

Kunene Regional Ecological Analyses: Assisting Conservancies with Seasonal Wildlife Monitoring

Progress and Methods

June 20, 2012

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ABSTRACT

Throughout March and April of 2012, Round River Conservation Studies continued its work with 5 communal conservancies and the Namibia Ministry of Environment and Tourism to conduct wildlife surveys to support wildlife monitoring in the Kunene Region. Our surveys are designed to supplement the North-West Annual Game Counts 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 similar and compatible to the Annual Game Count. During the second field season (March-April 2012), completed were 1,627 km of vehicular game count surveys with 108.3 hours of observation time; 25 foot-accessed timed point count surveys for 50 hours of observation time; and further exploration of remote-triggered cameras. With assistance provided by the Conservancy Game Guards, surveys were completed in 5 Kunene conservancies: Anabeb, Ehirovipuka, Omatendeka, Sesfontein and Torra. During the vehicular surveys, 18 different wildlife species were observed, of which 9 of these species were also observed during point count surveys. The most common species included gemsbok, springbok and zebra. Two test camera stations captured leopards, lion, cape fox, honey badger, and porcupine, as well as a diversity of more common species. As these survey efforts are repeatedly completed each year during February-April and October-November they will provide additional species abundance and seasonal distribution information for the conservancies and the Ministry of Environment and Tourism.

ACKNOWLEDGMENTS

We'd like to particularly thank our Namibia Project Coordinator, Vehi Kasupi, for his knowledge of the region and its wildlife, his skilled assistance with the field-work, 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 the Namibia World Wildlife Fund along with the five participating conservancies and their game guards: Anabeb (Rhonaldt Karugjaiua, Ismael Kaveterua, Linus Uazunga), Ehirovipuka (Jackson Kavetu, Matarakuani Kavetu, Boycky Kazahe), Omatendeka (Kamangah Zariama, Gerson Mukuaruuzze), Sesfontein (Rickey Tsipombo), and Torra (Erick Grewers, Ephraim Awarab).

INTRODUCTION

Round River Conservation Studies has thus far concluded two data collecting field seasons to fulfill our objective to supplement the data collected during the Annual Game Count in Namibia. Detailed background on Round River's work in the Kunene region can be found in Heinemeyer et al. 2012. Efforts were made to repeat the survey routes that were conducted during October-November 2011 during March-April 2012. Point count surveys continue to be assessed as we hope to eventually use the distance sampling method to procure an accurate game count in five conservancies: Anabeb, Ehirovipuka, Omatendeka, Sesfontein, and Torra.

Our continued training with the conservancy game guards to conduct this monitoring project has been successful. We look forward to building stronger relationships as well as educating the other conservancy staff on the importance of a thorough game count

that could influence hunting quotas and the designation of conservancy land use zones as a means to minimize conflict between wildlife and local communities.

With the distance sampling methodology in place, we evaluated our wildlife monitoring to test that the correct sampling techniques were chosen and are being properly conducted. The assumptions essential for game density quantification from line transects and point counts outlined by Buckland *et al.* (2001) are: (a) all game seen directly on the game route are accounted for, (b) game is detected from their original position if moving or fleeing, and (c) distances and angles are measured accurately with adequate equipment. A physical setting assumption for distance sampling methods assumes that the density of game observed on the route is uniform across the entire sample area. Assuming that all game was seen on the route travelled at distance '0', proportions of game seen in increasing buffer zones can be quantified based off the density at distance '0'. As long as these assumptions are met, we will continue our progress in providing validated data for game quantification and monitoring in the Kunene region.

We look forward to continued success as when we return to these five conservancies to repeat survey efforts in October-November 2012.

METHODS

We used a combination of road-based game counts, foot-accessed point counts and remote camera stations during March-April, 2012 in a preliminary assessment of conservancy-level survey methods to supplement the annual regional wildlife game counts. Surveys were conducted in five Kunene Region conservancies in the of northwest Namibia: Anabeb, Ehirovipuka, Omatendeka, Sesfontein and Torra (**Error! Reference source not found.**). 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).

VEHICULAR GAME COUNT SURVEY

Vehicular game counts used MET's Annual Game Count routes and key survey design parameters may be reviewed in Heinemeyer et al. 2012. The methodology for including additional spatial information with the use of tools such as compasses, rangefinders, and global positioning system (GPS) units is also detailed in Heinemeyer et al. 2012.

One adjustment this season was made to the vehicular game routes with one observer scanning behind the vehicle 180° from their left to right. The other two observers scanned 90° to their right or left in the direction of the moving vehicle. The accompanying game guard and driver functioned as the main observers of wildlife on or near the road. This change was made as we recognized a rear-faced observer increased the visual field. Rear-faced observers may see game behind hills and vegetation hidden from forward seated observers.

POINT COUNT GAME SURVEYS

As road-based vehicular surveys are limited to regions with existing roads they do not collect information on animal abundance in potentially other important areas without roads. Therefore, we continued to conduct point counts to collect data in more remote areas of each conservancy. During the latest field season, we attempted to find ideal point count sites that maximized the viewing field while eliminating less ideal sites. The detailed methodology can be found in Heinemeyer et al. 2012.

REMOTE CAMERA SURVEYS

Remote cameras were used to gather information on the presence of less commonly observed species such as predators and other nocturnal species (Heinemeyer et al. 2012). One methodology adjustment for cataloguing important species was developed. When the memory cards were replaced and the photos were reviewed, the observer would identify species and record pertinent information regarding the ‘sightings’ in an Excel spreadsheet. Species were recorded in the data sheet only if there was 30 minutes of inactivity between photos taken, so as to eliminate recording the same animal or group of animals consecutively during one long visit to the camera site.

GAME GUARD CAPACITY BUILDING AND COMMUNITY COMPUTER TRAINING

Game guards were interviewed, trained and provided a stipend during each of the five to ten day game count periods. This allowed for ample time to describe the project and conduct question/training sessions emphasizing the utility of this project to the conservancies.

A series of standardized questions were posed to the game guards. The questions pertained to the game guards’ prior experience, interests, general conservancy inquiries, and other topics. After the introductory questions, information was obtained regarding their experience with the census equipment and techniques: GPS devices, rangefinders, compasses, as well as, visual distance estimation and declination adjustment settings (Appendix I). The proficiency of the game guards with these devices and techniques determined the level of training administered. The following work timetable was established:

- Day 1: Introductions/colloquial conversation
- Day 2: Questions/gauge equipment experience/equipment training (Appendix I)
- Day 3: Implement methods in the field
- Day 4: Computer/data entry training; ask closing questions (Appendix II)

Before conducting the game counts, the nuances of the methodology were made clear. We found it imperative to convey that: 1) Animals must be sighted and recorded at their original locations, 2) Certain instances call for comments such as “fleeing” or “seen through binoculars,” and these items were clarified, 3) Some animals are sighted not as a group, but as individuals, 4) Animals are not to be counted twice, and 5) Recording notation should be standardized so as to be universally understood.

Using the rangefinder was taught first. Visually estimating distances was also taught at this time. An object (such as a tree or rock) would be selected and the rangefinder was used to estimate the distance (in meters). Other game guards then took turns estimating the distance of that object in comparison to the rangefinder.

The use of a compass was next. The basics of declination were explained, as well as the importance of outstretching the arm that holds the compass, keeping the compass completely level in the palm of their hand, shutting one eye when locking on the object that's being measured, and looking through the notch at the top of the mirror.

The final piece of equipment was the Global Positioning System (GPS) unit. We began by explaining how to power it on and the function of each of the other external buttons. The game guards were then taught how to mark a waypoint and how to record a previously taken waypoint to show where it is compared to one's current location. Additionally, tracks were illustrated in tandem with the waypoints on the GPS map. The ability to switch between the main menu, map and compass menu was also explained, as these show direction, tracks and routes, as well as the function icons.

After the game counts, computer/data entry training was conducted. If prior computer knowledge was non-existent, steps were taken to explain basic computer processing (Appendix II). Primary data analysis/input taught included importing tracks/waypoints and using Microsoft Excel to enter data and make simple charts to depict animal population trends. In addition to these computer programs, the game guards and conservancy staff were taught an overview of Microsoft Word (Appendix II). Upon completion of the interviews and training, a set of closing questions was administered to evaluate the training.

