work experience includes research on lions in the Greater Kruger National Park and hands-on chimpanzee work with the Jane Goodall Institute.

1.7. Expedition Team

The expedition team was recruited by Biosphere Expeditions and consisted of a mixture of all ages, nationalities and backgrounds. They were (with countries of residence):

12 - 24 September 2010: Daniela Gunz (Switzerland), Klaus Haselboeck (Austria) – journalist, Margret Kessler (Germany), France Laliberte (Canada), Jean-Francois Laliberte (Canada), Peter Laufmann (Germany) – journalist, Marie Mapstone (UK), Julie Meyer (USA), Martin Przewloka (Germany), John Rawnsley (UK), Marty Reid (USA), Catherine Thebault (France), Serge Thebault (France).

26 September - 8 October 2010: Benoit Bourdon (France), Francoise Fedele (Switzerland), Philippe Fedele (Switzerland), Anja Giles (Germany), Jane Harvey (UK), Margret Kessler (Germany), Susanne Koenig (Germany), Steffen Laubner (Germany), Anna Christen Rodrigues (Luxembourg), Gustavo Rodrigues (Luxembourg), Lorraine Whellams (Canada), Melissa Whellams (Canada).

17 - 29 October 2010: Peter Geoghegan (UK) – journalist, Heike de Jong (Germany), Conny Kirstein (Germany), Karin Klingner (Germany), Ulrich Klingner (Germany), Christian Leeb (Austria), Thomas Mayer (Germany), Anne Noack (Germany), Uwe Noack (Germany), Brigitte Posch (Austria), Katie Ridley (UK), Angela Smith (USA), Jackie Stevenson (Bermuda).

31 October - 12 November 2010: Barry Dore (UK), Janice Dore (UK), Jennifer Fry (UK), Adam Hill (UK), Christine Johnson (UK), David Johnson (UK), Susanne Nips (Germany), Sue Prutton (UK), Barbara Simmons (USA), David Simmons (USA), Annick Tamisier (France), Bernard Tamisier (France).

21 November - 3 December 2010: Mike Bishop (UK), Michael Clifford (UK), Juan Garcia (Spain), Melissa Hartigan (USA), Rod McGregor (UK), Manfred Müller (Germany), Sascha Müller (Germany), Shawn Pompian (USA), Jutta Schoppengerd (Germany), Lauren Westwood (UK), Fiona Zeiner (Germany).

5 - 17 December 2010: Muhammad (Rob) Amir (USA), Morena Barilani (Italy), George Benson (USA), , James Chubb (UK), Johannes Goerg (Germany), Regine Hink (Germany), Lindsey Judge (UK), Candida Krömer (Germany), Christine Marklow (UK), Marina Schmidt (Switzerland), Leslie Ruyle (USA).

30 January - 11 February 2011: Lydia Bell (UK) – journalist, Sharon Bickford (Australia), Mark Bilsland (UK), Susanne Bollinger (Switzerland), Branko Budisin (Canada), Helge Eek (Norway) - journalist , Michael Farnsworth (UK), Marie Forsyth (USA), David Glossop (UK), Neil Goodall (UK), Charlene Ingram (UK), Jacobien Kompier (Nederland), Jessica Ward (New Zealand).

13 - 25 February 20121: Mona Frolova (Russia), Avril Jean Gilding (Australia), Andrew Hart (Australia), Milton Hart (Australia), Tessa Heine (Germany), Summer Henderson (USA), Davina James (Australia), Martha Leitner (Austria), Angela Paul-Georg (Germany), Matthias Paul (Germany), Pat Shaw (USA)., Adam Summers (UK).

27 February - 11 March 2011: John Adragna (USA), Alexandra Broer (Germany), Thea (Rosa) Cooper (USA), Gabi Felter (USA), Alan M. Hoffberg (USA), Janet Hoffberg (USA), Linda Jones (UK), Greg Kruszewski (USA), Sam Owen (South Africa) – photographer, Sophie Stafford (UK) - journalist, Dolly Vergeer (Luxembourg).

7 - 19 August 2011: Katie Bunting (UK), Claudia Burkhardt (ZDF, Germany), Bill Caudwell (UK), Rachel Futter (Namibia - Stormsaver scholarship), Ludger Nüschen (ZDF, Germany), Jürgen Rapp (ZDF, Germany), Ilka Schweda (Germany), Ulf Schweda (Germany), Nicola West (Australia).

21 August - 2 September 2011: Joanne Flower (United Arab Emirates), Torsten Graf (Germany), Jutta Heiser (Germany), Jacqueline Korneffel (Germany), Catherine Marshall (Australia) – journalist, Anne Schroedter (Germany), Marianna Seubert (Germany), Nicola West (Australia).

11 - 23 September 2011: Brigitte Angehrn (Switzerland), Mario Angehrn (Switzerland), Dorothea Dentgen-Koenig (Germany), Renate Plaumann (Germany), Stefan Plaumann (Germany), John Rawnsley (UK), Maja Nicole Soreng-Robbins (USA).

25 September - 7 October 2011: Alena Bauer (Germany), Ronny Bonny Hoeseb (Namibia - Stormsaver scholarship), Simen Horne (Nederland), Tenille Petrilli (Australia), Matt Sanderson (Australia), Linda Snodden (UK).

16 - 28 October 2011: Lucea Keller (USA), Ryszard Miezanko (USA).

30 October - 11 November 2011: Vanessa Croll (Australia) – journalist, Chantalle Havenith (Germany), Lucea Keller (USA), Petra Loebel (Germany), Sigrid Lunzer (Austria), Christine Marklow (UK), Ryszard Miezanko (USA), Katrin Mueller (Switzerland), Katrin Sendt (Germany), Erica Smith (UK).

1.8. Expedition Budget

Each team member paid towards expedition costs a contribution of £1730 (in 2010) and £1940 (in 2011) per two week slot. The contribution covered accommodation and meals, supervision and induction, all maps and special non-personal equipment, all transport from and to the team assembly point. It did not cover excess luggage charges, travel insurance, personal expenses such as telephone bills, souvenirs, etc., as well as visa and other travel expenses to and from the assembly point (e.g. international flights). Details on how these contributions were spent are given below.

Income	£
Expedition contributions 2010 and 2011	254,813
Expenditure	
Start-up costs includes setting up base, research, staff, logistics, etc.	6,323
Staff includes local & international salaries, travel and expenses	53,762
Research includes equipment, animal capture and other research expenses	15,860
Transport includes fuel, car tax & maintenance	11,959
Base includes board, lodging and other base camp services	124,907
Administration includes office costs, registration fees, educational materials design & distribution	1,976
Team recruitment Namibia as estimated % of PR costs for Biosphere Expeditions	9,640
Income – Expenditure	**30,386**
Total percentage spent directly on project	**88%**

1.9. Acknowledgements

This study was conducted by Biosphere Expeditions, which runs wildlife conservation expeditions all over the globe. Without our expedition team members (listed above) who provided an expedition contribution and gave up their spare time to work as research assistants, none of this research would have been possible. The support team and staff (also mentioned above) were central to making it all work on the ground. Thank you to all of you and the ones we have not managed to mention by name (you know who you are) for making it all come true. Biosphere Expeditions would also like to thank Land Rover, Cotswold Outdoor, Motorola, Swarovski Optik, Globetrotter Ausrüstung, and the Friends of Biosphere Expeditions for their sponsorship and/or in-kind support.

The author would like to thank the Namibian Government, the Namibian Tourism Board and the Ministry of Environment and Tourism in particular, for giving me the permission to conduct this study. My thanks also goes to all expedition team members, as well as staff members for their amazing effort. The expeditions in 2010 and in 2011 made a major contribution to the exploration and establishment of the Ongos study site. I am grateful to Land Rover for providing essential vehicle support. A special mention goes to staff at Novel Motors, the Land Rover dealer in Windhoek, especially Fritz Rossler, Tony Bassingthwaighte and Martin Nell, for their patient and tireless help in dealing with the vehicles. I would also like to thank *mtc* Namibia for sponsoring SIM cards for the GPS/GSM collars. My thanks also go to Motorola for providing the two-way-radios and to Swarowski Optik for providing binoculars. A big thank you to the Alexander Koenig Gesellschaft e.V. and to IdeaWild for providing camera traps. Thank you to Sebastian Linnerz for macroscopic and microscopic scat analysis and statistical evaluation for his diploma thesis at the Zoological Museum Koenig in Bonn. I thank the Institute for Zoo and Wildlife Research in Germany for scientific advice and analysing blood samples. A special thanks goes to Ulf and Michaela Tubbesing, for giving me permission to run the expedition on their property, for their cooperation and allowing me to live on Ongos, and for their excellent work as veterinarians. Last but not least, I would like to thank Biosphere Expeditions and every team member for the contribution that this expedition has made to large carnivore conservation and community development. Finally I thank Jörg Melzheimer and the referees for their comments on various versions of this manuscript.

1.10. Further information & enquiries

More background information on Biosphere Expeditions in general and on this expedition in particular including pictures, diary excerpts and a copy of this report can be found on the Biosphere Expeditions website www.biosphere-expeditions.org.

Copies of this and other expedition reports can be accessed via at www.biosphere-expeditions.org/reports. Enquires should be addressed to Biosphere Expeditions via www.biosphere-expeditions.org/offices.

2. African leopard ecology on a Namibian game farm

2.1. Introduction and background

There are many studies of leopards (*Panthera pardus*), but all are of animals inside protected areas such as Kruger National Park (Bailey 1993, Broomhall et al. 2003, Mills et al. 2004), the Serengeti (Caro 1994, Durant 1998), and Etosha National Park (Stander 1997). However, the majority of leopards in Namibia occur on commercial farmland. Over the past three decades more and more livestock farmers have changed over to game ranching. Since the value of many of the game kept on game ranches far exceeds that of normal livestock, many of these game ranchers are obviously averse to losses due to predation and are therefore intolerant of big cats and other predators. Many of these farmers have joined conservancies, which aim to regulate the management and use of wildlife. There are no detailed studies on the prey preferences of leopards outside protected areas. Farmers often assume that leopards specialise on domestic livestock, and taking calves, sheep, goats and poultry as easy prey. There are strategies to protect livestock against depredation. Examples are guard dogs, the use of donkeys or herding. In addition, herds can be kept inside kraals overnight or animals can wear bells to make loud noises. However, none of these different strategies used for cattle are practical in protecting game species from predation.

Excessive leopard trophy take-off, often with the aid of questionable or blatantly unethical techniques such as hunting at night with flashlights and the use of dogs to chase the cats, in addition to a high “problem predator” take-off are putting the local leopard population under threat. Land management practices are profit-oriented and based on stock farming principles. The overall management of conservancies is rarely ecologically sound and/or the relevant information is simply missing.

The proximity of Windhoek and the Katutura township, with its many unvaccinated stray cats and dogs, poses a potential risk of disease transmission to wild carnivores present on the study site. In an effort to ascertain the risk (real or perceived) of disease spillover from domestic to wild carnivores, all predators captured during this study had blood samples taken for disease surveillance purposes.

In order to determine the status of the leopard population in the study area, the dynamics of the leopard population, prey species and their abundance need to be ascertained. The two basic questions that the study focused on were: What is the behaviour and ecology of leopards living on commercial farmland, particularly game farms? Are there any differences to leopards found in protected areas and national parks? In addition, this study focused on inter- and intraspecific relationships of different predators species in the study area. For interspecific interactions the following species were included: cheetah (*Acinonyx jubatus*), brown hyaena (*Hyaena brunna)* and smaller carnivores such as caracal *(Felis caracal*), black-backed jackal (*Canis mesomelas),* and African wildcat *(Felis silvestris libyca)*.

A central hypothesis was that in the presence of sufficient numbers of prime prey species (e.g. warthog, springbok, guinea fowl, francolin etc.) the statistical likelihood of leopards preying on those, rather than on the rare and expensive species, should reduce losses amongst the latter and will increase tolerance towards predators amongst game ranchers. This was termed the “cannon fodder hypothesis”.

2.2. Study site and training of expedition participants

The Daan Viljoen Game Reserve, a mere 45 km² in size, is the only state protected area in the Khomas Hochland and borders Ongos farm. The region, with the exception of the Game Reserve, is comprised of privately owned farmland used for extensive stock and game ranching. Many of these farms have joined conservancies, which aim to regulate the management and use of wildlife. Ongos borders onto the Brakwater small holdings in the East, and Katutura township lands and the Daan Viljoen Game Reserve in the South (Figure 2.2a). Ongos is situated 15 km North-West of Namibia's capital, Windhoek (Figures 1.2.a and 1.2b). The farm is 100 km² in size and entirely game fenced. All internal fences have been removed, thus allowing free roaming of wildlife. There is no/very limited hunting of prime prey species such as warthog, springbok, guinea fowl, francolin, etc. on Ongos. The farm has very varied landscapes (altitude range from 1500 – 2000 m) with many different habitat types ranging from typically African bushveld to riverine areas, including the constantly flowing Aretaragis river bordered by lush vegetation, to mountainous areas in the Khomas Hochland. There are 22 ground dams (man-made lakes) fairly evenly distributed over the study area. Most are relatively small and only keep water for a few months after the rainy season, but four dams hold their water for up to two years. The area has, for many years, not been used for any commercial farming activity, thus leaving the pasture and bush in good condition. The expedition base camp site (S 22.44308, E 16.96900) was situated close to a dry river bed. The farm Ongos is a promising area to study both leopard ecology in a game ranch setting, as well as disease spill over effects, because it is in close proximity to a large number of unvaccinated pets (Katutura and surrounds).

For the first two days of each group, expedition participants were given talks and practical lessons, learning the use of GPS, compass, range finder and other research equipment and safety techniques, skills and procedures. First excursions into the field were under the supervision of Biosphere Expeditions staff. After a few days, participants were mostly able to navigate around the study site, install camera traps, record tracks and signs of mammals and identify animals. Where necessary, research teams were accompanied by trained local personnel to improve the accuracy of field interpretations or to provide a safe working environment. Data entry and picture downloads were tasks performed at the expedition base.

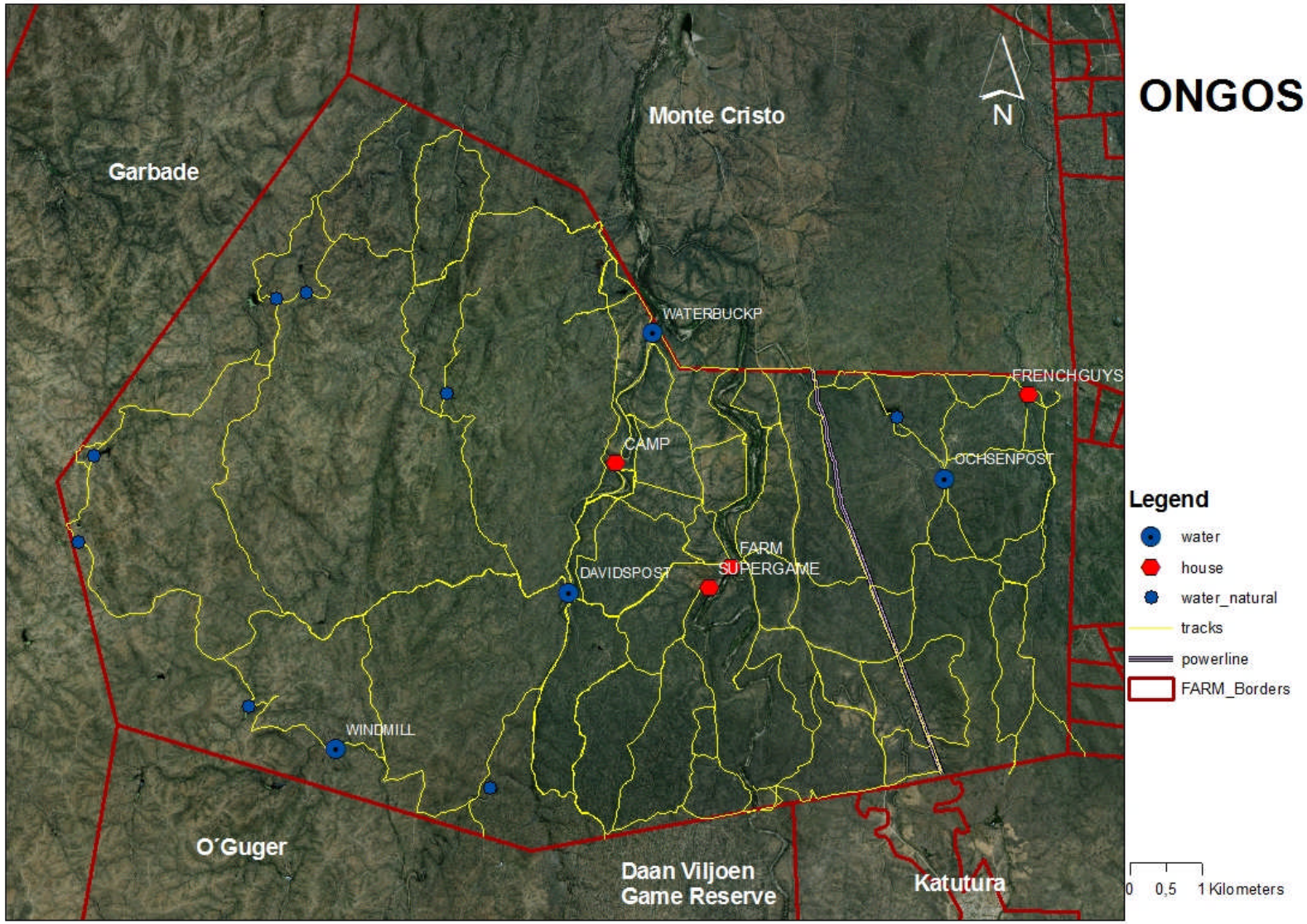

Figure 2.2a. Ongos, roads (yellow), houses (red dots), fence/border (red line), places of water (blue dots) and surrounding neighbours and game reserve Daan Viljoen.

2.3. Study animal

The leopard *(Panthera pardus)* was the key study species. It has the greatest geographic distribution of the wild cats (Nowell and Jackson 1996), covering a variety of different habitats ranging from desert to rainforest. Density varies with habitat, prey availability, and degree of threat, from less than 1/100 km² to over 30/100 km², with highest densities obtained in protected East and Southern African environments (Hunter 2011). Nevertheless the leopard is listed in Appendix I in CITES and classified as Near Threatened (IUCN 2010), with five genetically distinct subspecies; three of them are Critically Endangered and two are Endangered (IUCN 2008). Currently wild cats such as leopards, cheetahs and caracals are not listed in the Endangered category (IUCN 2009) although excessive trophy (Berry 1990) combined with a high "problem predator" take-off, and other factors such as habitat loss, fragmentation and local outbreaks of wildlife diseases, may potentially put the leopard (and the other predator species) populations locally under threat (Bailey 1993).

Leopards are nocturnal and solitary (Schaller 1972, Bailey 1993, Stander et. al 1997b) stalkers and pouncers; they do not chase their prey over long distances. Both sexes are territorial and defensive against conspecifics of the same sex (Hamilton 1976, Bailey 1993). Bailey (1993) noted at least 92 prey species used by leopards in sub-Saharan Africa, and known prey ranges in size from the much-cited dung beetle (Fey 1964) to adult male elands (Kingdon 1977). Yet despite this apparent ability successfully to exploit prey spanning such an enormous size range, leopard diet is generally dominated by medium-sized ungulates (e.g. Bailey 1993). A recent analysis of 33 studies on leopard feeding ecology revealed that leopards preferentially prey upon species within a weight range of 10–40 kg, even if prey outside this weight range is more abundant (Hayward et al. 2006). The optimum prey weight for leopards derived from this analysis is 23 kg, based on body mass estimates of significantly preferred prey species (Hayward et al. 2006).

2.4. Capturing and collaring

2.4.1. Introduction

In order to understand the ecological factors that determine demographic trends in carnivores, it is important to study free-ranging populations under natural selection pressure. As most parts of Namibia are under some sort of agricultural management, which very often entails removal of problem animals, the selection pressures include human factors. Demographic parameters such as fecundity, mortality, reproductive success, sex ratio, age structure and social structure will therefore differ from populations in protected areas. These demographic parameters are key elements to estimate long-term viability of populations and population viability models need to be fed with high quality data as the output of these models is extremely sensitive to the input. Information on leopards on commercial farmlands is scarce and very often preliminary data are used.

Leopards in protected areas, for example national parks, are very habituated to humans and often allow for extended periods of observation. However, leopards living on commercial farmland generally avoid encounters with humans. In order to obtain high-quality, data indirect sampling methods are required. Fitting individual animals with GPS collars is a suitable method to study solitary, elusive and nocturnal felids in their habitats (Seidensticker et al. 1970, Bailey 1974).

2.4.2. Methods

Box traps were used to capture leopards and checked on a daily basis. Once an animal was captured, it was darted and immobilised within 12 hours. Any captured animals including honey badger, jackal or hyaena were released immediately by the team checking the box trap. A combination of ketamine and xylazine or medetomidine with the reversal agent yohimbine or atipamezole HCl was used to anaesthetise captured animals. Drug choice, dosages and combinations depended on the body weight and type of species captured. Whilst under anaesthesia, animals were placed in a shaded place and a facial cover and eye lubricants were used to prevent damage to the eyes. Noise levels were kept to a minimum. Vital parameters were monitored and an intravenous line was placed to administer fluids if needed and to have access to the blood stream should an emergency arise. Various samples were taken for research purposes (a range of blood samples, smear of saliva, nasal and conjunctival fluid, faeces and body measurements). While working in the field, blood samples were put into a cool box. After that, the animal was fitted with a GPS or VHF collar (depending on species captured, age, collar availability and collaborating researchers). Once the anaesthetic was reversed, the animal was kept under observation to ensure complete anaesthetic recovery prior to its release to avoid risk of injury or predation.

GPS/GSM collars produced by Vectronic Aerospace, Germany were used. These collars provide the GPS position (WGS84) of the animal, a fine scale ambient temperature, an activity scheme and notification in the event of mortality. Data were transmitted as text messages via the mtc mobile phone network and received through a dedicated internet platform. GPS/GSM collars also had a VHF function so that they could be located in areas of no or low GSM coverage. The weight of the collar was less than 3% of the cat's body weight. Lightweight adult females (less than 38 kg) were collared with VHF collars from ATS. Positions of these animals were gained by regular triangulation of compass bearings obtained from three near-simultaneous measurements (White and Garrott 1990). The VHF collars weigh 240 g, which is less than 1% of the study animal's body mass. They are fitted with activity and mortality sensors and emit three types of signals: resting, activity and mortality.

2.4.3. Results

Capture activities started in September 2010. A second capture period was conducted from January to March 2011 (2011A) and a third one from August to November 2011 (2011B). Seven leopards were captured during these periods and one additional female was caught in May 2010 and fitted with a VHF collar (Table 2.4.3a & Table 2.4.3b).

Table 2.4.3a. Leopards captured at Ongos study site from May 2010 to November 2011.

Animal type	N_M	N_F	N_{SM}	N_{LM}	N_{LF}	N_{Tot}	$N_{collared\ animals}$
Number of individuals	1	3	2	1	1	8	4

N_M: number of adult males; N_F: number of adult females; N_{SM}: number of sudadult males; N_{LM}: number of large cub male; N_{LS}: number of large cub female; N_{Tot}: number of total animals. Age classes following Bailey (1993).

Except for one young male leopard (large cub – captured on 3 October 2010), all individuals captured were immobilised. A very young female (~6 months) and two sub-adult male leopards (~18-20 months) were released after samples and measurements were collected without fitting them with a collar. A female leopard was radio-collared (VHF) and one male and one mature female were collared with GSM/GPS collars (Table 2.4.3b). All individuals captured were in good to excellent condition. The average weight of the three adult females was 36 kg with the largest at 44 kg and pregnant (~30 days) (Table 2.4.3b). During the study, only three relative age classes (Bailey 1993) were recorded: prime adults, subadults and large cubs. Old adults and small cubs were not captured or seen.

Table 2.4.3b. Leopard captures data 2010 + 2011.

Date of capture	ID	Sex	Age	Mass (kg)	Condition	Collar	Comments
25.05.2010	LF01	female	4 years	34	good	VHF	
03.10.2010		male	6 months		excellent	no	not immobilised, weighed or ID assigned
11.11.2010	LF02	female	6 months		excellent	no	
11.08.2011	LM01	male	~4 years	63	excellent	GPS	shot by farmer 5.10.2011
25.08.2011	LF03	female	3 years	30	good	VHF	
19.09.2011	LM02	male	20 months	37	excellent	no	
01.10.2011	LF04	female	4 years	44	good	GPS	pregnant
07.11.2011	LM03	male	18 months	38	excellent	no	

During the expeditions between three and five box traps were set throughout the study site (Figure 2.4.3a – Figure 2.4.3c). Each trap that is set active, counts as one trap night. One night with four armed box traps is therefore counted as four trap nights. An "A" signals a new position of a box trap (Figure 2.4.3a; BoxTrap01 moved to location BoxTrap01A). During the expedition in 2010, three box traps were active on 70 days with a total of 131 trap nights (Table 2.4.3c). During 2011A, up to five box traps were set active on 32 days with a total of 135 trap nights. During 2011B, four box traps were active on 53 days in up to seven different positions with a total of 204 trap nights.

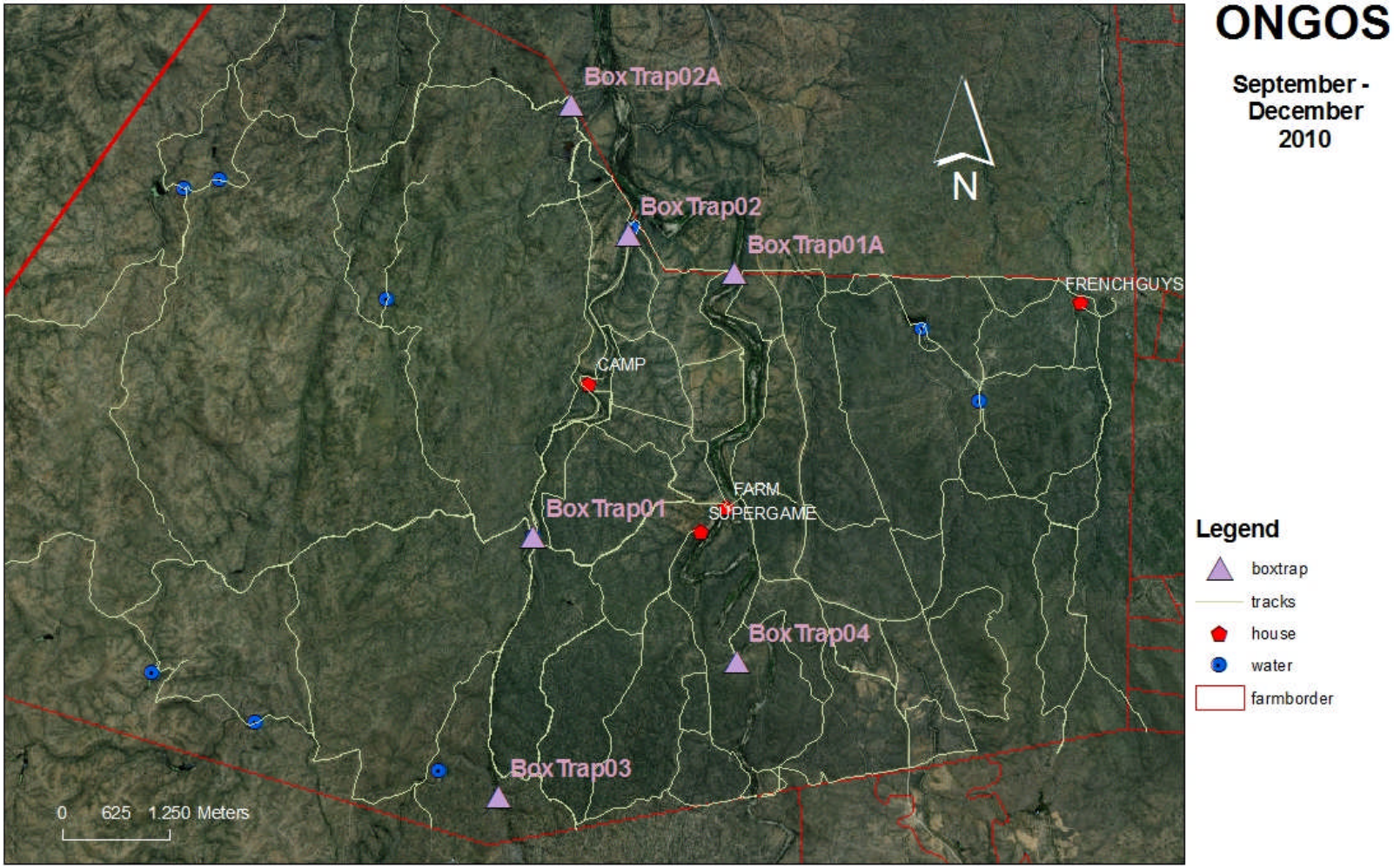

Figure 2.4.3a. Map of Ongos 2010 position of box traps.

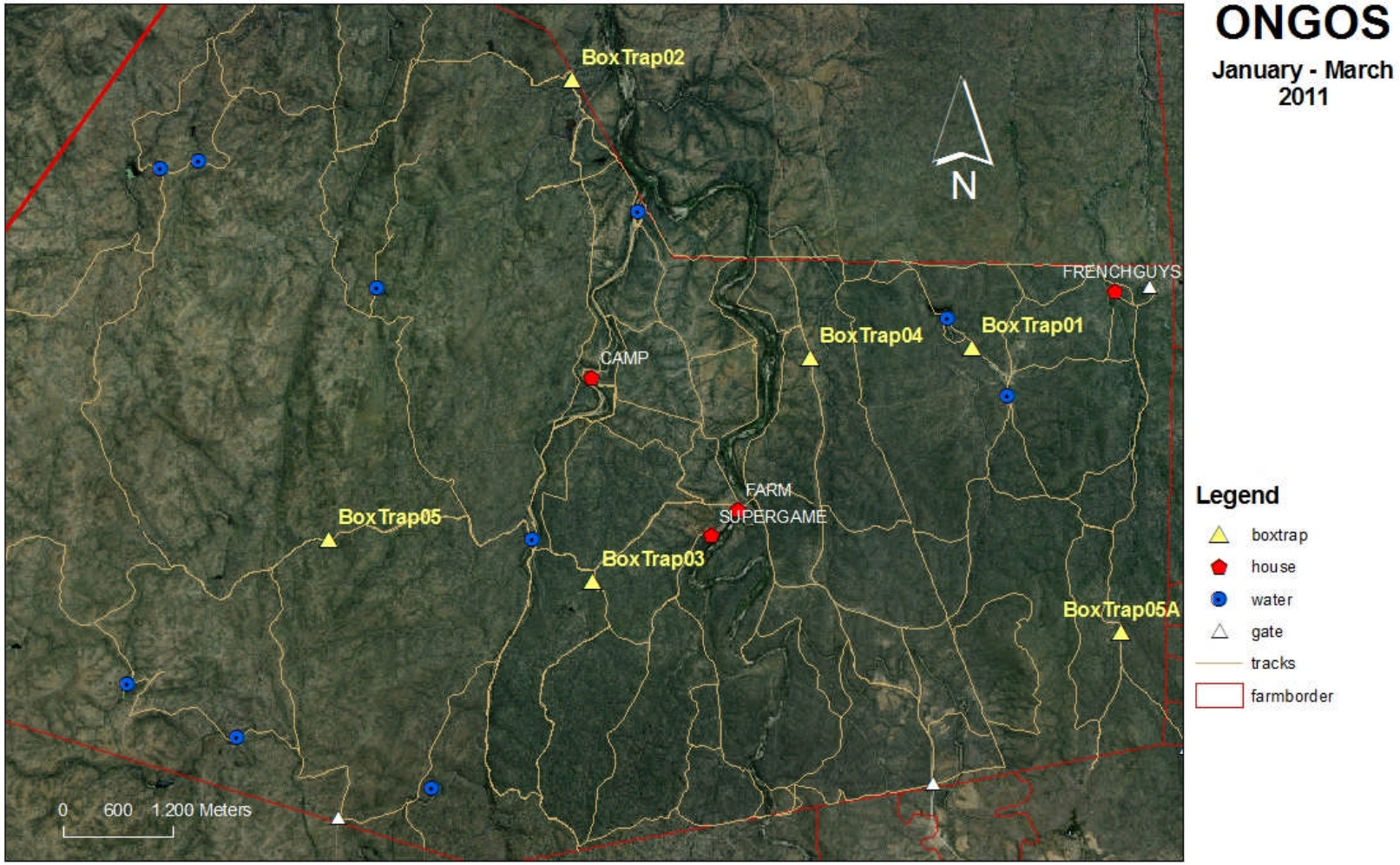

Figure 2.4.3b. Map of Ongos 2010 position of box traps.

