

Round River Conservation Studies

Kunene Regional Ecological Analyses

2011 Annual Report: Assisting Conservancies with
Seasonal Wildlife Monitoring Efforts

January 26, 2012

Kunene Regional Ecological Analyses: Assisting Conservancies with Seasonal Wildlife Monitoring

*Annual Report to the Namibia Ministry of Environment and Tourism,
with respect to Research Permit # 1621/2011*

January 26, 2012

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Kunene Regional Ecological Analyses: Assisting Conservancies with Seasonal Wildlife Monitoring

ABSTRACT

In October-November 2011, Round River Conservation Studies scientists and students worked with 5 communal conservancies in the Kunene region of northern Namibia and the Namibia Ministry of Environment and Tourism to initiate wildlife surveys to support the long established wildlife monitoring regime of the region. The North-West Annual Game Counts occur in June of each year and provide quality information on wildlife populations, to support wildlife management decisions. Our surveys supplement this annual census by providing wildlife count data during other times of the year or in areas not currently sampled during the Annual Game Count. Our methods use a sampling design and standardized data collection protocols that are similar and compatible with the Annual Game Count. During the initial survey period (October-November 2011), we completed 1,621 km of vehicular game count surveys with 100.7 hours of observation time; 28 foot-accessed timed point count surveys for 58 hours of observation time; and explored the use of remote-triggered cameras. Through assistance provided by the Conservancy Game Guards, surveys were completed in 5 Kunene conservancies: Anabeb, Ehirovopuka, Omentedeka, Sesfontain and Torra. During vehicular surveys, 18 different wildlife species were observed, of which 11 of these species were also observed during point count surveys. The most common species included gemsbok, springbok and zebra. Two test camera stations took photos of 2 different leopards, as well as a diversity of more common species. As these survey efforts are repeatedly completed (February-April and October-November) to supplement the June Annual Game Counts they will assist in providing additional species abundance and seasonal distribution information for conservancies and the Ministry of Environment and Tourism.

ACKNOWLEDGEMENTS

We'd like to thank Vehi Kasupi for his invaluable knowledge of the study area and its wildlife, and for his patience, humor and goodwill. This work could not be completed without the cooperation and support from the Ministry of Environment and Tourism and WWF staff, along with the five participating conservancies and their game guards: Anabeb (Lineus Mbomboro and Kauhepere Musaso), Ehirovipuka (Jackson Kavetu, Kavetu, Ngaipue), Omatendeka (Nelson Jakurama and Gerson Mukuaruuzze), Sesfontein (Rickey Tsipombo and Steven Kasaona), and Torra (Constansia Somses and Erick).

INTRODUCTION

A conservancy in Namibia is an area where rural communities have rights to jointly manage land and natural resources with the Namibian government for the improvement of individual livelihoods. Conservancies have a constitution, defined boundaries, defined membership and a committee of elected leaders. More than fifty conservancies in Namibia are registered with the Ministry of Environment and Tourism (MET) and natural resources are jointly monitored by MET and the conservancy. Conservancies provide benefits to their communities in the form of consumptive and non-consumptive use of wildlife, such as tourism, trophy hunting, and own-use hunting. Conservancies are required to distribute benefits equally to all members. In order to ensure the sustainable use and maintenance of wildlife, conservancies need an effective wildlife monitoring system. Without this, over-hunting and population degradation is a threat that can irreversibly alter biodiversity and local livelihoods.

MET, conservancies and the World Wildlife Fund (WWF) primarily through a region-wide annual game count jointly conduct wildlife monitoring in the conservancies of the Kunene Region of Namibia. The annual North-West Game Count is the largest road-based game count in the world, covering around 6.6 million hectares (NACSO 2010). For the last ten years, conservancy members, conservancy, MET and WWF staffs have jointly carried out this game count in the conservancies and concessions of the Kunene region, as well as in Skeleton Coast National Park (NACSO 2010). This cooperative effort has resulted in valuable information that provides the basis for wildlife management in the region.

Within each conservancy, staff and members undertake periodic foot and vehicle census to supplement the regional census. In addition, game guards continually monitor wildlife-related events (e.g. fire, poaching, problem animal incidents, wildlife mortalities, etc.) and wildlife sightings using the Event Book System that provides a consistent record-keeping approach across the conservancies (NACSO 2010). Each game guard has their own Event Book in which they record information within their designated area on events that are reported to them or which they encounter. Within each conservancy, the community makes collective decisions on what issues are most important in their conservancy to prioritize monitoring activities (e.g., vegetation monitoring or wildlife censuses) (Stuart-Hill 2005). The annual North-West Game Count and the Event Book System help determine annual quotas for wildlife utilization through own-use, trophy hunting, shoot-and-sell, or live-capture-and-sale that are shared in the conservancy's *Annual Natural Resource Report* (NACSO 2010; Stuart-Hill 2005).

The success of the cooperative efforts of the government, conservancies, and NGOs to systematically and consistently survey wildlife in the Kunene through the annual game count is unprecedented. Still, there remains an interest and an opportunity to collect wildlife distribution and relative abundance data that can complement the annual surveys and support conservancy efforts and capacity building in wildlife management. In particular, some conservancies are interested in completing multiple surveys each year or increasing survey efforts in selected portions of their conservancy lands (e.g., roadless areas that are currently not surveyed or areas of high wildlife values).

Our efforts in the Kunene region focus on working with MET and the conservancies to implement repeated wildlife surveys 2-3 times per year within selected conservancies. These surveys are conducted using methods consistent with the annual road-based game counts, and with data collection protocols that may eventually allow powerful distance sampling analyses (Buckland et al. 2001) while also being appropriate for less-demanding strip count analyses. In addition, we are investigating more localized survey methods that may improve information on rare species or on wildlife in areas not currently surveyed due to their remoteness from roads. The survey methods are taught to conservancy staff and Game Guards who are primary team members on all surveys, thus enhancing and expanding their skills and experiences.

STUDY AREA AND METHODS

We used a combination of road-based game counts, foot-accessed point counts and remote camera stations from October – November, 2011 in a preliminary assessment of conservancy-level survey methods and opportunities that may be employed to supplement the annual regional wildlife game counts. Surveys were conducted in five of the conservancies in the Kunene Region of northwest Namibia: Anabeb, Ehirovipuka, Omatendeka, Sesfontein and Torra (Figure 1, Table). The landscapes of these conservancies are comprised of hills, plains and wooded river valleys, with vegetated communities of sparse savannah and semi-desert (NACSO 2010).

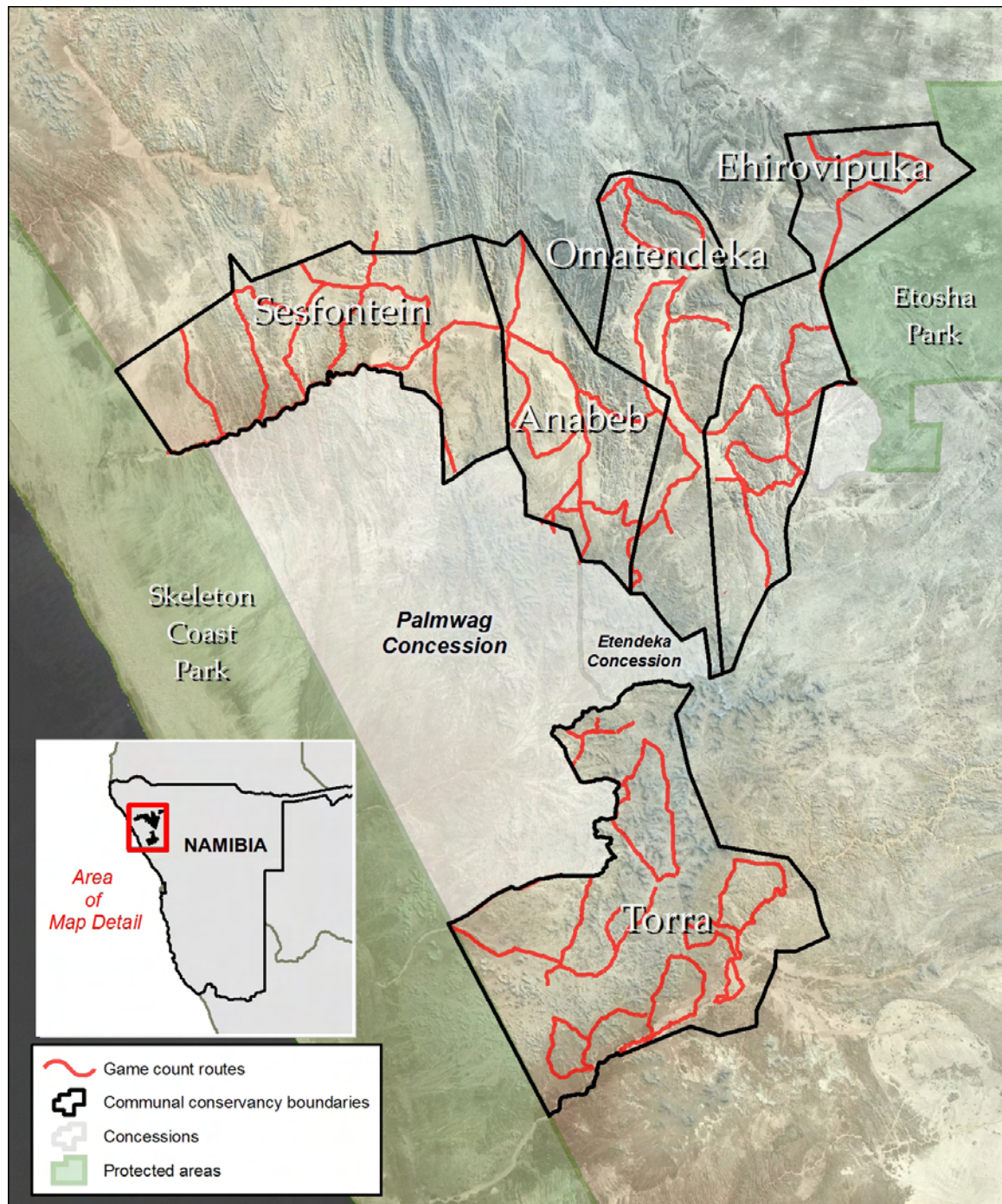


FIGURE 1. STUDY AREA IN THE KUNENE REGION OF NORTHERN NAMIBIA SUPPORTS SEVERAL COMMUNAL CONSERVANCIES, INCLUDING THE ANABEB, EHIROVIPUKA, OMATENDEKA, SESFONTAIN AND TORRA CONSERVANCIES WHERE WE CONDUCTED WILDLIFE SURVEYS IN OCTOBER-NOVEMBER 2011. REPLACE THIS MAP WITH A SIMPLER MAP, HIGHLIGHTING THE EMPHASIZING THE 5 CONSERVANCIES, AND INCLUDING THE ANNUAL GAME COUNT ROUTES

TABLE 1. INFORMATION ON THE CONSERVANCIES WITHIN THE STUDY AREA FOR OCTOBER-NOVEMBER 2011 (NACSO 2010).