METHODOLOGY EVALUATION

To ensure the distance sampling assumptions the game route methodology was evaluated. Histograms were produced to visualize the frequency of game seen with perpendicular distance away from the game route. These sightability histograms were used to create a sightability curves to show the inverse relationship of game seen and distance from the game routes (Buckland et al. 2001). If the sightability curve exponentially decreases with perpendicular distance following the assumption, the density of game observed on the route can be extrapolated out to quantify the total game in each buffer zone. This does not mean that the density of the game is decreasing with increased distance from the vehicle, only that sightability is inversely affected as distance increases.

Mathematical equations to determine the UTM locations of the game using their angle and distance from the observation vehicle were completed during the pilot season. These formulas were used in Microsoft Excel for the 2012 wet season data (Heinemeyer et al. 2012). This allowed for the placement of game at their exact location on a map using ArcView. Once the games' locations were mapped, fifteen 0.0999 kilometer (km) buffer zones were created laterally away from each route. Each buffer was created at 0.0999 km intervals to ensure that measurements were not counted twice if they were

at an even 100 meter (m) interval. The buffer zones ended at 1.49 km, but a final zone was created to cover distances greater than 1.50 km. The buffer zones ended at 1.49 km due to visual estimations not being as accurate at such a distance, and a lack of game beyond that point making increasing buffers unnecessary. This led to a truncation of the data set.

Truncation was performed on the data set to lower estimation bias and to improve data analyses as extreme observations provide little beneficial information for population estimations. Right-truncation usually eliminates the outer 5% of a data set (Buckland et al. 2001). However, due to our data collection methods, perpendicular game distance from the route could only be obtained after the buffers were created in ArcView. This did not allow for the quantification of what constituted the outer 5% of the data set to be right-truncated. Therefore, the right-truncation of this data set was based upon the researcher's knowledge of data collection accuracy and ability to see game past 1.49 km.

In ArcView, the game route data from Microsoft Excel was uploaded as individual points within a theme. The buffer zones were created as individual polygon themes. Using the clip feature in X Tools, the game point theme was clipped with the buffer zone themes. This produced new themes with just game route data points that fell within the outer limit of each buffer. The attribute table of the new themes provided the exact number of points within the entire area. However, the larger buffers included the smaller buffers, so subtraction was used to quantify how many game points fell within each individual buffer zone.

In order to create sightability histograms, densities of each buffer zone were calculated. This was accomplished by multiplying the length in km of game routes driven by 0.199 km (the sum of the widths of transect buffered on each side of the road) to quantify the area. The points within each buffer zone were divided by the area of land each buffer zone encompassed to calculate the densities of game seen per buffer zone. Assuming that the density of game recorded in the first buffer zone was the true density of the area, the proportion of game seen in each buffer zone was calculated based upon this density. By looking at proportion of game seen, the exponentially negative relationship of sightability and distance from the routes were isolated. Thus the histogram of proportion of game seen per buffer zone creates a sightability histogram. This process was completed for the combined 2011 dry season and 2012 wet season.

RESULTS

VEHICULAR GAME COUNT SURVEYS

Vehicular surveys were conducted between 4 March and 20 April 2012 for a total of 28 survey days. On most survey days, 2 teams were employed to conduct surveys along different routes (Figure 1). Most routes were surveyed a single time during this period, though in 6 cases routes surveyed earlier in the survey period were re-surveyed again. A total of 1,406 km of routes were surveyed with 221 km of these being surveyed twice for a total survey effort of 1,627km and 108.3 hours of observation time. The breakdown of

survey effort by conservancy is provided in Table 11 and details of each survey are provided in Appendix III (Appendix III. SUMMARY OF VEHICULAR AND POINT COUNT SURVEY EFFORTS Table III- 1). Average survey route length was 40.7 km, but was variable (range: 14 - 81 km) and took an average of 2.71 hours to complete (range 0.7 – 4.1 hrs). As per protocol, surveys started in the morning (average start time 7:06) and ended before 11:00 (average end time 9:49). 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 30°C (range: 16-40°C).

TABLE 1. SUMMARY OF VEHICULAR SURVEY EFFORT COMPLETED IN THE KUNENE REGION BETWEEN 4 MARCH - 20 APRIL 2012 IN 5 CONSERVANCIES.

Conservancy	Total Survey Routes	Total Survey Distance (Km)	Total Survey Time (Hours)
Anabeb	6	448*	28.13*
Ehrovipuka	7	281	17.92
Omatendeka	6	214	16.87
Sesfontein	6	269	13
Torra	9	415	32.37
Total	34	1406	95.01

*This total includes 221 km and 13.28 hours of repeat survey.

EIGHTEEN SPECIES OF WILDLIFE WERE COUNTED DURING THE VEHICULAR GAME COUNT SURVEYS (

TABLE 22). 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 (

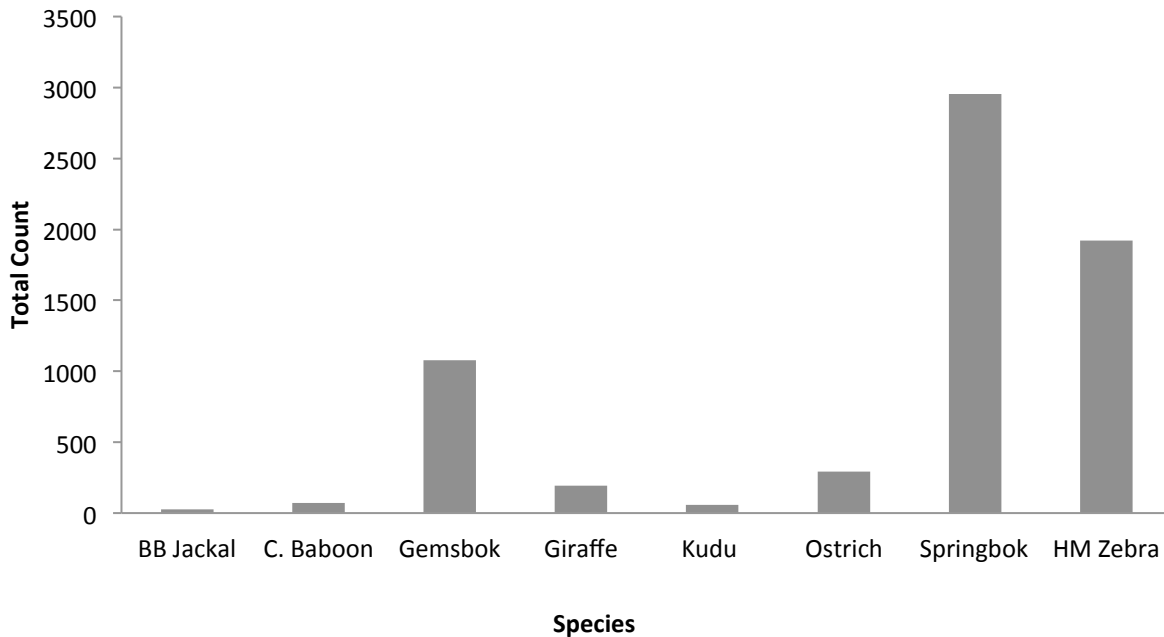


Figure2). Other species were found in low numbers in most conservancies but relatively more abundant in 1-2 conservancies (e.g., kudu in Torra, eland in Ehirovipuka). Noteworthy sightings included a caracal in Anabeb, a herd of 17 red hartebeest in Torra, and 3 bat-eared foxes and a leopard in Sesfontein. Overall wildlife counts per km of survey route were similar across the 5 conservancies (Figure 3).

TABLE 2. TOTAL COUNTS OF ALL SPECIES RECORDED DURING VEHICULAR GAME COUNTS IN 5 CONSERVANCIES IN THE KUNENE REGION OF NAMIBIA FROM MARCH-APRIL 2012.