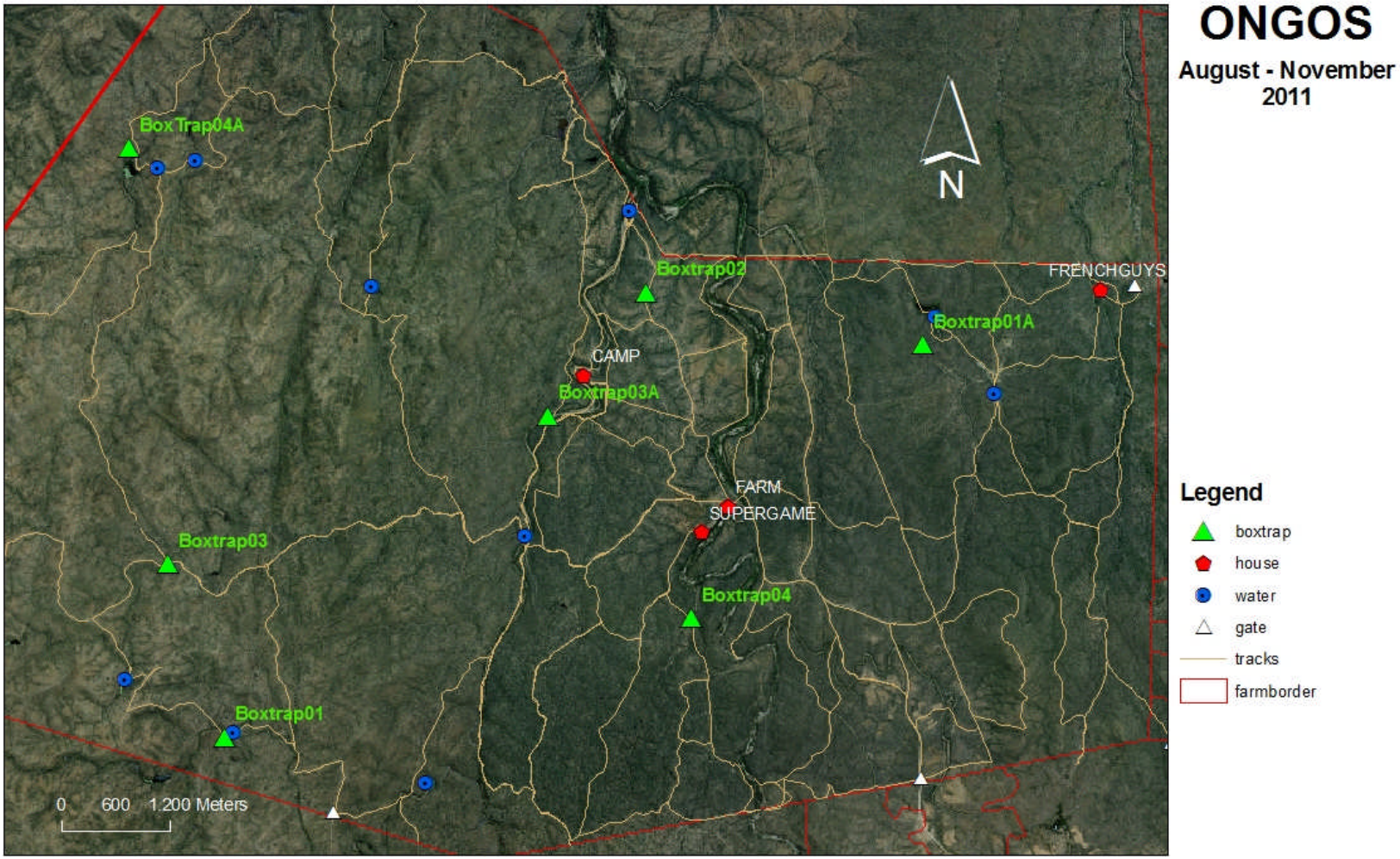

Figure 2.4.3c. Map of Ongos 2011B position of box traps.

Tab. 2.4.3c. Trap nights effort and success 2010 & 2011.

	Trap nights	Open	Closed/empty	Capture
2010	131	100	25	6
2011A	135	112	18	5
2011B	204	166	25	13

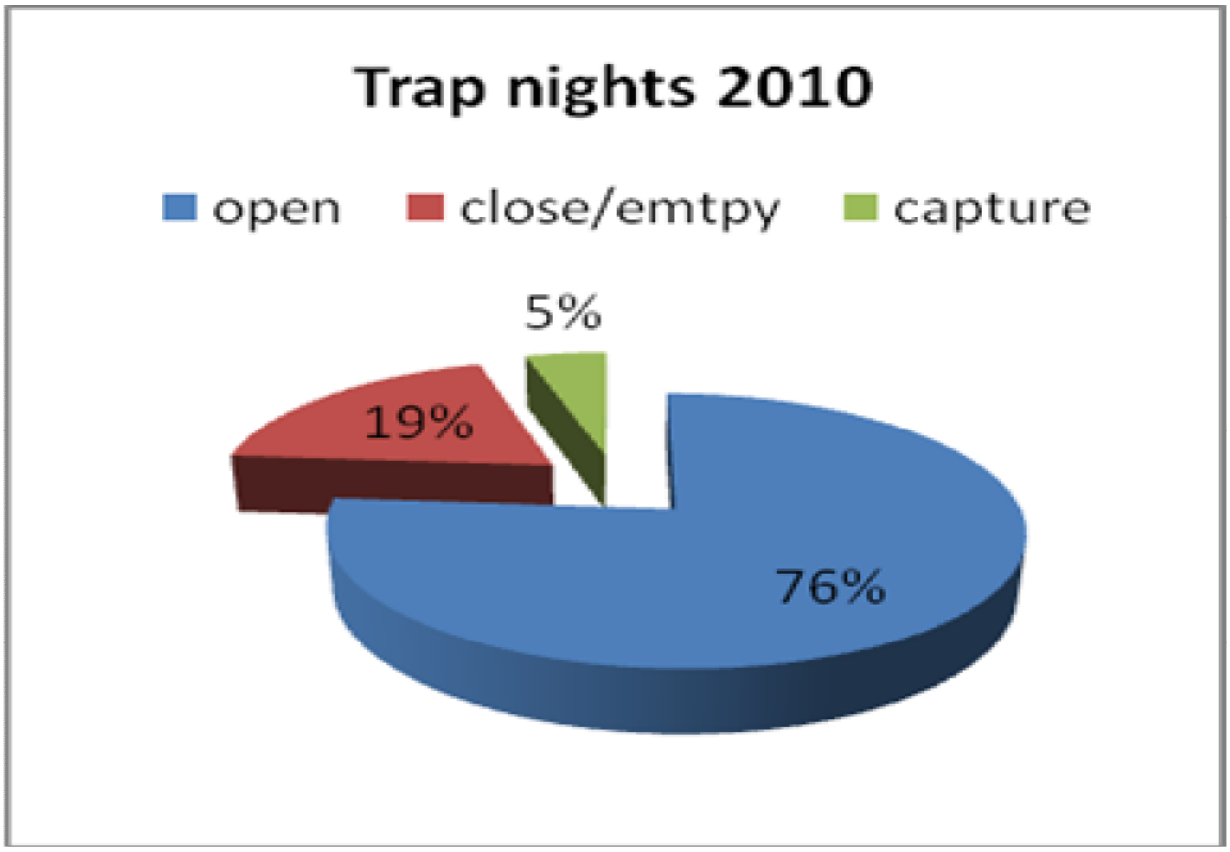

Figure 2.4.3d. Open traps, closed but empty traps and captures during expedition 2010

In 2010 76.3% of box traps were open, 4.6% had captured an animal and 19.1% of the traps had shut but were empty. Two leopards, two porcupines, one warthog and one honey badger were captured. Traps were set in six different places, but almost all captures were made close to Davidspost, a man-made watering spot (trap position BT01 on Figure 2.4.3a).

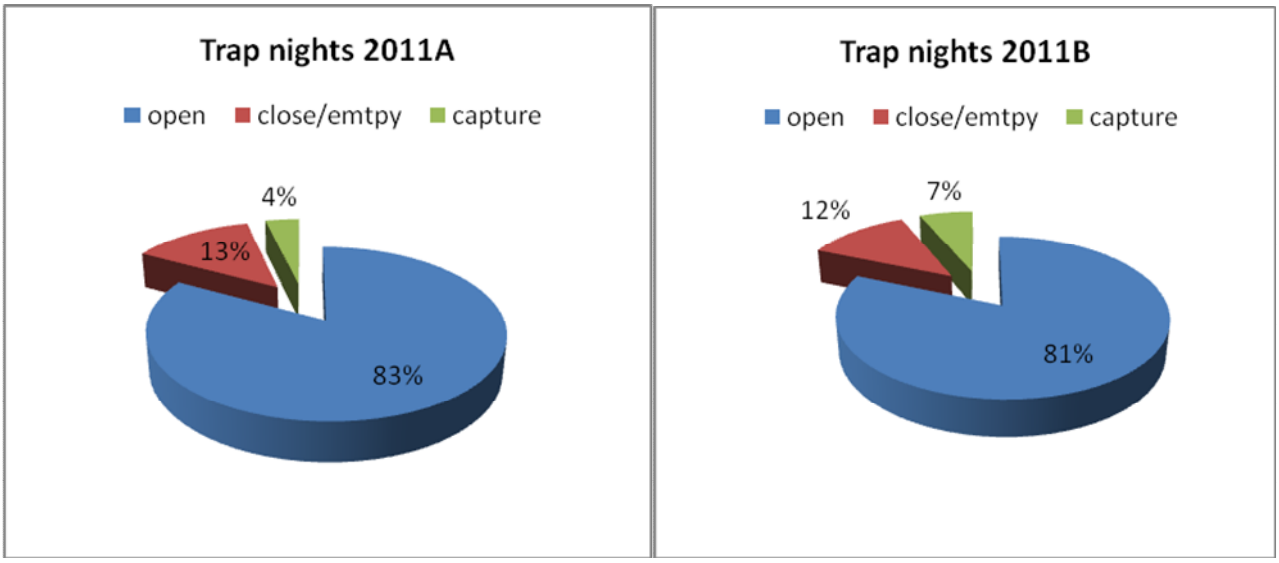

Figure 2.4.3e. & f. Open traps, closed but empty traps and captures during expedition 2011.

In the beginning of 2011 (2011A) box traps were 82.9% open, 13.3% closed and 3.7% with captures, none of them leopards (Figure 2.4.3e), but two porcupines, one warthog, one baboon and one lappet-faced vulture.

During 2011B 81.4% box traps were open, 12.3% closed and 6.4% with captures (Figure 2.4.3f). Seven animals were captured in “Box Trap 04A” in the mountains (Figure 2.4.3c). Two leopards went into this box trap and were collared with GPS/GSM collars. One aardvark, three warthogs and one porcupine were captured in the same trap. In total five leopards, two further warthogs and one jackal were captured, yielding the highest capture success with five leopards in 204 trap nights (an average of 41 trap nights per captured leopard).

2.4.4. Discussion

Capture success was lowest (zero) during the first survey in 2011 (January to March), probably because prey was plentiful and more importantly easy accessible as young calves of springbok and other antelopes were abundant. In addition leopards can capture their prey more easily during the wet season, because of the dense vegetation cover. Tracks clearly indicated that leopards were present in the areas where the traps were set, but they did not show any interest in the bait, passing it several times. The type of bait used (baboon and antelope) may also have been less attractive than the zebra meat used later. The successful 2011B capture season is likely to be connected to the bait being more attractive because of the season (lower availability of prey and less favourable hunting conditions) and the type (zebra instead of baboon/antelope).

There was no capture success with caracals or cheetahs. During the whole study period only one camera trap picture of a cheetah was obtained. Caracals and cheetahs are sometimes caught in traps set for leopards, but usually require different trap positions (e.g. at marking trees for cheetahs) and bait (live and/or heavily scented bait). This is strong evidence that the study area has very low cheetah density (see also chapter 2.6.2.), probably because of the high density of resident leopards and the hilly and bushy terrain (cheetahs prefer open terrain with few bushes because they rely mostly on straight-line speed to capture their prey).

During the study period, females and males were captured equally (4/4). Bailey (1993) and Hamilton (1976) reported female leopards were more difficult to capture than males, but this seems not to have been the case here, probably because two of the females were young and inexperienced and are unlikely to have encountered box traps before.

There was no recapture. This suggests that leopards have an excellent memory of trap location and most likely and unsurprisingly develop an aversion to traps (getting trap shy).

In the case of the young males that were captured, it can be assumed that they were roaming around to find their own home range. There was no evidence such as photos from camera traps from previous surveys that these young males resided permanently on the farm.

The capture of a pregnant female and two juvenile, as well as results from the camera trap survey, which captured a female leopard with a juvenile, indicates that there is a positive reproduction rate in the study area.

Blood samples taken during capture and immobilisation were sent to the Institute for Zoo and Wildlife Research (IZW) in Berlin, Germany for further analyses. Results gleaned will be published elsewhere when they are completed, which should be late in 2012.

Some leopard samples collected during this study have already been used in one paper published by Castro-Prieto et al. (2011) in the Journal of Heredity (see bibliography).

Blood smears collected during capture and immobilisation were examined under a microscope by a veterinarian. There were no abnormal findings such as blood parasites or high white blood cell (WBC) counts.

2.5. Monitoring of primary study animals

2.5.1. Home range

2.5.1.1 Introduction

Home ranges (the area regularly used by an individual) of some carnivore species overlap considerably among individuals, depending largely on resource density and distribution (e.g., leopard; Bailey 1993, Marker and Dickman 2005) and genetic relatedness (e.g. black bear; Moyer et al. 2005). Many carnivores have individual-specific defended ranges (i.e. territories) that often do not overlap among the same sex, but do overlap between sexes (Arthur et al. 1989). Where prey distribution is constant, these territories are often stable, but under other circumstances, they drift (e.g. red foxes; Doncaster and Macdonald 1991), move with migrating prey (e.g. wolves; Walton et al. 2001) or are fixed, but temporarily left by individuals to find prey (e.g. spotted hyaena; Hofer and East 1993). Leopard home range sizes average between 30-78 km² (males) and 15-16 km² (females) in protected areas (Bailey 1993).

Furthermore, in a spatial-temporal context, data can be used to analyse daily and seasonal movements of each individual and to reveal average distance between daily locations.

2.5.1.2. Methods

In this study radio telemetry (VHF = very high frequency) and GPS/GSM telemetry (Global Positioning System/Global System for Mobile Communication) were used. Animals collared with a VHF collar were located by volunteers and the researcher as often as possible. Research teams set out in a Land Rover to locate the collared individual using a Telonics TR4 receiver and Yagi folding antenna. Other equipment used included binoculars, GPS, clipboard, datasheet and pen. Once a collared animal was located, date, time, the GPS position, signal strength and activity status of the study animal were recorded. These data had to be collected at three different locations (triangulation) to obtain reliable positional data (Figure 2.5.1.2a).

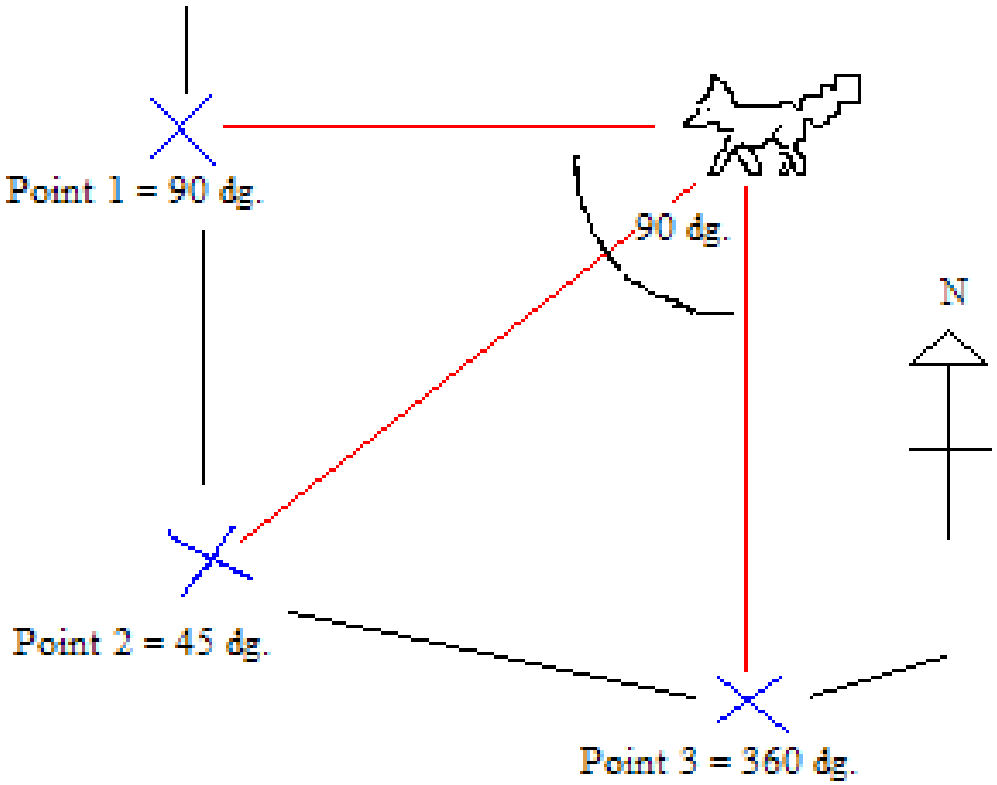

Figure 2.5.1.2a. Desirable three point intersection of 90˚ using the process of triangulation in radio-tracking

Telemetry data were entered into an Excel database for further processing using ESRI's ArcGIS 9 programme extensions such as the Home Range Tool (HRT9) and Hawth's Tools (Spatial Ecology 20 1997). The home range size was calculated using two standard methods: the minimum convex polygon and the kernel method.

Leopards fitted with GPS/GSM collars (made by Vectronic Aerospace, Berlin) were located by GPS, i.e. the transmitter inside the collar attempts – within defined intervals – to contact at least three satellites in order to determine accurately the animal's position. After taking seven positions, the GSM-unit tries to send a text message to the receiving station through the national *mtc* network. The receiving station then sends an email with the information (date, time, location of the collar/animal) to the computer of the researcher.

Analysing data

The MCP method is one of the earliest (Hayne 1949) and still a widely used method for calculating home ranges (Harris et al. 1990). In this method the peripheral locations of a given data set are connected so that they form a polygon. The MCP method is very simple and the resulting home ranges are comparable between studies, but it has several disadvantages. For example, the home range is highly correlated to the number of locations and it does not give any information on how the area is used. Evaluation of areas that are more important to the animal than others is not possible with the MCP method. Besides, occasional exploration trips of an animal may lead to overestimated home range sizes. To correct for this, a certain percentage of the dataset is excluded as outliers (e.g. 5% of the most remote points being excluded resulting in the 95 % MCP) (see Figure 2.5.1.3b).

Currently the Kernel method is considered to be the most suitable one for home range estimation (Powell 2000, Worton 1995). With this method a probability density function from the locations is calculated in order to determine a utility distribution. Home ranges are then defined by drawing contours around areas with equal intensity of use. The home range looks like a hilly surface. From a biological point of view, the Kernel method is much more useful than the MCP method (Figure 2.5.1.3c).

2.5.1.3. Results

The first leopard fitted with a GPS/GSM collar was an adult male (collar fitted on 11 August 2011). The leopard lived 55 days with that collar and more than 500 locations were obtained. Due to the accurate GPS positions and the high amount of locations sent by the GPS/GSM collar, accurate day-to-day “stories” could be collected. For example, after capture and release, the animal walked 1.2 km to the North of the capture site and rested there until the late afternoon.

In the evening of 2 September the leopard started a northward excursion. He travelled the whole night until the morning (see chapter 2.5.2 activity). The data show that the male roamed on different farms, but more than half of his MCP core area (MCP 50) was located on the neighbouring farm in the East (figure 2.5.1.3a). Table 2.5.1.1f shows all different MCP and Kernel data and unexpectedly his MCP (50%) core area, measuring 12.52 km^2, was almost half of his Kernel core area with 22.67km^2. Only the Northeast area of the mountains of Ongos was within his MCP 90% and 95% polygons. MCP 100% with 218.25 km^2 indicated a large area North of his main home range and was only visited by him once during the study period (excursion). In general, MCP (90% and 95%) data differ from Kernel results.

During the dry season the animal drank from several waterholes on Ongos (Figure 2.5.1.3b). The game–proof fence around Ongos was clearly not a barrier, as he regularly crossed under the fence.

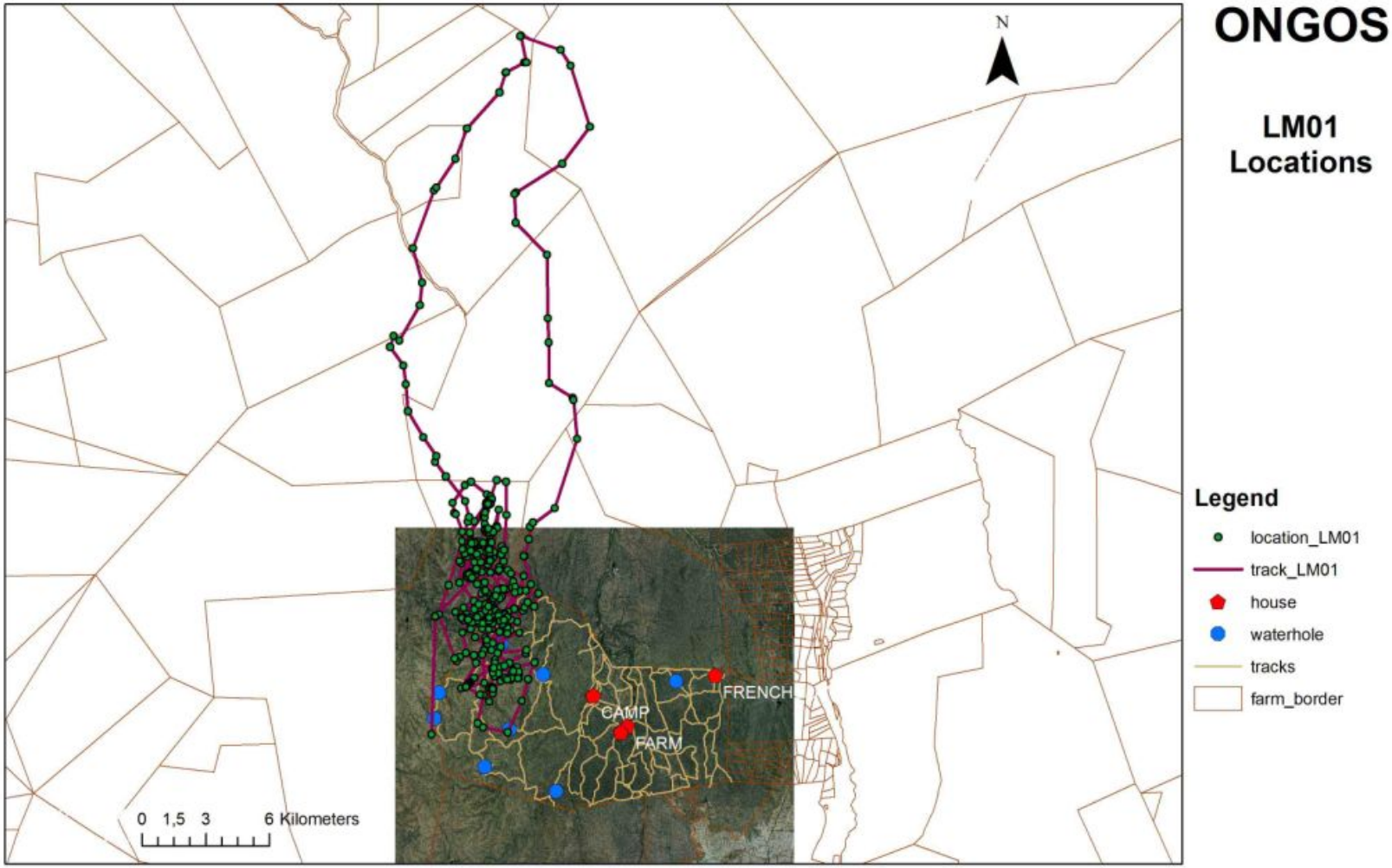

Figure 2.5.3.1a. Locations and tracks walked by male leopard LM01 between 11 August and 5 October 2011.

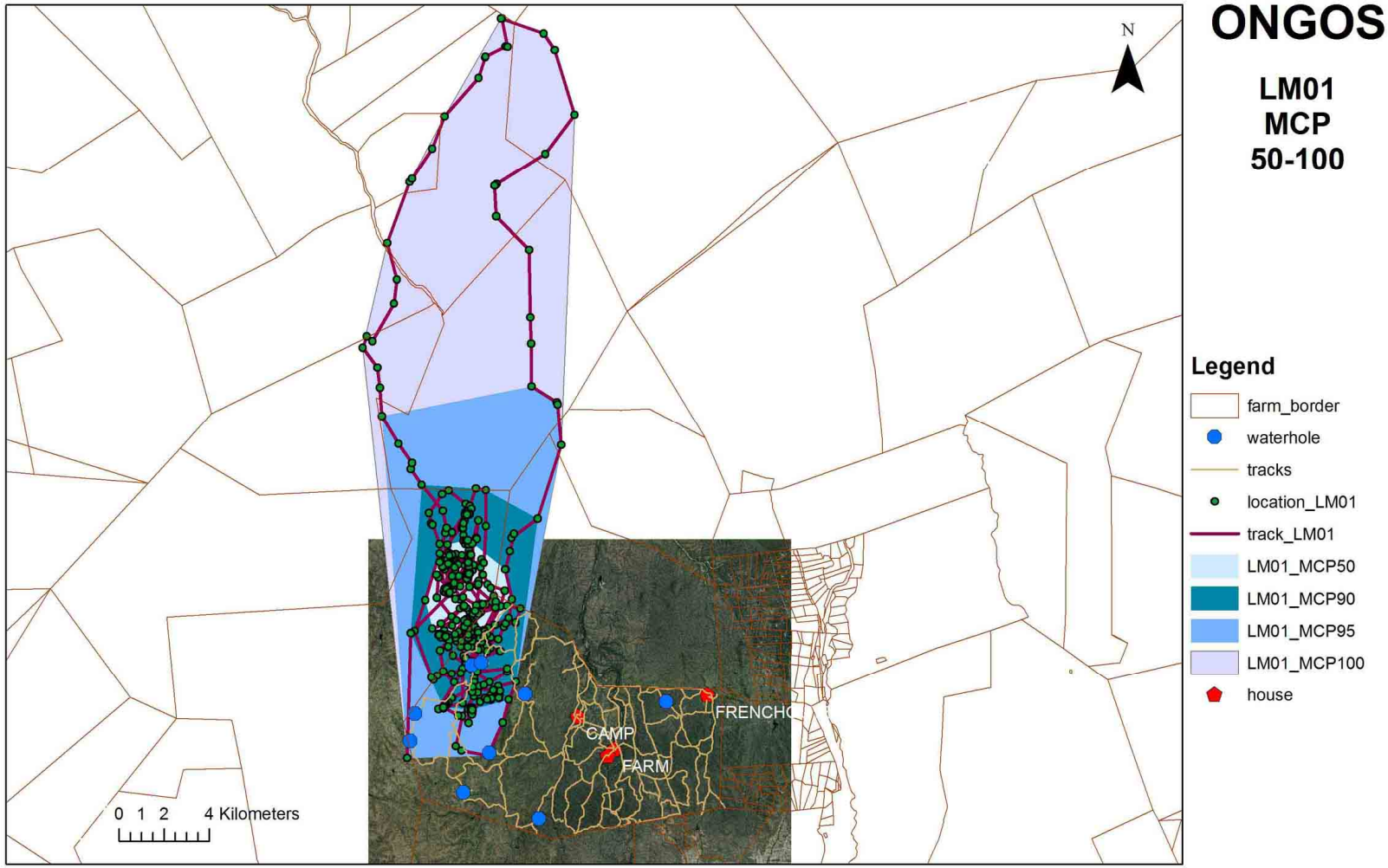

Figure 2.5.1.3b. MCP 50 -100 of male leopard LM01.

Figure 2.5.1.3c. Kernel description (50%, 90% and 95%) of LM01.

Table 2.5.1.3d. Distance moved (km) by LM01 from 1 to 20 September 2011.

Day (September 2011)	1	2	3	4	5	6	7	8	9	10
Distance moved (km)	6.1	10.1	13.72	11.54	17.59	10.72	8.86	3.6	7.5	3.5

Day (September 2011)	11	12	13	14	15	16	17	18	19	20
Distance moved (km)	0.51	0.14	2.26	0.33	0.38	1.32	2.26	5.77	3.6	6.5

Results from twenty days of movement of male leopard LM01 (Table 2.5.1.3d) exhibited an average distance between daily movements of 5.90 km/day. If the results from the exploratory trip are excluded, the average distance decreases to 3.3 km/day. The maximum distance covered was 17.59 km in 24 hours.

It seems that LM01 made kills on Ongos around 11 and 14 September (Figure 2.5.1.3e; turquoise blue spots in the lower part of the figure), because he did not move far (~140 – 500 m) during this time. On 18/19 September LM01 moved to the farm East of Ongos, but returned after a few hours. Personal communication with the neighbouring farmer indicated that he had calves killed on his property. On 24 September LM01 left Ongos again and it appears that he killed a calf on 25 September on the neighbouring farm (Figure 2.5.1.3e; turquoise blue area in the upper part of the figure), because he was very stationary until the end of 27 September. He did not move far on 28 September and it appears that he killed another calf 1.2 km away from the previous kill. On 3 October he killed yet another calf 1.4 km from the second kill. Understandably the farmer had by then identified LM01 as a "problem animal" and when LM01 returned to his third calf kill; the farmer shot him dead on 5 October and informed the author.

Table 2.5.1.3f. Home range size (km^2) of male (LM01) and female (LF04) leopards (MCP and Kernel).

	Home range size (km^2)			
	male		female	
	MCP	Kernel	MCP	Kernel
50%	12.52	22.67	6.32	7.08
90%	44.4	58.88	25.1	27.16
95%	98.13	64.5	30.04	34.52
100%	218.25	%	35.09	%

More than 600 locations were received for female LF04, which was collared on 1 October 2011. For the following analyses data until 17 February 2012 were used. At capture date, LF04 was around five weeks pregnant. Some locations are missing because of unreliable GSM reception.