Conservancy	Area (km ²)	Population	Annual Rainfall (mm)	Main River(s)
Anabeb	1570	2000	100	Hoanib/Ombonde
Ehrovipuka	1980	2500	250-300	Hoanib/Ombonde
Omatendeka	1619	2500	250	Hoanib/Ombonde
Sesfontein	2465	2500	150	Hoanib/Ombonde
Torra	3493	1200	100	Huab and Springbok

VEHICULAR GAME COUNT SURVEY

Vehicular game counts used MET's Annual Game Count routes (Figure 1) and key survey design parameters including daily timing, driving speed and observer numbers. Routes were surveyed in the morning, beginning no earlier than half an hour before sunrise and ending no later than 1100 hours, even if the route was not completed. This window maximized survey efforts during the highest visibility times and avoided surveying when animals are more likely to have bedded down to avoid the heat. Each survey route was recorded using a GPS unit. Information including survey route information, observers and weather conditions was recorded at the start of the survey (Figure 2).

Surveys utilized at least 5 people, of which at least one was a conservancy game guard, one was a RRCS project staff and 2 or more were RRCS students. The team consisted of a driver and a guide with sufficient local knowledge to ensure the survey followed the designated route and 3 observers in the back of an open vehicle. All team members were trained in the survey design and protocols, and the observers had practiced and were proficient and standardized in the data collection methods. All team members searched for wildlife, but 2 of the members in the back of the open truck were the primary observers while one was responsible for data collection. The driver did not exceed 30 km/hour, and was accompanied by the guide who was typically a game guard familiar with the area. The data recorder in the open back was responsible for taking a GPS waypoints at each wildlife sighting location and recording the species and location information called out by an observer, using the standardized data sheet (Figure 2).

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Conservancy _____ Date _____ Route ID _____ Leader _____

Game Guard _____ Observers _____ Temperate @ start _____

Cloud cover _____ Wind speed/direction _____ Time Start _____ GPS ID Start _____ Odometer Start _____

Time End _____ Odometer End _____ GPS End _____ Comments _____

GPS ID	Distance (RF/Vis)	Angle to Animal	Angle to Route	Species	Count	M	F	A	SA	YofY	Comments

FIGURE 2. TOP PORTION OF GAME COUNT SURVEY DATA SHEET.

The two observers were responsible for taking the distance between the vehicle and the animals using a laser range finder (Nikon Laser 1200 Monarch Gold) and the compass angle to the center animal of the group. When observers spotted an animal(s), the vehicle was turned off for data collection, assisting in the successful use of the laser range finder. The observer who spotted the animals was responsible for obtaining a distance with the range finder to where the animal was originally spotted (not to where it may have travelled since observation). If the animal exceeded the distance possible for the range finder, the reading on the range finder appeared inaccurate or the range finder was otherwise not functioning, the observer made a visual distance estimate to the original location of the animal; the data recorder noted that the distance was visually estimated on the data sheet. The observers had all practiced visual distance estimation to minimize errors in data collected without the aid of a laser range finder (Appendix 2). Each observer had a compass, set to the correct declination (for the Kunene region, this is 10 degrees west) and the angle (from true north) to the location where the animal(s) was (were) first sighted was recorded to the closest degree (Appendix 1). The species and count were recorded, and if possible the sex and approximate age (adult, sub-adult, young of year) of individual animals were recorded (Appendix 3). Other comments were noted such as “fleeing,” “seen through binoculars,” and “in village.”

Defining whether animals are counted in groups or individually is important during analyses, and is dependent upon social structure and seasonal ecology of each species. We chose to define all species we expected to encounter along the routes as occurring in groups (which could be composed of a single individual in some cases) except elephants (*Loxodonta africana*) and lion (*Panthera leo*). A group of animals was defined as individuals of the same species that appears to visually constitute a unit. When a group of animals was sighted, a central point was established within the group in order to measure a distance and angle. All individuals within the group were recorded with these measurements. Data were collected for all encountered wild mammals (excluding rodents) and for ostrich (*Struthio camelus*). When livestock was spotted, the vehicle was not stopped, however, a GPS waypoint, species, count, and visual estimated

distance from the road was recorded as the vehicle continued along the route, providing information sufficient for potential strip count estimation. The research permit (#1621/2011) for this study does not allow us to collect data on black rhino (*D. bicornis*), and any incidental sighting information was not kept but provided to employees of Save the Rhino Trust (SRT).

It is important for the analysis of density that location information on animal sightings is not strongly influenced by the animals fleeing from the survey vehicle. If sightings are of animals that are fleeing, this was noted on the datasheet and these data may be removed prior to analysis. In some cases, observers could identify the original location of the animals prior to their fleeing behavior. In these cases, a landmark was established in close proximity to where the individual was initially sighted. This allowed distance and angle to be measured even if the animal(s) was no longer present.

To improve accuracy of sightings for animals that did not appear disturbed by the survey vehicle, the driver slowly drove as along the survey route to a point close to the animal. When possible, data accuracy was increased by moving the vehicle closer to reduce the distance between the spotted animal(s) and the vehicle.

The Annual Game Count protocols do not allow observers to use binoculars to view known animals for sex or age identification or to use binoculars to search for animals. We allowed observers to use binoculars when the vehicle was stopped, to collect count, age and sex data on the spotted animal(s). If this led to increased counts for that group or new observations of other species or other groups of the same species, data were collected on these additional animals and the use of binoculars was noted within the comments section of the data sheet. However, the vehicle was not stopped only to scan the landscape with binoculars or beyond the time needed to record initial sightings and binoculars was not used from a moving vehicle.

Observers remained as quiet as possible during the survey period to avoid alerting animals to their presence. If another vehicle was encountered along the route, the research vehicle was stopped and remained so until the encountered vehicle had passed and was no longer in the field of view. No matter where on the route, at 1100 hours the survey was concluded. At the completion of the survey, the information including the time end, odometer end, and end GPS waypoint were recorded (Figure 2). At this time, the GPS track was also disabled and saved to ensure an accurate route.

POINT COUNT GAME SURVEYS

Road-based vehicular surveys are inherently limited to regions with existing roads, and as such; do not collect information on animal abundance in potentially important regions of low human use and disturbance. We conducted point counts as a survey approach to collect data in more remote areas of each conservancy. Point counts were conducted in areas more than 2 km from a vehicular survey route of the Annual Game Count. Vehicular survey routes were reviewed with MET, WWF and conservancy personnel to identify spatial 'gaps' in the existing survey coverage areas. Additional prioritization of potential point count survey areas was based on habitat types, such that habitats that are under-surveyed by vehicle had a higher priority for point count

surveys. The landscape of different areas also had to be considered, as point counts located on higher vantage points with larger viewsapes proved to be the most effective (Figure 3). At least two sites for point count surveys were identified in each of the five conservancies, with additional areas surveyed if time allowed.

Initial establishment of point count locations included foot reconnaissance of the potential survey region to find a suitable site for the point counts. At potential survey sites, observations were conducted and observers assigned a rating for the site on a scale 1-3 (1 being the best) for visibility and location. A site with a rating of '3' was either one with limited visibility or overlooking roads or settlements and will be replaced with another site with a rating of '1' in the future. The location of these sites were recorded with a GPS and identified as a potential permanent point count sampling site for future repeated surveys.



FIGURE 3. OBSERVATION SITE FOR A WILDLIFE POINT COUNT IN ANABEB CONSERVANCY IN THE KUNENE REGION OF NAMIBIA.

Point count surveys consisted of four observers searching for animals over a period of 2 hours. Point counts began no later than 0900 hours to ensure the survey was completed by 1100 hours. A GPS waypoint was taken at the location of the parked vehicle and the observation point, with a track recorded from one to the other. The GPS location for the observation location was applied to all sightings from this position. Once the observation point was reached, the GPS tracking capabilities and GPS were turned off.

The observers approached the point of observation quietly, while trying to minimize their silhouettes so as to blend into the horizon (Lee & Marsden 2008). There was minimal activity by the observers during the two-hour observation period. The four observers were positioned along

a ridge at the point count location. Each observer had a compass set to the correct declination (10 degrees west for the Kunene region). One observer was in charge of recording all of the data from the point count observation onto the data sheet (Figure 4). Data collection was first done for animals that were fleeing, followed by the foreground of the field of view and continuing towards the horizon. The field of view was established using the right and left most compass angles (Appendix 1). When an observer spotted an animal, its location was described to fellow observers so as to ensure that it was not counted twice. The observer took an angle from north to the location where the animal was first seen, as well as a distance (Appendix 1). If the range finder was not functioning properly, the animal exceeded the distance possible for the range finder, or the reading on the range finder appeared inaccurate the observer then made a visual estimate to the original location of the animal sighting (Appendix 2). Data were collected by all observers as to the species, count, sex, and approximate age (adult, sub-adult, young of year). There are particular characteristics of sexes that facilitated the evaluation of species gender (Appendix 3). Other comments were noted such as “fleeing” and “too far to sex.” Attention was paid to characteristics and behaviors of previously sighted animals to track an animal as it may have changed location during the two-hour observation period. Each observer conducted scans of the observation area through the use of binoculars every five to ten minutes.