Species	Latin Name	Anabeb	Ehrovipuka	Omatendeka	Sesfontein	Torra	Total
Bat-eared fox	<i>Otocyon megalotis</i>				3		3
Black-backed jackal	<i>Canis mesomelas</i>		4	2	7	15	28
Caracal	<i>Caracal caracal</i>	1					1
Chacma baboon	<i>Papio ursinus</i>	32	5			35	72
Eland	<i>Taurotragus oryx</i>		1	3			4
Elephant	<i>Loxodonta africana</i>		2				2
Gemsbok	<i>Oryx gazella</i>	68	66	261	244	440	1079
Giraffe	<i>Giraffa camelopardalis</i>	16	109	46	4	20	195
Hartman's mountain zebra	<i>Equus zebra hartmannae</i>	578	251	615	38	438	1920
Spotted hyena	<i>Crocuta crocuta</i>					1	1
Kudu	<i>Tragelaphus strepsicerus</i>	7	6	13		34	60
Leopard	<i>Panthera pardis</i>				1		1
Ostrich	<i>Struthio camelus</i>	44	13	122	34	81	294
Red hartebeest	<i>Alcelaphus caama</i>					17	17
Rock hyrax	<i>Procavia capensis</i>					4	4
Springbok	<i>Antidorcas marsupialis</i>	1259	102	374	151	1070	2956
Steenbok	<i>Raphicerus campestris</i>		8	1	3	10	22
Warthog	<i>Phacochoerus africanus</i>		4	2			6

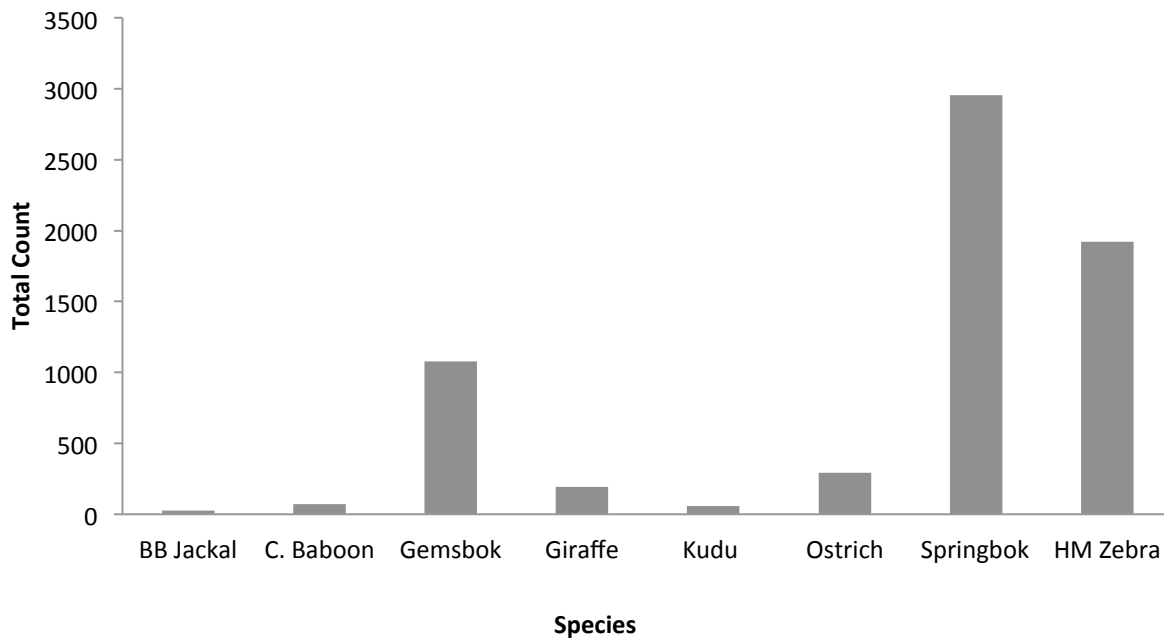


FIGURE 2. TOTAL COUNTS FOR SELECTED SPECIES RECORDED DURING THE VEHICULAR SURVEYS IN 5 CONSERVANCIES IN THE KUNENE REGION OF NAMIBIA, MARCH-APRIL 2012.

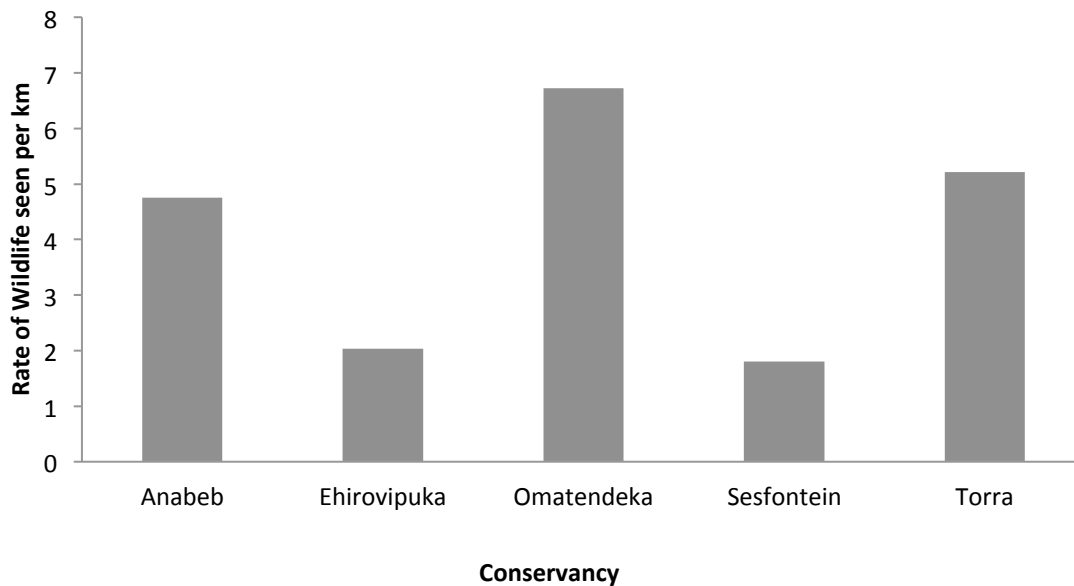


FIGURE 3. THE RATE OF WILDLIFE SPECIES SEEN PER KILOMETER DURING VEHICULAR GAME COUNT ROUTES IN THE KUNENE REGION MARCH-APRIL 2012.

POINT COUNT SURVEYS

Point count surveys were conducted, March 5 to April 20, 2012 for 19 survey days with most days employing 2 teams to conduct 2 surveys in different areas. Most sample sites were surveyed a single time during this period, though in Anabeb, one point was surveyed twice and another survey point was repeated from a better viewing angle. A total of 25-point count sample sites were sampled, 9 of which were repeated from the first field season (October- November 2011) (indicated by an asterisk in Table 3) and 6 new sites near the original points were designated this field season (indicated by a 'b' after the site number in Table 3). A total of 50 hours of survey effort were devoted to point count surveys, including 4 hours spent re-surveying 2 sites in Anabeb. Point count sample site locations and characteristics were recorded (Table3), and survey information for each point count is provided in Appendix III (Table III-2). As per protocol, surveys started in the morning (average start time 8:05) and ended before 11:00 (average end time 10:05) to minimize the potential effects of hot weather influencing wildlife behavior and sightability. The average temperatures at the end of the survey were 32°C (range: 24 – 41°C).

TEN DIFFERENT SPECIES WERE OBSERVED DURING THE POINT COUNT SURVEYS (

Table4). Noteworthy sightings included black-faced impala in Ehrovipuka, and 3 cheetah and 3 spotted hyenas in Torra. Hartman's mountain zebra, gemsbok, and giraffe were seen across all five conservancies. In addition to these species, kudu, springbok and ostrich were also commonly observed species. A summary of point count data is provided in Appendix IV.