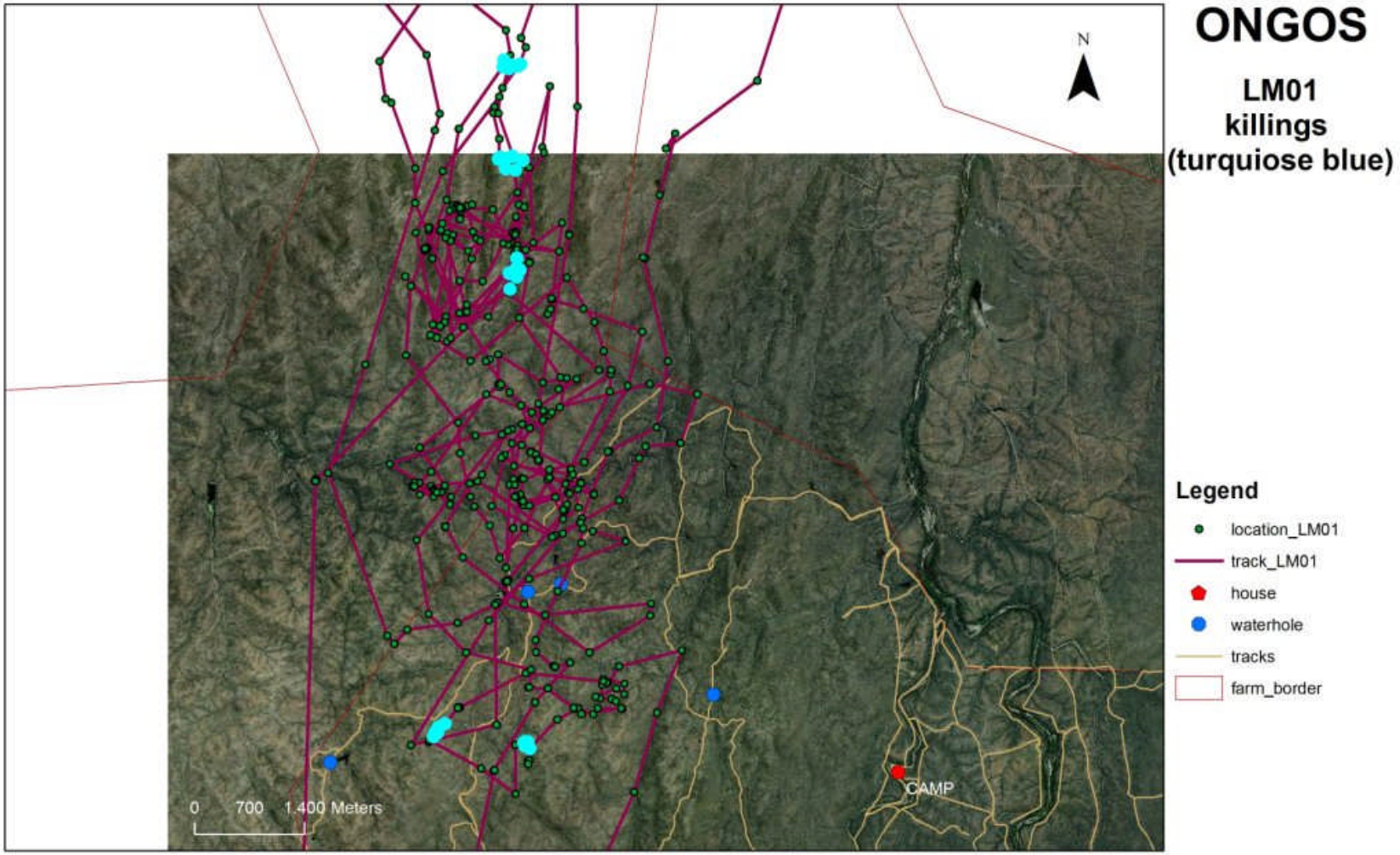

Figure 2.5.1.3e. LM01 killing spots (turquoise blue area) between 11 September and 3 October 2011; neighbouring farm calf kills are the three spots in the North.

The first location after her release was 2.2 km away from the box trap on the following night. On 13 October she rested for the whole day and started moving late in the night. Distance measurements from ten days before she gave birth indicated that she moved an average distance of 2.83 km in 24 hours (Table 2.5.1.3g). On 15 October she started walking along the edges of her home range in the North. She stayed two days in one area and was not very active; probably she had made a kill and was feeding on it and resting close to that area.

Around 25 November her movements changed abruptly. Until the end of 29 November she stayed almost in the same spot, most likely in her den to give birth. Starting in the evening of 29 November she travelled for 29 hours and returned to the den. She then stayed for up to 21 hours in the den before leaving. On some occasions she spent between 24 and 48 hours in the same spot, leaving only for a few hours during the night. After she had given birth, she travelled again for an average distance of 3.46 km in 24 hours. Her travels were punctuated by short bursts of activity or longer periods at the den site.

Table 2.5.1.3g. Distance moved (km) by LF04 from 3 to 13 October 2011 before giving birth.

Day (October 2011)	4	5	6	7	8	9	10	11	12	13
Distance moved (km)	7.60	0.97	1.70	1.38	0.49	3.05	2.23	signal lost	7.03	1.03

Table 2.5.1.3h. Distance moved (km) by LF04 from 11 to 20 December 2011 after giving birth.

Day (December 2011)	11	12	13	14	15	16	17	18	19	20
Distance moved (km)	4.20	1.69	4.38	2.26	4.19	8.00	3.50	5.85	0.00	0.56

In December (between 5 and 26) there was a conspicuous pattern in that LF04 always came back to a particular area. A representation of the same location visited on different days is shown in Figure 2.5.1.3i. After a 36 hour period, with a lot of movement, she was found 610 m East of the den. But during the end of January her movements suddenly changed and she spent five days in the same area without leaving it once. She then travelled 15.36 km in 48 hours and remained again for five days in the same spot, 1.9 km away from the previous rest stop. It is unlikely that she took her cubs with her. One of her other journeys lasted 41 hours (with only a few hours of breaks) and she travelled 13.54 km before she rested for 48 hours. She was seldom found near her cubs' suspected hiding place. The conclusion must be that LF04 had lost her litter for some reason.

During the twenty weeks period that LF04 was monitored, she used an MCP (50%) core area of only 6.32 km^2 and a Kernel core area of 7.08 km^2. Almost all of both core areas were inside the Ongos study site (Table 2.5.1.3f).

Figure 2.5.1.3j shows that there is little difference between MCP 90 and MCP 100. The same is true for the Kernel data (Figure 2.5.1.3k).

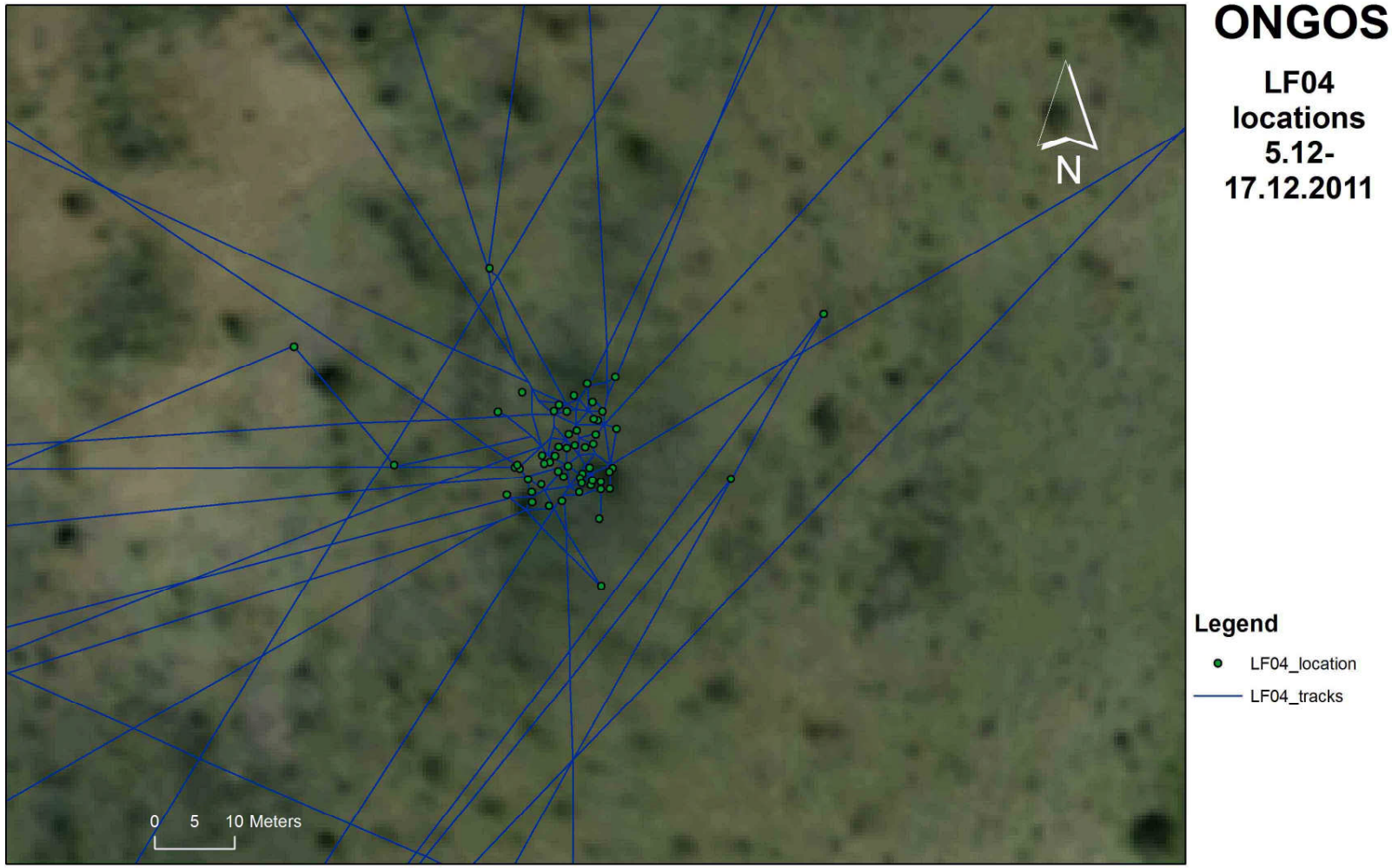

Figure 2.5.1.3i. Location of LF04; visiting same area for several days (5 - 26 December 2011).

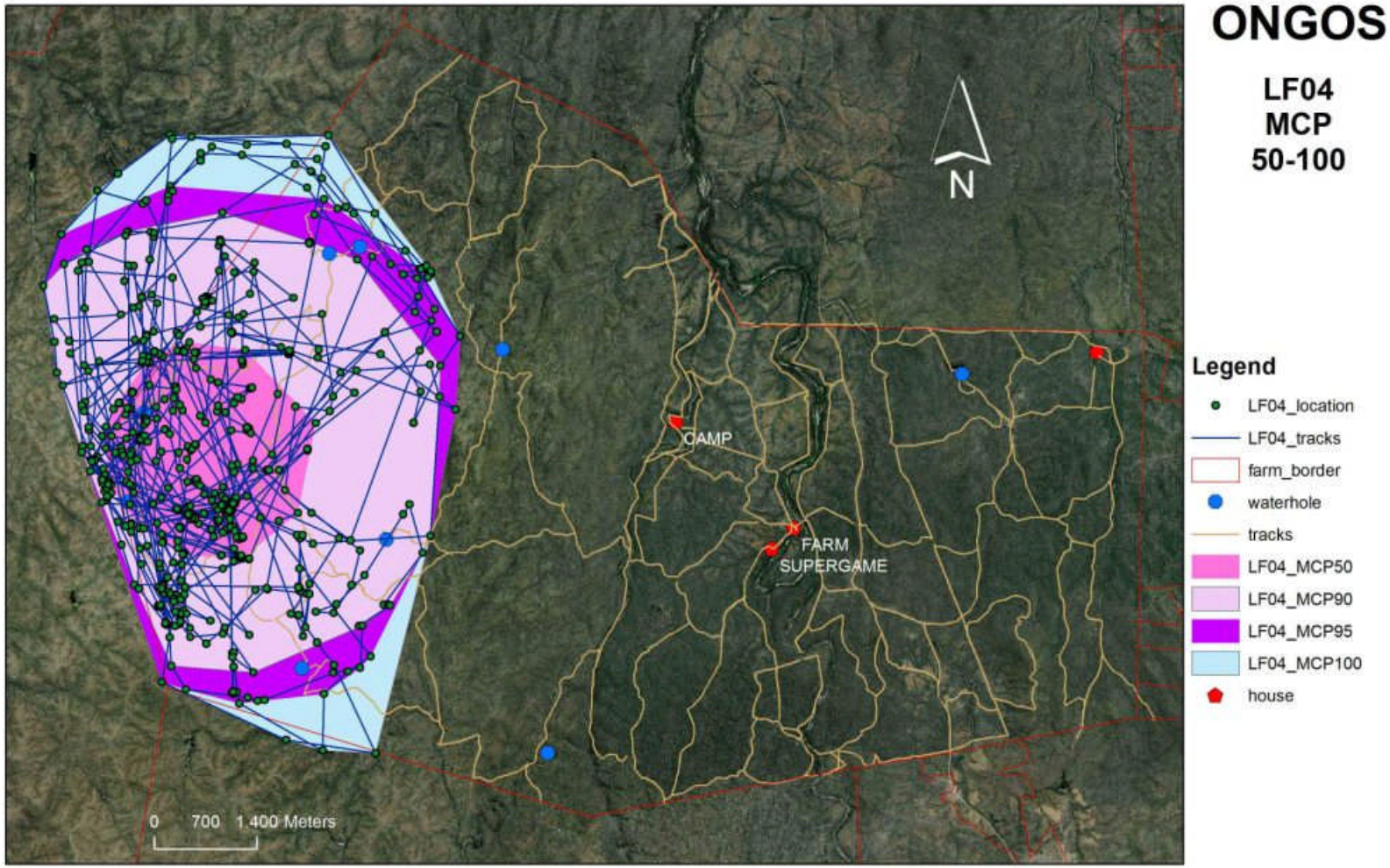

Figure 2.5.1.3j. MCP (50, 90, 95 and 100%) for female LF04 for 3.5 months.

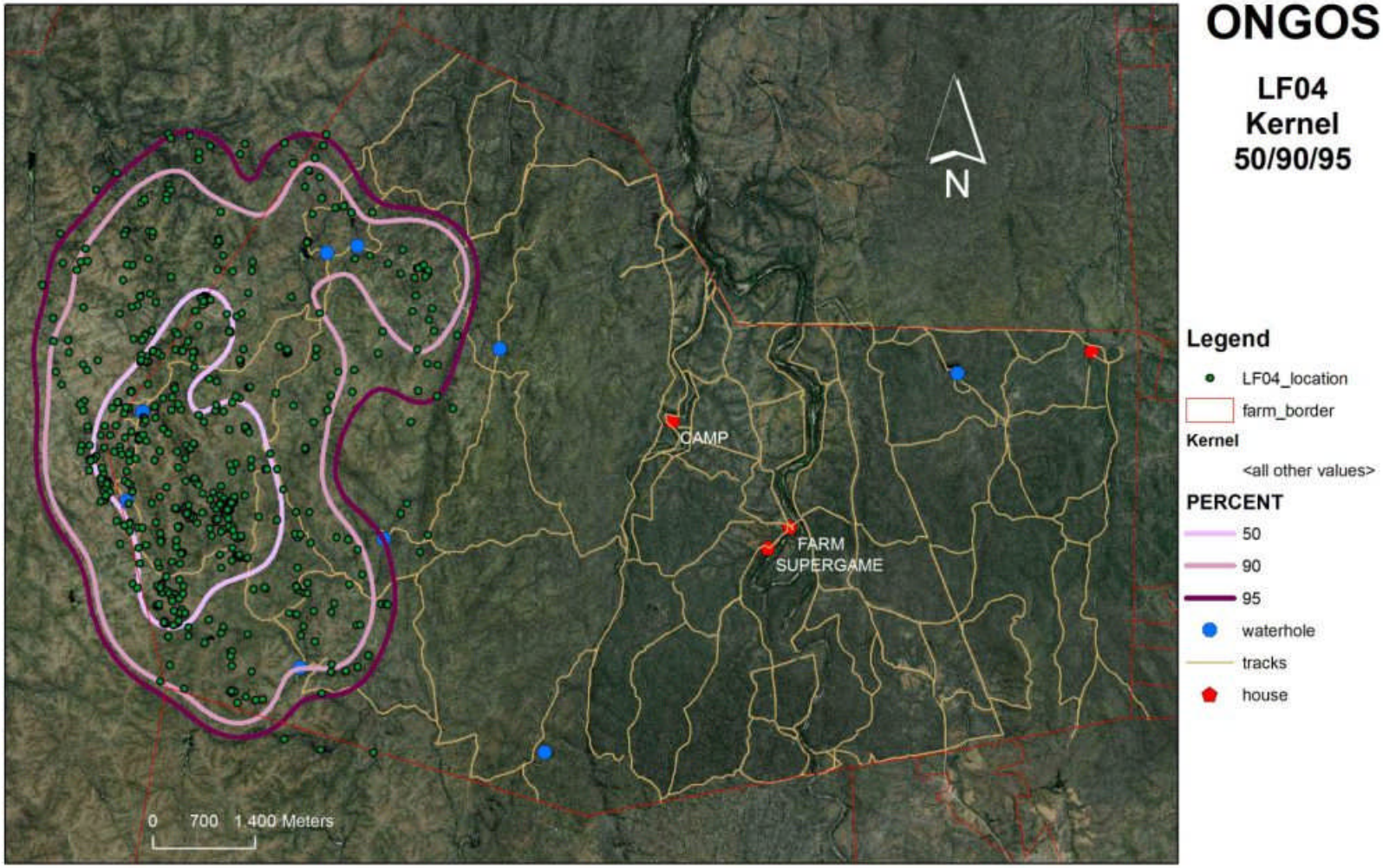

Figure 2.5.1.3k. Kernel description (50%, 90% and 95%) for female LF04.

2.5.1.4. Discussion

Bailey (1993) showed that the average distance between daily movements of individual leopards varies from 0.6 to 3.1 km/day. The daily movement of the leopard investigated (LM01) was over the average and his movement of 64 km in five days was very unusual. Lack of prey availability did not seem to be the reason for this movement. It is likely that instead the animal scouted the area in the North either to extend his home range or to look for a female in oestrus. Bothma and Le Richie (1984) discovered that male leopards in the Southern Kalahari Desert moved a maximum of 27.3 km/day during the non-mating period and 33.0 km/day during the mating period. Male leopards in the interior dune areas of the Kalahari Desert averaged 14.3 km/day, but there prey occurrence is the limiting factor. Leopards seldom remained in the same place on consecutive days; if they did they were usually feeding on a kill. In our study the male leopard moved greater distances than the female. This corresponds with Baileys' studies (1993), which show that female leopards move less than their male conspecifics. In addition LM04 was pregnant, further limiting her movements.

In this study the distance between kills was less than 1.5 km. Compared with other studies by Bailey in different areas and Bothma & Bothma (2005) this is a rather small value. In Bailey's study (1993) the average distance between consecutive kills was 3.9 km for adult male leopards (n=34). Quite a proportion of LM01's diet was cattle calves. Since cattle herds are often clumped and do not move great distances, it is clear that within a small area LM01 could make a number of easy kills.

Almost all home range data available for Namibia are from studies that were conducted in protected areas (see Appendix I). In Namibia the sizes of MCP 95% varied for males between 108 - 229 km^2 and for females 53 - 179km^2 (see Appendix I). The estimated MCP 95% for LM01 was 98.13 km^2. The mean MCP 95% (106 km^2) of other females studied is more than three times larger than the value for LF04. The likely reason for this is LF04's pregnancy and subsequent motherhood, but also the high quality habitat composed of high prey animal densities with restricted movement prevalent on game farms. Home ranges of females are determined by food supply as minimal areas needed for survival and reproduction (Bailey 1993). In addition, the fact that comparable studies in protected areas in Namibia featured low densities (0.6 – 4.5 individuals per 100 km^2; other African countries up to 16.4 individuals per 100 km^2, see Appendix I) shows that their habitat quality was low.

Comparing LM01 and LF04 data suggests that LF04 was capable of surviving in a smaller area than LM01. Remarkably LF04 MCP and Kernel home range data do not differ significantly. Her movement and the utilisation of her home range were philopatric (from Greek home-loving). Females with small cubs usually move outwards in a radial pattern from a central location, harbouring their cubs. This also happened in this study (see Figure 2.5.1.3i). Cubs left behind might be killed if discovered by a predator, so it will be to a female's advantage to hunt close to the cubs' hiding place so she can quickly return to protect them when not feeding or hunting. This behaviour obviously restricts the daily movements of leopard mothers. When LF04 had cubs, she moved longer distances (in a 24 hour rhythm), but spent less time away from the den. Such detailed investigations of leopard behaviour are rare and the data collected during this study make a significant contribution to leopard ecology studies.

2.5.2. Activity patterns

2.5.2.1. Introduction

The daily activity patterns of carnivores range from almost exclusively nocturnal (e.g. large-spotted genets; Fuller et al. 1990), to crepuscular (active mostly at dawn and dusk; e.g. African wild dogs; Fuller & Kat 1990a) to almost exclusively diurnal (e.g. cheetahs; Caro 1994). Activity patterns within a species may also vary with levels and kinds of human activities (e.g. coyotes; Kitchen et al. 2000) or with the composition of competing carnivore species (e.g. jackals; Fuller et al. 1989). Leopards are normally nocturnal or crepuscular (Hunter 2011) partly to avoid competition with other large carnivores such as lions and wild dogs. Under the specific circumstances that prevail on Namibian farmlands, (in particular the absence of competing lions, wild dogs or spotted hyaenas) leopards are almost the top predator and as such avoiding competition becomes a less important factor. Eisenberg and Lockhart (1972) found that where leopards are the dominant carnivore, they are often active during the day in open habitat. However, on Namibian farmland they are the top predator, but they still have to fear humans, which are very likely to affect leopard behaviour.

Hunting of leopards was banned on Ongos in 2002. It is unknown, but likely, that leopards were hunted on Ongos before the ban. Occasionally surrounding farmers shoot leopards legally for trophy hunting and due to conflict with their livestock.

Activity patterns of leopards have been studied on several occasions with the help of radio telemetry and by visible observation (Hamilton 1976, Bailey 1993), but not in the detail, which was possible with the technique described here. A central question of this study was therefore how leopards adapt their activity and movement patterns on farmland habitat.

2.5.2.2. Methods

The GPS collars manufactured by Vectronic Aerospace, Berlin, contain two sensors orientated in longitudinal and transversal directions for activity measurements. For activity analysis the data of the two acceleration sensors are summarised and plotted as an actogram. They show the activity coded in different colours in daily records, which are displayed one beneath the other (Figure 2.5.2.3a). Activity data of one day were averaged to daily means (Figure 2.5.2.3b; daily means) and activity data of one week were averaged to weekly mean activity (Figure 2.5.2.3c). In the same way, the daily day/night activity relationship (diurnality index) was calculated. This index can vary between 1 (no activity at night) and -1 (no activity during the day). UTC (Universal Time Coordinated) correction is necessary to plot the data in local time. Nautical dawn/dusk is defined to begin in the morning and end in the evening when the sun is geometrically 12° below the horizon. At this time at dawn the outlines of ground objects might be distinguishable for humans and most mammals should be able to see properly at this time.

As these datasets amount to large volumes of data, they can only be obtained once the collar is retrieved. Therefore in the following activity analysis only LM01 is considered, as his collar was retrieved after LM01 was killed by the neighbouring farmer.

2.5.2.3. Results

LM01 activity data were analysed for the whole data recording period of 55 days from 11 August until 5 October 2011.

After his release (12 August 2011) LM01 was active in the late morning (~10.00) and before sunset and rested at night. Basically, this leopard was especially active just before dawn and then again at dusk. The activity period in the morning was longer than the one in the evening. During the night he was repeatedly active, while in the late morning until the evening he usually rested. From 09.00 until 17.00 he was usually inactive with a few exceptions (Figure 2.5.2.3a). In the following weeks his mean activity level did not vary considerably (20.1%) except in the week of 4 September (30.7%) (Figure 2.5.2.3c). By the end of August he showed higher activity in the morning and was moving around Ongos and the neighbouring farm to the West. On 2 September he started to move to the North. He was then even active at noon and in the evening when he was 9 km away from the place where he was captured. During the night of 3 September he travelled the whole night (see the violet areas in Figure 2.5.2.3a). In the late evening he was 19 km and one day later more than 28 km away. He then started to move back to his home range on Ongos.

A local farmer reported calf kills on 7 and 19 September. Around 14 September there was another kill and LM01 was not very active until 16 September, most likely because he was resting and digesting. During the following days, particularly the first two nights, his activity level was very high (Figure 2.5.2.3d). In general LM01 often had quite high activity levels during the night (minus value, Figure 2.5.2.3d) as would be expected for this nocturnal predator. However, a clear nightly pattern showing peaks around the midnight hours is not apparent (Figure 2.5.2.3a). In general LM01's diurnality index presented very irregular values.

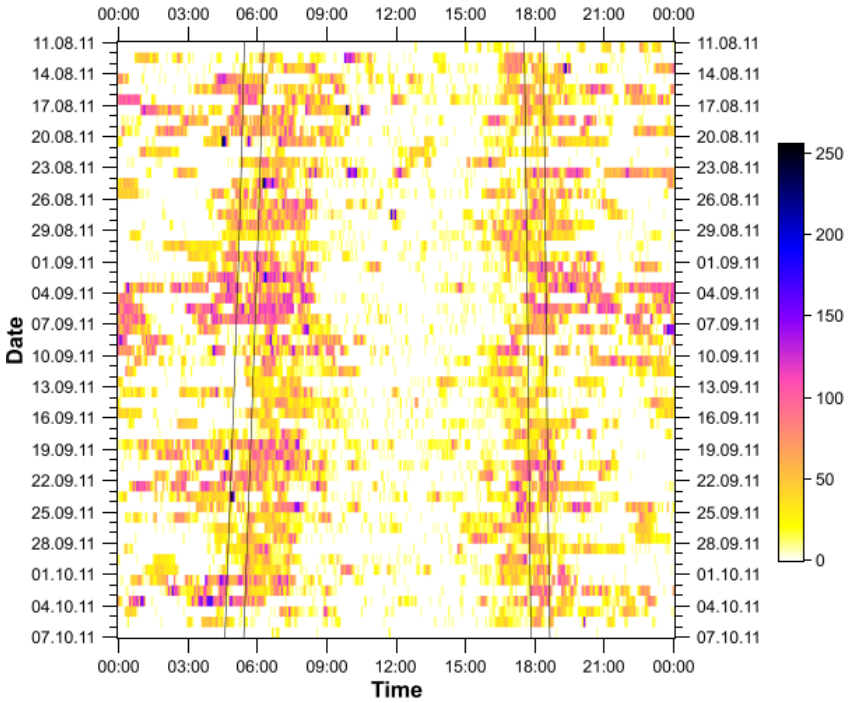

Figure 2.5.2.3a. Actogram: LM01 activity plot from 11 August to 5 October 2011; sunrise and sunset is indicated by black lines, outer line indicates nautical dusk and dawn.

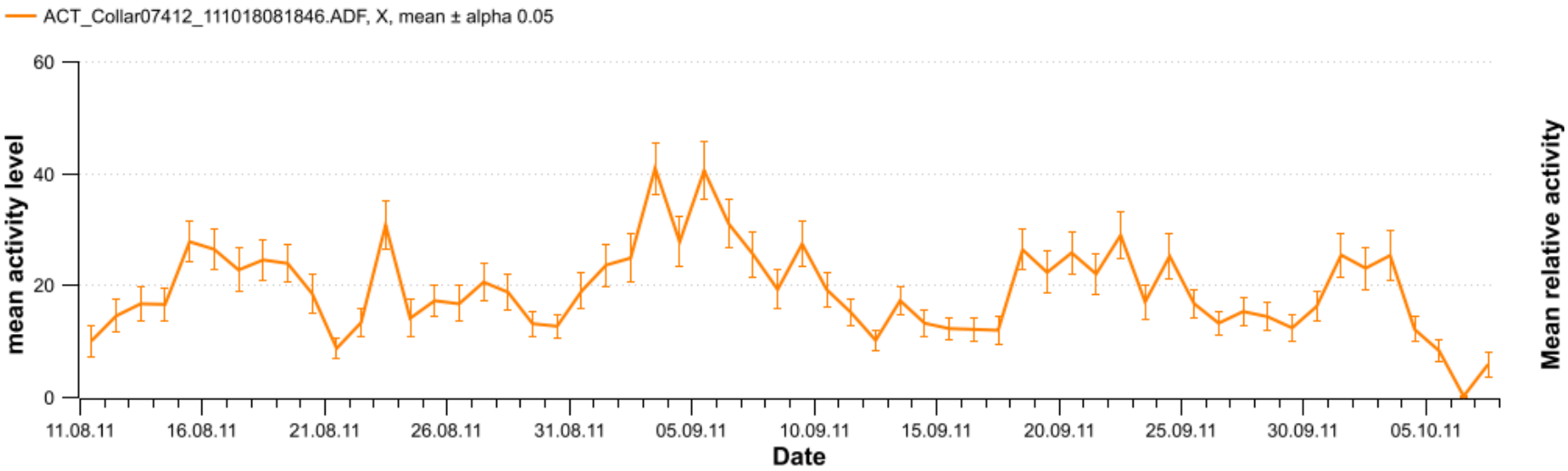

Figure 2.5.2.3b. LM01 daily mean activity level.

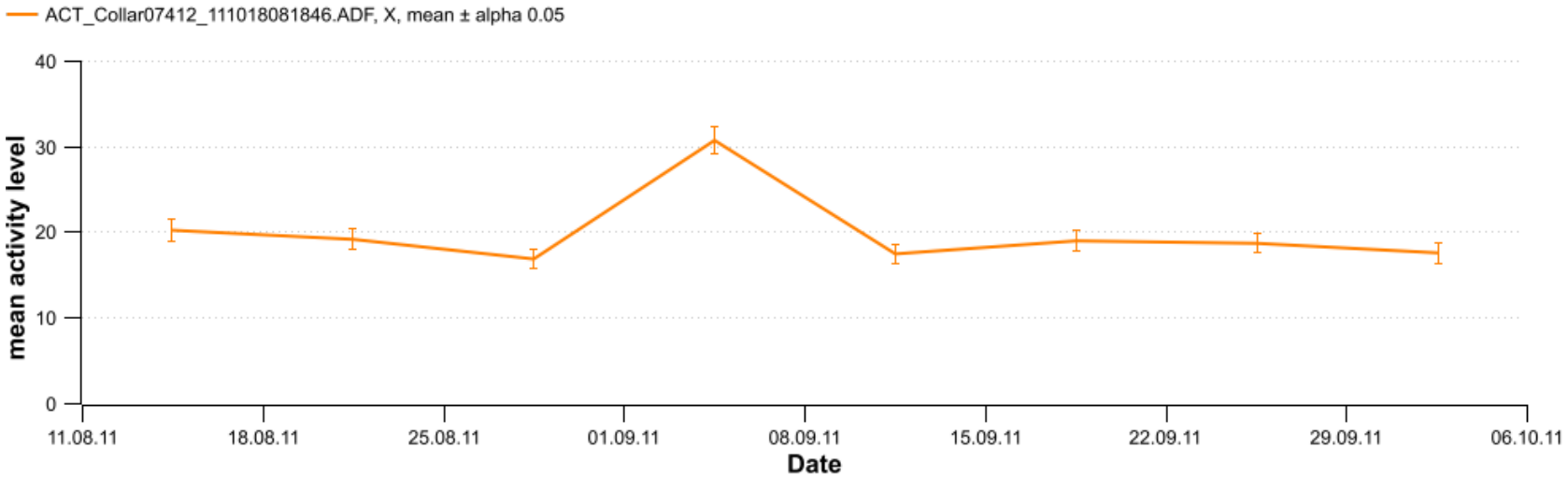

Figure 2.5.2.3c. LM01 weekly mean activity level.