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Conservancy _____ Date _____ Point ID _____ Leader _____

Game Guard _____ Observers _____ Start Temperature _____

Cloud cover _____ Wind speed/direction _____ GPS Number _____ GPS ID at car _____ Time at car _____

GPS ID at point _____ Time Start _____ Time End _____ End Temperature _____ Field of View _____

Comments _____

Distance (RF/Vis)	Angle to Animal	Species	Count	M	F	A	SA	YofY	Comments

FIGURE 4. TOP PORTION OF POINT COUNT SURVEY DATA SHEET USED FOR WILDLIFE POINT COUNTS IN THE KUNENE REGION OF NAMIBIA IN OCTOBER-NOVEMBER 2011.

If a group of animals (defined as a closely situated gathering of individuals of the same species that appears to visually constitute as a unit) was sighted, a measurement for angle and distance was taken to a central point within the group. All individuals within the group were recorded with these measurements. Exceptions to this rule included elephant and lion; for these, locations data were recorded for each individual. The research permit (#1621/2011) for this study

disallows data to be collected on black rhino and any incidental sighting information was provided to SRT. Data were collected for all wild mammals (excluding rhinos and rodents) and ostrich. Unlike in the vehicular game count survey described above, data on livestock sightings were collected in the same manner as other species seen. At the conclusion of the two-hour observation period, the data sheet was completed with information pertaining to the conclusion of an observation period (Figure 4).

DATA MANAGEMENT AND PRESENTATION

We used trigonometric equations to calculate the UTM location of the animal using the UTM location of the observer (using a GPS), the distance from the observer to the animal (using a laser range finder, or, if needed a visual estimate) and compass angle of the animal from true north (true north declination set to 10 west).

To obtain the animal's UTM Easting:

- A. If compass Θ is between 0° - 179° , then UTM Easting = Observer UTM Easting + $\sin\Theta$ *distance;
- B. If compass Θ is between 180° - 359° , then UTM Easting = Observer UTM Easting + $\sin(\Theta-180)$ *distance.

To obtain the animal's UTM Northing:

- A. If compass Θ is between 90° - 269° , then UTM Northing = Observer UTM Northing + $\cos\Theta$ *distance;
- B. If compass Θ is between 270° - 89° , then UTM Northing = Observer UTM Northing + $\cos(\Theta-180)$ *distance.

Where Θ is the compass angle of the animal from true north.

We entered these equations into an Excel worksheet to calculate the UTM location of the animal or animal group. These data were then used for mapping and calculating summary statistics presented in this report, and is available for future analyses and mapping efforts.

For each conservancy we calculated the sighting rate of each species by dividing the number of individuals of each species by the total kilometers surveyed for vehicular surveys and the hours of observation for both vehicular and point counts.

REMOTE CAMERA SURVEYS

We explored the use of remote-triggered camera surveys to gather information on the presence of less commonly observed species such as predators and other nocturnal species (Stein et al. 2008). Cameras were established at water source locations identified by conservancy game guards as high value wildlife areas. The chosen locations were distant from established communities and thought to be infrequently visited by humans, so as to reduce the possibility of tampering or displacement of wildlife. When placing a camera, data was taken on the UTM coordinates, habitat/vegetation, camera angle, and direction camera was facing (heading taken from north). A GPS waypoint was taken and saved for later location reference. Memory cards were

downloaded twice from each camera trap over the sampling window. This was done to evaluate camera placement and functionality, clear memory space, and to test if the camera meets the intentions of capturing the more elusive species of the Kunene region. All data taken during camera placement and any important findings in the photos were recorded in an Excel spreadsheet. Before placing a camera trap, conservancy offices and stakeholders were informed of camera trap placement to avoid removal. Although future groups may use mud and dust surveys, we did not establish a methodology for these studies. However, mud and dust surveys may serve a similar purpose to the camera surveys in the potential identification of rare species.

RESULTS

VEHICULAR GAME COUNT SURVEYS

Vehicular surveys were conducted the 8th of October to the 23rd of November 2011 for a total of 23 survey days (Figure 5). On most survey days 2 teams were employed to conduct surveys along different routes. Most routes were surveyed a single time during this period, though in 2 cases routes surveyed earlier in the survey period were re-surveyed again. A total of 1,528 km of routes were surveyed with 93 km of these being surveyed twice for a total survey effort of 1,621km and 100.7 hours of observation time. The breakdown of survey effort by conservancy is provided in Table and details of each survey route effort is provided in Appendix 5. Average survey route length was 46.7 km, but was variable (range: 8 – 89 km) and took an average of 2.95 hours to complete (range 1.0 – 4:33 hrs). As per protocol, surveys started in the morning (average start time 7:07) and ended before 11:00 (average end time 10:05). This is intended to minimize the potential effects of hot weather on wildlife behavior influencing sightability, with the average temperatures at the end of the survey of 31C (range: 18 – 44C).

TABLE 2. SUMMARY OF VEHICULAR SURVEY EFFORT COMPLETED IN THE KUNENE REGION BETWEEN 8 OCTOBER – 23 NOVEMBER 2011 IN 5 CONSERVANCIES.

Conservancy	Total Survey Routes	Total Survey Distance (Km)	Total Survey Time (Hours)
Anabeb	5	234	14.13
Ehrovipuka	5	405*	25.77*
Omatendeka	6	325	17.05
Sesfontein	6	288	16.12
Torra	8	369	27.65
Total	30	1,621	100.7

*This total includes 93 km and 6.82 hours of repeat survey.

Eighteen wildlife species were counted during the vehicular game count surveys (Table 3). The most prevalent species included gemsbok, springbok and Hartman's mountain zebra; these species were relatively common across most conservancies and abundant in some conservancies (Figure 6). Other species were found in low numbers in most conservancies but relatively more abundant in 1-2 conservancies (e.g., kudu in Torra, eland in Ehrovipuka). Overall wildlife counts per km of survey route were similar across the 5 conservancies (Figure 7).

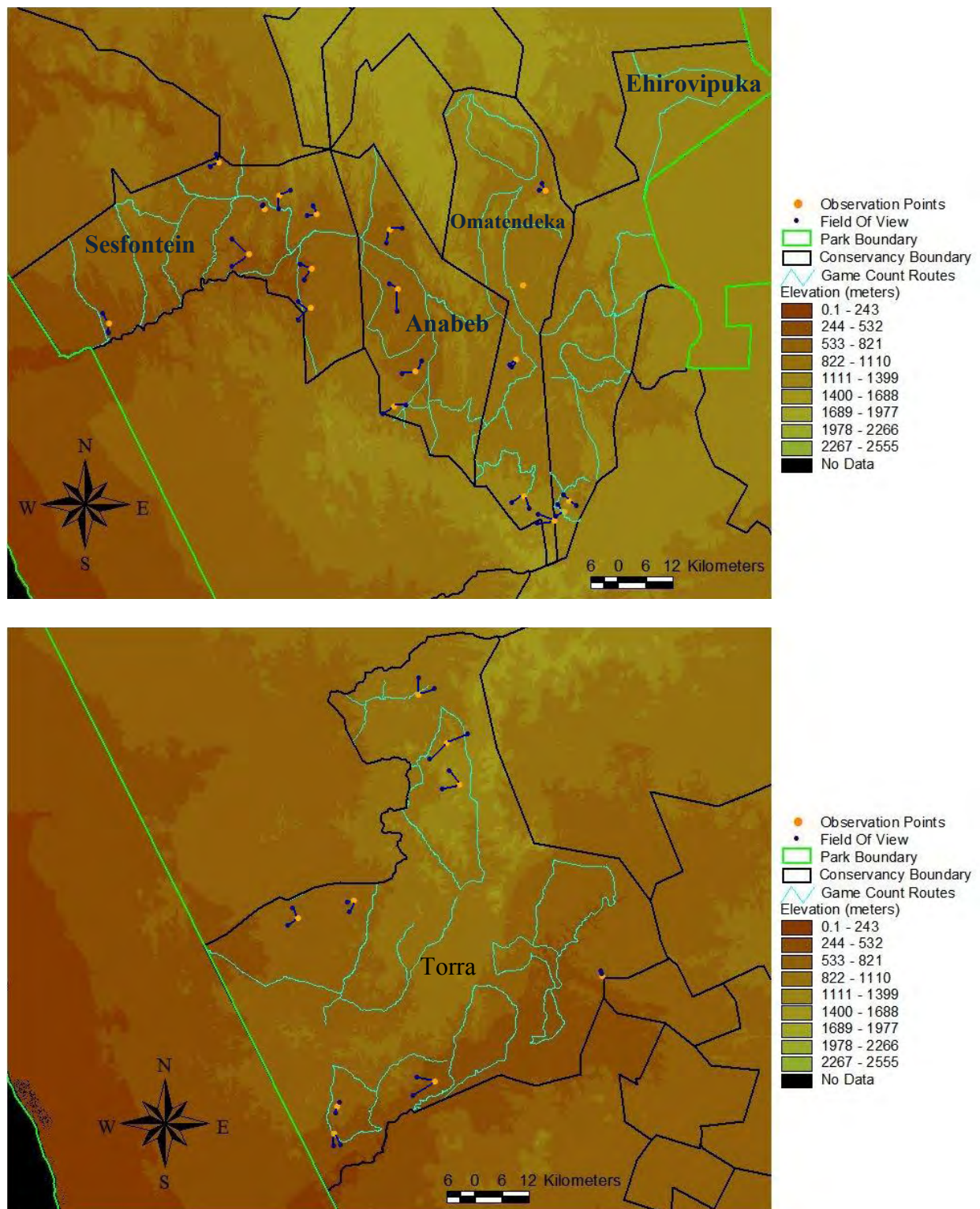


FIGURE 5. MAPS OF VEHICULAR GAME COUNT ROUTES AND POINT COUNT LOCATIONS WHERE WILDLIFE SURVEYS WERE CONDUCTED IN OCTOBER-NOVEMBER 2011 IN ANABEB, EHIOVIPUKA, OMATENDEKA, SESFONTEIN AND TORRA CONSERVANCIES IN THE KUNENE REGION, NAMIBIA.