TABLE 3. 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
Anabeb-3*	2	153	378649	7852016	S
Anabeb-4*	1	208	373583	7843745	NE
Anabeb-4b	2	142	374607	7844212	S
Ehrovipuka-4	1	122	413196	7853766	W
Ehrovipuka-5	2	184	413403	7818954	None
Ehrovipuka-6	1	136	415061	7842701	SW
Omatendeka-4*	1	213	404000	7821332	NW
Omatendeka-5	2	224	408810	7894560	E
Omatendeka-6	2	-	395915	7901220	N
Sesfontein-3*	1	142	354427	7875965	S
Sesfontein- 4b	1	146	339772	7877927	W
Sesfontein-5*	2	146	339772	7879527	No Wind
Sesfontein- 6b	2	177	323706	7895955	No Wind
Sesfontein- 7b	1	207	343319	7890098	No Wind
Sesfontein- 8b	2	200	354816	7893253	SE
Torra-1*	1	118	380590	7759372	No Wind
Torra-2*	1	176	370973	7756366	SW
Torra- 4b	1	140	394366	7728071	SE
Torra-8*	1	164	396521	7786559	SE
Torra-9*	1	281	398660	7779495	No Wind
Torra-10	2	170	402061	7757773	S
Torra- 11	1	219	377994	7745910	N
Torra- 12	1	206	392058	7789070	W
Torra- 13	2	130	383578	7749732	E

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

² Field of view is the degree of the angle of viewshed

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.

* Sites that were repeated from the previous field season (October-November 2011)

'b' after the site ID indicates new sites that were in the viewing area of the originally designated sites

TABLE 4. 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	Latin Name	Anabeb (8 hrs)	Ehrovipuka (6 hrs)	Omatendeka (6 hrs)	Sesfontein (12 hrs)	Torra (18 hrs)
Black-faced impala	<i>Aepyceros melampus petersi</i>	0	10/1.67	0	0	0
Cheetah	<i>Acinonyx jubatus</i>	0	0	0	0	3/0.17
Eland	<i>Taurotragus oryx</i>	0	2/0.33	0	0	0
Gemsbok	<i>Oryx gazella</i>	6/0.75	38/6.33	8/1.33	40/3.33	80/4.44
Giraffe	<i>Giraffa camelopardalis</i>	2/0.25	14/2.33	1/0.17	2/0.17	17/0.94
Hartmann's mountain zebra	<i>Equus zebra hartmannae</i>	389/48.63	82/13.67	103/17.17	30/2.5	256/14.22
Kudu	<i>Tragelaphus strepsicerus</i>	0	1/0.17	0	1/0.08	12/0.67
Ostrich	<i>Struthio camelus</i>	2/0.25	0	0	23/1.92	5/0.28
Spotted hyena	<i>Crocuta crocuta</i>	0	0	0	0	3/0.17
Springbok	<i>Antidorcas marsupialis</i>	31/3.88	12/2	0	249/20.75	2/0.11

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

REMOTE CAMERA SURVEYS

Infra-red remote triggered cameras were placed at Collin's Spring (49 trap days) and Jebico Spring (55 trap days) in Torra for a total of 104 trap days. Leopards were identified at both sites. At Jebico Spring, more species were identified such as a brown hyena (*Hyaena brunnea*), honey badger (*Mellivora capensis*), lion (*Panthera leo*), and spotted hyena (*Crocuta crocuta*) (Table 5).

TABLE 5. CAMERA TRAP PHOTOGRAPHS OF SPECIES IDENTIFIED AT TWO SITES IN TORRA CONSERVANCY. SPECIES' PHOTOS WERE COUNTED WHEN A PERIOD OF 30 MINUTES HAD PASSED WITHOUT A PHOTO BEING TAKEN.

Identified Species	Scientific Name	Colin's Spring UTM E0380334, N7747214	Jebico Spring UTM E0389222, N7753653
Black-backed Jackal	<i>Canis mesomelas</i>		1
Brown Hyena	<i>Hyaena brunnea</i>		3
Cape Fox	<i>Vulpes chama</i>		1
Chacma baboon	<i>Papio ursinus</i>		7
Gemsbok	<i>Oryx gazella</i>	10	12
Giraffe	<i>Giraffa camelopardalis</i>		2
Hartmann's mountain zebra	<i>Equus zebra hartmannae</i>	65	13
Honey Badger	<i>Mellivora capensis</i>		1
Klipspringer	<i>Oreotragus oreotragus</i>		2
Kudu	<i>Tragelaphus strepsicerus</i>	6	5
Leopard	<i>Panthera pardis</i>	1	4
Lion	<i>Panthera leo</i>		1
Ostrich	<i>Struthio camelus</i>		5
Porcupine	<i>Hystrix cristata</i>		4
Rock Hyrax	<i>Procavia capensis</i>		5
Slender Mongoose	<i>Galerella sanguine</i>		1
Spotted Hyena	<i>Crocuta crocuta</i>		4
Unknown species	-	1	4

GAME GUARD CAPACITY BUILDING AND COMMUNITY COMPUTER TRAINING

All game guards interviewed had previous GPS training/units primarily through working with Save the Rhino Trust/Minnesota Zoo wildlife biologist Jeff Muntifering, currently working on a zebra radio telemetry project (Muntifering pers. comm.) (Table 6). In some cases there has been additional training done by IRDNC employees as well as Simpson Uri-Khop of SRT.

The majority of game guards had not used compasses or rangefinders. For visual distance estimation, there was a large disparity between abilities. Half of the game guards trained required significant distance estimation calibration through trial and effort to estimate accurately, while others were very accurate at distances up to approximately 300 meters. The only main problem associated with compass training was the placement of the hand flat so as to minimize compass magnetic distortion. It was explained that the user's hand

should be held parallel to the earth so that if the compass were to drop, it would land flat on the ground.

TABLE 6. GAME GUARD EXPERIENCE WITH EQUIPMENT

Game Guard	Range Finder*	GPS*	Compass*	Computer*
Anabeb 1	1	3	1	2
Anabeb 2	1	3	1	2
Anabeb 3	1	1	1	2
Ehi-rovipuka 1	2	4	1	3
Ehi-rovipuka 2	1	4	1	N/A
Ehi-rovipuka 3	1	1	1	1
Omatendeka 1	1	4	1	1
Omatendeka 2	1	1	1	1
Sesfontein 1	1	2	1	1
Torra 1	2	4	1	1
Torra 2	1	4	1	1

* The scale [1-5] is our interpretation of game guard responses to our questionnaire.

1: Never used previously

2: Somewhat familiar with technology; recognized a few uses, buttons, etc.

3: Proficient; familiar with basic operating tasks

4: Comfortable; familiar with most tasks, including some advanced uses

5: Expert; knows the “ins” and “outs” of the tool

Game guards were most fluent in their native tongues. Otjiherero was the most common of these, followed closely by Damara, and lastly Afrikaans. All game guards were more comfortable speaking and reading Afrikaans than English. Despite these linguistic obstacles, game guards were in agreement that formal instructional pamphlets and conservancy texts be written in English. Translation was commonplace within the conservancy committee, where those who understood English translated official conservancy manuscripts and NGO-derived instructional manuals into tribal languages and/or Afrikaans.

In one instance on a repeat-game count, a previously trained game guard mentioned that the conservancy computer received much more use after our training the committee members and game guards in basic computer literacy. All game guards expressed interest in digitizing their game count data, but indicated reservations regarding computer literacy, technical issues, and a lack of appropriate computers.

METHODOLOGY EVALUATION

To test the assumptions of the distance sampling method, data from both seasons were evaluated together. The sightability histogram created followed the basic assumptions; the proportion of game decreased exponentially with perpendicular distance away from the route ($y = 1.02e^{-0.27x}$; $R^2 = 0.948$) (Figure 4). By combining the data sets and thus creating a larger sample size, the R^2 value increased indicating that the data set better fit the sightability curve.