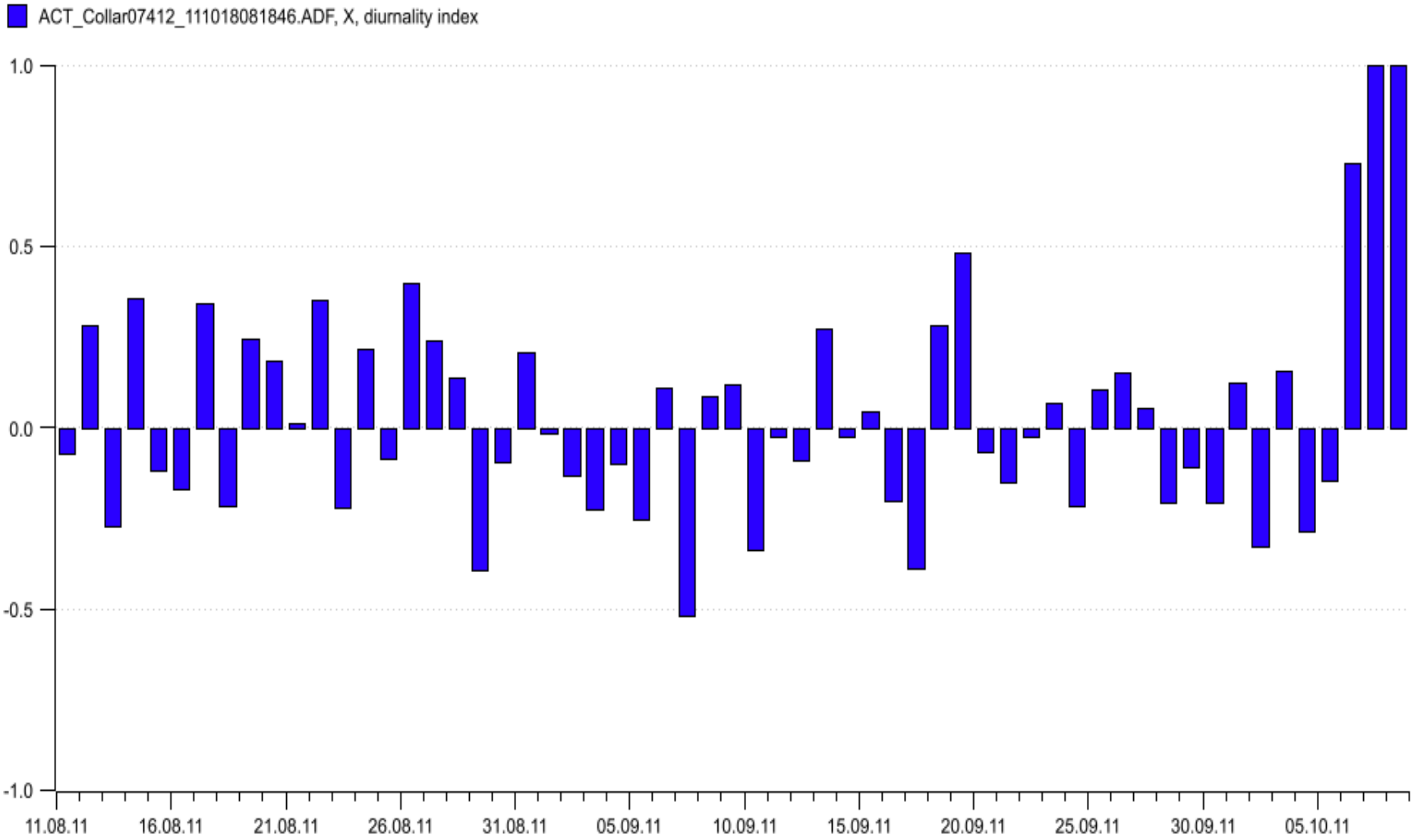

Figure 2.5.2.3d. Diurnality index indicates the relationship between the day/night activity levels (set in relation to the length of day by LM01 for 55 days in 2011).

2.5.2.4. Discussion

This study measured the activity of a male leopard in its natural habitat continuously over a period of 55 days.

Unsurprisingly there was nearly no activity during the day around noon, the hottest part of the day.

When there is activity, different forms exist: walking, resting, feeding, hunting, courting, hiding, and travelling. LM01 (estimated age 4 years) travelled far to the North (28 km away from his core area). Travelling this far is more characteristic younger male leopards (Bailey 1993) in search of a vacant area. A female in oestrus might be a reason why LM01 left his range. Bailey's studies showed that males travelled rapidly while exploring and that travelling was primarily a nocturnal activity and resting a daytime activity. In this study resting was the dominant activity during the day too. But resting LM01 was alert and changed positions frequently. The collar registers even these small movements such as head turns, albeit as low activity values. The activity data indicate that LM01 fed on a carcass even in the daytime. Depending on the previous prey weight, this leopard should have made a new kill approximately every 5 to 7 days. But at the end of September he killed three calves within 10 days.

Although leopards are the dominant predators in the study site, evidence presented here suggests that they do not change their activity patterns in a way that Eisenberg and Lockhart (1972) predicted in their studies. The question whether leopards on farmland are less active during the day because of avoiding human encounters and hot temperatures and/or to increase the possibility of a successful hunt remains unanswered.

Activity information of the VHF collared leopards was considered by this study too. Two female leopards were fitted with VHF collars, one in May 2010 and the other in August 2011.

Throughout the study it was possible to pinpoint only four locations of the female collared in August (LF03) before she apparently disappeared. For three more months attempts were made to receive a signal without success. Data were collected only during the day and LF03 was inactive on all four readings. These data are not sufficient to draw further conclusions.

More location and activity information points were collected for the female collared in May, (LF01) because she remained by and large on the Ongos study site. Direct observations of that leopard were rare, however. Most signals and observations showed her resting. Some observations made during the night suggest that LF01 was active frequently. This is a pattern that would be expected and no further conclusions can be drawn because of the paucity of data.

2.6. Predator abundance, interspecific encounters and identifying individuals

Monitoring the abundance and distribution of animals is fundamental to research, management and conservation of wildlife populations. Large carnivores are particularly difficult to study, as they range widely, occur at low densities, capture probabilities are heterogeneous between different individuals and they are often secretive or elusive (Karanth 1995, Boulanger et al. 2004). Direct assessments of population density depend on recognition of individuals and groups and as such they are very expensive and time-consuming (Stander 1998). Indirect sampling methods (Becker et al. 1998, Mills et al. 2001) are cost-effective, objective and repeatable, but the results are scientifically questionable (Norton 1990). In general, recordings of predator tracks are designed to provide presence/absence data only, but by following tracks of foraging cats, a wide range of additional data about behaviour such as prey-encounter frequencies, hunting success, prey species selection, home range use, and social interactions can be gathered (Stander et al. 1997). Because of logistical and practical problems, physical capture and tagging is typically difficult to use as a tool for demographic studies. One further non-invasive method is photographic captures from camera trapping. Photographic capture of individual leopards, together with information on date, time, and capture location provide the basic data for population analyses (Karanth et al. 2004). Photos thus obtained can be used to identify individual animals and may add valuable information towards population density estimates and population dynamics. Results from the capture/recapture methods can be examined by the program CAPTURE (Otis et al., 1978, Rexstad & Burnham 1991). This program offers different models to calculate population size.

2.6.1. Tracks survey

2.6.1.1. Methods

Twelve different transects were designed for track counts. GPS positions were recorded for all leopard, cheetah and hyaena tracks found. Data such as date, number of animals, sex and age class, age of track (very fresh, fresh, old, not sure) and track size (pad width, pad height, total width, total length), direction of track, start and end point of the track and further comments were recorded.

2.6.1.2. Results

Track analyses evaluate presence/absence of different predators. Table 2.6.1.3a and Figure 2.6.1.3a show the distribution of large carnivore tracks. The dominant animal is clearly the leopard. 192 leopard tracks were recorded, 57 brown hyaenas, 4 caracal, 3 aardwolf and 1 cheetah track. Results from 2011A and B are summarised in Table 2.6.1.3a. Very few data points were collected between January and March 2011 due to the extremely high rainfall.

Table 2.6.1.3a. Predator tracks found.

Species	Tracks found (total)	2010	2011
Leopard	192	109	83
Hyaena	57	41	16
Caracal	4	2	2
Aardwolf	3	0	3
Cheetah	1	1	0

Leopards ranged all over the study site (Figure 2.6.1.3a). Often tracks were located close to each other. Leopards used two of the three roads into the mountains frequently (North and Middle Path). A path next to a 32 ha enclosure with a castrated male leopard inside (until March 2011), was often patrolled by leopards. Virtually all leopard tracks had a high overlap with other predators. Two tracks of foraging leopards could be followed and a fresh hartebeest and warthog kill were found. Both were killed by the female leopard LF01 (see 2.7.3.3.).

Figure 2.6.1.3b shows different predator tracks in both years. Aardwolf tracks were found in 2011, but that is likely to have been because of more tracking experience in that year. Tracks of caracal were always detected in or close to the mountains. An almost equal number of hyaena tracks were identified in the mountains and plains areas. Close to the camp and on the way up to the mountains in the North of the farm, a high track frequency of brown hyaena was found. Tracks were often found next to places with water and even to the South of the farm close to Katutura too.

2.6.1.3. Discussion

Results of these non-invasive methods show that different predators occur on Ongos. Leopard roaming patterns were identified by analysing tracks. Box traps and camera traps were installed in those locations that are highly frequented.

Stander and other researchers deduced relative density of predators with the help of track records. Stander (1998) first identified all leopards in a study area, based on the assumption that experienced San trackers could identify these animals individually from their tracks (Stander et al. 1997). The counts were then calibrated against the known cat population size. This is a useful method, however, the data gathered in this study does not allow an accurate estimate of true population densities for leopards on Ongos. The low amount of caracal and aardwolf records might be because these species are hunted by leopards and therefore avoid areas of high leopard density, such as Ongos.

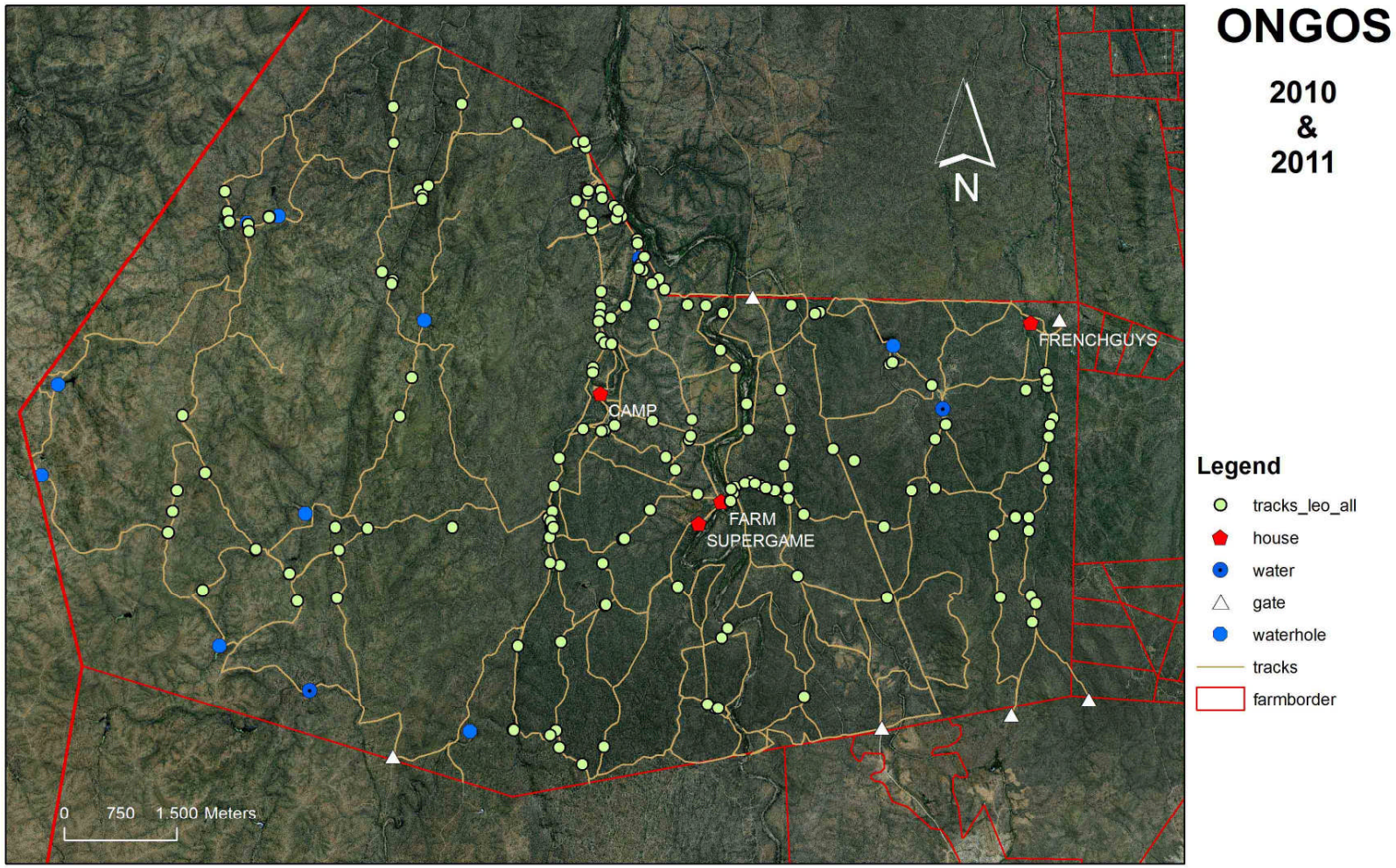

Figure 2.6.1.3a. Leopard tracks 2010 and 2011 (green).

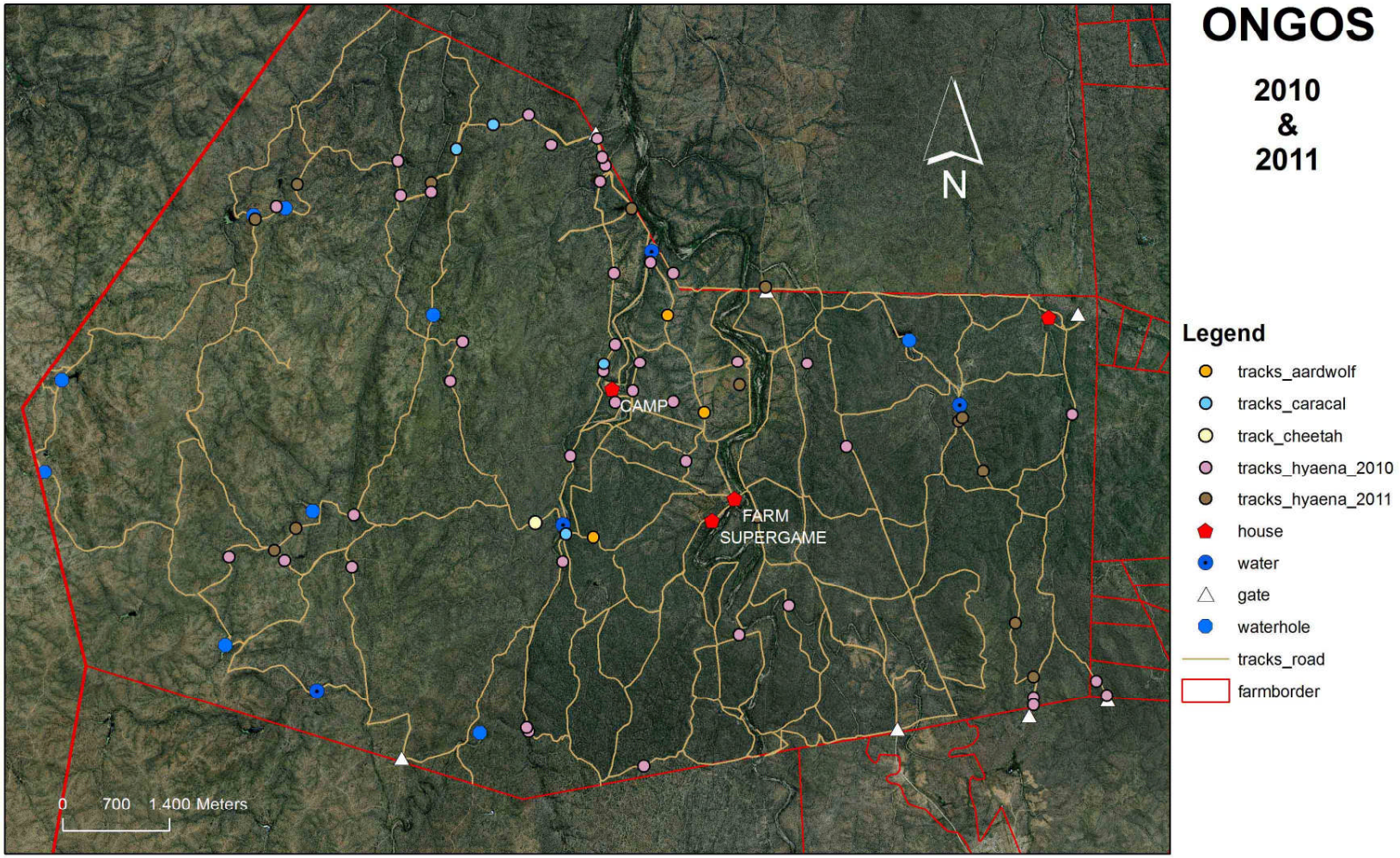

Figure 2.6.1.3b. Tracks of aardwolf (orange), caracal (light blue), cheetah (yellow) and brown hyaena 2010 and 2011.

2.6.2. Camera traps

2.6.2.1. Methods

Two different brands of camera traps (Bushnell and Stealth Cam) were deployed during the study. Both were equipped with SD memory cards up to 2GB (yielding up to 2000 pictures at medium quality setting). Camera traps were positioned either in wildlife hotspots close to natural or man-made water sources or scattered over the study site mostly alongside vehicle tracks. Camera traps were checked two to three times a week to exchange SD cards, make minor adjustments and verify battery status. Single leopard individuals were identified by the use of pictures, which were taken during the study period. The coat pattern of each individual leopard is unique and individual leopards could be identified based on the photos taken by the camera traps. The program Camera Base (Version 1.4, Tobias Dobler) was used to organise camera trap pictures and make analyses. Leopard abundance was estimated using the program CAPTURE (Rexstad and Burnham 1991). This program offers different models and identifies which model fits the data set best and then generates capture statistics for all models (Jackson 2006). The null model (M_0) assumes that capture probability is the same for all individuals and is not influenced by behavioural response, time or behavioural heterogeneity among individuals. The most important statistical requirement to calculate population size based on mark-recapture data is the assumption that the population is closed (no immigration, no emigration, no mortality and no birth) during the sampling period. To meet this requirement, a sampling period of 60 days was chosen. In order not to overestimate the research area, a buffer needed to be added. To estimate the area effectively sampled (A), a convex polygon connecting the outermost camera traps plus a buffer area, where width (W) is an estimate of half the home range length, for female leopards in the sampled area was computed following Karanth and Nichols (2004).

2.6.2.3. Results

Capture success

Sampling over 60 days was conducted from 4 October to 20 December 2010, 10 February to 10 April 2011 and 5 August to 3 October 2011. Camera traps were placed at strategic points (based on fresh tracks, kills, scats found, etc.) around the study site. Eight camera traps were used in the first two surveys, 12 in the last. Baboons and eland destroyed two camera traps. Another camera stopped working due to water ingress during heavy rain.

In 2010 and 2011, 24, 23 and 32 events were recorded respectively, where an event is an individual leopard being captured by a camera trap, representing capture successes of 40.0, 38.3 and 53.3 individuals per 100 trap-nights for the whole study period (Table 2.6.2.3a). This equals one leopard capture for every 2.5, 2.6 and 1.8 nights of trapping, respectively. Altogether 79 events were recorded. A total of six different individual leopards in the study area were identified (Table 2.6.2.3a). In 2010 four leopards were camera-trapped, judged to be one adult male, two adult females (LF01 & LF05), and one juvenile of unknown gender (LX01) related to one of the females (LF05). In the beginning of 2011 three individuals were recaptured: two adult females and the by then sub-adult cub of LF05, along with one new female (LF04). During the third sampling period starting in August 2011 all three females (LF01, LF04 & LF05) and the cub LX01 of LF05, as well as one male from the first survey in 2010 were recaptured. One new male was also recorded.

Table 2.6.2.3a. Camera-trapping effort and leopard captures in the study site 2010 – 2011.

Year	Sampling period	Trap stations	Leopards	Identified individuals
2010	4 Oct - 2 Dec	8	24	4
2011	10 Feb - 10 April	8	23	4
2011	5 Aug - 3 Oct	12	32	6

Identification of leopard photos

Individual cats can be identified by their unique spot pattern.

Four leopards were drinking simultaneously on the same waterhole (Figure 2.6.2.3d left picture). Two animals were identified as mother (LF05; notch ear) with her cub (LX01). It is very rare to have four different leopards photographed on the same picture.

It is also noteworthy that the collared female (VHF, LF01, Figure 2.6.2.3b) and the female with the cut ear (LF05, Figure 2.6.2.3d) appear to have been resident on Ongos (many camera trap pictures from both years were taken). In 2010 pictures of LF05 showed her accompanied by a young cub. In the following year that cub was still with her at an estimated age of 14 months.

In June 2011 the first cheetah picture (Figure 2.6.2.3e) was taken during the night close to the man-made Davidspost watering place and in 2010 cheetah tracks were found in the mountains (Figure 2.6.2.3b). No more additional sightings of cheetah were recorded during the study period.

More than half of the caracal pictures were taken in the mountains and only three pictures were taken of aardwolves during the day (not recorded in Table 2.6.2.3b, but see Figure 2.6.2.3b).

Table 2.6.3.2b. Camera trapping pictures of different predators.

Year	Sampling period	Brown hyaena	Caracal	Honey badger	African wildcat	Jackal
2010	Sep - Dec	11	3	6	3	20
2011	Feb - April	7	2	4	0	11
2011	Aug - Nov	25	2	7	27	59

A large number of brown hyaena and jackal pictures were taken during all sampling periods. All of the predators shown in Table 2.6.2.3b avoid encounters with leopards as none of them were detected in leopard scats (see 2.7. Prey and feeding ecology).

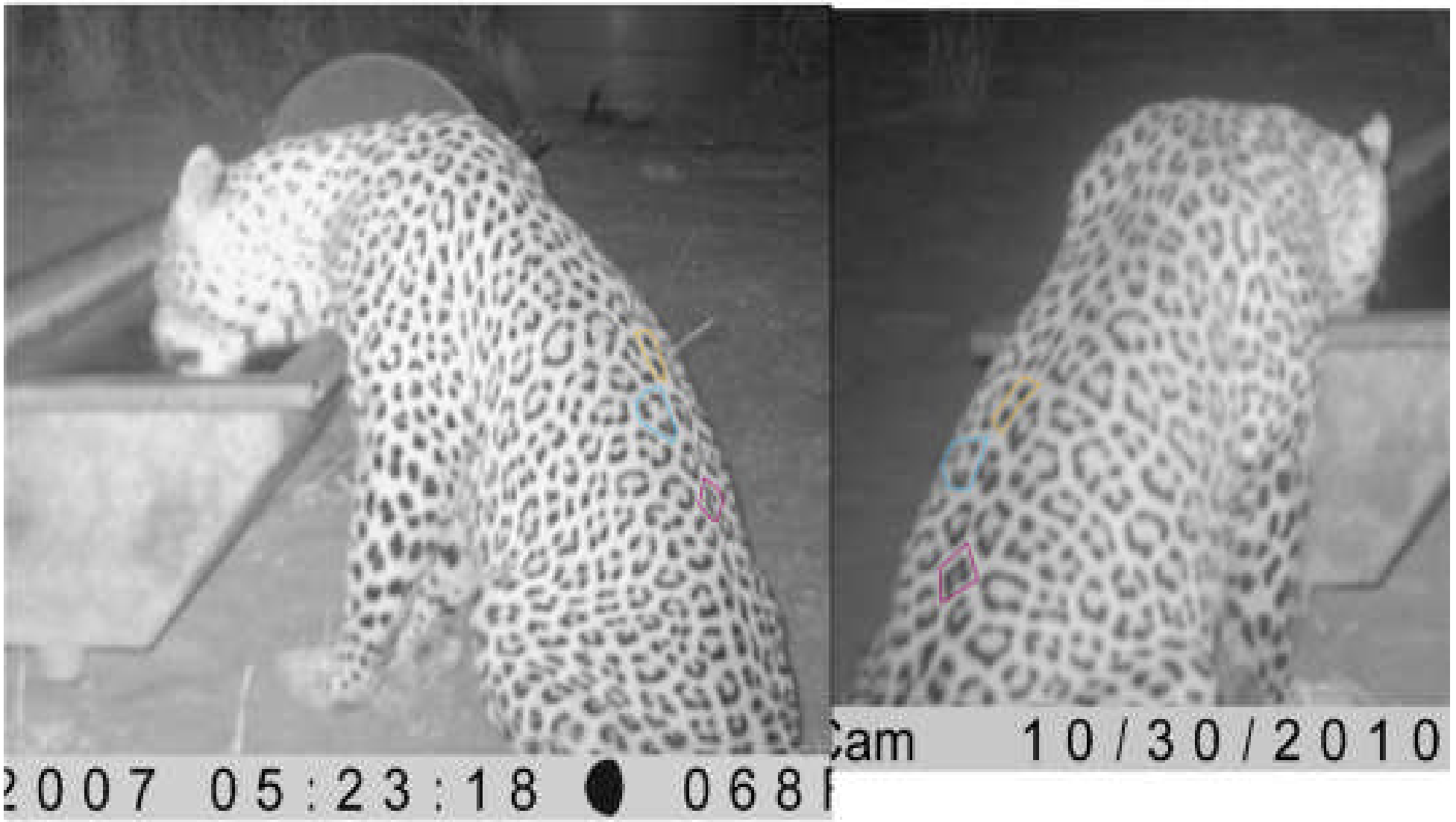

Figure 2.6.2.3a. Identification example: same individual (left picture: date should be 2010!) gender unknown; for identification see identical spot pattern on the back (marked orange, blue and violet).

Figure 2.6.2.3b. VHF collared female LF01 (day & night).

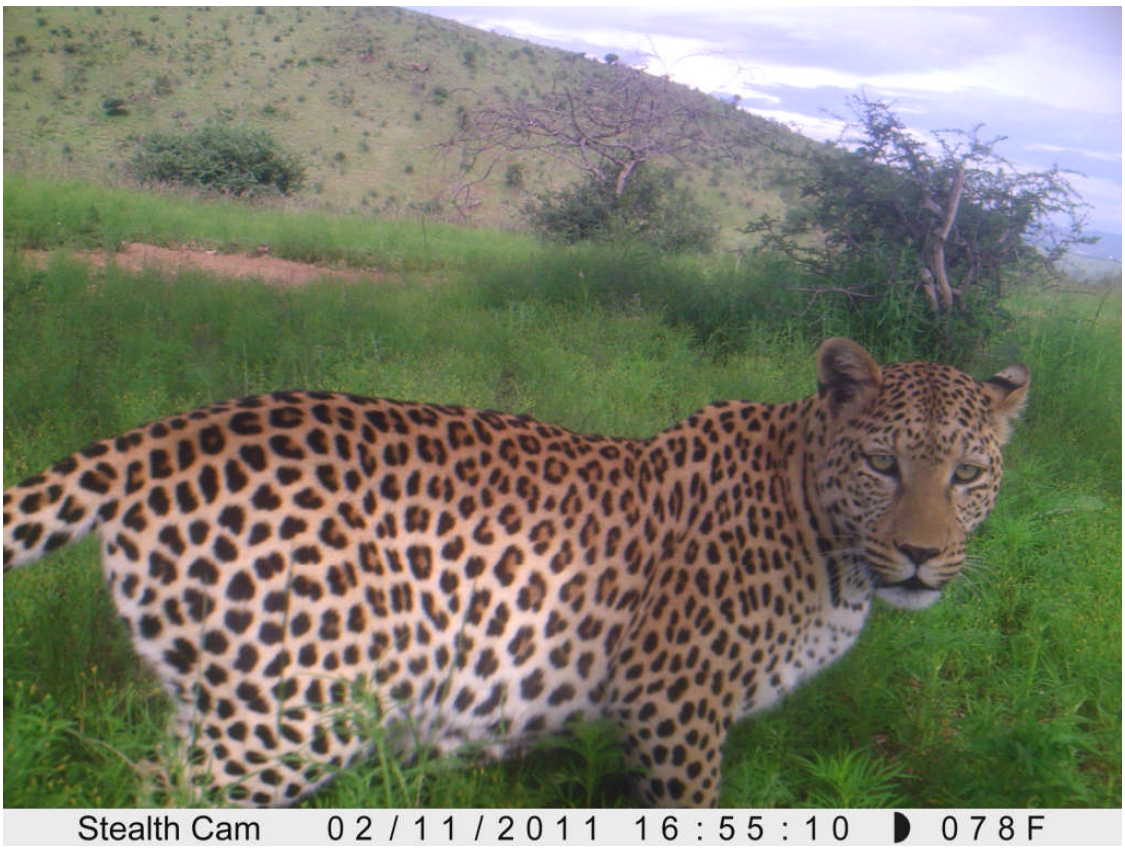

Figure 2.6.2.3c. Female LF04. Top picture taken in February 2011 in the mountains; bottom picture taken in October during collaring.

Figure 2.6.2.3d. Top: female FL05 sitting, right ear with notch with juvenile (LX01 in front of LF05, lying) and two other leopards (not identified) hiding behind the bush. Bottom: 2011 subadult (LX01) with mother LF05.

Figure 2.6.2.3e. Single cheetah picture taken in June 2011.

Figure 2.6.2.3f. Aardwolf (top) and caracal pictures (bottom).

Estimates of leopard capture probabilities, population size and density

The CAPTURE test for closure supported the assumption of population closure (i.e. no immigration, emigration, births or deaths) during all surveys. CAPTURE selected the null model for all three surveys. Relatively high capture probabilities (0.229; the probability that a leopard in the sampled area is photographed on a single sampling occasion) (Table 2.6.2.3c) were recorded during the first year and lower ones in 2011 (0.187-0.089). The sample population was estimated to be four leopards (SE +/- 0.469, 95% CI 4–4 individuals) for 2010. In the first survey of 2011 the population was estimated to be four leopards (SE +/- 0.694; Cl 4-4) too. For the second survey in 2011 the sample population was estimated to be eight leopards (SE +/- 3.025, Cl 7-22). When computing the 95% confidence interval, CAPTURE converts the values to the nearest integer rather than printing decimals (Jackson 2006).

Table 2.6.2.3c. Results of population closure, capture probabilities, estimated abundance, standard error and 95% confidence interval of leopards sampled on a game farm, Namibia 2010–2011.

Year	Test for closure	Null Model (M_0)		95% CI
		Capture probability	Abundance (SE)	
2010	z= 0.777	0.229	4 +/- 0.469	4-4
	P= 0.781			
2011A	z=-1.258	0.187	4 +/- 0.694	4-4
	P= 0.104			
2011B	z=-1.504	0.089	8 +/- 3.025	6-22
	P= 0.066			

For the survey in 2010 four individual leopards were estimated to occupy an area of 15.39 km^2 (ct2010polygon, see Figure 2.6.2.3g). The buffer width (half of the home range length) was 4.4 km. The estimated effectively area sampled was 148 km^2. A density of 2.7 individuals/ per 100 km^2 was calculated. For the third survey (2011B) six leopards, a camera trap polygon area of 43.03 km^2 and an effectively sampled area of 222.30 km^2 were calculated. There was remarkable agreement in the estimated leopard density, which computed as 2.7 individuals per 100 km^2 for the 2011B survey too.

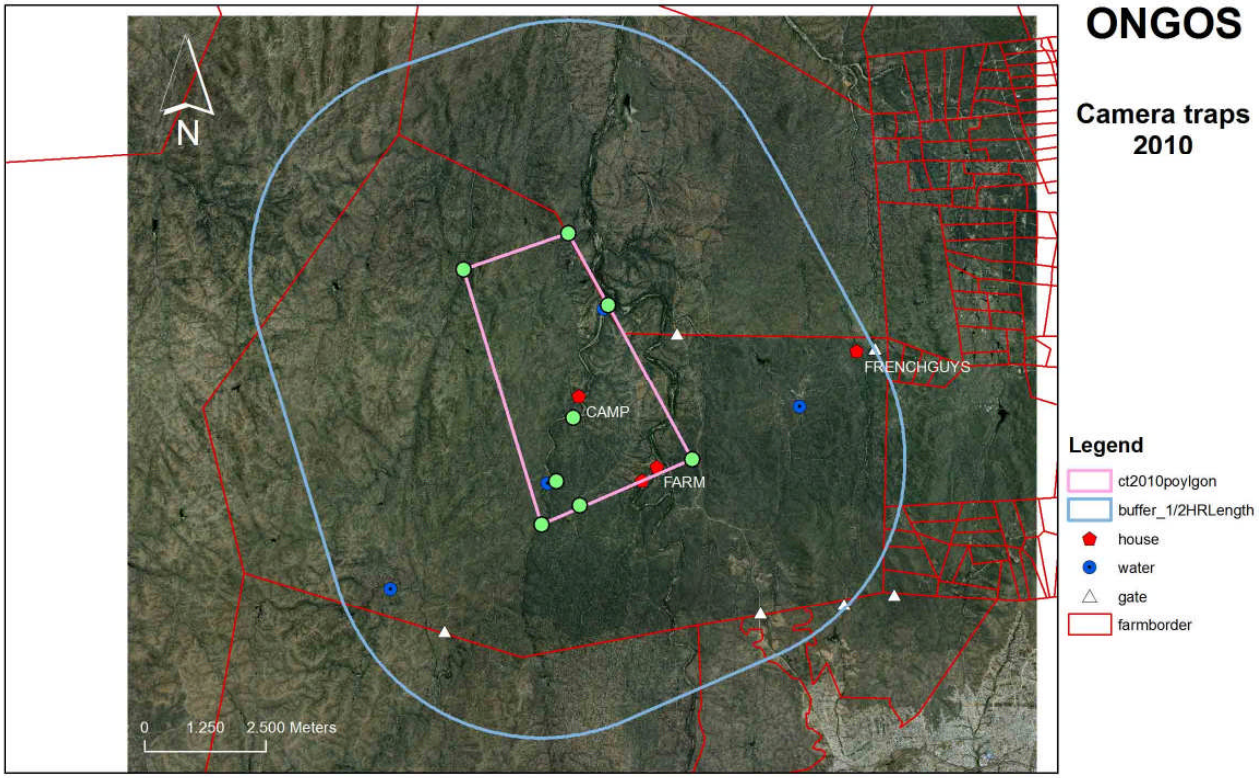

Figure 2.6.2.3g. Camera trap survey 2010 effectively sampled area (camera trap polygon and buffer).