TABLE 3. TOTAL COUNTS OF ALL SPECIES RECORDED DURING VEHICULAR GAME COUNTS IN 5 CONSERVANCIES IN THE KUNENE REGION OF NAMIBIA FROM OCTOBER – NOVEMBER 2011.

Species	Latin Name	Anabeb	Ehrovipuka	Omendeteka	Sesfontain	Torra	Total
Aardwolf	<i>Proteles cristatus</i>				2		2
Black-backed jackal	<i>Canis mesomelas</i>	2	1	3	4	11	21
Bushpig	<i>Potamochoerus porcus</i>		1				1
Chacma baboon	<i>Papio ursinus</i>	29	36		30	46	141
Dik-dik/Duiker	<i>Madoqua kirkii</i>		4				4
Eland	<i>Taurotragus oryx</i>		17				17
Elephant	<i>Loxodonta africana</i>			1		9	10
Gemsbok	<i>Oryx gazella</i>	69	52	261	140	392	914
Giraffe	<i>Giraffa camelopardalis</i>	7	51	22	8	41	129
Scrub hare	<i>Lepus saxatilis</i>					1	1
Hartman's mountain zebra	<i>Equus zebra hartmannae</i>	207	79	227	85	636	1234
Honeybadger	<i>Mellivora capensis</i>		1				1
Spotted hyena	<i>Crocuta crocuta</i>					2	2
Kudu	<i>Tragelaphus strepsicerus</i>	19	4	7		111	141
Ostrich	<i>Struthio camelus</i>	10	8	4	51	44	117
Rock hyrax	<i>Procavia capensis</i>		6				6
Springbok	<i>Antidorcas marsupialis</i>	226	20	257	257	641	1401
Steenbok	<i>Raphicerus campestris</i>	6	5	3	1	4	19
Domestic cattle		466	1355	1377	381	257	3836
Domestic donkey		55	44	59	7	38	203
Domestic goat		1806	877	704	423	124	3934
Domestic horse		4	18	32	2		56
Domestic sheep		2	4				6

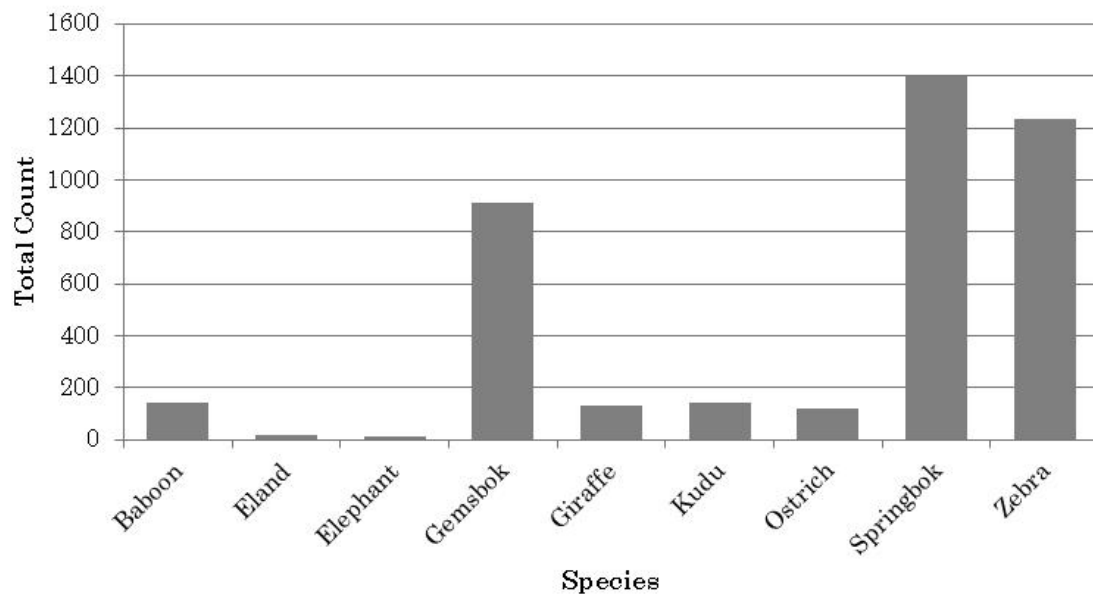


FIGURE 6. TOTAL COUNTS FOR SELECTED SPECIES RECORDED DURING THE VEHICULAR SURVEYS IN 5 CONSERVANCIES IN THE KUNENE REGION OF NAMIBIA, OCTOBER-NOVEMBER 2011.

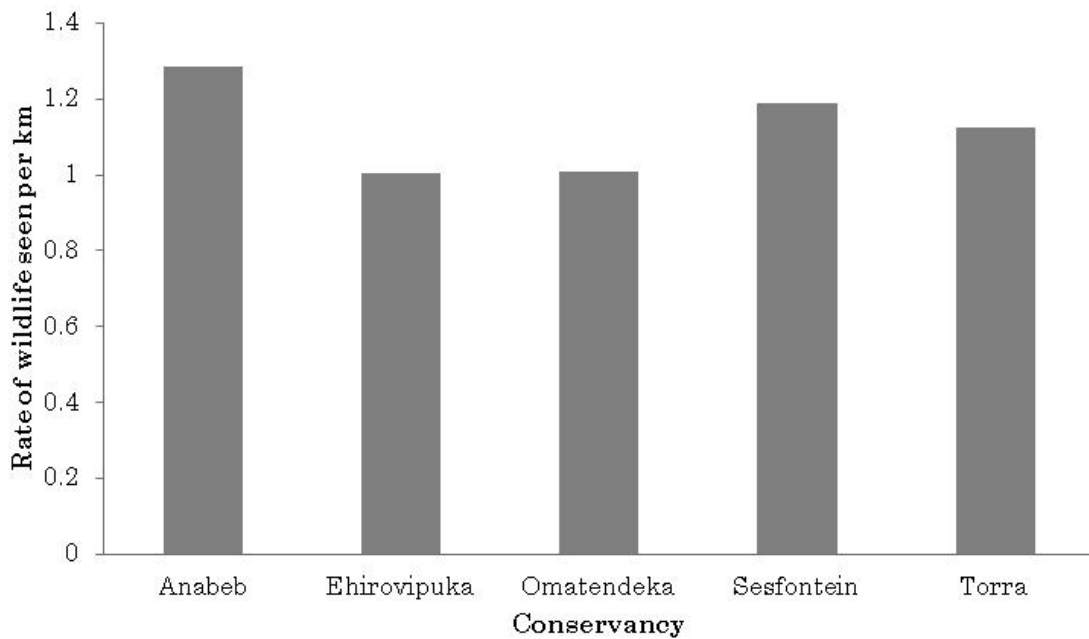


FIGURE 7. THE RATE OF WILDLIFE SPECIES SEEN PER KILOMETER DURING VEHICULAR GAME COUNT ROUTES IN THE KUNENE REGION OCTOBER-NOVEMBER 2011.

POINT COUNT SURVEYS

Point count surveys were conducted from October 11 to November 19, 2011 for 15 survey days with most employing 2 teams to conduct 2 surveys. Most sample sites were surveyed a single time during this period, though in 1 case a site surveyed early in the survey period were re-surveyed later. A total of 28 point count sample sites were established and surveyed with a total of 58 hours of survey effort (including 2 hours spent re-surveying 1 site). Point count sample site locations and characteristics were recorded (Table 4), and survey information for each point count completed is provided in Appendix 5. As per protocol, surveys started in the morning (average start time 8:43) and ended before 11:00 (average end time 10:43). This is intended to minimize the potential effects of hot weather wildlife behavior influencing sightability, with the average temperatures at the end of the survey of 36C (range: 24 – 46C).

TABLE 4. SUMMARY OF POINT COUNT GAME SURVEY SITES ESTABLISHED DURING OCTOBER-NOVEMBER 2011 IN THE KUNENE REGION OF NAMIBIA.

Site ID	Site Quality ¹	Field of View ²	Location UTM E	Location UTM N	Wind Direction ³
Ehrovipuka-1	1	330 to 182	413408	7818975	East
Ehrovipuka-2	3	12 to 90	414640	7821517	Southeast
Ehrovipuka-3	2	64 to 205	411280	7816944	None
Torra-1	2	100 to 240	380594	7759371	S/SE
Torra-2	1	75 to 245	370972	7756372	West
Torra-3	2	290 to 50	423052	7746294	SW
Torra-4	1	272 to 93	394488	7728042	SW
Torra-5	1	120 to 268	377268	7719164	NE
Torra-6	3	78 to 205	377651	7723718	NE
Torra-7	1	88 to 20	391683	7794906	W
Torra-8	1	220 to 20	396520	7786576	E
Torra-9	1	219 to 10	398660	7779495	NA
Anabeb-1	2	180 to 350	374493	7871254	NE
Anabeb-2	2	230 to 52	372805	7885144	NE
Anabeb-3	2	188 to 32	378647	7852010	W/NW
Anabeb-4	1	225 to 52	373585	7843743	NE
Sesfontein-1	2	260 to 60	355472	7888926	SW
Sesfontein-2	1	346 to 110	307004	7863127	W
Sesfontein-3	1	357 to 212	354440	7875962	No Wind
Sesfontein-4	1	332 to 130	354182	7866999	N
Sesfontein-5	1	118 to 320	339782	7879512	N
Sesfontein-6	2	182 to 41	332495	7901025	S/SE
Sesfontein-7	3	50 to 280	343323	7890099	No Wind
Sesfontein-8	1	224 to 46	346818	7893255	W
Omantendeka-1	2	319 to 50	409018	7894377	No Wind
Omantendeka-2	2	232 to 358	403866	7872101	No Wind
Omantendeka-3	3	228 to 342	402338	7854837	No Wind
Omantendeka-4	1	101 to 248	404070	7822611	NW

¹ Subjective rating from 'High Quality' = 3 to 'Limited Quality' = 1 as an indication of quality of viewscape and access restrictions

² Field of view is indicates the viewshed as defined by the first declination from true north indicating the left side viewshed boundary and the second declination indicating the right-side viewshed boundary

³ Wind direction at time of sampling, for future sample planning. To avoid disturbing animals, access should be planned to enter area downwind from viewshed, if possible.