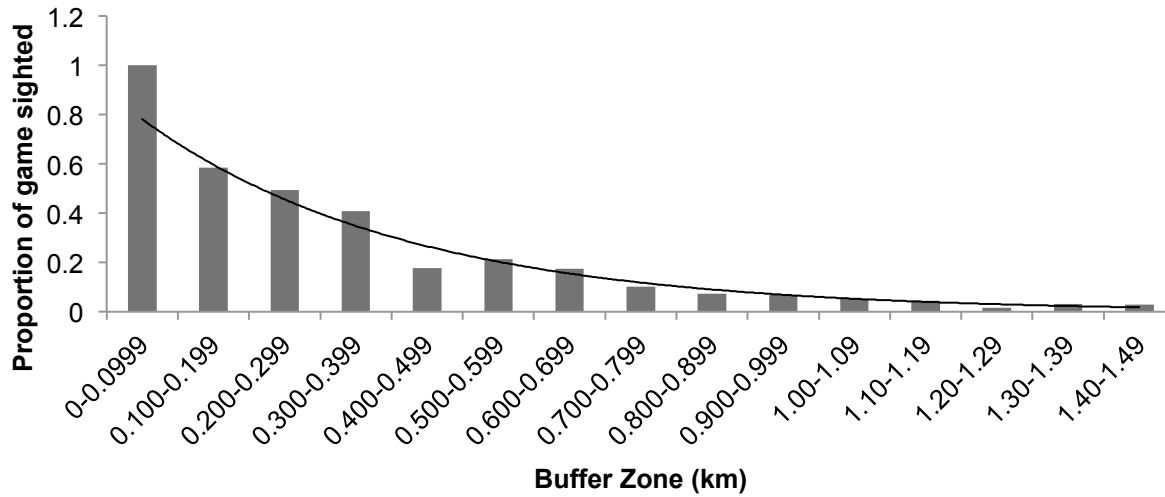


FIGURE 4. SIGHTABILITY HISTOGRAM OF TRUNCATED TOTAL DATA SET FROM BOTH THE 2011 DRY SEASON AND THE 2012 WET SEASON WITH SIGHTABILITY CURVE ($Y = 1.02E^{-0.27X}$; $R^2 = 0.948$).

Results from individual conservancies appeared to hold true to the distance sampling assumptions, except for Omatendeka. Proportion of game seen per buffer zone varied between conservancy sightability histograms, causing them to appear as though they followed different rates of decay (Figure 5).

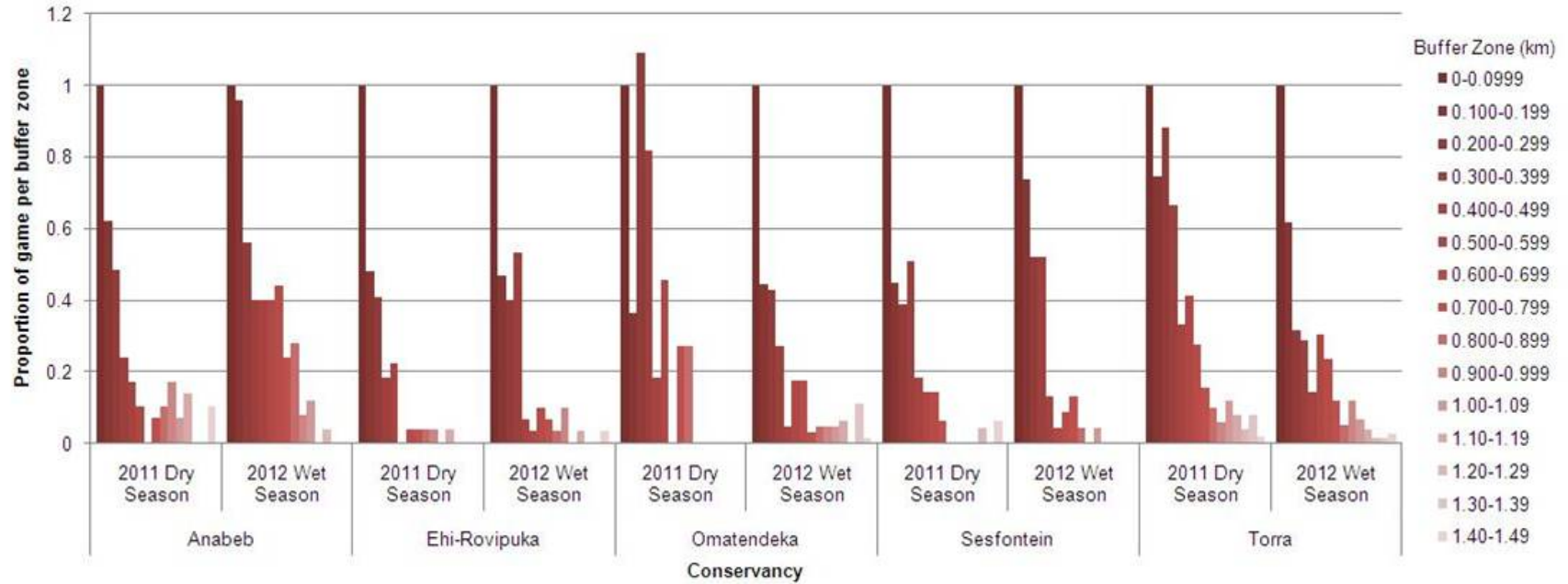


FIGURE 5. SIGHTABILITY HISTOGRAMS OF TRUNCATED CONSERVANCY DATA. BOTH SEASONS ARE SHOWN PER CONSERVANCY, BUT SIGHTABILITY CURVES WERE NOT CREATED DUE TO SMALL SAMPLE SIZES.

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 in the Kunene region. The second field season (March-April 2012) conducting wildlife monitoring in the Kunene was successful in the diverse but standardized approaches to collecting valuable spatial data on the wildlife populations.

VEHICULAR GAME COUNT SURVEYS

During the second field season of this work, we have been able to define and survey all routes surveyed during the Annual Game Count according to the game guards present during the count in June, including some routes that the conservancies would like to include in the Annual Game Count. Overall, the routes should be comparable to those surveyed in the preliminary season.

Repeating surveys on routes at different time increments may provide useful information on count variability. During the April-March 2012 season, we were able to repeat game count routes in Anabeb. We will continue to repeat one conservancy per field season in hopes that the long-term data will be adequately sampled across our study area.

The wet season did not affect the route plans as much as we had anticipated, but we were able to concentrate efforts on game guard capacity building and training due to our efficiency at conducting the game count the second time. However, future wet seasons may fare differently and routes may need to be adjusted in the future due to access limitations. Several of the routes are along river-beds and others require river crossing that may not be navigable. Adjusted routes may follow along the bank of a river rather than in the riverbed itself, or parts of routes may need to be excluded altogether.

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. During the second field season, we continued to concentrate on identifying optimal sites from which to conduct point counts. Sites that were scored as optimal during the initial season were repeated and those sites that were not as optimal were either replaced with another higher quality site, or eliminated altogether.

The constraints of point count surveys that were identified in Heinemeyer et al. 2012 still exist, but rather than spending field effort on a sub-optimal site, we decided to concentrate our efforts on high quality sites that were repeated, or invest more effort in the vehicular game routes.

REMOTE CAMERA SURVEYS

The constraints that apply to the point count approach also apply to the camera trap approach. The largest challenge with the camera trap study is the mobility required to complete the game counts, where as there is not an opportunity to frequently visit camera trap sites to ensure they are working properly and set up for a prolonged period. As this

work continues to evolve, we anticipate that sites that are both feasible and likely to get nocturnal and elusive visitors may be identified. Meanwhile, we have now established a method for organizing and sorting the photographs captured at two Torra Conservancy waterholes.

DATA COLLECTION PROTOCOLS

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) are detected with certainty. This becomes the basis for estimating the probability of sighting
- 2) Animals are 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) Distances that the animals are observed from center-line measurements are 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).

All but one sightability histogram decreased exponentially with perpendicular distance from the route, so it is implied that the first assumption has been met. If more game were observed in outer buffer zones then the curve would not decrease exponentially, which was seen in the 2011 dry season data for Omatendeka conservancy. Since the Omatendeka 2012 wet season histogram followed the assumption, it could be that water availability has altered the game distribution. Hassler et al. (2009) found that wetter weather causes a homogenization of species distribution in semiarid savannas. This could cause animals to congregate around water sources during the dry season and to disperse during the wet season, which would alter game distribution across a region, especially where water is limited. More results are needed to further assess if the difference between the two seasons are indeed seasonal shifts or if they are due to short-term game fluctuations. In order to produce more accurate results, larger data sets are needed as was shown with the square regression coefficient closer to one for the combined data than when they were separated by season.