2.6.2.4. Discussion

The camera-trap survey was conducted to record the presence of different predators. 266 pictures of all predator species prevalent in the area, such as leopard, caracal, brown hyaena, jackal, aardwolf and honey badger were recorded. Apparently there are more jackals per study area than leopards as shown by camera trap pictures (90/79), yet leopards are the dominant predator due to their greater strength, size and stealth. In general, on Namibian farmland, the leopard is the only competitor for brown hyaena and cheetah, and the latter is therefore likely to avoid areas where many leopards occur. This and the bushy, mountainous terrain explains the very low detection rate of cheetahs during this study with only a single picture taken and one track found. Brown hyaenas and leopards can and do coexist, but they try to avoid each other. Generally, leopard and brown hyaena are better adapted to poorer habitat conditions than cheetah (Estes 1997). The conclusion is therefore that the dominance of leopards and the hilly and bushy habitat are limiting the cheetah population.

Camera-trapping was also used to identify individual leopards and to estimate leopard population size and density. Over the study periods leopard density remained remarkably constant at 2.7 individuals per 100 km^2. This finding corroborates Hansen and Stander (2004) who report 2.5 – 3.8 individuals per km^2 and demonstrates that the study site is located in a high leopard density area.

Two females were regularly detected by the camera traps and one of them was always accompanied by a litter. By the second camera trap survey, another female was indentified and subsequently captured and collared with a GPS collar. When she was captured, she was pregnant. These observations suggest the study area harbours a healthy cohort of breeding females and possibly also a stable population. An increase in the leopard density was detected at the end of 2011, but this is likely to be an effect of using four additional camera traps.

The camera-trap survey produced meaningful results, but small sample sizes from low-density, cryptic carnivores (Karanth and Nichols 2002), which makes precise analysis difficult. Karanth and Nichols (1998) noted that CAPTURE performs poorly with population sizes of 20 or fewer individuals. Therefore, the statistical analyses performed here and based on just 6 recaptured individuals can only be an indication of reality.

Results suggest a tendency to underestimate population size when using camera trap pictures as the primary source of information. We physically captured eight leopards on Ongos (2010 and 2011, see 2.4.) but only two of them were photographed regularly before and after the capture.

At a minimum, camera-trap surveys can yield the minimum number of leopards present and trapping efforts can be viewed as an index of relative abundance providing capture probabilities (Jackson 2006). The standard error of our estimated population size (3.02) in the third survey and probabilities of captures per occasion (mean 0.16) are comparable to other camera trapping studies of large felids such as Karanth and Nichols (1998), Silver et al. (2004) and Karanth et al. (2004).

Leopards were captured in all camera trap locations, in the plains and in the mountains. Although further studies on habitat preference are needed, this is an indication that leopards do not just prefer mountainous habitat, as is often said, but were nearly equally active in the plain, shrub-dominated Eastern part of the study side.

Overall results suggest that local conditions are particularly favourable for leopards with abundant prey, good habitat features and minimal competition from other predators or, crucially, humans.

2.7. Prey and feeding ecology

The Africa-wide problem of human-predator conflict due to predation on livestock is well documented. But large carnivores can come into conflict with people due to predation on game species too. Where wild ungulates are utilised by people for either commercial gain (commercial hunting and game farming) or for eco-tourism purposes, competition and conflict may occur between land (and thus game) owners and large predators. With the advent of game ranching, game prices for most species have increased by more than 50% over the last 20 years. Many game farms are stocking up with rare and valuable species such as roan (*Hippotragus equinus*) and sable (*Hippotragus niger*) antelope, resulting in a large increase in their value in recent years. People's attitudes to and tolerance of predation by wild felids varies widely. Antipathy towards carnivores may be a result of historical or cultural attitudes as well as based on past experiences and personal perceptions. Farmers often mistakenly believe that removal of carnivores will protect ungulate populations.

Traditionally, the predominant line of defence for Namibian game farmers has been the erection of electric fences (to protect rare and expensive game species) supplemented by the killing of predators that transgress these boundaries. Electrification should be 70-80% effective, but the price of fence maintenance and electricity is frequently prohibitive (Marker-Kraus et al. 1996). One of the main problems with fencing comes from warthogs (*Phacochoerus aethiopicus*), aardvarks (*Orycteropus afer*) and porcupines (*Hystrix africaeaustralis*), all of whom dig holes under fences and hence provide access for leopards and other predators (Schumann et al. 2006). Here use of swing gates could minimise the predator numbers coming onto a farm or game camp (Schumann et al. 2006). Both the material and labour costs of erecting and maintaining electric fences are high and thus often not readily acceptable. Practical solutions to minimise the risk of predation, especially in a game ranch setting and/or means of identifying (with subsequent removal of) real "problem predators" out of a system are sadly lacking.

This chapter focuses on the study site's composition of prey, on the diet of leopards and a brief comparison of the diet of different predators, for instance hyaena, caracal and jackal. Prey abundance will be tested against prey catchability hypotheses. The first hypothesises that leopards kill prey that are most commonly available (prey abundance hypothesis, Hopcraft et al., 2005), whereas the second catchability hypothesis postulates that leopard hunt prey that is easier to capture, regardless of its frequency (Balme et al. 2007).

Scat analysis is used to understand the prey preferences of leopards and obtain further insights into predation habits, thus elucidating if diet overlap and potential competition among carnivores and even smaller prey occurs. Such findings are very important to demonstrate predator dietary preferences and thus enable game ranchers to manage optimally predators on their land. Information gleaned can be incorporated into farm management and helps to keep financial losses to a minimum, which in turn makes cooperation by stakeholders more likely.

Kills and carcasses were recorded in order to gain an insight into species-specific prey preferences.

2.7.1. Scats

2.7.1.1. Methods

The hair of prey is relatively undamaged and indigestible in carnivore scat and can thus be used to identify the prey species eaten (Wachter et al. 2006,). This study predominately collected leopard scat, but also brown hyaena, caracal and jackal scat. Scats were collected along vehicle tracks and game trails along with date and GPS coordinates, and then air dried and stored. Leopard faeces can be discerned from faeces left by other species according to size, shape, consistency (Stuart and Stuart 2000), odour and adjacent tracks visible. In terms of size hyaena scats are similar, but easy to distinguish as they are much harder in comparison to leopard scats and white in colour due to a high ratio of calcium residue of digested bones (Walker 1996). Additionally, in many cases tracks of leopards were found close to the faeces.

Scats were sifted with water and hairs, bone fragments and other hard parts were extracted and dried again. Bone fragments, teeth and hooves were used to support the results of the hair examination. Hairs were compared against a hair reference catalogue, to determine the prey animal. For statistical quantification each species found in one scat sample was assumed to characterise a single predatory event.

Various calculations were performed in order to obtain consumed biomass and individuals. For instance, a Jacobs's index value (Jacobs 1974) was calculated for each prey species. The mean of these was then tested against a mean of 0 using ***t*** or sign tests for preference or avoidance for each species.

Leopard prey species were categorized into the following four body weight classes: 0 ± 15 kg, 15 ± 30 kg, 30 ± 45 kg, < 45 kg.

2.7.1.2. Results

Leopard and hyaena scats were evenly distributed over the entire study area. There was no significant difference in the distribution of faecal samples ($p = 0.94$, Chi^2-test). More than half of the leopard and brown hyaena scats were found in the plains. All caracal scats and 84 % of black-backed jackal samples were also found in the plains.

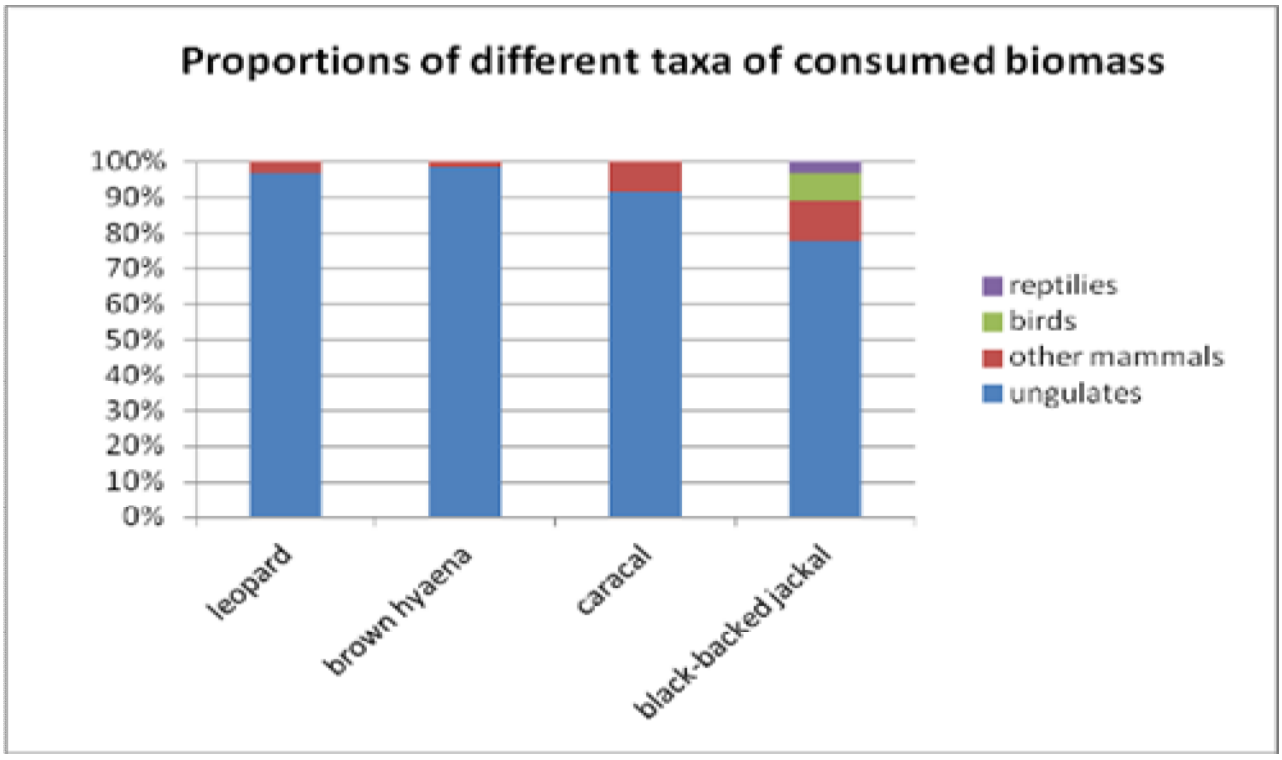

Figure 2.7.1.2a. Porportions of different taxa of consumed biomass by all four predator species.

In this study 95% of the faeces contained ungulate remains as the most frequently eaten prey of leopards, brown hyaena, caracal and jackals.

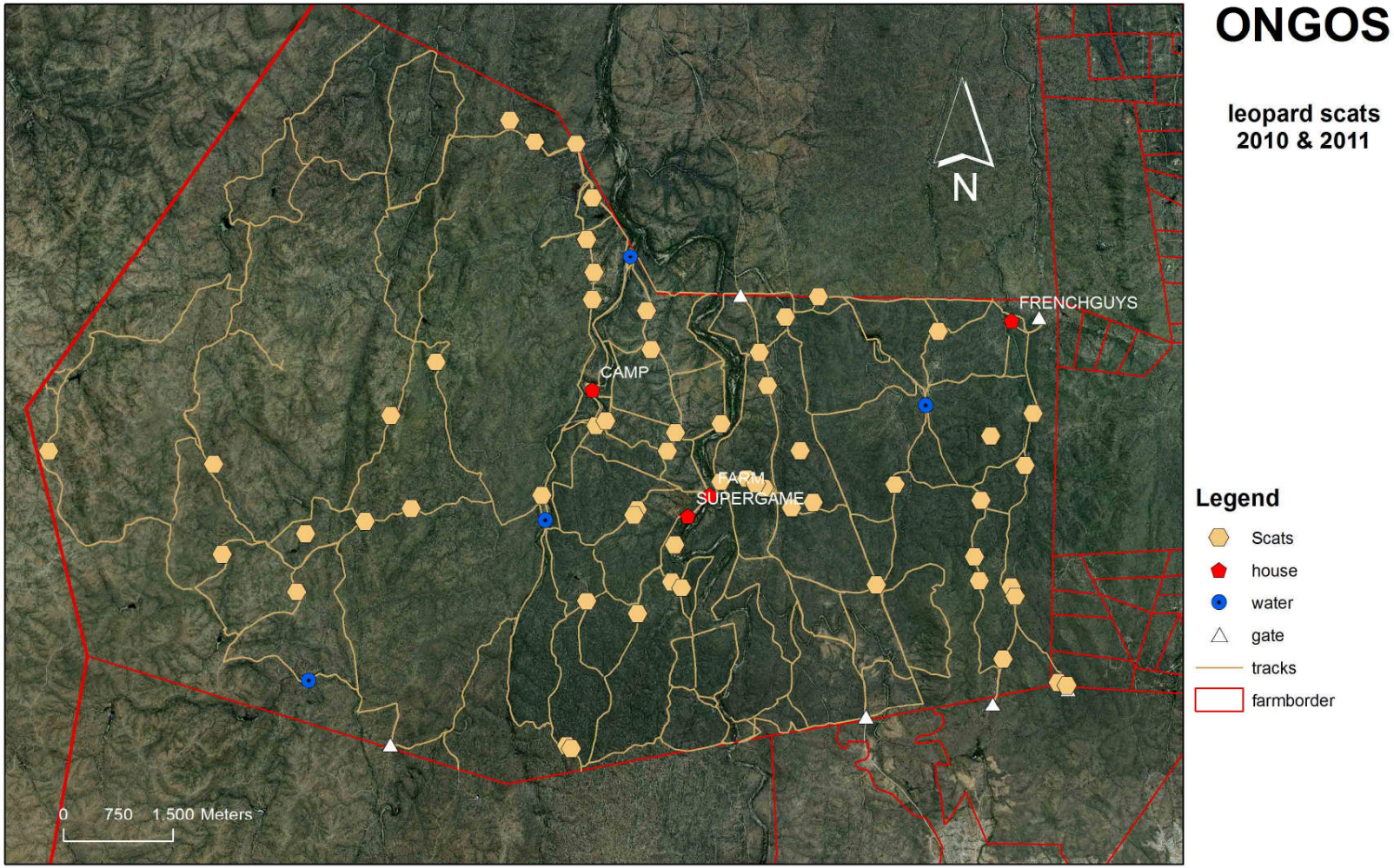

Figure 2.7.1.2b. Location of leopard scats (69) in 2010 and 2011.

69 leopard (Figure 2.7.1.3a), 19 hyaena, 18 caracal and 13 jackal scats were found. 68 of 69 leopard faecal samples could be assigned to a prey animal. After 52 samples all prey species in the region were recorded and no additional new species were found (Figure 2.7.1.2c).

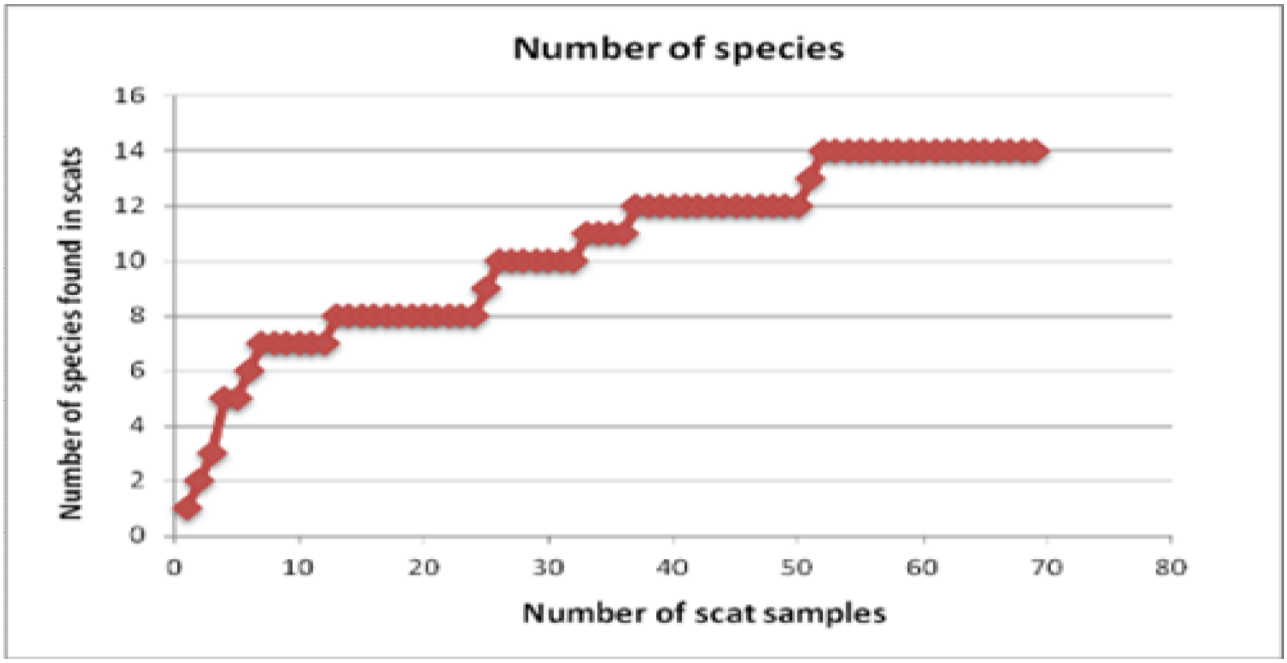

Figure 2.7.1.2c. Accumulated number of prey species in leopard scats.

One leopard sample contained cat hairs, but because of the similar medulla structure, it could not be determined if the cat was a wild cat or a pet cat. Overall 14 different species were detected in the 69 faecal samples (Figure 2.7.1.2c). Total biomass calculated from 69 leopard scats was 332.64 kg. Kudu had the highest value of consumed biomass, but, based on the number of consumed individuals, constituted a lower priority (Figure 2.7.1.2d). In the analysis of the number of individuals consumed (= total consumed biomass (prey species A) divided by live weight (prey species A), the common duiker achieved the highest value with more than 20%., although their biomass was a third of the kudu (Figure 2.7.1.2e).

Leopards prefer to hunt prey that weighs between 15 – 30 kg (Figures 2.7.1.2f & 2.7.1.2g). Common duiker, springbok and baboons are in this category and made up 46% of kills. In the third weight class (30 - 45 kg) only warthogs were captured. The second lowest value (18%) was in the more than 45 kg category (Figure 2.7.1.2f) and with six different species (hartebeest, kudu, eland, wildebeest, oryx and waterbuck) had the highest diversity. Zebra and ostrich occurred in such small amount in the scats that they were not included in the calculations.

Between the four predators, there was an overlap in the prey spectrum of just one ungulate, the common duiker. Springbok was found in all but jackal scats. Chi-square tests showed that while springbok was similarly important to leopards and brown hyaena ($p = 0.84$), it was most important for the caracal ($p < 0,01$). There was no significant difference in the consumption of biomass of common duiker between leopard, brown hyaena and caracal ($p > 0.3$), but for the black-backed jackal duikers constituted a significantly higher proportion of biomass ($p < 0.01$).

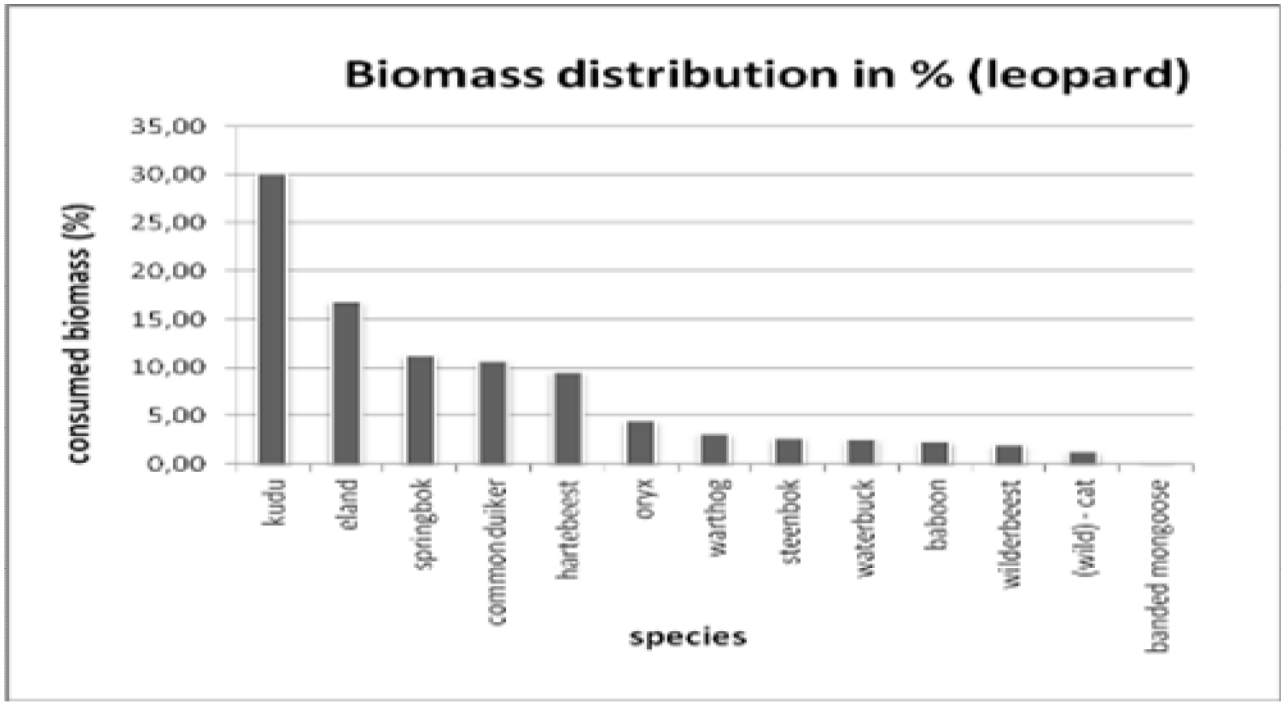

Figure 2.7.1.2d. Biomass distribution (%) consumed by leopards.

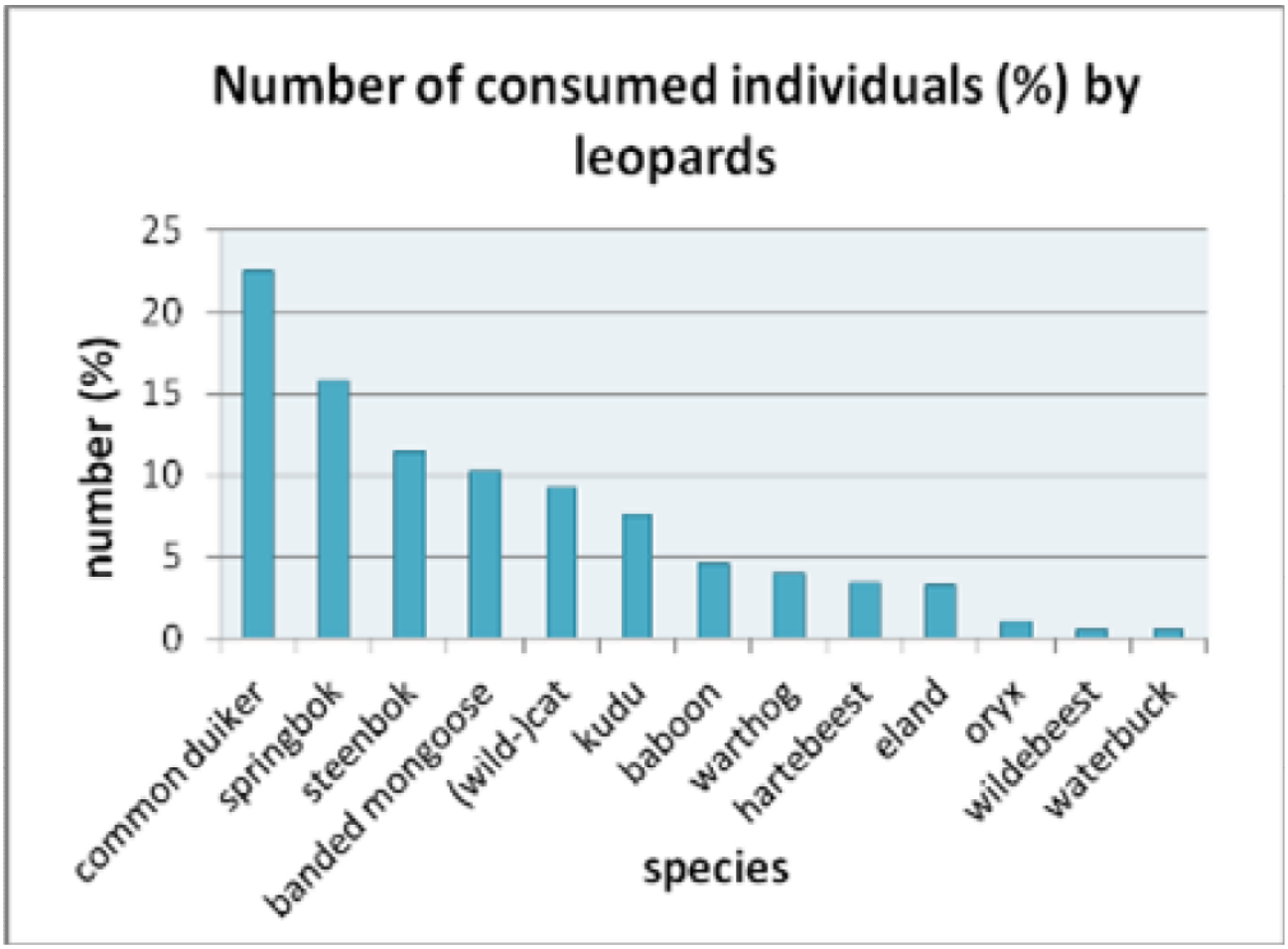

Figure 2.7.1.2e. Number of individuals consumed (%) by leopards.

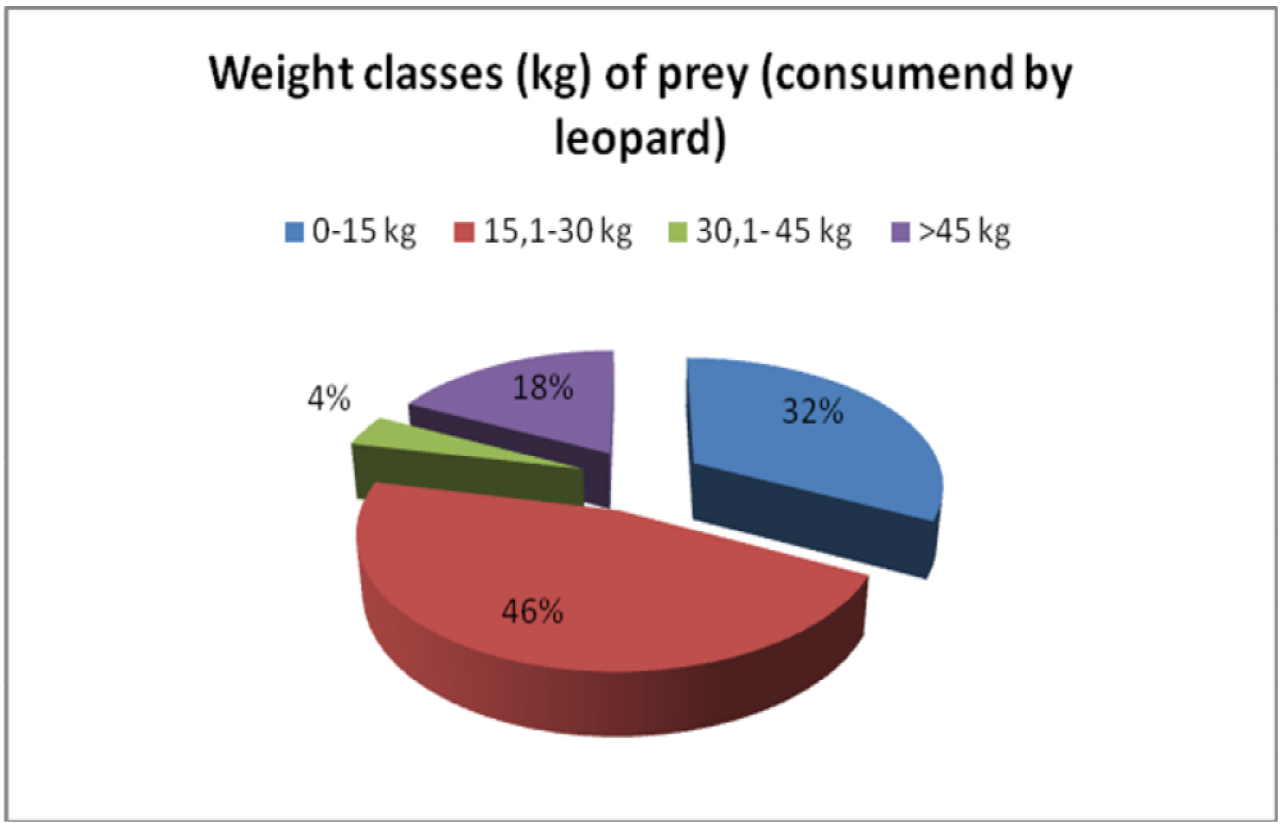

Figure 2.7.1.2f. Weight classes (%) of prey consumed by leopard.

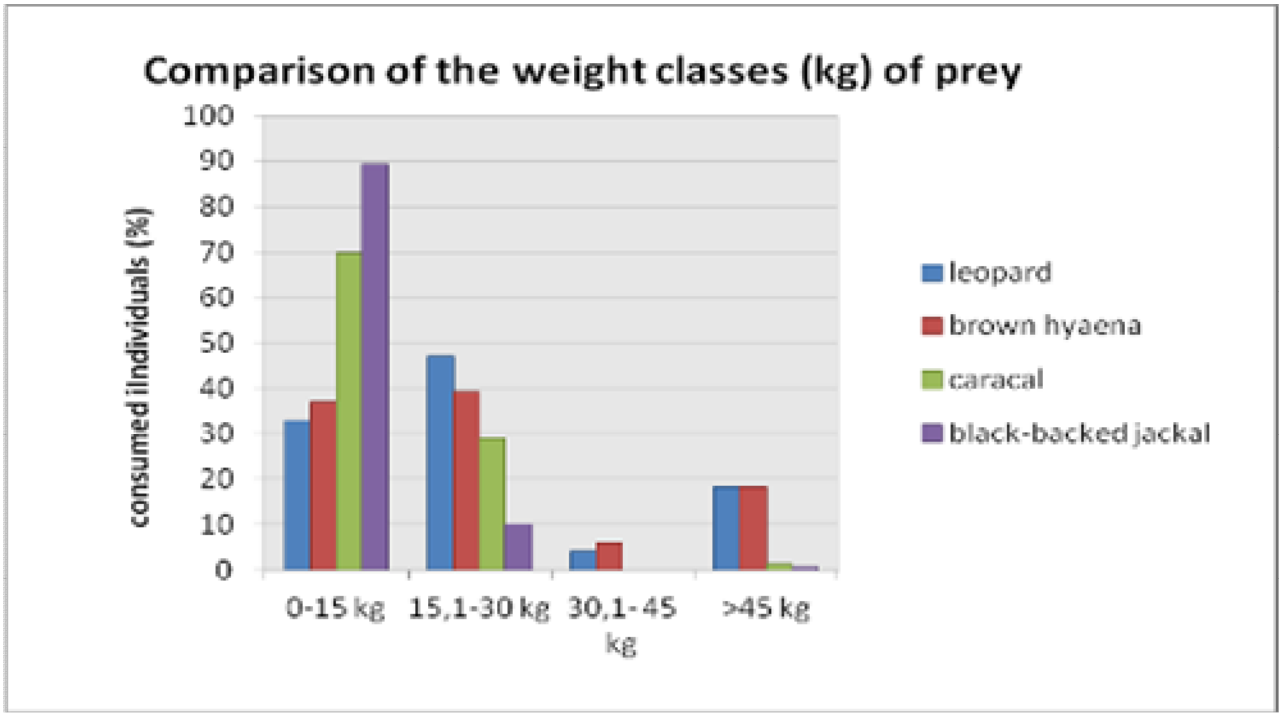

Figure 2.7.1.2g. Various weight classes of prey (each in 15 kg increments) and the total number of individuals (%) consumed by the four predators.