We observed eleven different species during the point count surveys (Table 5). Hartman's mountain zebra and giraffe were seen across all five conservancies. In addition to these species, gemsbock, kudu, springbok and ostrich were also commonly observed species.

TABLE 5. SUMMARY OF POINT COUNT SURVEY RESULTS, LISTED AS TOTAL COUNTS/SIGHTING RATES¹ FOR SPECIES SEEN IN THE FIVE CONSERVANCIES DURING POINT COUNT SURVEYS. HOURS OF FIELD EFFORT ARE IN PARENTHESES AFTER CONSERVANCY NAME.

Species	Anabeb (8 hrs)	Ehrovipuka (6 hrs)	Omatendeka (8 hrs)	Sesfontein (16 hrs)	Torra (18 hrs)
Black-backed jackal	1/0.12	0	0	0	0
Chacma baboon	0	0	0	0	0
Eland	0	7/1.17	0	0	0
Gemsbok	7/0.88	0	31/3.88	28/1.75	15/8.61
Giraffe	2/0.25	13/2.17	6/0.75	8/0.44	1/0.06
Hartmann's mountain zebra	159/19.88	34/5.67	24/3	15/0.94	163/9.06
Kudu	5/0.63	4/0.67	5/0.63	0	48/2.67
Ostrich	12/1.5	2/0.33	0	14/0.88	7/0.39
Rock hyrax	0	0	0	3/0.19	0
Springbok	63/7.88	0	15/3.63	173/10.81	61/2.78
Steenbok	0	0	0	1/0.06	0

¹ Sighting rate is the total count/total observation hours in each conservancy.

CAMERA SURVEYS

Infra-red remote triggered camera were placed at Collin's Road Spring and Jebico Spring in Torra for 61 days. One leopard was photographed at each of the two camera trap sites, one male and one female. The cameras also captured hyenas at nighttime as well as abundant photos of more common wildlife species. While sample size is low, the 2 camera traps were successful in capturing elusive and nocturnal species (Appendix 5).

TABLE 6. SIGHTING RATE IS THE TOTAL COUNT/TOTAL OBSERVATION HOURS IN EACH CONSERVANCY.

Water Source	Camera Site #	UTM (Easting, Northing)	Camera Orientation and Placement	Habitat Description	Placement Duration	Focal Wildlife Seen	General Wildlife Seen	Comments
Collin's Spring	1	0380334, 7747214	Angle to ground: 100° Heading from N: 49° Distance to water: 15m	Cliffs to the NW, small stagnant pools, sandy soil, Vegetation: <i>Salvidora persica</i> , <i>Tamarix usneoides</i> , <i>Cyperus marginatus</i>	10/15/2011 to 11/26/2011	Male leopard seen walking away through spring towards the east in the morning. Hyena facing the camera in the morning.	Oryx, Zebra, Kudu, Giraffe	Found camera knocked off original placement with teeth marks on the lens from what is believed to be a hyena according to photos. Camera batteries died on 11/13/2011, before trap was picked up
Jebico Spring	2	0389222 7753653,	Angle to ground: NA Heading from N: NA Distance to water: 3.8m	Between two hills, small stagnant pools, sandy-muddy soil, Vegetation: <i>Cyperus marginatus</i>	10/15/2011 to 11/7/2011	Female leopard seen at night walking across the spring very close to the camera lens. Hyena seen at night, only back is pictured, shoulders are diagnostic.	Baboon, Black-backed Jackal, Oryx, Ostrich, Zebra, Kudu	Camera was reset on 11/7/2011 but when we went to pick it up on 11/30/2011 it had been removed by Torra Conservancy

DISCUSSION

The objective of this ongoing project is to use vehicular game count surveys, point count surveys, and methods of remote or indirect sampling to supplement the Northwest Annual Game Counts conducted by the conservancies, MET and partners in the Kunene region. The Northwest Game Counts have been conducted for over 10 years, and provide an unprecedented effort at monitoring wildlife populations across a vast area. Our efforts supplement the annual counts with more localized, repeated game counts that fill in both seasonal information and information about wildlife in areas not surveyed by the Annual game counts. These supplemental surveys are broadly supported by the 5 conservancies interested in obtaining more frequent survey information using standardized and compatible approaches to the annual game counts, and are also supported by the local and regional governments and the MET. The project uses the availability of Round River University students and project leaders as well as conservancy game guards and staff, all who are in situ in the Kunene region for up to 6 months per year. The partnerships represented by the project provide the capacity to undertake relatively ambitious and diverse survey efforts focused on seasons and areas not surveyed during than Annual Game Counts.

The October-November 2011 survey season represents the initial effort to explore and develop survey approaches and design. We used a combination of vehicular game counts, timed point counts and remote camera surveys to evaluate opportunities to meet conservancy interests for seasonal and repeated survey information on wildlife species. The data gathered during this initial study period provides assurance that the study will be able to gather useful data using diverse but standardized approaches to achieve goals related to methodological development and capacity building, as well as wildlife monitoring.

VEHICULAR GAME COUNT SURVEYS

During this preliminary season, we surveyed a subset of the Annual Game Count routes within each of the 5 conservancies, but overall effort in most conservancies is comparable to the Annual Game Count. In some cases, our total survey kilometers within a conservancy exceeded the effort recorded by the Annual Game Count, and this is partly due to the addition of new survey routes at the request of the individual conservancy. These new routes are identified in (Figure 5) and include a new route in the southern portion of Ehirovipuka that fills in an acknowledged spatial gap in the road route system.

In future surveys, it may be feasible to increase the sampling effort to include more or all of the routes surveyed during the June annual census to allow more consistent data collection across the different survey efforts. At a minimum, we recommend that these seasonal counts continue along the routes identified during this initial sampling session. These routes were collaboratively selected as areas of highest interest to each conservancy and sampling a representative sample of available regional ecosystem types. If additional capacity is available during future surveys, this may be allocated to expanding to include additional survey routes or to repeat the identified priority subset of routes. Repeating surveys on routes at different time increments may provide useful information on count variability. In particular, repeating surveys within a short enough

timeframe should provide information on potential variation that can be expected even when the wildlife population is expected to be relatively stable (i.e., same animals expected to still be occupying general same areas). In the long run, this may assist in explaining some portion of the variability seen in annual or seasonal game counts, thus increasing the ability to predict population numbers with greater confidence.

The survey routes will need to be adjusted in some cases during Namibia's wet season due to access limitations. Several of the routes are along river-beds and others require crossing river-beds which are not navigable during the wet season. Adjusted routes may follow along the bank of a river rather than in the riverbed itself, or, when necessary, parts of routes may need to be excluded altogether.

Little can be done with data from a single survey effort, and we present the data only to document effort and the data collection completed to date. Still, an initial comparison of relative numbers of species counted during the October-November 2011 surveys with the June 2011 North-West Annual Game Count provides an indication that, despite some differences in survey effort, we may anticipate seeing notable seasonal shifts across conservancies in the relative abundance of species between survey periods or seasons (Figure 8).

For example, the relatively high counts of zebra and springbok we documented in the more eastern conservancies is a fairly dramatic increase in those species abundance since the prior counts in June were completed. Conversely, the counts of springbok in the more western Anabeb conservancy were dramatically higher in June than in the October-November counts. In addition, gemsbok numbers were remarkably higher in Omantendeka in the October-November surveys as compared to the June surveys. Seasonally repeated surveys may assist in documenting the movements of animals across the region, which can be important for conservancy-level wildlife management strategies. We only surveyed 5 conservancies in the region and we did not survey the state lands such as Palmwag, so complete spatial data are unavailable.

POINT COUNT SURVEYS

A common interest across the conservancies and MET is to obtain information on wildlife in areas not accessible to road-based survey efforts. Thus, we explored two different potential approaches to conducting wildlife surveys from foot in these areas. Initially, we explored the use of walking transects, with data collected in a manner consistent with the vehicular game counts and appropriate for distance analyses or strip count analyses. We found that our movement on the landscape was detected readily and at great distance by the wildlife, severely compromising the quality of data we could feasibly collect due to animals fleeing from us when they were at distances often greater than 500m. Thus, we found that the point count approach to wildlife surveys in these remote areas were more effective and more consistent in the quality of information we could obtain.

Efforts this initial season focused on identifying the characteristics of high quality sites for point count surveys and collecting initial data at sites that have potential as permanent sampling points for repeated seasonal data collection within each of the 5 conservancies. The initial data collected indicates that this approach may prove feasible to supplement the vehicular game

counts, and that data can be collected at these point counts in a similarly rigorous fashion potentially suitable for distance sampling analyses. Additional work needs to be undertaken to determine the sampling intensity and spatial distribution of a survey approach utilizing point counts, within the confines of logistical and temporal constraints. Still, combining point count surveys with the vehicular surveys appears to us to be a feasible and potentially powerful approach for this diverse landscape

Future considerations for point count surveys

Point counts can be biased because more species will be detected in open habitats such as savannahs and less species will be detected in closed habitats such as woodland (Buckland et al. 2001). Therefore, we noted habitat type; we are also exploring qualitative measures of vegetation density of the viewshed as an index of sightability.