The conservancy data separated by season indicates that the second and third assumptions are also being met. These assumptions are more reliant on how the data was collected and could have been influenced by materials, training, or observer bias. It is expected that if observers experience the same hindrances in game observation (i.e topography or vegetation), proportions of game seen in each buffer zone will be similar when routes are repeated (Buckland et al. 2001). Since similar proportions of game were seen within each conservancy, methodology and observer training must be sufficient for data collection. If game were fleeing from the vehicle and not recorded from their original location, proportion of game seen in outer buffers would potentially be higher than in the nearest buffer since game tends to flee when approached. Inaccuracy of data collection could produce similar results. Since this was not the case, it is assumed that the second and third assumptions were met.

One physical setting assumption is that game is distributed evenly across the sample area. For the Kunene region, this assumption may not hold true based on data obtained thus far. It is therefore recommended that game densities be calculated based off smaller land areas, most likely by conservancy, in order to be the most accurate because sightability between the conservancies was noted to differ. In the Kunene region, the topography and vegetation vary spatially between conservancies and within conservancies. The conservancies are also variable in size, shape, and geographic location that alter their climate. Rain is also very localized and sporadic causing an unpredictable shift in vegetation growth and game migration between the conservancies, both of which can alter game distribution. For example Omatendeka is comprised mainly of densely vegetated rolling hills, which leads to hindrances for viewing game. Torra, however, has varied topography that includes plateaus overlooking plains in the west ideal for game observation that shift towards more varied topography in the south, which is less ideal. Torra's vegetation was drier and less vegetated than other conservancies, even in the wet season, allowing for higher sightability. This variation can be seen when comparing the sightability histograms between conservancies. Although variation is apparent, it does not contradict the basic assumptions of the methodology, but rather suggests that the most precise game monitoring should be completed per conservancy. There is too much variation within each conservancy to gain an accurate sightability curve for the region that may affect game population estimations. A larger data set may help to verify this variation.

So far, the methodology analyses shows that the basic distance sampling methodology assumptions are being met for the vehicular road-based route surveys. All game on the route was accounted for, game was quantified based on their original location, and data was adequately recorded. This research reiterates the importance of monitoring wildlife many times throughout the year rather than all at once because game distribution varies with behavior and/or season. In order to ensure that game quotas are sustainable, frequent monitoring is necessary.

CONSERVANCY CAPACITY BUILDING

Compass, distance estimation, and computer analysis skills will require the most training and will be the first priority for time allotted to spend with the game guards. Generally, the game guards are lacking in experience with the methodology behind this equipment.

Distance estimation should be a particularly high priority given that the Annual Game Count methodology does not employ range finder technology. Computers were highly valued but require more immersion than other technologies. They present a novel approach that could augment conservancy event book efficiency, but their intricacies require more frequent checks on upkeep, as well as overall training to increase computer literacy.

Educating the game guards and conservancy staff on the purpose of collecting spatial data is integral to the success of this project. It is important to have all three measures of spatial data to calculate exact positions of animals: GPS coordinates, distance from the car, and angle from the car. Understanding this helped the game guards to visualize how the data could serve the conservancy: a spatial snapshot of animal locations/numbers at various times throughout the year. The game guards thoroughly understood that this information might be beneficial in assessing how appropriately the zoning captures the animal distribution. In future field seasons, we will continue to review methodology (and teach new game guards these methods), with an emphasis on incorporating game guards as observers and participants on the vehicular and/or point counts.

The training described serves as the beginning of a long-term project to, 1) to more involve the community in game count surveys, and 2) transfer of autonomy over distance sampling methods to monitor wildlife.

CONCLUSION

With two field seasons completed, we are optimistic for the future of wildlife monitoring in the Kunene region. The success of the capacity building and the enthusiasm of the communities are indicative of successful long-term collection of wildlife monitoring data.

BIBLIOGRAPHY

- Buckland, S.T., D.R. Anderson, K.P. Burnham, J.L. Laake, D.L. Borchers and L. Thomas. 2001. 1.2 Distance sampling methods. *Introduction to Distance Sampling: Estimating abundance of biological populations*. Oxford University Press, New York.
- Hassler, S.K., J. Kreyling, C. Beierkuhnlein, J. Eisold, C. Samimi, H. Wagenseil, A. Jentsch. 2010. Vegetation pattern divergence between dry and wet season in a semiarid savanna - Spatio-temporal dynamics of plant diversity in northwest Namibia. *Journal of Arid Environments* 74: 1516- 1524.
- Heinemeyer, K.S., Karimi, R., Endjala, V., Fancik, C., Hogfeldt, M., LeClerq, A., Louis, M., Miller, J., Shawler, A., Tingey, R., & Youngblood, E. 2012. Round River Conservation Studies. *Kunene Regional Ecological Analysis. 2011 Annual Report: Assisting Conservancies with Seasonal Wildlife Monitoring Efforts*. Salt Lake City, UT, US.
- Kasupi, V.W. Personal communication. March 2012.
- Menzies, C.R. Introduction. In *Traditional Ecological Knowledge and Natural Resource Management*. Eds. C. Menzies and C. Butler 4-14.
- Muntifer, Jeff. Personal Communication. February 2012.
- Namibia Association of CBNRM Support Organizations (NACSO). 2010. *Namibia's communal conservancies: a review of progress and challenges in 2009*. Windhoek: NACSO.
- Scanlon, Lauren J, & Kull, Christian A. 2009. Untangling the links between wildlife benefits and community-based conservation at Torra Conservancy, Namibia. *Development Southern Africa* 26.

APPENDIX I. APPROACH TO GAME GUARD COLLABORATION/TRAINING

Background Info:

- Explain the KREA and seasonal wildlife monitoring project
- Explain RRCS work
 - Supplementing data, wet and dry season
 - Emphasize utility to conservancy
- Explain our project on game guard training specifically

Initial Questions:

1. How long have you been a game guard for?
2. Do you enjoy it?
3. How many game guards are there for this conservancy?
4. Have you worked with a GPS, Compass or Range Finder before?
 - If yes:
 - Who provided your equipment and training?
 - Do the other game guards have training as well?
5. What are you most interested in learning?
6. What languages are you most familiar with?
7. Do you think our work will benefit the conservancy?
8. What do the game guards/conservancy need?
9. What has your experience been with NGOs?
10. Do you have any questions for us?

Training:

- Explain why we need to use all 3 devices; to know exact animal location
- If no prior experience:
 - Start with distance estimation, checked with the range finder
 - Compass
 - Explain Declination
 - GPS
 - Basic use
 - Waypoints
 - Tracks
 - UTM versus Latitude/Longitude system
- If they have experience with one or more of the devices, start from *their* experience level

Follow-Up Questions:

1. Do you think you have improved?
2. Did you enjoy the training/learning how to use the equipment?
3. Which equipment would you use the most?
4. Would you be able to teach the other game guards how to use this equipment?

Computer/ Data Entry Questions:

1. Have you ever used a computer before?
 - a. If yes:
 - i. Whose computer?
 - ii. When?
 - iii. Who provided the training?
 - iv. How often?
 - v. What programs?
2. Do you think computer data has more benefits than handwritten data, such as that which appears in the Event Book System?
3. Do you believe that computers benefit the conservancy?
4. Have you ever looked at GPS data on a computer?
 - a. If yes:
 - i. For what?
 - ii. How often?
 - iii. Where?
5. Would you be able to teach this to others?

Conservancy Questions

1. What year was the conservancy founded?
2. Were there difficulties forming the conservancy?
3. How many people are in the conservancy and how many are registered members?

Note: Conservancies count those over 18 as “people”

4. What brings in the most revenue for the conservancy?
 - a. Do you have a joint venture?
 - b. Do you think that having one would benefit the conservancy?
5. In your opinion are the benefits distributed equally?
 - a. If not, how are they distributed?
6. What does the name of the conservancy mean?
7. What is the conservancy’s process for hiring game guards?