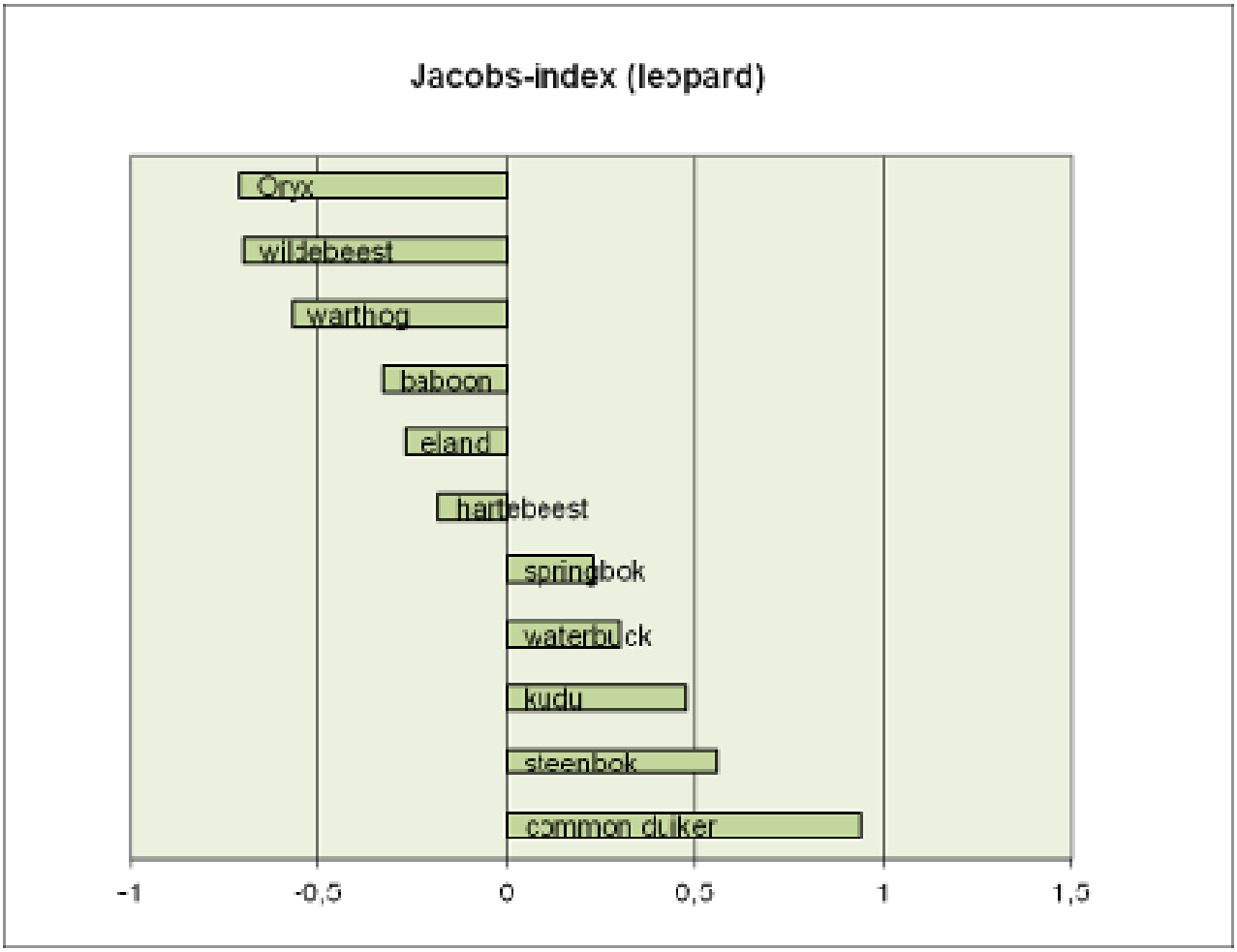

Figure 2.7.1.2h. Jacobs – index for leopard prey species (preferred or avoided prey species).

In Figure 2.7.1.2h the following species were avoided by leopards in comparison to their frequency: oryx, wildebeest, warthog, baboon and eland. The common duiker was preferred by all four predators. Kudu and steenbok were also a preferred prey species.

2.7.2. Prey

2.7.2.1. Methods

Distance sampling is one of the best methods to estimate wildlife populations accurately (Buckland et al. 2008). For this purpose the study area was divided into line transects following Buckland et al. (2008). The area was classified in two easily discernable vegetation types: dense and open. Two different game counts were conducted, a foot game count and a road strip count. Parallel foot game counts were arranged and covered all habitat types. Observer groups walked up to four fixed transects at the same time. The distance between transects was approximately 700 m to make sure animals were not counted twice. The length of foot transects was about 4 km. All prey animals in front of the observer were counted and only sightings recorded within a 150 m semi-circle (the average viewing distance on foot) were used in the analyses using the computer program DISTANCE (Buckland et al. 1993). Equipment used included one rangefinder, binoculars, an angle measurer, clipboard, datasheet, pen and African mammal identification field guides.

Species, number(s), distance and angle of the detected animal(s) were recorded, as well as GPS position of the observer plus, if possible, any notes about species age and sex. Birds and reptiles were not recorded.

Vehicle game counts were conducted on farm tracks. The length of transects was around 15 km. The driver operated the Land Rover at a very low and relatively constant speed (about 15-20 km/h) and observers on the back counted all animals they detected on both sides of the road, no matter how far away they were detected. Observers then identified and counted all animals detected and recorded the distance to the Land Rover, the angle from the transect (midline of the Land Rover), the number of individuals and, if possible, sex and age composition (Figure 2.7.2.1a).

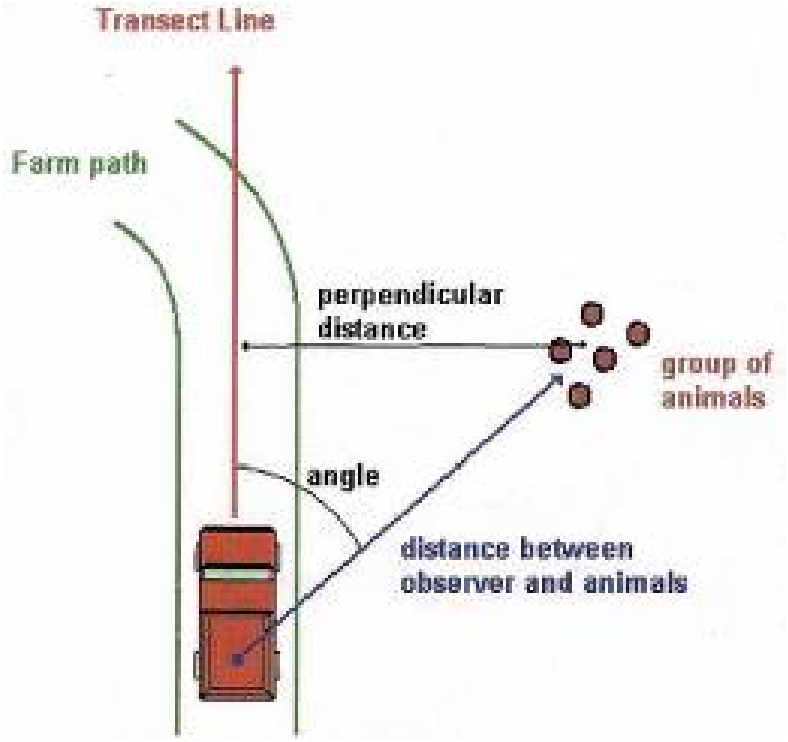

Figure 2.7.2.1a. View distance sampling method / vehicle game count.

2.7.2.2. Results

Foot and vehicle games counts were conducted between October 2010 and October 2011 using line transects and distance sampling methods. 21 game counts were conducted. In total 1650 animals were detected (Table 2.7.2.2a). The program DISTANCE (Buckland *et al.* 1993) calculates for all observed species individual densities per square kilometre. Accuracy is relative to the rate of sightings of species, which provides a lower standard deviation. Values with standard deviation over 40% are not accurate enough for analysis (Table 2.7.2.2a). All game counts were carried out during the day, so nocturnal animals such as aardvark were not detected. Common duiker is active during both day and night with a tendency towards being more nocturnal. Data from solitary animals or those living in pairs such as steenbok were difficult to determine because the animals can easily be overlooked in dense vegetation and data collected did not yield conclusive results. Warthogs were counted most frequently and therefore had the lowest standard deviation. 59.7% of the kudu population were females, 29.8% were juveniles and only 10.5% were males.

Table 2.7.2.2a. Numbers of game species and their standard deviations (%;+/-) 2010 and 2011.

Species	Number of individuals	Standard deviation 2010 & 2011 (%; +/-)	Standard deviation 2010 (%; +/-)
Warthog	309	16	21
Zebra	217	50	64
Oryx	215	19	41
Springbok	195	35	36
Hartebeest	173	22	34
Eland	140	48	56
Kudu	129	16	23
Baboon	118	22	23
Wildebeest	109	47	68
Steenbok	25	32	44
Ostrich	21	50	55
Waterbuck	13	65	80
Common duiker	11	23	42
Total	**1650**		

The same groups, for instance of hartebeest, springbok and wildebeest were observed continuously in certain areas of the farm. In the dry season giraffes avoided the plains. No more than eight ostriches exist on the farm according to the farm owner. 21 waterbucks were introduced at the end of 2010 with five already on the farm. During the counts, Hartmann's mountain zebra (*Equus zebra hartmannae)* and Burchell's zebra *(Equus quagga)* were not distinguished and neither of them were ever seen on the plains.

2.7.3. Large carnivore kills & carcass records

2.7.3.1. Methods

All research teams carried a kill and carcasses datasheet in case they located a kill made by one of the study species. Information about carcasses was recorded, for instance species, gender, age and location.

2.7.3.2. Results

During the study period only ungulate carcasses were found. In 2010, 43 different carcasses were found on Ongos, 15 males, 11 females and 17 indeterminates. The most frequently found carcass was of kudu, with 16 adult and 6 juveniles (Figure 2.7.3.2a). Adult eland and young and older red hartebeest were the second most frequently found, followed by adult blue wildebeest. Only young oryx carcasses were found. One waterbuck and one ostrich carcass were recorded.

One carcass of a young oryx and young kudu were found in a tree. Both of them were more than half eaten. One of our collared female leopards killed a young red hartebeest and a warthog. In general we found more dead adult animals than young ones (30/13).

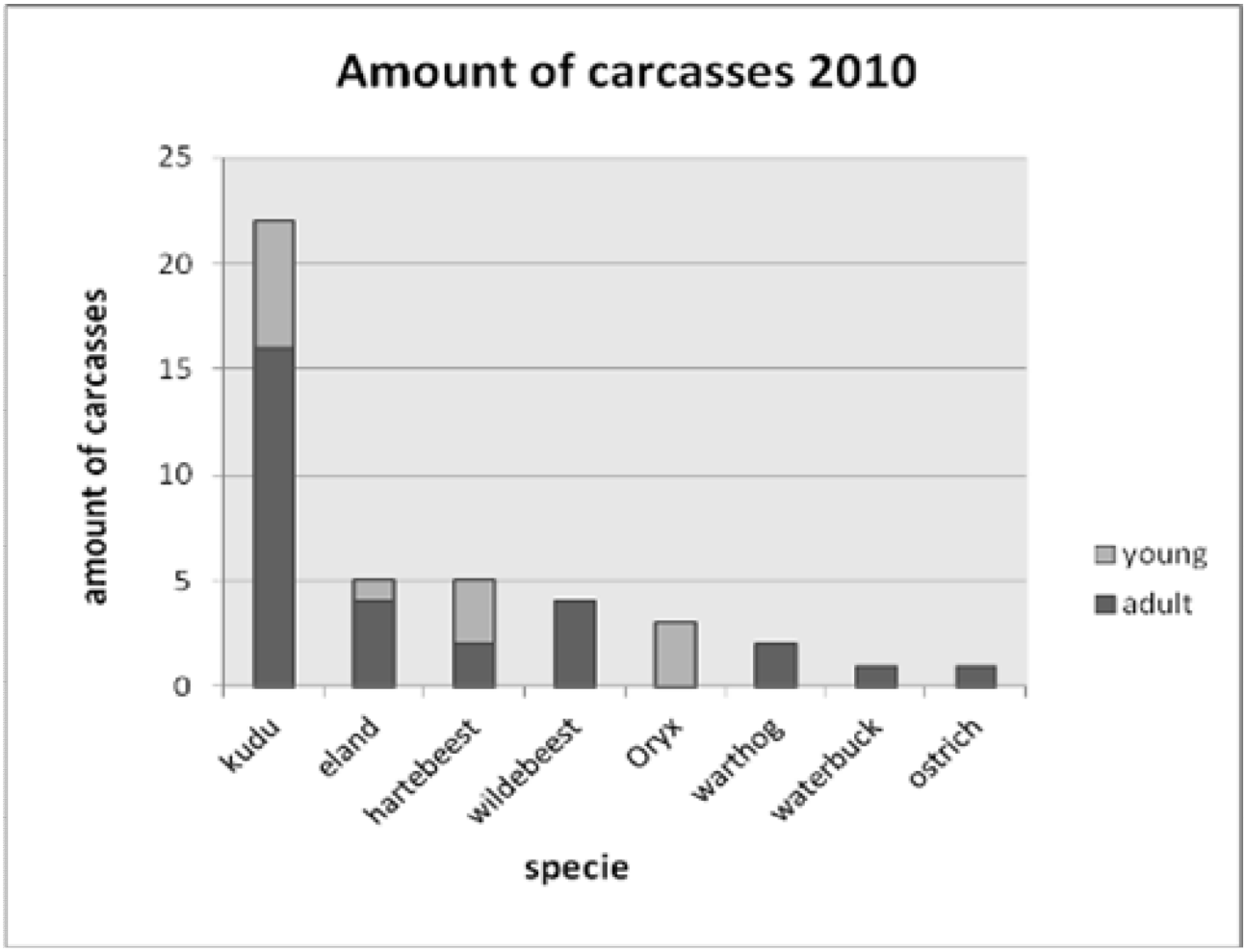

Figure 2.7.3.3a. Prey species carcasses 2010.

In 2011, for reasons unexplained, we found only a few carcasses. Direct observation identified only one adult springbok and one warthog killed by a leopard. In October one leopard attacked a foal, which was the first documented attack on a domestic animal on Ongos.

2.7.4. Discussion

The leopard is considered to be a generalist with a very wide range of prey. In Africa South of the Sahara, 92 prey species of leopard are known (Hayward et al., 2006). They range from small rodents (Mitchell et al. 1965) to large antelope. Bailey (1993), Ray & Sunquist (2001) and others found more than 20 different prey species in leopard scats in studies conducted mostly in national parks, where the prey spectrum is more varied compared to game farms. In this study, the prey spectrum of leopards on a game farm reached a plateau at fourteen different species. On game farms game species are prevented from migrating by fences and have to adapt to farm conditions. Therefore good farm management is required to maintain stocks of healthy game animals. With good management, fenced areas can be very good conservation tools, for rare species in particular. On Ongos leopards are the only predators able to kill large antelopes. As the results of this study show, large ungulates such as oryx and eland are rarely killed by leopards, probably because of the danger involved in tackling a large animal. Leopards prefer to kill medium-sized antelopes (47%; 15 - 30 kg), which occur in small herds, in dense habitat and present minimal risk of injury during the hunt. These findings are corroborated by Hayward et al. (2006) who cite an average prey mass of 23 kg.

Species with a negative Jacob-index are not preferred prey for leopards and most of them are large ungulates. Zebras, although present on the study site, do not feature here or in Figure 2.7.1.2h., because adults are unavailable to leopards due to their large size and social organisation in protective herds. In this context it is interesting to note that the highest box trap capture rates during this study were achieved with zebra meat baits. Clearly then leopards do consume zebra, but avoid the two zebra species present on Ongos because of the high costs and dangers involved in hunting them.

The same is probably true for warthogs that are also dangerous to hunt as they are known to have maimed or disembowelled leopards with their sharp tusks (Pienaar 1969). Furthermore, warthogs prefer to sleep in abandoned aardvark burrows at night and are therefore mostly unavailable at the time when leopards usually hunt.

Baboons are also dangerous because large males can kill leopards.

Kudu are listed as preferred prey probably because females and juveniles lack large horns and strength. Results from the carcasses/killing records show that leopards do prey on large ungulates, but when doing so focus on juveniles of, for instance, hartebeest, oryx and kudu. The large number of dead adult animals found was probably the result of a drought at the end of 2010.

99% of consumed biomass was from mammals. Ungulates accounted for the largest part by far (96%), followed by baboons (2.3%) and other carnivores (0.8%). Surprisingly, remains of a banded mongoose were identified in one scat. Before this study the assumption was that predators such as jackals would be consumed by leopards as well, but there was no evidence of this.

Consumed biomass, consumed individuals and the weight class of preferred prey species showed significant parallels between leopard and brown hyaena. It is likely that brown hyaenas can thrive as scavengers on Ongos, because the leopard leaves a lot of carcasses for them as a result of its hunting activity.

For all four predators ungulates provided most of their diet. Still each predator occupied a different ecological niche, thereby and by preferring different habitats, limiting direct competition and encounters.

Prey catchability versus prey abundance hypothesis

The hypothesis that common ungulate species are captured more frequently (prey abundance hypothesis) was not upheld. Warthogs are the most common ungulate on Ongos, but they play no significant part in leopard diet. Other large species of antelope, such as hartebeest or oryx, with high population density on Ongos, were consumed relatively infrequently too (see above).

For the prey catchability hypothesis criteria of combat willingness and group size are considered. Results of this study show that the prey catchability hypothesis is the one that applies on Ongos, where leopards predominantly hunt species that represent easy prey. The results presented here corroborate results by Hayward et al. (2006) and Balme et al. (2007), who found that leopards prefer prey with (a) a solitary lifestyle, who (b) present a low risk of injury when being hunted and (c) live in dense vegetation. Therefore springbok, steenbok and common duiker are significantly (Chi^2-test) preferred, contributing over 55% of the leopard's diet on Ongos (Figure 2.7.1.2e). Findings presented here also indirectly corroborate Bailey (1993) who cites that impala is an important ungulate prey species of leopards throughout Southern Africa, because the species yields the greatest return of energy for that expended in locating and killing its individuals. There are no impala on Ongos; their closest relatives present on the farm are springbok, which is one of the preferred prey species.

The number of kills recorded over the study period was not large. This is probably because kills of small prey are likely to be eaten almost entirely and/or scattered by scavengers into undetectable pieces. It is therefore difficult to make a reliable statement about kill rates. Bailey (1993) estimated that an average 52.8 kg male leopard must consume 3.8 kg of meat per day and an average 37.5 kg female leopard 3.0 kg/day.

Sampling was limited to Ongos and it would be interesting to collect predator scats from neighbouring farms too, especially the cattle farm in the West and the goat farm in the East. It is important to note in this context that no leopard scat with cattle or goat hair was collected. Only two caracal scat samples contained goat hair. This is a very important result to communicate to farmers and other stakeholders, i.e. that leopards do not have a natural tendency to be livestock killers, but concentrate their hunting and killing activity on small endemic ungulates. The results of this study clearly suggest that one strategy to reduce leopard attacks on livestock and expensive game such as sable and roan antelopes is to provide leopards with an abundance of low-cost, small-sized prey animals such as springbok, steenbok and common duiker. We suggest that this management strategy is called the “cannon fodder approach” and communicated intensively to stakeholders such as farmers.

2.8. Katutura questionnaire (disease surveillance)

2.8.1. Introduction

In recent years there have been a number of significant disease spillovers from domestic dogs and cats to wild predators (Cleaveland et al. 2000), with subsequent devastating outbreaks of diseases. Canine distemper severely impacted on Serengeti and Kalahari lion populations as well as wild dog populations (Roelke-Parker et al. 1996), whilst the latter were also seriously affected by rabies (Burrows 1992, Gascoyne 1993). There is still a paucity of knowledge concerning the susceptibility of wild predators to and the risk of spillover of these diseases from domestic dogs and cats living in close proximity to conservation areas. Considering the fact that human populations are continuously encroaching on conservation areas, this poses a potentially serious threat.

The Northwestern part of Katutura township adjoins the Southern area of the Ongos study site. The distance between these neighbourhoods is no more than 1200 meters of sparse bush or tree vegetation. Every day Katutura residents go out to look for firewood. Occasionally inhabitants cross the fence to cut trees or to poach game animals, often with the help of dogs. The largely unvaccinated and diseased dog and cat population of Katutura may thus pose a serious infection risk to predators. This posed several questions, which this study attempted to answer: (1) Do wild predators advance into the Katutura township? (2) Why would a predator venture so close to human settlement? (3) Are they looking for prey animals (pets) or are they scavenging rubbish dumps? (4) Will contact with unvaccinated pets influence the health status of wild populations?

2.8.2. Methods

In 2010 Katutura residents were interviewed to find out if they observed wild predators such leopards, cheetahs, caracal, jackals and brown hyaena in or around their township. In 2011 a second interview survey was conducted in Katutura to obtain an overview of pets and their condition, targeting residents in the Northwest, as this area is closest to Ongos.

2.8.3. Results

During the first survey in 2010 94 residents living close to the border to Ongos were interviewed. None had seen a leopard, one person correctly identified a brown hyaena and four others claimed to have seen jackals and baboons. Many interviewees claimed to have heard jackals and baboons making noises during the night.

During the first investigation in 2011 (Namibia A; January to March) 70 households with pets were interviewed. 70% of respondents owned dogs (85 individual dogs of which 22 were puppies). The average age of the adult dogs was approximately 29 months. 26 adult cats and 10 kittens were noted; the average age of cats was 1 year. 25% of interviewees had no previous experience as pet owners. More than half of the interviewees felt they took care of their animals and attempted to treat sick animals against diseases by self-medicating or going to a vet. 22% of the owners took their animals to a vaccination campaign against rabies (conducted by the SPCA Windhoek-Society for the Prevention of Cruelty to Animals). Many owners reported that they rubbed their pets with motor oil as a “prevention” against tick infestation (biliary fever and ehrlichiosis are widespread diseases in Namibia and even humans can contract a form of tick bite fever).

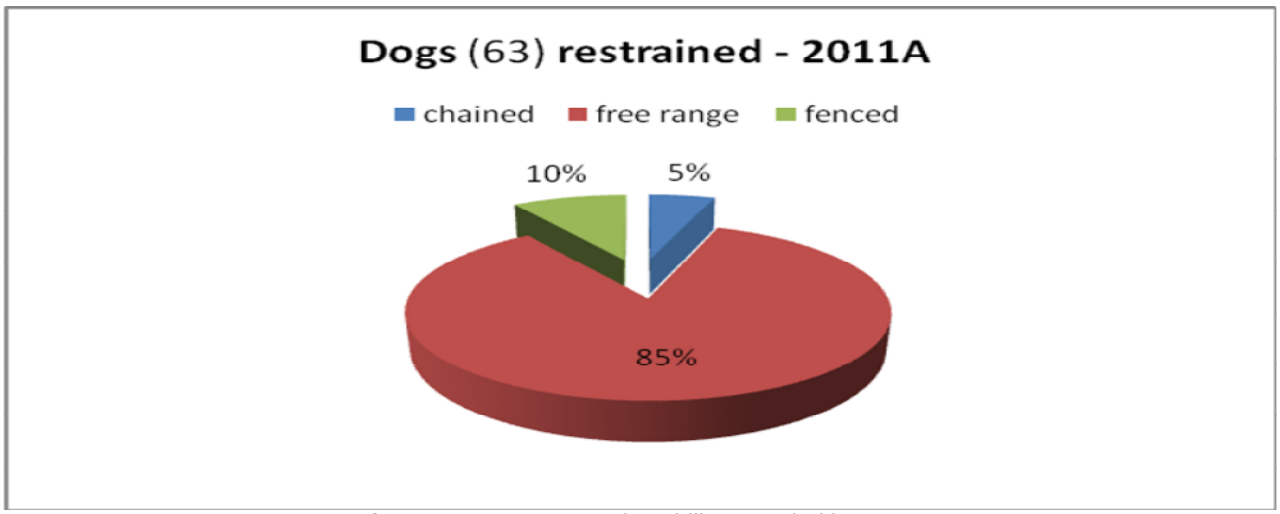

Figure 2.8.3a. Dog roaming ability recorded in 2011A.

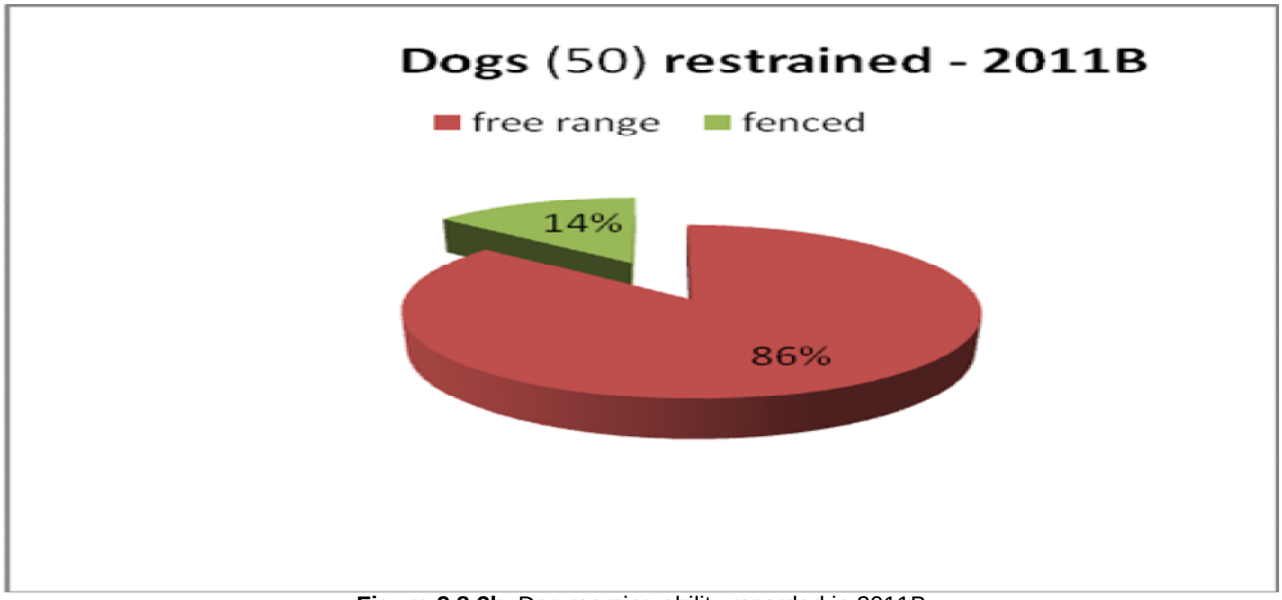

Figure 2.8.3b. Dog roaming ability recorded in 2011B.

Only six dogs were chained and four were fenced, all others were roaming freely (Figure 2.8.3a). Pets, especially dogs, are kept mainly to protect properties. Cats were used to keep mice and snakes away. 90% of pets were fed with leftovers.

A second survey was conducted in Katutura from mid-August to mid-November 2011 (Namibia B) in an area adjacent to the previous survey area. 55 households with pets were surveyed. 79 dogs including puppies (29) and 14 cats (one kitten) were recorded. The average age of cats and puppies was higher compared to the Namibia A survey. More than 80% of the adult dogs roamed free, the rest were fenced or chained (Figure 2.8.3b). As in the previous survey, all cats roamed free. 22% of respondents took care of rabies vaccinations. Katutura residents tended to own more dogs than cats. In all surveys the life expectancy of pets was very low at around four years.

During the study period nine sightings of domestic/feral dogs were made on the farm. Since these are usually involved in poaching, four dogs were shot.

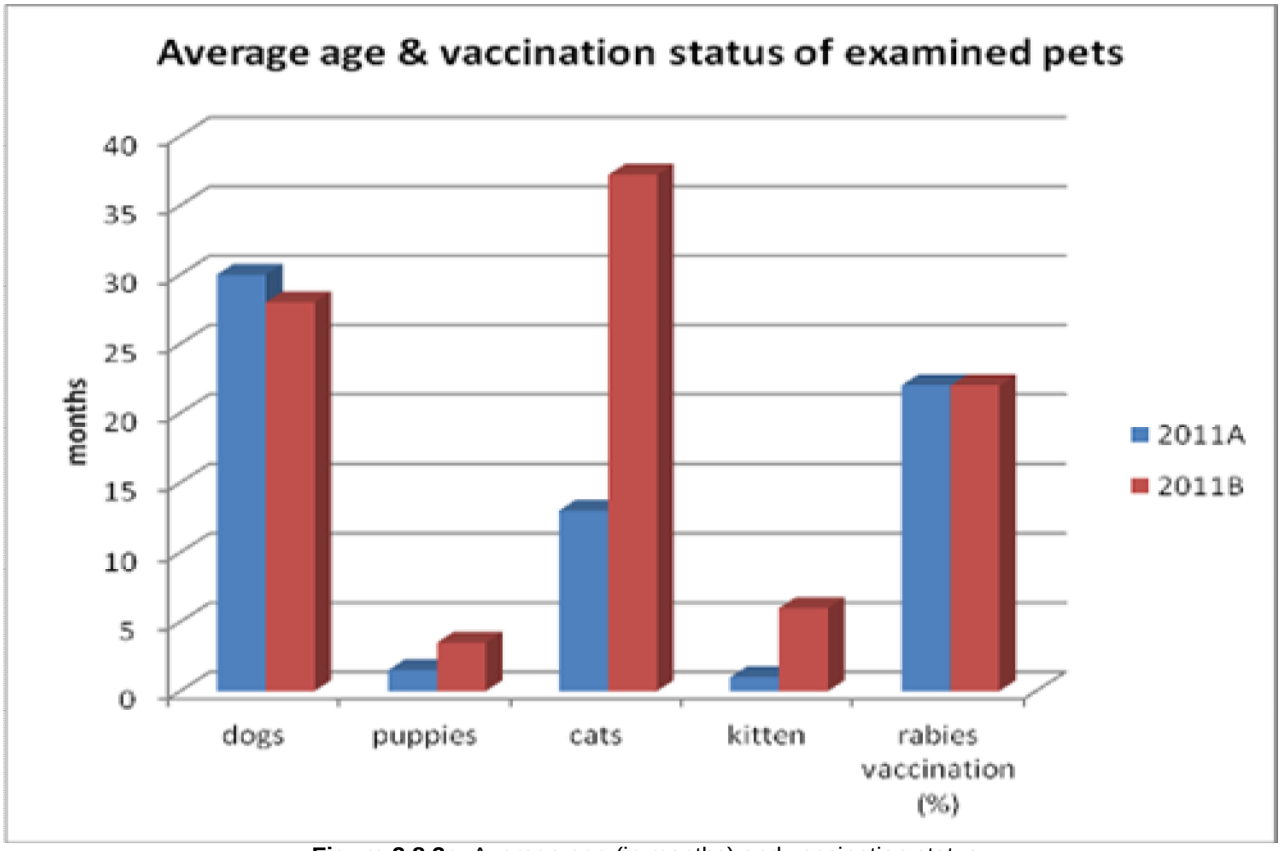

Figure 2.8.3c. Average age (in months) and vaccination status of pets examined during both surveys 2011 (rabies vaccination only dogs).