We made an effort to ensure that the sampling viewshed of point counts did not include roads, but in some cases this was not possible. In some cases during the establishment and search for suitable point count locations, roads were found to be within the viewshed of a site, and in some cases these included roads used for vehicular game counts. In these cases, notes were made regarding these issues and included in the assigning of the 'rating' for the sample point location. Point counts with a rating of '3' included sites with game count routes within their viewshed and will not be repeated. Alternatively, point counts rated '1' indicate excellent visibility and location while point counts rated '2' indicate good conditions with some constraints that may result in them being discarded depending on availability of other more ideal sites.

Each conservancy has different terrain that influences the successful establishment of point count survey locations. For example, Anabeb lies in a valley between two high mountain ranges and has limited topographic relief itself. This makes it difficult to find vantage points for viewing animals. In addition, the adjacent mountains are too high to climb efficiently on foot within the time frame of the survey window, and spotting animals is difficult because they would be far below the sample point. Ehirovipuka is a long, narrow conservancy with hills in the southern portion and plains in the northern, and it will be challenging or not feasible to establish point counts in the northern portion of the conservancy lacking in good vantage points. The October-November 2011 data reflects this, with the limited number of point count surveys limited to the southern part of the conservancy. Omatendeka is composed predominantly of rolling terrain, with very few vantage points with acceptable viewsheds. Sesfontein is quite large and has a varied landscape, and we anticipate portions of this landscape will make for ideal point count surveys. But, in the western portion of the conservancy during October-November 2011, animals tended to congregate at the Hoanib riverbed because it was the dry season. Point counts not overlooking the riverbed counted few animals, reflecting the clumped distribution of animals during this time. Torra is the largest conservancy in this study and also has varied terrain. In the western portion, plateaus that overlooked large plains provided good vantage points for observing animals. In the northern portion, several hills with good visibility also were identified as good sites for point counts. In the southern portion, terrain limited the quality of the viewsheds in some cases. In all conservancies, additional spatial design development, discussions with game guards and field reconnaissance are needed to identify a larger suite of potential point count locations.

REMOTE CAMERA SURVEYS

We only were able to undertake a limited exploration of the use of remote cameras as tools for surveying rare and nocturnal animals. This approach has been broadly and successfully used for surveying rare species in a wide diversity of habitats and conditions, and we expect that the preliminary success we experienced will continue with expansion of this approach. Still, there are significant logistical challenges to consider when working within a large study area such as the Kunene, of which the feasibility and utility of fine-scale sampling implicit in camera surveys is an important consideration given the potential sample size requirements combined with the expense of quality remote camera equipment. In future survey efforts, we will also explore the use of indirect index surveys including mud and dust track surveys as a potential inexpensive and widely-used approach to complement camera survey efforts for rare or nocturnal species; this approach may allow a higher sampling effort not constrained by equipment. A combination of indirect index sampling such as track surveys followed by selected use of camera surveys to confirm species identification may provide a feasible strategy for future consideration.

DATA COLLECTION PROTOCOLS

We followed many of the design and data collection protocols developed for the North-West Annual Game Count surveys, including the selection of survey routes, vehicle type (i.e., open-back), minimum number of observers (2 observers in an open-backed vehicle), timing (dawn to 1100 hours), speed (<30 km/hr), etc. We changed some data collection approaches to better ensure the data would meet assumptions of a distance sampling approach to estimating animal densities. To appropriately use the distance sampling method, four main assumptions must be met to a reasonable degree (Buckland et al. 2001):

- 1) Animals on the survey center line (or center point) were detected with certainty. This becomes the basis for estimating the probability of sighting
- 2) Animals were detected at their initial location prior to being influenced by the survey effort. A precise initial location is important in distance sampling because the initial distance from the center line is used to estimate the density of animals at that particular distance, seen or unseen.
- 3) Animals are recorded once along a survey route. If animals are pushed ahead of the survey team and thus seen multiple times on the survey route, they must not be counted. It is *not* a violation of this assumption if their natural movements result in them being observed in a new area on a different day or a different route (or along the same survey route on a different day).
- 4) Distance from center line measurements were exact. The analyses method is sensitive to the quality of data used to estimate the distance animals are from the center line (or point) of the survey.

We have attempted to meet these critical assumptions using standardized data collection protocols as well as equipment including Global Positioning Systems, digital laser range finders and compasses for both transect (vehicular) and point count surveys. When design and collection assumptions can be met with reasonable certainty, the distance sampling approach to data analysis for both survey types has important advantages over less-demanding analytical techniques. For example, distance sampling analysis accounts for the possibility that animals were present but not spotted away from center line or point, and the

approach allows maximum use of field efforts by not limiting data collection to a fixed distance width (e.g., fixed strip width for transect surveys). More detailed topographic maps, in addition to continued input from the conservancy game guards' knowledge, would enable us to improve upon point count locations.

CONSERVANCY CAPACITY BUILDING

We undertook both formal and informal training with game guards assisting us with the survey work, including training with the survey equipment (laser range finder, compass and GPS), on the sampling designs, methods and critical assumptions about the data sampling protocols and basic computer training including data entry and management and, in some cases, data summary and basic analyses. During the wet season, there may be increased opportunities for training during inclement weather that prevents us from surveys. These sessions would also be used to further game guard understanding of the methodology and equipment, allowing them to later replicate the study and enhance their current wildlife monitoring scheme.

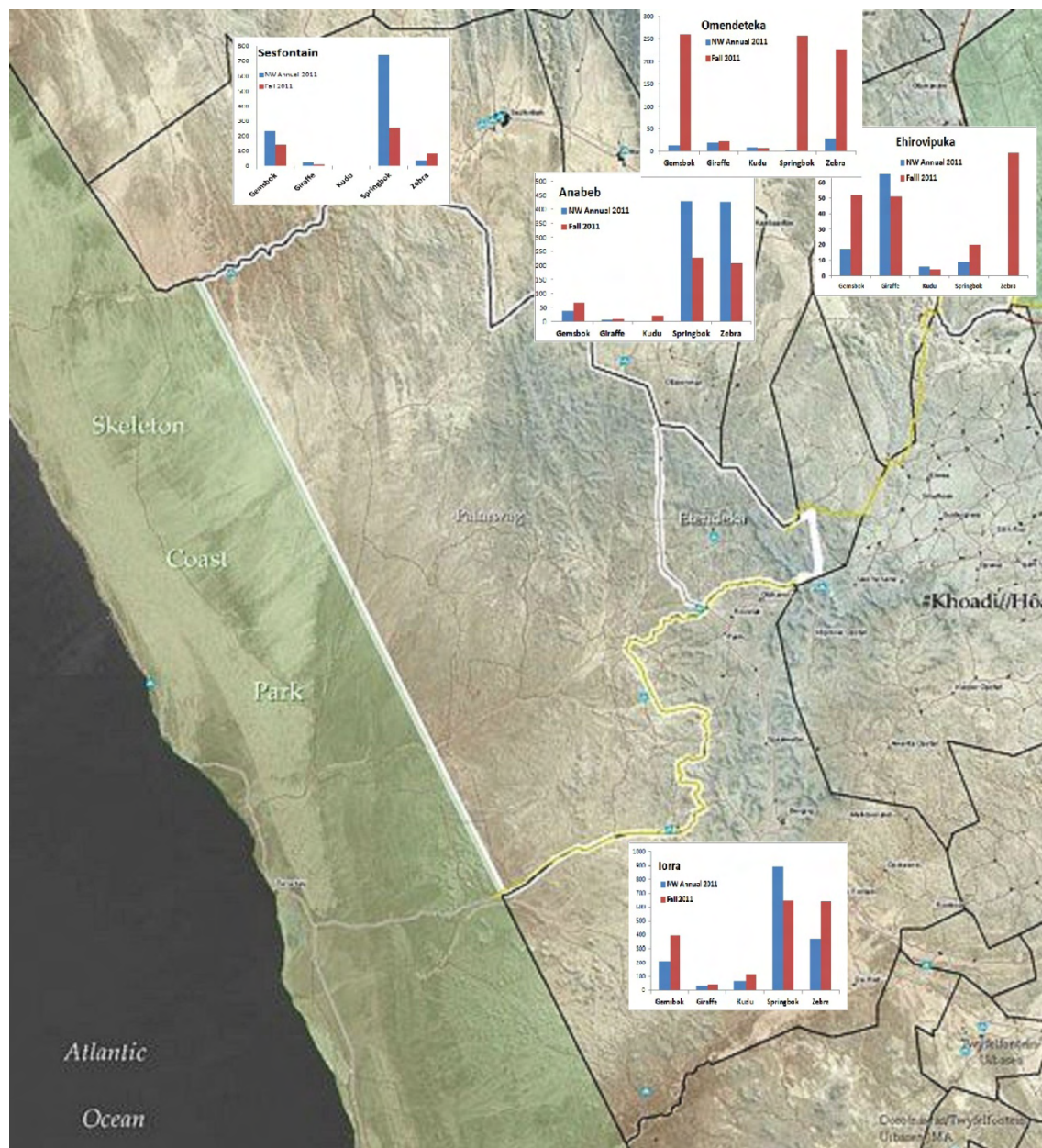


FIGURE 8. SUMMARY OF COUNTS FOR SELECTED WILDLIFE OBTAINED IN 5 DIFFERENT CONSERVANCIES IN THE KUNENE REGION OF NAMIBIA DURING VEHICULAR GAME SURVEYS IN JUNE 2011 BY MET AND PARTNERS, AND IN OCTOBER-NOVEMBER 2011 BY ROUND RIVER CONSERVATION STUDIES AND PARTNERS

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APPENDIX 1. SURVEY EQUIPMENT GENERAL INSTRUCTIONS

Range Finder (Nikon Laser 1200 Monarch Gold™):

1. Turn device on by pressing down the power button once.
2. To change units if not already set to “Meters” hold mode for 3 seconds until display changes from “Yards” to “Meters.”
3. When wildlife is spotted, if range finder is off, press the power button twice (automatically powers down after 10 seconds) with animal in scope. A distance reading should appear directly above scope.*
4. To adjust focus of image, turn the eyepiece to the right (for closer objects) and left (for distant objects.)