Common Questions asked by Game Guards

1. What will you do with this data?
2. How does our conservancy compare to other conservancies?
 - a. Wildlife
 - b. Management
 - c. Development
3. How long will RRCS be in the Kunene conducting research?
 - a. What other services *do* they provide to the community?
 - i. Can they participate in game guard patrols?
 - b. What other services *can* they provide to the community?
4. When will we see the results from your research?

APPENDIX II. COMPUTER TRAINING: QUESTIONS AND BASICS


Appendix B: Computer Training-Questions and Basics

Computer Questions:

1. Have you ever used a computer before?
 - a. If yes:
 - i. How often?
 - ii. For what?
 - iii. How comfortable?
 - Scale of 1-5
 - iv. What programs?
 - v. Who taught you?
2. What would you want to use it for?

Computer Basics:

- Turn on (describe universal button, pictured below)


- Right Click vs. Left Click
 - Click and Drag
- Desktop
 - Icons → Shortcuts from menu
- Start Menu
 - Explain programs
- My Computer
 - Folders
- Minimizing windows
 - How to re-open from the task bar
- Highlighting
- Word
 - Keyboard and toolbar
 - Shift, arrow keys, enter, delete, caps lock, etc.
 - Copy and paste
 - Undo
 - Centering, and alignment
 - Fonts, sizing, bold, italics, underline
 - Saving and re-opening
 - Tables
 - Hovering to display functions of buttons
- Excel
 - Toolbar
 - Charts
 - Practice with data

APPENDIX III. SUMMARY OF VEHICULAR AND POINT COUNT SURVEY EFFORTS**TABLE III- 1. SUMMARY OF VEHICULAR GAME COUNT SURVEY EFFORT COMPLETED MARCH-APRIL 2012 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	17 Mar 2012	7:07	18	8:57	26	40	1:50
Anabeb	Rte 1	16 Apr 2012	7:00	21	8:46	26	39	1:46
Anabeb	Rte 2	18 Mar 2012	7:19	20	10:27	30	42	3:08
Anabeb	Rte 2	17 Apr 2012	7:10	23	9:52	33	46	2:42
Anabeb	Rte 3	20 Mar 2012	7:05	26	9:39	32	26	2:34
Anabeb	Rte 3	20 Apr 2012	7:00	24	9:15	36	26	2:15
Anabeb	Rte 4	19 Mar 2012	7:04	24	10:59	35	42	3:55
Anabeb	Rte 4	19 Apr 2012	7:05	26	10:19	28	43	3:14
Anabeb	Rte 5	17 Mar 2012	7:10	21	8:44	22	32	1:34
Anabeb	Rte 5	16 Apr 2012	7:02	22	8:13	26	24	1:11
Anabeb	Rte 6	18 Mar 2012	7:11	25	9:01	27	45	1:50
Anabeb	Rte 6	17 Apr 2012	7:01	26	9:10	33	43	2:09
Ehrovipuka	Rte 1	5 Apr 2012	6:42	18	10:08	29	81	3:26
Ehrovipuka	Rte 2	6 Apr 2012	7:05	20	10:58	32	60	3:53
Ehrovipuka	Rte 3	6 Apr 2012	7:05	20	9:56	32	48	2:51
Ehrovipuka	Rte 4	8 Apr 2012	7:05	18	9:44	35	33	2:39
Ehrovipuka	Rte 5	5 Apr 2012	6:35	11	8:05	25	17	1:30
Ehrovipuka	Rte 6	8 Apr 2012	7:04	16	9:36	33	28	2:32
Ehrovipuka	Rte 7	7 Apr 2012	6:59	17	8:04	22	14	1:05
Omatendeka	Rte 1	13 Apr 2012	7:05	19	9:35	32	54	2:30
Omatendeka	Rte 2	12 Apr 2012	7:04	21	10:27	37	34	3:23
Omatendeka	Rte 3	11 Apr 2012	7:06	22	11:00	37	45	3:54
Omatendeka	Rte 4	13 Apr 2012	7:04	21	9:55	32	37	2:51
Omatendeka	Rte 5	14 Apr 2012	7:08	21	10:42	40	27	3:34
Omatendeka	Rte 6	14 Apr 2012	7:00	19	7:40	20	17	0:40
Sesfontein	Rte 1	29 Mar 2012	7:30	20	9:47	27	45	2:17
Sesfontein	Rte 2	30 Mar 2012	7:10	18	10:00	23	53	2:50
Sesfontein	Rte 3	30 Mar 2012	7:20	19	9:29	16	29	2:09
Sesfontein	Rte 4	24 Mar 2012	7:16	26	9:41	34	54	2:25
Sesfontein	Rte 5	22 Mar 2012	7:15	24	9:19	29	33	2:04
Sesfontein	Rte 6	22 Mar 2012	7:15	24	8:30	-	55	1:15
Torra	Rte 1	4 Mar 2012	7:15	17	10:40	-	55	3:25
Torra	Rte 2	8 Mar 2012	6:54	26	10:58	28	42	4:04
Torra	Rte 3	7 Mar 2012	7:00	18	9:13	26	42	2:13

Conservancy	Route ID	Date	Start Time	Start Temp (C)	End Time	End Temp (C)	Km Surveyed	Survey Time (h:mm)
Torra	Rte 4	5 Mar 2012	7:12	18	11:00	-	49	3:48
Torra	Rte 5	13 Mar 2012	7:16	22	10:56	30	47	3:40
Torra	Rte 6	7 Mar 2012	7:02	21	11:00	40	36	3:58
Torra	Rte 7	12 Mar 2012	7:11	16	11:00	34	51	3:49
Torra	Rte 8	4 Mar 2012	7:11	19	11:00	-	55	3:49
Torra	Rte 9	6 Mar 2012	7:30	14	11:00	24	38	3:30

TABLE III- 2. SUMMARY OF POINT COUNT GAME SURVEY EFFORT COMPLETED APRIL-MARCH 2012 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 Time End	Temp End
Anabeb-3*	20 Mar 2012	0:48	26	S	0-5	8:26	10:26	41
Anabeb-3*	19 Apr 2012	0:31	28	SE	0-5	8:31	10:31	28
Anabeb-4*	20 Apr 2012	0:24	30	S	0-5	8:42	10:42	37
Anabeb-4b	19 Mar 2012	0:51	30	S	0-5	8:44	10:44	37
Ehrovipuka-4*	7 Apr 2012	0:20	22	W	0-5	8:25	10:25	32
Ehrovipuka-5	9 Apr 2012	0:16	23	-	-	7:53	9:53	37
Ehrovipuka-6	9 Apr 2012	0:30	20	SW	0-5	8:20	10:20	32
Omatendeka-4*	14 Apr 2012	0:41	26	NW	5-10	8:31	10:31	38
Omatendeka-5	11 Apr 2012	0:25	25	E	0-5	7:50	9:50	38
Omatendeka-6	12 Apr 2012	0:57	33	N	0-5	8:40	10:40	35
Sesfontein-3*	25 Mar 2012	0:20	25	S	0-5	7:50	9:50	28
Sesfontein- 4b	25 Mar 2012	0:09	26	W	0-5	8:11	10:11	33
Sesfontein-5*	26 Mar 2012	0:19	26	-	-	7:54	9:54	29
Sesfontein- 6b	26 Mar 2012	0:02	25	-	-	7:31	9:31	34
Sesfontein- 7b	27 Mar 2012	0:17	21	-	-	7:55	9:55	25
Sesfontein- 8b	24 Mar 2012	0:15	28	SE	0-5	7:39	9:39	38
Torra-1*	12 Mar 2012	1:09	26	-	-	8:00	10:00	31
Torra-2*	13 Mar 2012	1:02	22	SW	0-5	8:07	10:07	30
Torra- 4b	6 Mar 2012	0:41	20	SE	0-5	7:51	9:51	25
Torra-8*	8 Mar 2012	0:33	21	SE	0-5	7:50	9:50	25
Torra-9*	9 Mar 2012	0:27	21	-	-	8:04	10:04	24
Torra-10	5 Mar 2012	0:49	20	S	0-5	7:54	9:54	24
Torra- 11	10 Mar 2012	0:24	23	N	0-5	7:34	9:34	29
Torra- 12	9 Mar 2012	0:14	24	W	0-5	8:59	10:59	35
Torra- 13	10 Mar 2012	0:55	24	E	0-5	7:50	9:50	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

*Repeated from pilot season

'b' = a new site near an original point count site

APPENDIX IV: SUMMARY OF RESULTS FROM WILDLIFE POINT COUNT SURVEYS

TABLE IV-1. SUMMARY OF SPECIES COUNTS OBTAINED THROUGH POINT COUNT SURVEYS IN 5 CONSERVANCIES OF THE KUNENE REGION OF NAMIBIA IN MARCH-APRIL 2012.