2.8.4. Discussion

In the 2010 study, there was no evidence that predators such as leopards, caracals, and cheetahs were present in Katutura township or its proximity. As these animals are very shy, elusive and nocturnal, this is good evidence that they avoid human settlements.

The sighted jackals show, however, that an exchange between wildlife and domesticated animals is possible, and therefore disease spill over. A recent nature documentation showed brown hyaenas and leopards visit urban areas at night in Pretoria (South Africa). Camera traps demonstrated that hyaenas scavenged at disposal sites and leopards were looking for live food.

The 2011 results demonstrate that most pets are free roaming (Figure 2.8.3a & b). Their survival rate is higher than for chained or fenced animals, because they are able to search for additional food and this may take them out of the township into wilderness areas. Few pets receive regular vaccinations against rabies (although this is offered free of charge by the state veterinary authorities), distemper and other canine diseases (vaccinations agains which are not free) or cat-specific diseases such as feline panleukopenia (FPV), feline corona virus (FCoV) and feline infectious peritonitis (FIP).

Infected domestic animals can transmit disease via direct contact with wild predators (either pets ending up as prey or feral dogs chasing down smaller predators e.g. jackal and African wild cat). Indirect transmission of disease, for example through contact with faeces/scats from infected animals is also possible.

Due to the relatively asocial habit of the predators found in the study area, the risk of horizontal spread of disease within the species is relatively low (compared to lion, wild dog and bat-eared fox) thus putting these species at a lower risk of severe disease outbreaks.

The average life expectancy of dogs is very low (around 4 years as compared to 12 – 15 years in a vaccinated dog population), suggesting very significant attrition due to disease. This clearly demonstrates the potential risk of disease spill over to wild predator populations if pets are infected and roaming free to search for food or dying in the field. Another reason for the high mortality rate may be vehicle accidents.

The most practical method of minimising the risk of disease spillover from domestic animals to wild predators would be through intensive vaccination campaigns against all (not just rabies) common diseases of dogs and cats. Due to financial constraints on the side of both the pet owners as well as the local SPCA, it is unlikely that this will happen soon unless these vaccination campaigns are sponsored by a third party.

Proper serological disease surveys on domestic pets in the area would obviously provide a better insight into the exact disease status of the pet population. However, we believe the circumstantial evidence collected strongly suggests high pet attrition due to disease. Keeping the high costs associated with a serological survey as well as the developing world situation in mind, these funds may be better spent in initiating vaccination campaigns.

We also discovered that many people still practise traditional “medicine” to treat their sick pets, for instance by cutting off ends of ears and tails or “removing the worm” (a normal blood vessel) from under the tongue. Even though cruel and risky to the animal, these “treatments” are essentially done out of ignorance and in good faith. In order to minimise animal death and suffering, awareness training or workshops should be organised to inform pet owners how to improve animal care.

2.9. Discussion and conclusion

The expedition’s research, conducted on Ongos farm close to Windhoek and bordering on the Katutura township, has shown that different carnivore species can naturally inhabit a game farm situated close to a national capital and its outlying urban area. Urban areas are very dynamic, especially in the outer ring, where land conversion is never-ending and can be dramatic. This was the situation close to the study site with the growing Katutura township bordering the study area in the South. However, the Ongos fenceline is a very clear border and control factor between predator/game-rich African bushveld savannah habitat and almost predator/game-free lands of urban development.

Disease surveillance and interviews with local people showed that close contact between wild carnivores and unvaccinated domestic dogs and cats increases the risk of serious disease transmission to wild carnivores. Vaccination and education programmes are suggested activities to mitigate this threat.

A relatively high occurrence of leopards (a remarkably consistent result of 2.7. individuals per km^2) was found in the study site. The habitat quality present is sufficient to ensure the survival of the different carnivore species if no other threats arise. Home range sizes of leopards were found to be smaller than in protected areas. We suggest here that this due to the farm fence, which limits prey movement, which in turn means that leopards do not have to roam as widely as in fenceless national parks in order to find enough food to survive. It is noteworthy, however, that overall activity levels of leopards studied here did not differ from those of leopards living in protected areas.

Camera trap pictures, scats and tracks detected co-existence with other predators such as brown hyaena, caracal and others. Using camera trap pictures, several individuals could be identified. Two females with cubs (one was pregnant, another one was seen with a cub on the camera trap pictures) showed that the habitat is suitable for reproduction.

The scat investigations and the game surveys elucidated leopard diet on game farms, an area where dietary information was lacking so far. Leopards prefer to hunt prey that weighs between 15 – 30 kg with common duiker, springbok and baboons making up 46% of their diet. 18% of leopard diet is composed of hartebeest, kudu, eland, wildebeest, oryx and waterbuck and given the prey weight preferences, it is likely, though unproven, that the majority of these prey animals were juveniles or smaller females. It is noteworthy that banded mongoose and (wild) cat also featured significantly on leopard menus studied, but that warthog was one of the least preferred species, despite its small size.

The “cannon fodder hypothesis” is therefore upheld, with the important addition that warthogs are not preferred cannon fodder species, but common duiker and springbok are. This means that high densities of common duiker and springbok in particular, should make attacks on other, more valuable game and livestock less likely. This has important implications for farm management (see management recommendations below).

Importantly, no evidence of livestock was found in leopard scats despite the fact that the Ongos study site borders onto livestock farms in the West and East. This is another important finding with implications for farm management, as it shows that leopards do not have a preference for livestock prey, even if it is readily available. However, the 55-day GPS-based “life story” of LM01 presented here also shows that leopards can develop a taste for livestock if presented with easy prey options such as readily available, unprotected calves. Under such circumstances, leopards are very likely to become “problem predators” and the familiar pattern of predator-farmer conflict resulting in the violent death of the predator, as documented in this study, is the likely scenario that is undoubtedly played out all over Namibia and Africa time and time again. These scenarios result in the loss of top predators and with them loss of biodiversity and revenue streams for farmers. Besides, removing a leopard, will make its territory available to other, young leopards roaming the area in search of a territory. Killing a leopard is therefore likely to do nothing more than exacerbate the situation as one (or more) leopards will be attracted to the area and simply take over.

The results presented here provide information to assist wildlife managers and conservation bodies on predator carrying-capacity and predator–prey interactions. Understanding the human-carnivore relationship is central to rural and respectively commercial carnivore conservation and management and ultimately to the possibility of sustainable coexistence.

We hope that science-based results such as the ones presented here, transposed into readily understandable management advice, will promote co-existence of stakeholder farmers and predators by reducing conflict and pointing towards revenue streams such as ecotourism. Biosphere Expeditions itself working on a Namibian game farm with international volunteers is a showcase of the oft-quoted win-win-win situation: income for the farm through low-impact ecotourism – useful scientific results that translate into sound management advice – and predator/biodiversity conservation all benefitting from one another.

In the end, successful management of carnivores will require modifying both human and wildlife behaviour. Long-term success can only be attained by changing human behaviour, especially people's attitudes towards, and tolerance of, human/predator conflict situations.

2.9.1. Management recommendations for stakeholder farmers

Leopards living on Namibian farmland naturally prey on small-sized game species, particularly common duiker and springbok (no livestock was found in any leopard scat analysed).

Leopards are likely to become problem animals if presented with easy options to make a kill. Such easy options are inexperienced, weak and essentially defenceless large antelope as well as livestock juveniles.

In order to protect valuable game species and livestock from leopard depredation, farm managers should ensure that

1. Their farm is well-stocked with low-value "cannon fodder" species, particularly common duiker and springbok. Leopards are likely to then concentrate on these preferred easy target species and stay away from larger, more valuable species.

2. During the calving period, livestock is protected at all times. Protection strategies are guard dogs, the use of donkeys or herding. In addition, herds can be kept inside kraals overnight or animals can wear bells. Keeping animals close to human settlements also offers protection. Note, however, that none of these strategies used for cattle are practical in protecting game species from depredation. Instead this is where the "cannon fodder" approach should come in.

2.9.2. Outlook and recommendations for further work

To develop effective conflict resolution strategies, more about leopard biology on game farms must be known. Therefore more presence/absence and relative abundance surveys will be conducted. Capturing and collaring of further predators is a high priority in order to monitor individual animals and their social units. Testing the cannon fodder and livestock protection strategies for their effectiveness is another priority area.

In general, studies do not provide significant insights into why humans respond to carnivores the way they do. For this reason interviews with farmers will be conducted in the future.

2.10. Literature

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Appendix I: Studies reporting mean home range sizes (95% minimum convex polygons) and densities of leopards in sub-Saharan Africa.

Study Area	Home range size (km2)		Density (no. per 100 km2)	Reference
	Male	Female		
Serengeti National Park, Tanzania	18	16	10.40	Schaller 1972, Bertram 1982
Kruger National Park (SRSA), SA	28	18	16.40	Bailey 1993
Tsavo National Park, Kenya	36	14	10.80	Hamilton 1976 & 1981
Kruger National Park (NRSA), SA	76	15	9.5	Bailey 1993
Tai National Park, Ivory Coast	86	25	9.5	Jenny 1996
North central Namibia	108	53	4.5	Stein 2008
Waterberg Plateau Park, Namibia	119	64	1.3	Zeiss 1997
North-eastern Namibia	217	128	0.6	Hanssen & Stander 2004; Stander et al. 1997
North central Namibia	229	179	3.2	Hanssen & Stander 2004; Marker & Dickman 2005
Cape Province, SA	388	487	0.9	Norton & Lawson 1985
Kalahari Desert, Botswana	2,182	489	0.6	Bothma & Le Riche 1984

Appendix II: Expedition diaries 2010/2011

20 August 2010

Dear Namibia expeditioners

This is the first diary entry for the 2010 Biosphere Expeditions projects to Namibia. My name is Matthias Hammer and I am the founder & Executive Director of Biosphere Expeditions, and I will also be your expedition leader for the first group of this, our new Namibia expedition. I don't get to do that much expedition leading any longer, so I am excited about dipping my toe in again as well as the whole new Namibia set-up & of course the expedition itself.

It's an early entry because I am about to leave for Namibia well in advance of the expedition to help with sorting out lots of things, seeing our research camp having its finishing touches put toit (I hope), and generally trying to make sure that we are ready for you when the first group arrives on 3 July. I am sure there will be lots of running around like headless chickens to do before the trailblazers arrive, so this is just a quick one to saythat I am off and will be reporting again soonish with an update on the weather (of course), camp construction, Land Rover repairs and other disasters ;)

One point of admin, before I go: the expedition leader mobile phone number in Namibia is +264 81 6208673. This number is for emergency calls only, such as being late for assembly due to late flights, etc.

That's it for now. More in a few days. I hope your preparations are going well & I look forward to meeting some of you soon.

Dr. Matthias Hammer
Executive Director
Biosphere Expeditions

24 August

It's good to be back in Namibia, where not much has changed. Life still proceeds at a different pace, the sky is large & blue, and the kudus still have the same incredulous stare on them when you drive past.

I met up with our chief scientist Ulf and his wife Michaela and our field scientist Kristina. Our first visit was to our research camp building site.

And a building site it still is (see pictures), albeit a very picturesque and beautiful one. It's goingto look great with a thatched central building (called a "lapa") and 10 large safari tents dotted along the river. It's going to look great and Ulf assures me it's also going to be ready by 3 September, not 3 July-that was just my wishful thinking ;)

We'll only have 10 safari tents this year, so we will rely on the cooperation of some of you to make friends and share a tent, two persons to a tent. We'll also rely on your co-operation and charity to let our poor expedition leaders and assistants, shoved into small dome tents on the side of camp somewhere, to have a shower in one of your fancy showers every now and then (navy showers only, of course-we'll explain what that means when you get here). The tents are spacious and comfortable, so you won't be treading on each other's toes. Snorers have to sleep half a kilometre away in the riverbed and act as bait anyway ;) Talking about bait, we now have one leopard collared for the start of research activities. Of course we hope to add more while you are here,but please don't arrive expecting animals galore in the traps. It takes time and patience and your help to trap and collar more, and it may takes days, but it also may take weeks until we are

successful - such is the life of a field biologist, which you are about to become part of. Anyone still there thinking they have booked on a safari holiday?

More admin: the research activities have been set and we have enough sleeping bags to go round for the night activities, so if you want to save some luggage space, there is no need to bring yours any longer.

I'll probably send another one or two updates and I'll see slot 1 soon.

1 September

Our camp is coming along in leaps and bounds and I am hopeful that everyone on slot 1 will have a place to sleep when you arrive, even though there will definitely not be double beds, Marty.. I'll send another picture or two a few days prior to slot 1 arriving.

Our research activities plan is also coming along (see attached). As you can see, it's a pretty packed schedule, so please make sure you arrive rested and perhaps book a week's holiday after the expedition to recuperate (www.acacianamibia.com).

Enough scaremongering! The days are beautiful and warm, but the nights are chilly (down to single centigrade figures), so please make sure you bring at least one set of warm clothing.

5 September

Good news-Ulf still thinks the camp will be ready in time. Even better news, especially for Marty-there are some single beds that clip together into doubles! Thanks for sharing tents, Marty & Julie, Serge & Catherine, Jean-Francois & France, Klaus & Peter in slot 1. Any more takers for slot 1 and beyond? More brilliant news-your field scientist Kristina & her assistants Jenny & Dany know how to use a GPS (more about them and their skills when you get here ;). There is also a picture of them on our Facebook page http://www.facebook.com/pages/Biosphere-Expeditions/132594724471.

Admin: update on phone numbers. +264 81 6208672 is the expedition leader phone (Ronald, etc.) and +264 81 6208673 is my personal number in Namibia. Remember these are for emergencies only. Attached is the updated day-to-day plan, a sample datasheet and the kit list, just so that you can get mentally prepared...

See you in a week, slot 1.

26 September

Just a quick note from the new team of Ronald (expedition leader), Jenny & Dany (expedition leaders in training) to say that slot 2 has arrived safely and survived the first day of training. With Ronald busy as expedition leader and Matthias having left Namibia, it falls to us (Jenny & Dany) to keep this diary from now on. We look forward to working with you all and thanks again slot 1.

P.S. A picture of the new team is also on www.facebook.com/pages/Biosphere-Expeditions/132594724471.

P.P.S. Slot 1 (and everyone hereafter), please do not forget to share your photos on www.biosphere-expeditions.org/pictureshare.

27 September

Surprisingly everyone was at breakfast on time in their first morningand tolerated the datasheet sessions in a good humour. With only 3 NON drivers in this group we will all get the chance to be on the back of the Land Rover spotting leopards, so thanks to all the drivers!

I want also to thank Jane who couldn't stay in the tracks during the driving course so we could spot fresh hyaena tracks close by the camp and which brought the lesson to an abrupt halt.
We also activated the box traps and changed the places of camera traps so hoping that the first activity day may be successful. The whole team also likes to thank Philppe and Francoise for bringing all the Swiss chocolate…..

28 September

We had our first rain during the night so we can watch out for new tracks. Two groups moved the box traps and activated it at a new place where group number 1 found leopard and hyaena tracks the day before. Both telemetry groups found strong signals of Lucy in the morning and in the afternoon but Lorraine, Steffen, Susanne and Ronald got confused with her as she seemed to play a game with them as she seemed always walking around them in a
circle....Well, and the next waterhole observation should be on a hole filled with water ;-)

29 September

The second box trap was moved with "women power" to Davidsposten where we hope to catch the leopard, which was on the camera trap picture. Our resident leopard Induna made the day for group 1 when we spotted him lazying about in a tree at sunset. In the evening groups 1 and 2 had to make a presentation about a study animal each and all team members had to learn how to spit "Eland" poo...thanks for this experience... good shot Melissa. We ended the day sitting around the camp fire talking and watching the thunder and lightning the distance....

4 October

As our school visit with the first slot was very successful, we visited the local school in Katutura again, which was founded by the Family of Hope Services (FHS). After they showed us around, we then took 12 excited kids to the farm and put big smiles on their faces by showing them animals they just had seen in books so far. The afternoon was spent counting whatever moves through the bush (vehicle game count). Melissa was lucky spotting an almost newborn giraffe baby and finally got to see the zebras.

5 October

Because one Land Rover was on strike and had to see the mechanics, we split into three groups. Two groups went with Kristina to move a box trap to a spot where we had seen a brown hyena on the camera trap pictures quite regularly. Just before they got there, the groups ran into two honey badgers (the ones we had seen on the camera trap pictures??) But this was not the only encounter with rarely seen animals. Just after moving the trap, our girl group (Jane, Melissa and Anja) spotted three bat-eared foxes on the road, which now increases our encounters with mammals to 21 different species.

6 October

At 6.30 am it was already 24 degrees Celsius and everyone prepared themselves with tonnes of water to get through the morning activity. One group put some fresh bait into our second box trap and had a good opportunity to visit and to gain more information about the Boma.

7 October

Half a day of activities .... we inactivated the box traps, finished data entry, found strong signals of Lucy and discovered new waterholes in a canyon. In the afternoon there was the big clean up before we all listened to the final presentation and results. We spent the last team sundowner on "Elephant mountain" laughing, enjoying and taking funny shots. The BE staff would like to thank slot 2 and hope you all had a good time.

17 October

Welcome slot number three! 12 team members and one journalist were picked up this morning. With nine German and four English speaking members we still have nine different languages. If you think African time is running slow, you haven't met Peter, our journalist from Ireland, yet.

The special of the day was from Festus, our local cook! Vanilla ice cream on hot raspberries for dessert!

18 October

After yesterday's campfire and Ulf's welcome drink for everyone, all team members met on time at 6:30 for breakfast. But the Irish clock was still behind. Today we had the hottest day with 36C, so everyone was happy that we had the

Land Rover introduction early in the morning. This afternoon seven team members took the Land Rover driving training with Ronald, Jenny and Dany, while Kristina took Christian, Brigitte, Heike, Uwe and Angela for a walk, finding leopard tracks and scats.

19 October

First day of activities and “getting ready and prepared”. Anne and Heike took it very seriously and tested our fire extinguisher properly, so one of the Land Rovers turned white! After cleaning up, two groups went together to put out and activate our box traps. As we have continued to capture leopards on the camera trap photos at Davidspost, Jackie,

Uwe, Karin, Jesaja and Dany were instructed to build a proper hide there in the afternoon.

Warning! It's not only amongst the animals that you see scavengers. Watch out for your dessert everyone!

20 October

Leopard party! What a day. After another restless night for a few team members, observing kudus at their tents, we found four different fresh leopard tracks on the farm. It seems that the big leopard male is back, inspecting Induna even during the daytime. Another surprise was a caracal, an African wildcat and honey badgers on the camera trap pictures.

In order to detect the noises around the tents (or maybe in the tents?) at night, the staff have decided to set up a camera trap at camp. Sleep well everyone!

21 October

Again a day full of laughs. One group followed the famous “scat boulevard”, while the other group sat in the “waterhole castle”. Brigitte was surprised to discover just how much she gets excited about “scat” and “desert”. After dinner, we all learned that the aardwolf can defecate 10 % of its body mass…. Thanks to group two, three and four for their very funny, active presentations.

22 October

For a few team members the day started early in the morning, at 03:00 am, when they decided to observe Davidsposten at full moon. Anne was desperate to see an Aardvark, which unfortunately appeared on the spot 10 minutes after they left (seen on the camera trap afterwards) In the afternoon Thomas, Conny and Katie turned our vehicle game count into a night drive and were rewarded by spotting a genet on their way back.

23 October

Day off! Everyone decided to stay at Ongos and explore more of the beautiful countryside. A few team members went for a bushwalk in a canyon and spotted parrots, black stork and lovebirds. In the evening two groups had a lovely sundowner at sunset with our leopard.

24 October

Up early again, but it still took team members more than one hour to get prepared (the tyres of all four Land Rovers had to be pumped up). Thomas wanted more exercise so he really got into cutting thorny bushes for the new “Kraal” for the removed box trap. The camera trap group was very happy to see the male leopard near Induna’s enclosure, plus hyaenas on two different camera trap pictures. We are all looking forward to seeing these animals face to face…. Stay tuned!

25 October

Another lovely education day with our school kids from the Family of Hope Services. All the team members went early to pick the children up from their school in Katutura and spent 2.5 hours in the bush with them. A few of the kids enjoyed their first time swimming and jumped into the waterhole just next to the lapa. The kids left at lunchtime with smiling faces and new impressions.

26 October

We are getting closer! In the morning the telemetry group found signals of Lucy very close to the farm and they even found fresh tracks around Induna's (the tame Leopard) camp so we all decided to set up more camera traps next to Induna's fence. After the foot game count in the afternoon most of the team had glowing faces :-)

27 October

Excitement! In the morning Anne, Uwe, Heike and Daniel went to find signals of Lucy and while they were getting a strong signal next to Induna's camp, Daniel spotted Lucy INSIDE Induna's enclosure! She seemed to have jumped the electric fence. We also caught her on the newly set up camera trap pictures a few times, so now we have to cope with two leopards in one enclosure, a tame male and a wild female.... will have to make a plan.... to be continued....

28 October

Last half day of activities. The telemetry group with Karin, Ulli and Jackie found out that Lucy is still in Induna’s enclosure and the waterhole group with Conny, Thomas and Katie finished the hide at waterhole number six. In the afternoon Ulf showed all team members the boma and for our last sundowner we all drove up to the elephant mountain where we had a cold beer and a wonderful sunset :-).

29 October

Happy Birthday Katie! Last breakfast with chocolate cake! Everybody got ready to leave and on the way to Windhoek was the big surprise: fresh leopard tracks around Induna's enclosure...incredible! Two leopards in and one leopard out. Thank you slot 3, team 'unglaublich'. We have had a great time with you. (Thanks also for the Nutella :-)).

31 October

Welcome slot number 4. This morning we picked up 12 new team members from the UK, US, France and Germany. In the afternoon (while we were explaining the compass and GPS) we spotted some baboons at our waterhole close to the lapa. So we decided first of all to take some pictures and after that Ronald chased them away with stones.

After dinner we rounded off the day with a glass of champagne at the lapa.

1 November

Land Rover driving day! After receiving instructions about the vehicles in the morning, nine drivers were ready to take the practical driving lesson in the afternoon. And what a surprise… all of them passed the driving test. Jennifer, Chris and Barbara bravely went with Kristina to put a baboon with stinky rotten meat water in the box trap.

2 November

Activities! After all the theoretical instructions three groups head out for collecting data in the field. Annick who actually checked the box traps with Bernard and Susanne, spontaneously joined the anti-poaching-unit on horse. The data entry group in the afternoon found two leopards on the camera trap pictures in areas where they have never been spotted before!

3 November

Big news this morning! Last night Kristina stumbled across a leopard just a few hundred meters away from camp! After the feedback from the morning activities it was clear that this was not the only leopard around. Tracks of at least three individuals have been recorded. The telemetry group also discovered that the leopard Lucy has left Ongos. Leopard Party number two. We must catch one soon!

4 November

The teams performed a foot game count in the morning. David had announced at breakfast that he wouldn't come back until he had seen an oryx. Well, he did come back for lunch but slightly disappointed. After his telemetry activity he was happier because he saw a "demi"oryx far far away. For their sundowner beer, David, Barbara, Chris and Adam enjoyed meeting Induna in his enclosure.

5 November

Fresh hyaena tracks were found by Group 1, close to the box trap in the south. What a pity there was no animal inside the trap. However, by putting some rotten meat water above the bait, Adam, Chris, Dave and David are confident they will catch something very soon. After dinner two groups presented their animal ID presentations: A great 'waterbuck-drama' and a cool 'wildcat-rap'

Well done!

6 November

Today was spent with the children from the Katutura school. We went to pick up 16 kids… well nearly all of us did. Dave was left behind. Even his wife didn't notice his absence. After meeting Induna, the children went on a game drive where they spotted all sorts of animals, including a new species–a 'hot-dog' (warthog). After dinner we had two active animal ID presentations: A mongoose-questionnaire and a honey badger-pantomime.

7 November

Day off relaxing. Our birders particularly enjoyed the day off, spending their time near the river. While staff went out to get a new box trap in the afternoon, some of the team members headed off for a game drive and spotted giraffes, which came close to the vehicle.

8 November

Susanne, Bernhard, Barry and Adam set up our new box trap at Davidsposten and enjoyed building the Kraal with all the thorny bushes! The chance of catching a leopard or hyaena is increasing now. The telemetry group figured out that Lucy is back at Ongos and there were big surprises on our camera trap pictures: A caracal at Nordpass, Aardvark at Davidsposten and a leopard at Ochsenposten. Exciting!

9 November

Saint Christopher day:-) It turned out that Jennifer had her personal travel saint during the foot game count in the morning also called Barry :-). The tracks and scats group checked the famous 'scat boulevard' and discovered hyaena and leopard tracks and scats! After dinner a few of our team members enjoyed playing 'Jenga'… fits of laughter.

10 November

Leopard party–the third! Camera pictures of last night showed FOUR leopards drinking at Davidsposten. Incredible – never have so many been seen at the same time. And more news on the pictures: one leopard again at Nordpass and another one at Induna's enclosure. The box trap group is looking forward to seeing what surprises await them tomorrow :-).

11 November

Leopard in the box trap! Everybody is so excited…and guess where? Again Davidsposten! It was a female leopard approximately 8 months old. Unfortunately she is too young to put a GPS collar on, but during immobilisation we took some blood and hair samples and ID pictures. Thanks Adam for being the infusions holder :-). We rounded off the day with a camp fire and heard a poem from Dave who wrote a few wonderful lines for each team member and staff. That was amazing, thank you so much Dave.

12 November

Last day. After all the excitement of yesterday everybody is so sad to leave our camp today! And also the staff….thank you to all team members, you did a great job. As a momento we took a group picture in front of the Land Rover. We had good fun with Bernhard and the timer on his camera… the timer was too fast and he was too slow :-).
Thank you slot 4.

To see the leopard during immobilisation have a look at the Facebook entry-
http://www.facebook.com/pages/Biosphere-Expeditions/132594724471

17 November

Hi, this is Jenny. I am taking over as your expedition leader for slots5 and 6 and Dany will be my assistant. Ronald has done a great job training us over the last few months, so I think we are well prepared and ready to catch some more big cats. A big thanks to Ronald. It has been great working with you and we will miss your expertise.

As it has started to rain heavily out here, it would be great if you could come prepared for rain by bringing some appropriate clothing.

Looking forward to meeting slot 5 on Sunday.

23 November

Our first day of activity. Manfred, Sascha, Melissa, Juan, Jutta and Lauren set up the box trap at Davidsposten and built a new Kraal. Michael, Wolfgang and Shawn drove through the farm to check the camera traps. In the afternoon came the big surprise of the day -a leopard on the camera pictures near Davidsposten.

24 November

A honey badger was found in the box trap, so we radioed everybody in to release the animal. What excitement! Two groups also set up a new box trap along the fence at Nordpass, so we're ready to catch a big mammal. In the afternoon Fiona, Mike and Rod enjoyed doing the questionnaires in Katutura. They found out that in one area of the township, dogs are disappearing and sometimes found killed in the field. We'll keep an eye on it, so stay tuned.

25 November

Yippie! Finally after a week of silence we heard the familiar "beep" sound. Lucy is back on the farm and Juan, Lauren and Jutta excitedly followed our collared leopard. After dinner we had two presentations: a questionnaire about porcupines and a shadow puppet show about blue wildebeests. Thank you for entertaining us.

26 November

What a day! In the morning Fiona, Rod and Mike checked the box traps and found a porcupine in the trap at Nordpass. Thanks Rod for releasing it. Right before our afternoon vehicle game count we received two "little" visitors. The rhinos suddenly appeared at our camp and really enjoyed a massage by team members.

27 November

Today we had a wonderful morning with the Katutura kids. 14 children between 13 and 16 years old enjoyed the game drive with our team members and meeting Induna. In the evening Jutta, Lauren and Juan checked the box trap in the north and found a baboon inside. Juan was brave enough to release it. We also had two more great presentations. Fiona, Rod and Mike gave us a short interesting talk about the African wildcat and Shawn, Michael and Wolfgang presented us their exclusive, self-made Ongos production about the bat-eared fox: a movie. Stay tuned…you'll find it on YouTube soon :-)

Check the website of FHS: http://www.familyhopenamibia.org/kids-participate-in-biosphere-expeditions-experience/

28 November

Day off. Some of the team members drove to the mountains in the morning, where Ulf showed them a wonderful canyon. While the guys decided to come back for lunch, Jutta, Fiona, Lauren and Melissa enjoyed their picnic at the canyon. Team members had a good day off with a walk to the bushman paintings, relaxing and game drives.

29 November

We created a new route for the foot game count because the river current is too strong to cross on foot. All groups had a great bushwalk, but there were only a few animals around today. It seems that someone released the wild animals just after picking up our team members :-)

In the afternoon Rod, Mike, Fiona and Jutta found another strong signal of Lucy near Ochsenposten, while and Wolfgang, Shawn and Michael found some old scat of the brown hyaena in the mountains.

30 November

After checking the box traps Rod, Mike, Fiona and Jutta went off in search of tracks and scats and found leopard and aardwolf tracks near Induna's enclosure, plus a snare in the north. Meanwhile the waterhole group built a hide at Ochsenpostdamm. They say that 10 people plus a minibar will fit inside :-).

In the afternoon all groups headed off for the vehicle game count. A thunderstorm started just towards the end of the game counts, but luckily all came back safe and sound.

1 December

Our box trap group consisting of Sascha, Melissa, Lauren and Manfred first checked the box traps, then set up a new camera trap between Davidsposten and Roiberg and after that walked a 4 km route searching for tracks and scats.

Well done!

In the afternoon the Katutura group enjoyed interviewing and chatting with the locals and marvelled at one of the houses at the edge of the township which was decorated with colourful metal sculptures made by the owner.

2 December

Everybody enjoyed the final activity in the morning, but were also a bit sentimental, knowing that it will be the last time driving around Ongos and helping us with our research. We celebrated with a sundowner at elephant mountain and took a great group picture as a memento.

3 December

In the morning we had another task for our boys group-Shawn, Michael and Wolfgang. We carried the box trap at Davidsposten back to the farm where Frederick, one of the farm workers, will build another box trap for the next slot.

Thanks guys.

So now it's time to say goodbye…thank you so much slot 5, we will miss you. We would like to say a special thank you to our A-team (Wolfgang, Shawn and Michael) who supported us with chocolate :-)

5 December

Welcome slot number 6! Sunny blue sky and 10 happy team members were picked up in town…but where was team member number 11? James was delayed at Frankfurt airport, but luckily arrived at camp during lunch time. Everybody had a great time on our first introduction day. Thanks guys for being so much fun.

6 December

Second day of introduction and training. While going through the vehicle checklist in the morning, we observed two big eagles in the sky at the camp. It seemed that these Marshalls were actually watching us. Today's timetable also included datasheets, GPS, equipment table, presentation of the brown hyaena and an overview of prey animals, driving course and setting up the box traps.

7 December

What a team! First day of activities and everyone was ready even BEFORE they had eaten breakfast. While out on the activities we tested the team member's orientation-GPS and compass skills that were taught yesterday-and we promptly observed team one heading south instead of north. However after four wrong turns even Group 3 learned how to read a map. While checking camera trap pictures we were happy to find "Genet Jackson" just behind the camp.

8 December

Box trap number 3 is back in place. A big thank you to George for checking the fluid levels in the vehicle. This is a repetitive job but an essential one. After lunch group 3 (Johannes, Rob, Christine and Lindsey) was sent to find waterhole 6. Well done, they found the water but they set up their chairs in the open plains just on the edge of the water. They sat there for ages wondering why there were no animals, until they finally spotted the hide which they were supposed to sit in :-) On their way back they encountered a snake, but Johannes protected his females just as the zebra stallion they had seen before had done.

9 December

Today our adventurous group 3 had to manage a foot game count without a GPS (they brought empty spare batteries) and if that challenge wasn't big enough, they also managed to lose the radio on their way. So they split up and Johannes got lost, breaking three rules all in one morning. In the evening we couldn't stop laughing at our convincing acrobatic demonstrations of African wildlife. Kristina and I were used as buzzers in a springbok quiz and we know now how to sound like elephants, frogs and baboons.

10 December

In the morning James, Regine and Candida (our birthday girl) went to look for Lucy by telemetry. Soon after they left the camp they found leopard tracks next to Induna's enclosure, that were then identified as Lucy's. In the afternoon we had vehicle game counts and after a lot of diurnal animalswere seen, eight team members decided to go on a night
drive to spot the nocturnal ones as well.