*Recommendation: Use stabilizing pole or tripod if available.

Compass (Brunton Type 15™):

1. For this particular study, conducted in northern Namibia, the declination of the compass must be set to 10 degrees west. To do so insert the key attached to the compass into the small gold screw found at northeast on compass dial. Turn key to the right to set the declination if originally found at true zero.
2. When an animal is sighted, align one eye with the animal in notch on top of compass cover holding compass at arm's length. Level compass to ensure accurate reading. Turn dial so that floating needle aligns with north found on face of the compass. Read angle at the top most mark on compass face which is aligned with sighting notch.

GPS (Garmin Etrex Venture HC™):

1. Turn on GPS at beginning of route using bottom button on right side.

Setup:

1. On main menu screen toggle to “Setup” and select.
2. In “Setup Menu” select “Time”. “Time Format” should read “12 Hour,” “Time Zone” should read “Paris,” “UTC Offset” should read “+01hrs00min,” “Daylight Savings Time” should read “Auto,” adjust settings if incorrect.
3. In “Setup Menu” select “Units”. In “Units Setup” screen “Position Format” should read “UTM UPS,” “Map Datum” should read “WGS 84,” “Distance/Speed” should read “Metric,” “Elevation (vert. speed)” should read “Meters (m/min),” “Depth” should read “Meters.” Adjust settings if incorrect.

To Mark a Waypoint:

On the main menu screen use toggle to scroll to “Mark”. Press down toggle to select. Press down toggle again on screen labeled “Mark Waypoint” to select “OK”. This will save the waypoint.

To Rename a Waypoint:

When in “Mark Waypoint” screen use toggle to scroll up to name line next to flag image. Press toggle to select, keyboard should appear. Use toggle to scroll to desired letter/number and select. When finished spelling desired name move toggle to “OK” on keyboard and select. Select “OK” on “Mark Waypoint” screen to save.

To View a Waypoint:

Use upper bottom on the right side of the GPS and click until “Find” screen appears. On this screen select “Waypoints” and a list of marked waypoints will appear. Select desired

waypoint to view detail information. From this screen you can also delete individual waypoints. Select “Go To” in order to delete all waypoints when in “Waypoints” screen. Click bottom button on the left side of the GPS. “Menu” appears. Toggle to “Delete” and select “All Symbol” on “Used Symbols” screen.

Tracks:

1. On “Main Menu” screen, use toggle to scroll to “Tracks” and select. Turn on tracks by scrolling to “On” and select. Turn off tracks by scrolling to “Off” and select.
2. To save track: toggle to “Save” in “Tracks” screen and select.
3. To clear track: toggle to “Clear” in “Tracks” screen and select.
4. To access saved tracks: Toggle to desired track in “Track Log” screen and select. To delete saved track, toggle to desired track in the “Track Log” screen and select. “Save Track” screen appears for selected track, toggle to “Delete” and select.

Moultrie Camera Trap™ (Model #MFH-DGS-M100):

Setup:

1. Click “Mode” while camera is “On.”
2. In “menu selections” screen, select “Camera Setup” by highlighting and pressing “Enter.”
3. To set date and time, click “Date/Time” in “Camera Setup” screen.
4. To set capture mode, click “Capture Mode” and select “Trail Cam.”
5. To set photo quality, select “Photo Quality” and select “Medium.”
6. To set photo delay, select “Photo delay” and then select “30 seconds.”
7. To take only one photo per sighting, select “Multi-shot” and choose “1-shot.”
8. To set temperature, select “Temperature” and choose “Celsius.”

APPENDIX 2. VISUAL DISTANCE ESTIMATION TRAINING

It is important to have consistent and high quality data collection. While technology has improved what science can accomplish by increasing accuracy and precision of data collection, it is not infallible. Being able to accurately estimate distance without the aid of technology is important for both the vehicular game count and point count surveys. In some cases, the Monarch Gold Range Finder™ cannot determine the distance to an object itself for a diversity of potential reasons. Before beginning data collection, observers must go through training to estimate distances, both short and long range. All observers then must practice until they are able to estimate distance consistently and accurately. We describe the training and practice undertaken by observers for visual distance estimation.

Short Distance Training:

1. Set out marked poles at distances of 50m, 100m, 300m and 500m and become familiar with what each distance looks like. Establish mental tools to recognize these common distances in the landscape.
2. Test distance knowledge by picking random points/landmarks between 50m-500m. Make a visual estimate of the distance to this point. Take a measurement using a Monarch Gold Range Finder™ to compare to the visual estimation. Alternatively, using a GPS, mark a waypoint where the initial distance estimations was made. Walk to the point/landmark and mark another waypoint which allows the actual distance to be determined.

Long Distance Training:

1. Along a straight flat road, using two vehicles, park one vehicle at an initial waypoint (marked with a GPS). Use a second vehicle to drive, stop, and mark a waypoint at 500m, 1km, 1.5km, and 2km. Measure each distance first with visual estimation, followed by a Monarch Gold Range Finder™ (for distances between 500m and 1km), and finally confirm distances with a GPS. Establish mental tools to recognize these common distances in the landscape.
2. Test knowledge of 500m to 2km (distances will be determined by leaders) using two vehicles. One car will remain stationary at a marked waypoint, while the other moves to random lengths along the road where additional waypoints will be marked. Both cars will estimate distances between vehicles using visual estimation and the Monarch Gold Range Finder™. Compare estimated distances with vehicle's odometer (walkie-talkies used to communicate between vehicles), as well as by the GPS waypoints. Each group will complete five trials.

Accuracy Testing:

Distance analysis assumes that there is limited or no error in measurements. In order to provide such data, it is important to not only train oneself on how to use the provided equipment, but also to check that angle and distance measurements taken are accurate.

1. Using one vehicle on a fixed route (with at least four individuals in the vehicle), begin by taking a waypoint at the start of the route along with turning on a GPS track.

2. When vehicle stops, take a GPS waypoint marking the location of the vehicle along the track. One individual will then leave the vehicle and become a mock animal in the landscape, taking the GPS with them to mark a waypoint where they stop. The individual should aim for a distance between 10-300m, at a random angle. Everyone who remains inside the vehicle will visually estimate the distance to the mock animal.
3. One person will use the Monarch Gold Range Finder™ to find a distance, one person will use a compass to establish a heading from north to the mock animal, and one person will record data onto a data sheet.
4. Repeat until all individuals have done each role twice.

APPENDIX 3. SPECIES SEXING GUIDELINES

Table A3-1. Notes on gender characteristics for species of the Kunene Region, Namibia.
Information gathered from Anabeb Conservancy game guard, Lineus Mbomboro, Fall 2011.

Species	Male	Female
<i>Antidorcas marsupialis</i> (Springbok)	Thick horns	Thin horns
<i>Equus zebra hartmannae</i> (Hartman's Mountain Zebra)	Thick necks, thick white stripes on behind	Thin necks, thin white stripes
<i>Giraffa camelopardalis</i> (Giraffe)	Larger body, darker spots, muscular necks, and bald horns	Smaller body, lighter spots, and hairy horns
<i>Loxodonta africana</i> (Elephant)	Angular head, longer front legs, and a rounded butt flap	Circular heads and a 'V' shaped butt flap
<i>Oreotragus oreotragus</i> (Klipspringer)	Thick horns	Thin horns
<i>Oryx gazella</i> (Oryx)	Thick neck, Thick side stripe, short and thick horns	Thin neck, thin black stripe, long and thin horns
<i>Papio ursinus</i> (Chacma Baboon)	Larger body with darker coloring, long narrow faces, and separated butt pads	Smaller body with lighter coloring, and a connected butt pad
<i>Raphicerus campestris</i> (Steenbok)	Horns	No horns
<i>Struthio camelus</i> (Ostrich)	Larger body with black plumage	Smaller body with brown plumage
<i>Taurotragus oryx</i> (Eland)	Dark tan coat, hairy neck, large horns	Light tan coat, with small straighter horns
<i>Tragelaphus strepsiceros</i> (Greater Kudu)	Horns	No horns

APPENDIX 4. DATA ENTRY GUIDELINES

Data were entered following each survey by at least one of the observers who collected the data. This helped ease the data entry process as it ensured data was entered with minimal gaps in understanding. Data entry includes transferring hand written data into an Excel spreadsheet, downloading and saving GPS tracks and waypoints, and filling in the correct UTM points for each waypoint in the spreadsheet.

Suggested Order of Operations for Game Count Data Entry:

1. Transfer waypoints and tracks from GPS onto computer using the “Map Source” software. Connect GPS to USB port using the “Garmin USB Connector” cable. Turn on GPS. Open “Map Source” software. On upper toolbar click “Transfer” followed by “Receive from device...” in the drop down menu. When “Receive from Device” screen opens click “Find Device,” this should locate the information on the Garmin GPS. Make sure that “waypoints” and “tracks” are selected on the “Receive from Device” screen before clicking “Import.” Waypoints and tracks will download and appear on the left hand side of the “Map Source” screen. Check data to see that everything has been downloaded correctly and that no extraneous waypoints and tracks exist (i.e. “Active Log”). Delete any extraneous waypoints or tracks once certain that they are not pertinent to current game count data. To save waypoints and tracks, click “File” in the upper toolbar and select “Save As” in the drop down menu. In “Save As” screen change file type to “Text (Tab delimited)(*.txt.)” Locate respective folder for data type, point counts will be saved in the “Point_Count” folder and game counts will be saved in the “Game_Count” folder. Both of these folders will be found in “Game Counts and Water Surveys” on the desktop of the RRCS computer. Waypoints and tracks will be saved following the format of “datatype(gamecount or pointcount)_first letter of conservancy_GPS#_Route#_Date(day month year).txt” (i.e. gamecounts_T_GPS1_Route1_28Oct2011.txt). This text file will then be used to enter data into the spreadsheet for UTM coordinates of all the waypoints.
2. The data taken during the game count survey needs to be entered into the appropriate spreadsheet found within the “Game Counts and Water Surveys” folder on the desktop screen of the RRCS computer. Within this folder the spreadsheets will be found in “Game_Counts_2011_Spreadsheet” Dependent upon the type of data completed (point counts or vehicle game counts) choose the correct and updated pre-formatted spreadsheet to transfer current data. To avoid re-writing previous day's entries, begin by saving the new spreadsheet as “Game_Count_current date (day-month-year)”. Enter all pieces of data and confirm that every cell of the spreadsheet is properly completed, remember to include UTM coordinates which were downloaded prior. Save the updated spreadsheet.
3. Once completed, place a checkmark in the upper right hand corner of the data sheet and store in the respective folder. Delete all GPS waypoints and tracks, clear the track routes, and confirm that the track is set to “Off.”