Species ↓ Point Count Site ID →	Anabeb			Ehrovipuka			Omatendeka			Sesfontein						Torra										
	3	4	4b	4	5	6	4	5	6	3	4b	5	6b	7b	8b	1	2	4b	8	9	10	11	12	13		
Black-faced impala				10																						
Cheetah																3										
Eland				2																						
Gemsbok	5	1		24	12	2	8			1	9	15				15	5	3	38	14	7	1	8	2	2	
Giraffe	2			14			1			2						314										
Hartmann’s mountain zebra	41	318	30	20	58	4	103			7			7	10	6	29	19	5	26	61	52		14	50		
Kudu				1						1						111										
Ostrich	2									518						5										
Spotted hyena																3										
Springbok	25	4	2	11	1					1			239			9	1			1						
Domestic cattle	33									7			184													
Domestic donkey																										
Domestic goat	17		380							200			7													
Domestic horse							1																			

APPENDIX V. ILLUSTRATIONS OF TOOLBARS TO ASSIST WITH COMPUTER TRAINING

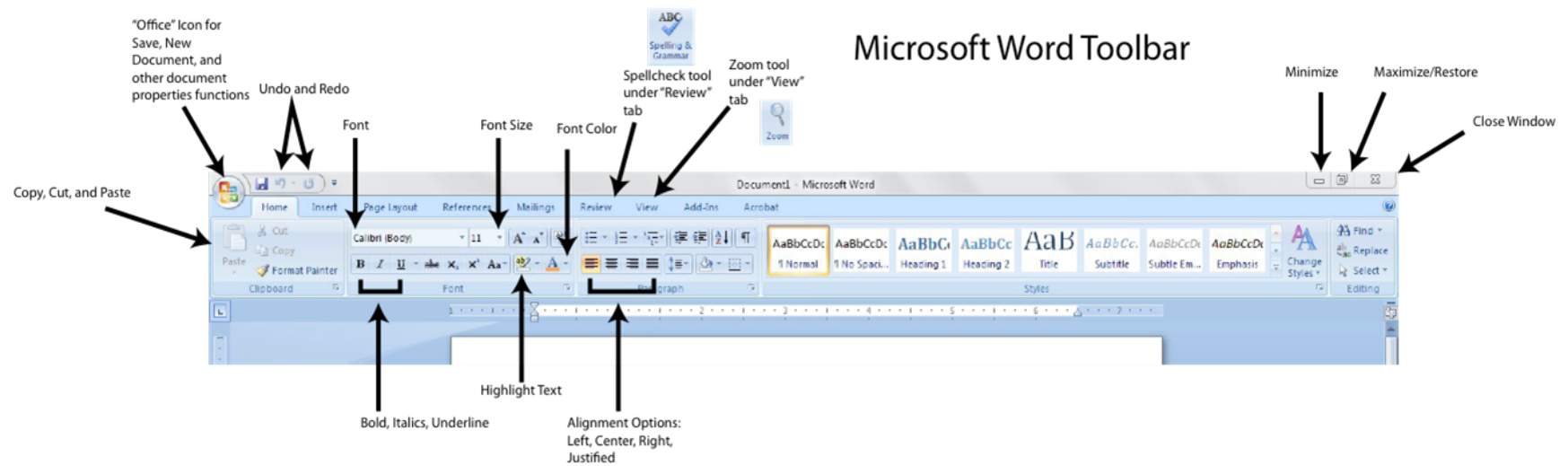


FIGURE V-1. MICROSOFT WORD REFERENCE GUIDE

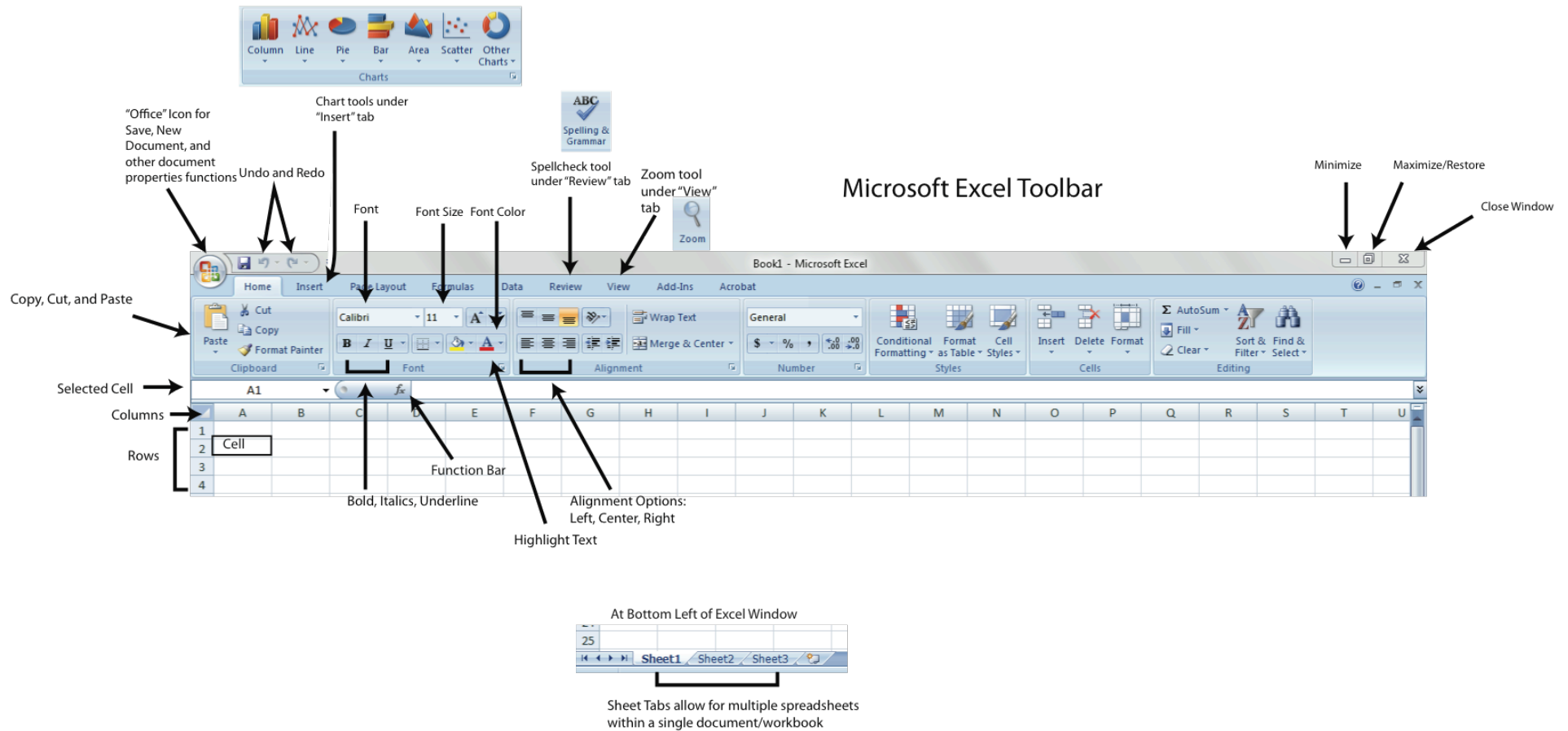


FIGURE V-2. MICROSOFT EXCEL REFERENCE GUIDE