11 December

Day off for almost everyone. The whole group decided to stay at the farm and split up into diferent groups. Our “girlie group” seemed to have lots of fun when not being surrounded by the guys. Marina spent eight hours at Davidspost watching red dragon flies and observing their behaviour. Later on, lightning struck Elephant mountain and set it on fire, so Kristina and Jenny had to help out fire fighting together with several Ongos workers and neighbours. Luckily some rainfall helped and after a while our first fire of the season was extinguished before sunset.

12 December

After yesterday's 57° C in the sun, this morning started with nice overcast weather. Everyone was rested and by lunchtime two groups had already found two fresh leopard tracks. Morena, Leslie and George went on a search for Lucy this afternoon and were lucky enough to find a fresh kill by her, in between some rocks.

13 December

School holidays didn't prevent us from picking up school kids from Katutura. 18 kids and three supervisors kept us busy with questions and excitement in the morning. Luckily we had James with us who is an expert in mimicking aardvarks.

Coming back from our vehicle game count in the evening, Regine, James, Marina and Candida had seen 137 animals in only three hours! And our smart group 3 at least found 11 animals, but Johannes always tries his best :-)

14 December

Incredible morning for Group 2: they spotted fresh blood in the bush and found a place where a warthog had been injured by a leopard just moments before. They decided to follow the blood trail and came across a baby hartebeest, which was very recently killed and only half eaten. The leopard must have been here minutes before and probably felt disturbed by the approach of the group. So they promptly left and on the route home discovered the injured warthog; they must have almost been on top of the leopard.

15 December

Our leopard group 2 was sent to check the box traps in the morning and they again found very fresh leopard tracks in the north... even without a tracker! Well done.... all the community interviews went well and our team members got a positive impression about social life in a township. In the afternoon our famous group 3 had another flat tyre and neither radio nor mobile reception... so in my opinion they should stay back at camp tomorrow doing data entry. At least there they are under supervision and can't break anything :-)

16 December

Cleaning day. Thanks to everyone for your great help collecting the box traps and giving them a wash. Candida and Morena did a great job cleaning the cars and everyone else was busy helping with the inventory.

17 December

Last day. Thanks everyone over the past four months for having been so supportive in so many ways, for the work done in wildlife conservation, the fun we had, for the lovely goodbyes..just thank you for everything, you have been fantastic! The Biosphere Expeditions staff in Namibia wishes every team member a Merry Christmas and a Happy New Year. We hope to see some of you somewhere again, some day. Farewell and thanks again.

Jenny Kraushaar
Expedition leader

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21 January 2011

Dear Namibia expeditioners

I hope everyone has had a great start to the new year. This is the first diary entry for the 2011 Biosphere Expeditions project to Namibia. My name is Jenny Kraushaar and I will be your expedition leader. I am on my way to Namibia, where I will meet Dr. Ulf Tubbesing and Kristina Killian, our scientists and together we will get everything ready again to continue our research on large cats on Ongos.

We have been busy building new box traps and they are now ready, with your help, to catch some more leopards and other cats. As the rainy season has started and water levels are quite high, please bring some adequate clothing and be prepared for humid weather and gorgeous sunsets. Everyone is looking forward to seeing you out here soon.

A few quick points of admin, before I go: the expedition leader mobile phone number in Namibia is +264 81 6208672. This number is for emergency calls only, such as being late for assembly due to late flights, etc. Excerpts of this diary will appear on www.facebook.com/pages/Biosphere-Expeditions/132594724471 and the site to share pictures on is www.biosphere-expeditions.org/pictureshare.

We'll see you in Africa :-)

Jenny Kraushaar
Expedition leader

30 January

After the heavy rain during the last few days we were a bit worried if we would be able to collect the team from the assembly point. Luckily the level of the river dropped overnight so that we were able to cross the ford.

All team members were in a good mood when we met them. We were pleased to see that this team represents eight different countries, so we are really happy to welcome volunteers from Australia, New Zealand, Norway, Canada, UK, Netherlands, US and Switzerland. As this was the first day without rain we wonder which of them brought the sunshine. We discovered that they all have something in common: they are always late. We must give them dictation 'we must not be late'

31 January

It seems that Michael and Branko are real women as they kept their team members in neighbouring tents awake all night with their never ending chatter and gossiping. They even drowned out the frogs.

In the morning everyone was greeted by the rhinos who came for a visit at the lapa and after learning everything about changing tyres and how to clean Land Rovers, we had a fabulous lunch prepared out of “Omajova” (the huge mushroom that grows on the local termite mounds).

The afternoon was full of excitement as the “non-drivers” went out with Ulf for a game drive and David spotted a leopard on a kill. So this will be the spot for our box trap tomorrow....

1 February

Setting up box traps were the main activities of the day and almost everyone had an encounter with a black Mamba (luckily it was found dead). It is only the first day of activity but we have already caught a leopard on the camera trap picture, found leopard tracks on the road and seen one hanging in the tree (our tame Induna). Unfortunately there are millions of caterpillars around and everyone got them everywhere. We all wonder if Charlene will make it on time for breakfast tomorrow...

2 February

Everyone was at breakfast ON time so we were able to make an early start with the activities. Unfortunately it was still raining but everyone was well prepared. Group 1 and 4 went to set up the third box trap while the other groups were busy checking camera traps and looking for tracks.

Box trap 1 and 2 worked very well last night and a porcupine and a vulture were caught. Mark, Lydia, Helge and Susanne went to the township of Katutura to gather information about the health status of domestic animals.

3 February

Foot game count between caterpillars, snakes, spiders and thorns - and no complaints! Thanks to everyone, you did a great job. In the evening we had a quiz about white rhinos and waterbuck, a ‘balloon’ story about mongooses and a nice demonstration from Branko, the black-backed jackal.

4 February

A very successful morning. After patting the rhinos everyone went out on activities. Charlene spotted leopard tracks in front of Induna’s enclosure and Sharon, Branko, and Jessica spotted different tracks of a leopard with a cub. We then checked the camera trap and there we found a big male leopard looking straight at the camera. In the afternoon we weren’t able to conduct the game drive as it was pouring with rain so we stayed back at the camp and enjoyed a presentation given by Ulf.

5 February

Day off. Almost everyone stayed back at camp and enjoyed heavy rain, thunderstorms and lightning. Our hero Branko saved Charlene’s life in the wet river. The box trap caught a warthog which wasn’t too happy about being trapped, so Michael released it. Jacobien, Mark, Michael and Sharon thought they were smart enough to escape the rain and went up the mountains but after only 10 minutes they got caught by thunder and heavy rain and the back of the Land Rover turned into a swimming pool. We are still busy drying all their clothes.

6 February

Wow! It finally stopped raining so we were able to do some telemetry work. Mark, Helge and Susanne were the lucky ones tracking Lucy's signal and finally spotting her. That was the first time we have seen her in the flesh since she was collared in May 2010. Great!

Another leopard was found on one of the camera trap pictures this morning, close to our box trap. Three words only about the afternoon: rain rain rain. By the way, in the Windhoek district it is the record rainfall for the last hundred years ;-)

7 February

We can't believe it. When we got up the sun was out. Happy birthday Charlene! We went to pick up 12 school kids from Katutura and we were happy to see 30 other kids going on a trip to an education centre in the desert, which was kindly sponsored by Biosphere and Stormsaver. We had a great morning with the kids and when it was time to leave we had difficulties getting them out of the waterhole. And hey, as we had a look at the afternoon sky we found big heavy clouds and thunder again so only a few volunteers went still out to count game and they got rewarded by a leopard sighting! This is the third wild leopard sighting within this slot, amazing!

Welcome Slot 2. Before we even introduced ourselves at Casa Piccolo, the team members had already learnt how to change a tyre. We only have three Land Rovers at the moment so Adam, Summer and Andrew were kind enough to volunteer to ride on the back of the Land Rover. Poor Summer figured out that she got a holiday visa for one week only, so we will take her to Home Affairs tomorrow.

14 February

First night in the bush and everyone was kept awake by frogs and baboons. After breakfast the team members were taught how to fill out datasheets, how to use a GPS, a compass, telemetry and how to change tyres on the Land Rover. In the afternoon we trained five team members in driving skills and we are wondering how they will cope with our washed out roads in the mountains.

15 February

Adventure day. Group 2 and 3 went out with Kristina, Jenny and Emanuel to set up a box trap and before they even got to the spot, they experienced the maximum speed of rhinos. Luckily Adam didn't follow the speed limit so we escaped just in time. After the friendly rhino chase, we found fresh tracks of a leopard attacking a red hartebeest, so we put up the box trap just next to it. In the afternoon, Summer, Davina and Andrew found out that it can actually hale in Afrika. Sorry guys, we didn't see that thunderstorm coming ….

16 February

Box trap 5 was set up this morning and we were probably being watched by leopards as there were fresh tracks around. Poor Milton, Avril and Pat had to bait Box trap 3 with a stinky warthog leg. During lunch break Milton, Andrew and Adam tried their best to repair a camera trap, but without success.

17 February

Summer, Milton, Tessa, Mona, Adam, Andrew and Davina were so excited about our new box trap that they decided to check it... at 6 am! The trap was closed but empty. On their way back they hit a road block of rhinos, so the foot game count start had to be delayed and after the heavy rain last night no one was prepared for the sunshine.

Pat did an incredible job walking the 4.3 km up and down the hills in rubber boots.

18 February

After Matthias and Angela realised this expedition is NOT a Land Rover Experience trip through Namibia, they actually got used to walking through the bush. They returned 2 hours late from their trip in the mountains and Matthias ended up naming his blisters Jenny and Kristina :-). We started the vehicle game count with thunder and lightning but only Milton, Avril and Pat caught the heavy rain.

Surprisingly we had a clear sky in the evening so we could sit around the campfire. Then Adam decided to change a flat tyre by the light of the full moon.

19 February

The day off was almost like a holiday. No clouds in the sky, no cars were broken, no caterpillar accidents, no one got lost, no one was chased by rhinos and everyone came back smiling. Summer, Andrew, Tessa, Mona and Adam decided to walk up and down the canyon and whenever it got too hot, they jumped in one of the waterholes.

20 February

After a "quite" normal morning of activities, group 2 had fun in the afternoon. They were meant to do a vegetation survey but when they had arrived at the main gate, Bernd realized he had lost his shoes. They must have fallen off the roof of the Land Rover where he had absent-mindedly put them before the group set off from base. So group 2 had to do a new activity in the afternoon- SHOE TRACKING.

In the evening we started sorting out gifts for the school kids. As soon as our male team members spotted the soccer ball that Adam had brought, they were all ready for a barefoot soccer game at the lapa. Adam is now suffering from black and blue toes so he had to remove himself from the Tracks and Scats activity on Wednesday.

21 February

After surviving the kids in the morning, Group 4 went on a vehicle “spider count” which was meant to be the vehicle “game count”. The girls sitting on the roof of the Land Rover had to fight their way through spider webs. However, even with their harsh screaming they still managed to see a few animals... these must have been the deaf ones. After dinner we were treated to a surprise for dessert: an unpeeled banana on a plate with a spoon.... someone forgot to fry them :-) The nights have now become the time for soccer games where the spotlight and Land Rover headlights are turned into floodlights. Half of the team members are now injured but the girls almost beat the guys. ;-) Stay tuned for the next exciting ‘gender football’ showdown.

22 February

Due to heavy rain, only seven brave people went out for the foot game count. They also had to cross the river and needed time to wring out their socks afterwards. Our evening presentation was split in two parts as the projector and the computer broke down at the same time. So we filled the break with SOCCER :-)

23 February

Almost a sunny day of activities. And the Hyaena seems back. We found her on one of the camera trap pictures. Two groups went to Katutura to interview local people today and got a good impression of how local people use their pets for protection.

24 February

The last survey morning started in the rain, so our tracks & scats group had to come back earlier. The telemetry group had success finding Lucy and more tracks close to Induna. The afternoon is filled with cleaning up, presentations and SOCCER of course. Unfortunately we couldn't have our last day sundowner at Elephant mountain due to heavy dark clouds.

28 February

All the team members from Slot 3 had been out for dinner the night before we picked them up, so everyone had already got to know each other by the time we collected them at Casa Piccolo in the morning. Luckily Gabi found out just in time that the Namibia Expedition is NOT a diving expedition.

After 2 days of training, everyone was confident enough to experience the African bush. We are very happy with our nine new camera traps that Alan brought along from the US and we have already put them up. So our number of camera traps has increased now to 13. Our fifth box trap was placed in the Mountains and poor John has already had a bad encounter with the caterpillars. The camera trap pictures proved our skills in tracking and showed a brown hyaena just where we found some tracks.

4 March

On Thursday we had a very early morning with everyone showing up for breakfast by 06.00. The foot game count started at sunrise and everyone came back talking about thorny bushes and spiders. In the evening, Greg and Dolly felt the itch to dance. Just before dinner a chilling noise was was heard not far away from camp and we figured out it must have been leopard catching a baboon for its dinner. On Friday, we conducted our vehicle game count and spotted 28 red hartebeest, 15 giraffes, 3 ostriches, 46 oryx, 7 kudu, 20 eland, 37 warthogs, 31 zebras and on top of it group 3 spotted an African wildcat.

7 March

The data entry group had to look through 3000 pictures from our camera traps. When we suddenly heard cheers and screams of excitement, we rushed to have a look and thought it had to be a perfect leopard picture, but they were celebrating an ostrich picture! Later on, they also found three different leopard pictures taken by three different camera traps. The day off was very relaxed and everyone stayed back at camp. Thea and John were brave enough to release a big female warthog which was trapped in one of our box traps.

On Sunday night we had clear sky so decided to conduct a night drive after dinner.

10 March

After a very wet morning on Tuesday we were fortunate to still be able to conduct our vehicle game count in the afternoon. Poor Gabi got several thorns in her while in the back of the car so the “after dinner activity” was removing thorns from Gabi. As we had to remove one of the box traps, we found a very good new spot just behind the camp where we had found leopard and hyaena tracks the other day.

Alan and Greg are still being a big help in solving some camera trap problems, they even walk up and down the lapa at night to check the settings. Thanks guys.

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20 July

Welcome to the first entry of our Namibia rotation 2 diary. I am Matthias Hammer, founder & executive director of Biosphere Expeditions, and I will be with you for the first week of the expedition (7-14 August), handing over to the very capable hands of Jenny Kraushaar, who will be your expedition leader from then on. Our expedition scientist Kristina Killian is already in Namibia, conducting her research and getting things ready for us.

Kristina has been very successful with camera trapping (see video at http://www.youtube.com/watch?v=Gva8J-lsl0M; ignore the dates on some photos as the traps were not set up correctly) and has captured leopard, hyaena, cheetah and all sorts of other species on camera, so they are around! A word of warning though: you are joining an expedition working with truly wild animals who are very good at avoiding their biggest threat - humans. You are not joining a safari to a national park where animals are habituated and you can tell where they are by following the other tour buses! On our study site animals are wild and elusive, and as a result they are bloody hard to catch and/or see. If you are hoping to see and photograph the cats in a safari-style operation, then you will be disappointed. If you are coming to help Kristina with her work and obtain an insight into how conservation works on the ground; warts, successes, failures and all, and if you are prepared to put lots in to get lots out, then you will have a great time.

As you can see from the team list, rotation 2 will be relatively small teams throughout. Namibia is an expensive expedition, because we need expensive logistics to run the project properly (a research base, four Land Rovers, equipment, food, local helpers, etc.) and we've taken a hit during these times of economic hardship for many people. So you coming out to help with the project is doubly appreciated, your contribution is doubly important and we'll work you twice as hard ;)

Jenny's mobile number in Namibia is +264 (816) 164407 and Kristina is on +264 (81) 4549827. Remember that these phone numbers are for emergency communication only (such as being late for assembly). We're packing up as we write this and Jenny, just back from our snow leopard expedition to the Altai, is off to join Kristina in a few days. I'll follow a few days later and we all look forward to seeing you at Casa Piccolo sooner or later.

Safe travels

Matthias

29 July

One week to go until the start of the expedition. Kristina tells me that they are busy getting base camp ready for us. She also tells me that it is still VERY COLD at night with temperatures around zero. If you have been to Africa before, you'll know the pattern: it's bloody freezing when you get up in the morning but it soon warms up to a pleasant temperature when the sun rises. Make sure you bring warm clothes and make sure this includes a hat (you loose much of your body heat through your head so a hat at night really helps to keep warm). If you get cold easily, you may want to consider bringing a sleeping bag to supplement the bed sheets and blankets we have.
This I recommend for the group starting 7 August at least - for the other groups we'll keep you informed about how temperatures develop via this diary. See you in a week!

9 August

Team one has arrived and been put through its training paces - animal ID, datasheets, GPS, compass, Land Rovers; you name it, it's been covered. The nights are still very cold (single figures above freezing), but the days are warm & sunny, as expected. Today was our first day of activities and we spent it putting box traps into place (see the video on www.facebook.com/biosphere-expeditions1 - remember you do not need a Facebook account, just click the link and go to the "Wall"; there's also a video of our research base on there now). Wish us luck in that they will capture the ever-illusive cats.

Admin: will everybody please bring a plastic box for the lunch packs you will be making at breakfast.

11 August

After all the training and putting the box trap into place, our plan was to conduct the educational half-day on Thursday morning and then split into activity teams. The morning worked according to plan (well, as much as herding two dozen primary school children can go according to plan ;). Just as the children were leaving we received a message from our local helper Emmanuel that there was a leopard in the box trap we had only put up the day before!

Needless to say that this changed everything and that the place had a certain buzz about it, as we were getting ready to put the (male) leopard under and put a GPS collar on him. When we arrived in the remote part of the mountains where we had placed the trap the day before, he was in a foul mood, but looked a fine and healthy specimen. He was quickly put under by Ulf, the farm owner who - very conveniently - is also an expert wildlife vet, and then Kristina, Jenny and Ulf were busy around him, whilst the rest, including the very luck ZDF film team, put their cameras into overdrive at a respectful distance. The GPS collar was put on, he was weighed (over 60 kg), given a health check (and found to be in excellent shape). Blood samples and facial recognition photos were taken and we then decided to let him sleep the drug off and release him in the morning.

Back at base, sparkling wine flowed and the film team set up a little bush cinema and shared the day's events. We also decided on "Ongwe" as the name. This was suggested by our local staff and simply means "leopard" in their language.

12 August

We returned this morning to set up the pulley system to release Ongwe (no jumping on the trap and pulling up the door with cranky leopards!). You can see just how cranky he was when I approached him on www.facebook.com/biosphere-expeditions1. The pulley system worked fine and everyone was there in the Land Rovers with doors and windows firmly shut and roasting in the sun as Ongwe took almost an hour to come out of the trap. In the end Jenny and her team did some extreme off-road driving in their Land Rover to approach the trap from the back, which brought Ongwe shooting out and running full tilt up the hill. What an awesome sight - and in time too; three minutes before the tape on the video recorder we had set up on a tripod outside his trap ran out.

His collar is working and we now have another leopard to follow around and collect important data on. Well done everyone. We should all consider ourselves very, very lucky!

14 August

Day off for almost everyone. Matthias and the film crew were busy packing and all of us felt a bit weird not to have a camera following us wherever we go anymore. All the team members volunteered in the morning to check the box traps and then spent the afternoon relaxing.

15 August

Matthias and the film crew left us yesterday and I am pleased to take over as expedition leader now. The group spirit is fantastic. A big thanks to Ulf and Ilka who bought us champagne to celebrate on Sunday evening that everything went so well the first week. The teams are now working hard. We guessed that Lucy might be around during the morning, so Ilka, Bill and Katie went out on telemetry work and found her signal next to the river. Our “lucky” Box trap was surrounded by fresh leopard tracks again but unfortunately the mongooses had played their “closing the trap” game and closed the gates before any another animal could get in.

16 August

Foot game count in the morning… we started off early in the morning and both teams did well walking up and down the hills counting prey animals. We already received some data sent from the GSM collar on our leopard “Ongwe” and due to the GPS points we obtain, we are now able to get an idea of his movements. In the afternoon Ilka, Ulf and Emmanuel followed him with the telemetry equipment and got a signal not far from the trap where we caught him. We are happy to report he is still around where we expected him to be. The evenings and mornings are still very cold and after dinner we all stand around the indoor fireplace sharing the adventures of the day.

17 August

Today we went to Katutura to interview locals and to gain more information about pets and their health status. Telemetry was again very successful. We found signals from Ongwe and Lucy at Ongos and we are looking forward to getting more information about their home ranges next week. The tracks & scats group ran out of Ziploc bags as they had found so many predator scats along their way. In the evening we could hardly understand each other due to the noise of frogs croaking, so we decided to play “Jenga”.

18 August

Thursday we spent hours scrubbing the cars and cleaning the equipment and team members were rewarded with a beautiful “farewell” sundowner at Elephant mountain. Kristina and I want to thank the whole group for having been so patient and so good humoured. It was a pleasure to have you. You did a great job and we really hope to see you again soon.

19 August

Just dropped off everyone at Casa piccolo where we will pick up our next group at 8.30am on Sunday and looking forward continuing our work at Ongos next week.

20 August

We've now uploaded a "Namibia impressions" video to www.youtube.com/watch?v=GD_VF1Y_wNQ and www.facebook.com/biosphere.expeditions1 .

And for anyone who's interested, there's now also a video FAQ playlist (shot in Namibia) on www.youtube.com/playlist?list=PL5C68C53828C8E744. Thank you for the idea Claudia, the help with editing Ludger, and the input into the questions all of group 1.

21 August

The second slot arrived safely and after a long day listening to talks, practising telemetry and refining their skills on GPS use, the team members experienced a cold evening in the bush. Thanks to all the hot water bottles no one froze during the night.

22 August

A day of learning all the bits and pieces of the Land Rovers. 90% of the group are women so we weren't surprised that the driver lessons went so well and we finally have 7 drivers in this group. The night was freezing and in the morning the windows on the cars were frozen.

23 August

After defrosting by the fire in the morning, we started all together to remove one of our box traps. We checked the surroundings of our waterholes for tracks and scats and were successful finding leopard and hyaena scats. Discovering new areas and spotting lots of animals while having our lunch in the mountains brought smiles and sunburnt faces in the evening. We were happy with the new spot we found for the trap and we will be back tomorrow to set up the kraal and activate the trap.

24 August

After checking the box traps in the morning, Ann, Joanna, Torsten and Marianna helped us build a big Kraal around the newly set up box trap in the mountains. Group 2 went to Katutura to gain more information about the pets out there. They found the animals in good conditions and were very welcomed by the locals.

25 August

After the sun rose from behind the mountains, we started off with three groups and the first foot game count. But after one hour the teams were collected by Kristina and Jenny, as they had found a female leopard in the box trap just behind the camp! It seems that Thursdays are leopard days! Second leopard within two weeks! WOW. So the plans were changed and we sedated her and got all the samples and measurements we needed. As she was only 30 kg we decided to release her after lunch with a lighter VHF collar. The evening we spent celebrating the success and named her "Shandy".

26 August

Finally a normal day of activities. Everyone now knows how it feels to be a field biologist. The groups were out all day counting prey animals and looking for tracks and scats in the mountains. With three leopards collared we are struggling to decide each morning which one we will look for first. Today we decided Lucy was the first one and we were lucky to find her still on Ongos. The bed times seem to get earlier each day… what's wrong:-)

27 August

A beautiful day to take off. The temperature rose to 28 degrees during the day and we had breakfast in T-shirts for the first time. Ever keen, everyone volunteered to check box traps all the same and the girls did a fantastic job looking through almost 5000 pictures taken by our camera traps. Finding nothing but baboons.

28 August

Marianna, Joanne, Torsten and Ann went out for a 7 km walk to find tracks and scats and came back with the bags full of leopard and hyaena scats.

Today Rafael (our facility manager) decided that summer has begun so there won't be any more hot water bottles in the evening ;(

29 August

It's school holidays, but the Katutura kids still wanted to come to Ongos, which is a sure indicator that they are enjoying their time with us. We had a great time watching the rhinos and lots of antelopes. After a long lunch break to avoid the heat, we started off with the vehicle game count and were able to count lots of animals.

30 August

Foot game count early in the morning to escape the heat. In the afternoon, Anne, Joanna, Marianna and Torsten had a big go at typing in all the data we have collected so far. They did a great job and Anne said she felt like being back in her office already (just the ringing phone was missing). After that exciting "office afternoon" they decided to go on a night drive and it seemed worth it: they came across a rabbit and a mouse!

31 August

Telemetry and community interviews went very well and we collected lots of useful data about the pet health status on the west side of Katutura. The last afternoon of activities was spent looking for more tracks, scats and signals of our leopards and enjoying the beautiful sunrise behind the mountains.

degrees during the day and we could have breakfast in t- shirts. J Checking box traps was still a task even on our day off, so everyone volunteered in the morning to have a quick look if the traps are empty and still activated. The afternoon was mainly spent around the camp site. The girls did a fantastic job looking through almost 5000 pictures taken by our camera traps. Finding nothing but baboons.

1 September

The two weeks went far too quickly and everyone was surprised that this was already our last morning of activities. We spent the afternoon car washing, and packing before we headed up to our favourite spot for a sundowner. We shared all the impressions of the last weeks around the campfire with marshmallows and red wine. A big thanks for the great help and the success of catching another leopard.

Kristina and I are now busy getting prepared to follow up three collard leopards and to gain as much data as possible with the help of the upcoming groups. The next one arriving on the 11th. We wish you all a safe trip whichever way you are travelling and we are looking forward chasing Slot 3 through the African bush :-) see you next weekend.

11 September

Sunday morning 8.30: two Biosphere Land Rovers are driving through the gates of Casa Piccolo, collecting 7 very excited research volunteers from Switzerland, Germany, UK and the US. Kristina and I are delighted to have a masseuse amongst the group. We guess Brigitte will have some extra work to do here. As all the team members had all travelled within the same time zone, everyone was awake and listening to the lectures, talks and training.

12 September

The second day of training went by fast and in the evening team members learnt how to catch flies for the chameleon. ;-) After dinner Brigitte conducted a yoga lesson and did stretching and everyone now feels ready to set up a new box trap tomorrow.

13 September

We were very surprised this morning that almost everyone had already made their lunchboxes by 7.00 am, so we could leave on time! The yoga and stretching course was very helpful as everyone had lots of energy out in the bush. The group cut bushes, set up the trap and built a kraal within a record time and so we are all excited about what we are going to catch in it.

14 September

We are back to cold mornings. We only had 5 degrees in the tents in the morning so everyone was waiting for the sun to come up before we started with our foot game counts. The groups were quite successful spotting wildebeest, springboks, hartebeest, oryx, kudu and lots of warthogs on foot!

The afternoon was spent searching for predators on the camera trap pictures… and we found leopard, caracal and brown hyaena.

20 September

Following a quiet day off on Saturday, we checked the camera traps on Sunday and noted another "not yet collared" leopard is in the area.

Plans to visit the school on Monday changed quickly as Group 1 found a male leopard in the box trap, which had only been set up last Tuesday. We immobilised the young male in the afternoon, measured his body, tail, face, and took blood. Because this youngster leopard is still growing, we released him without a collar in the morning. And as current team member, John, has been with Biosphere in Namibia five times now, we decided to name our young leopard "Johnny" in his honour.

24 September

On the last day of this group we discovered that you can capture a nocturnal termite-eater in a box trap baited with meat! Team 1 found an aardvark in the box trap this morning and we released this animal, which we just had a presentation about the night before.

Kristina, Jenny and all the staff want to say good-bye to everyone from group 3 and thank you for your help and for catching yet another leopard for us. And hey, John, see you next year on your sixth Biosphere expedition to Namibia.

Thanks to everyone who has supported our school kids in Katutura with pens and pencils and lots of papers. We still have plenty of pencils to distribute and we would love to add some other little give-aways, such as balloons, stickers or posters.

See you soon

28 September

Slot four training sessions commenced without a few team members because our poor Aussie couple was delayed by almost 24 hours. But brave as the people are down under, they still managed to keep their eyes and ears open until we finished our last "prey animal" lecture late in the evening. Surprisingly we have had a huge change in weather and have already experienced the first rain on Ongos. We are happy to see that the team is well prepared and even in the rain we were able to remove and set up our Box trap 1 in the East. After a day of cutting thorny bushes, the team really deserved a sundowner in the bush.

1 October

The rain lasted a few more days and unfortunately we had to break up our telemetry session due to thunder and lightning. But the overcast conditions were nice and cool for our foot game count on Thursday morning.

Saturday was meant to be our day off but it was interrupted in the early morning by another LEOPARD in the trap. She is a 40 kg female and is now equipped with a GPS collar. We are very excited to be receiving her data via satellite and we are especially interested about her home range as she was caught in the same spot as our big male “Ongwe”. This is the 4th Leopard we have caught within 8 weeks and we can’t believe are so lucky trapping a leopard in each Slot. We are glad to announce that all our 30 volunteers so far were able to participate in the experience of catching this amazing big cat.

Take a look at http://www.youtube.com/watch?feature=player_embedded&v=eOmbU3BzgLQ to see our third female leopard "Ondundu" (meaning mountains in Oshivambo) being carried back to the box by Linda, Matt, Simen and Ronny where she was to stay overnight to recover.

5 October

On our foot game count we split into a “girls” and a ‘boys” group as we wanted to find out who are the better animal spotters. Of course the girls won by spotting more than 60 animals on foot! But our guys came back very excited cause they found a “dead foal” and they guessed it was a fresh leopard kill. Well done guys! But unfortunately our tracker Jesaja checked on it later in the afternoon and by finding lots of car tracks around he discovered that this must have been the sick foal which was euthanized and placed in the bush for the predators. ;-)

The “Katutura Kids Day” on Wednesday morning went very well. Everyone ended up playing soccer and the kids loved getting so much attention from our team members. The movie shows our team members playing soccer with our kids from the "family of hope services" http://www.youtube.com/watch?v=UG2QrwODnPs&feature=player_embedded.

8 October

After another 12 days of collecting scat, tracks and data, Slot 4 departed on Friday. Unfortunately we received some bad news about our male leopard Ongwe on Thursday morning. He was shot Wednesday night by our neighbour as he was reputedly killing the farmers calves. So we faced reality and discovered even more how important it is to gain and provide data about big cats behaviour on game farms. Thanks again to everyone who supported us so far with collecting data and catching leopards. Take care and all the best.

3 November

Welcome Slot 6. Riszard, is either very lucky or unlucky being the only man amongst a group of nine women. But he is coping very well so far. After two days of training everyone is very competent at changing tyres, reading maps and identifying prey animals. During this Slot we are also involved in a secondary research project about giraffes, where we have to identify the individuals to record their behaviour and gain more knowledge about giraffe ecology. The first two surveying days have already been very successful. On the camera trap pictures we found three more sightings of, as yet, uncollared leopards hanging around the camp. In one of our box traps we caught a warthog and on the pictures we found a leopard trying to get to it at night. We released the warthog in the morning. The telemetry group obtained some good signals from Lucy and Katrin, Chantalle and Christine already found some leopard tracks in the south.

7 November

During the last few days we have been really busy getting all the research jobs done. After we captured two warthogs and a jackal in the first week, we found ourselves in luck with this group and another leopard (one leopard capture per group this year!). We captured our fifth leopard since August on Monday morning at Oxenpost dam: a 2 year old male leopard who had already been sniffing around the box trap the night before. Unfortunately we couldn't collar him due to his age as he is still growing. We took blood samples and measurements and after that exciting day celebrated at dinner time and decided to call him "Elago", which means "lucky" in Oshivambo, one of the local languages. When we pulled the gate open to release him on Tuesday morning he couldn't wait to get out and run up the hill back into freedom (see www.facebook.com/biosphere.expeditions1)

9 November

On Wednesday morning we had a great time in Katutura interviewing the local people. When we passed a local hair dresser, Erica decided to support the local economy and get a new haircut (not the Greek kind).and came back in tears and almost no hair left ;) Watch the video of the momentous event on www.facebook.com/biosphere.expeditions1.

14 November

Hello to everyone who joined our big cats project with us in Namibia over the past four months. I am on my way to the airport leaving Namibia this evening. Kristina and I want to say thank you very much to everyone for your great help out here and for the big success we had capturing 5 leopards within 6 Slots. I especially want to thank all the team members from Slot 6 for your support, patience and understanding. I hope to see you again in Namibia or on another expedition. Have a safe journey wherever you are going.

All the best from Jenny