APPENDIX 5: SUMMARY OF VEHICULAR AND POINT COUNT SURVEY EFFORTS

Table A5-1. Summary of vehicular game count survey effort completed October-November 2011 in the Kunene region of Namibia.

Conservancy	Route ID	Date	Start Time	Start Temp (C)	End Time	End Temp (C)	Km Surveyed	Survey Time (h:mm)
Anabeb	Rte 1	26 Oct 2011	6:56	20	9:16	31	41	2:20
Anabeb	Rte 2	26 Oct 2011	7:04	20	10:00	31	51	2:56
Anabeb	Rte 3	28 Oct 2011	7:06	19	9:30	27	32	2:24
Anabeb	Rte 4	28 Oct 2011	7:05	21	10:34	38	40	3:29
Anabeb	Rte 5	25 Oct 2011	6:57	22	8:09	24	25	1:12
Anabeb	Rte 6	25 Oct 2011	6:57	22	8:44	24	45	1:47
Ehirovipuka	Rte 1	08 Oct 2011	7:13	26	11:00	31	58	3:47
Ehirovipuka	Rte 1	23 Nov 2011	7:13	22	10:18	39	85	3:05
Ehirovipuka	Rte 2	09 Oct 2011	7:05	15	10:20	34	50	3:15
Ehirovipuka	Rte 3	09 Oct 2011	7:17	17	10:49	34	56	3:32
Ehirovipuka	Rte 4	10 Oct 2011	7:18	24	10:20	-	35	3:02
Ehirovipuka	Rte 4	20 Nov 2011	7:28	22	10:12	27	39	2:44
Ehirovipuka	Rte 5	11 Oct 2011	7:11	24	11:00	-	35	3:49
Ehirovipuka	Rte 5	20 Nov 2011	7:08	20	9:40	23	47	2:32

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Conservancy	Route ID	Date	Start Time	Start Temp (C)	End Time	End Temp (C)	Km Surveyed	Survey Time (h:mm)
Omatendeka	Rte 1	16 Nov 2011	7:29	14	10:18	28	78	2:49
Omatendeka	Rte 2	15 Nov 2011	6:59	15	10:30	39	78	3:31
Omatendeka	Rte 3	14 Nov 2011	7:05	19	11:05	40	89	4:00
Omatendeka	Rte 4	16 Nov 2011	7:03	16	9:32	26	45	2:29
Omatendeka	Rte 5	18 Nov 2011	7:12	-	10:27	27	27	3:15
Omatendeka	Rte 6	18 Nov 2011	7:13	24	8:12	29	8	0:59
Sesfontein	Rte 1	02 Nov 2011	7:18	16	9:54	44	40	2:38
Sesfontein	Rte 2	02 Nov 2011	7:21	15	10:28	44	53	3:07
Sesfontein	Rte 3	01 Nov 2011	7:00	16	9:00	32	37	2:00
Sesfontein	Rte 4	31 Oct 2011	7:16	21	10:37	27	70	3:21
Sesfontein	Rte 5	31 Oct 2011	7:12	18	9:59	24	33	2:47
Sesfontein	Rte 6	30 Oct 2011	7:12	17	9:26	30	55	2:14
Torra	Rte 1	17 Oct 2011	6:42	13	10:45	27	62	4:03
Torra	Rte 2	21 Oct 2011	7:00	12	11:00	38	48	4:00
Torra	Rte 3	19 Oct 2011	7:13	13	9:55	18	34	2:42
Torra	Rte 4	23 Oct 2011	7:16	20	9:02	25	36	1:46
Torra	Rte 5	15 Oct 2011	6:40	-	11:00	-	55	4:20

Conservancy	Route ID	Date	Start Time	Start Temp (C)	End Time	End Temp (C)	Km Surveyed	Survey Time (h:mm)
Torra	Rte 6	21 Oct 2011	7:03	15	10:59	38	43	3:56
Torra	Rte 7	16 Oct 2011	7:04	20	9:51	32	36	2:47
Torra	Rte 8	17 Oct 2011	6:56	20	11:01	-	55	4:05

Table A5-2. Summary of point count game survey effort completed October-November 2011 in the Kunene region of Namibia.

Point Count Site ID	Date	Walking time ¹	Temp Start	Wind Direction ²	Wind Speed (km/hr)	Survey Time Start	Survey End Time	Temp End
Ehirovipuka-1	11-Oct-11	0:18		East	0-5	7:33	9:33	
Ehirovipuka-1	19-Nov-11	0:24	26	No Wind	0	7:27	9:27	42
Ehirovipuka-2	11-Oct-11	1:40		Southeast	6	8:40	10:40	
Ehirovipuka-3	19-Nov-11	-	26	No Wind	0	7:30	9:30	42
Torra-1	15-Oct-11	1:31	25	S/SE	0-5	8:16	10:16	
Torra-2	15-Oct-11	1:13	17	West	0-5	8:09	10:09	32
Torra-3	15-Oct-11	-	18	SW	5	7:16	9:16	24
Torra-4	19-Oct-11	0:36	18	SW	0-5	8:42	10:42	37
Torra-5	19-Oct-11	0:17	21	NE	10-15	7:31	9:31	31
Torra-6	19-Oct-11	0:59	21	NE	10-15	8:15	10:15	31

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Torra-7	22-Oct-11	0:26	24	W	5-10	7:41	9:41	33
Torra-8	22-Oct-11	0:29	15	E	0-5	8:04	10:04	33
Torra-9	23-Oct-11	-	22	NA	0			34
Anabeb-1	27-Oct-11	0:30	26	NE	0-5	7:50	9:50	32
Anabeb-2	27-Oct-11	0:21	26	NE	0-5	7:46	9:46	32
Anabeb-3	29-Oct-11	0:30	23	W/NW	0-5	7:50	9:50	36
Anabeb-4	29-Oct-11	0:30	26	NE	0-5	8:00	10:00	37
Sesfontein-1	30-Oct-11	0:33	23	SW	0-5	7:37	9:37	
Sesfontein-2	1-Nov-11	0:42	21	W	0-5	8:29	10:29	34
Sesfontein-3	3-Nov-11	0:28		No Wind	0	7:51	9:51	46
Sesfontein-4	3-Nov-11	0:21	37	N	0-5	7:54	9:54	43
Sesfontein-5	4-Nov-11	0:15	24	N	0-5	7:25	9:25	33
Sesfontein-6	4-Nov-11	0:05	27	S/SE	0-5	7:08	9:08	34
Sesfontein-7	5-Nov-11	0:11	25	No Wind	0	7:20	9:20	37
Sesfontein-8	5-Nov-11	0:16	25	W	0-5	7:15	9:15	37
Omantendeka-1	15-Nov-11	0:31	-	No Wind	0	8:00	10:00	
Omantendeka-2	17-Nov-11	0:37	30	No Wind	0	8:20	10:20	43
Omantendeka-3	17-Nov-11	0:38	25	No Wind	0	7:56	9:56	40
Omantendeka-4	18-Nov-11	0:22	30	NW	0-5	8:37	10:37	34

¹Estimated based on time elapsed between arrived at parking spot and starting survey; provided for future planning efforts.

²Wind information at time of sampling; provided for future planning to avoid disturbing animals as approach site on foot

APPENDIX 6: SUMMARY OF RESULTS FROM WILDLIFE POINT COUNT SURVEYS

Table A6-1. Summary of species counts obtained through point count surveys in 5 conservancies of the Kunene region of Namibia in October-November 2011.

Species	Anabeb					Ehirovipuka			Omatendeka				Sesfontain									Torra							
	1	2	3	4		1	3		1	2	4		1	2	3	4	5	6	8		1	2	4	5	6	7	8		
Black-backed jackal		1																											
Chacma baboon																									15				
Eland						7																							
Gemsbok	5	1	1								31			2	11	8	3		4		34	11	20	11	13	27	39		
Giraffe			2			13					6							8		1									
Hartman's mountain zebra																													
		23	44	92		18	16				24				5	7	3			61	27	11			49	3	12		
Kudu		5					4		5																	9	39		
Ostrich		2	3	7		2									3	1	7	2	1	1		6							
Rhino																				1					1				
Rock hyrax																	3												
Springbok	9	8	3	43							15					91		8	74	43	8	1	1	7	1				
Steenbok															1														
Domestic cattle	12								30	9			44		20														
Domestic donkey										1																			
Domestic goat				640					100				113																
Domestic horse									1				1																

APPENDIX 7: CAMERA SURVEYS SAMPLE PICTURES



Figure A7-1. Spotted Hyena (*Crocota crocuta*) at Collin's Spring on November 3, 2011 at 0825 hrs, Torra Conservancy, Kunene Region, Namibia.



Figure A7-2. Male Leopard (*Panthera pardus*) at Collin's Spring on October 17, 2011 at 0950 hrs, Torra Conservancy, Kunene Region, Namibia.



FIGURE A-3. NIGHT IMAGE OF FEMALE LEOPARD (*PANTHERA PARDUS*) AT JEBICO SPRING ON OCTOBER 23, 2011 AT 0215 HRS, TORRA CONSERVANCY, KUNENE REGION, NAMIBIA.



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