Results
of the
NamibRand Nature Reserve
Bi-annual Game Count

3 -4 June 2005

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Introduction

The NamibRand Nature Reserve conducts a bi-annual game count in order to effectively monitor the plains game on the Reserve. These counts are conducted each year at the end of the dry season (October/November) and at the end of the wet season (May/June). This allows us to monitor, among other things, the seasonal migration of the plains game, while also allowing us to keep a watch on population numbers, trends and the distribution of wildlife.

This year our end-of-wet season game count took place on the 3rd and 4th of June 2005. The event was hosted by the Sossusvlei Mountain Lodge and coincided with the Reserve's annual general meeting (AGM). Turn out was excellent this year, as land owners, concessionaires and other stakeholders who attended the NamibRand Nature Reserve's AGM were also keen to help with the game count.

The preparation for the annual census began on the afternoon of the 3rd of June. Participants were briefed on the background, theory and methods for the count, scheduled the following day. We were fortunate to have assistance for this briefing session from Dr. Chris Brown of the Namibia Nature Foundation. We feel that Dr. Brown's presence helped reinforce the validity and credibility of this vehicle-based survey methodology. His expertise also assisted us in answering any queries or uncertainties with regard to the survey methodology.

The actual count started early the next morning and the teams chosen to survey the eight routes, which cover the whole Reserve, started recording wildlife sightings at 07h00 in the morning. Most teams completed their assigned route by 12h00, after which the data that they collected was brought to Keerweder for analysis. The afternoon was then spent analyzing this information to extrapolate results for the whole of the Reserve. This work was compiled by Reserve management with the help of Dr. Brown.

Everyone who participated in the count then gathered at the Sossusvlei Mountain Lodge for a late-afternoon feedback session. Nils Odendall presented the analyzed results of the game count, including actual sightings, population estimates, trends and distribution of wildlife (please see results later in this document). This presentation was then followed by a question and answer session after which all those involved indulged in a sumptuous meal prepared by our hosts and enjoyed a sociable evening at the fabulous Sossusvlei Mountain Lodge.

Objectives of counting

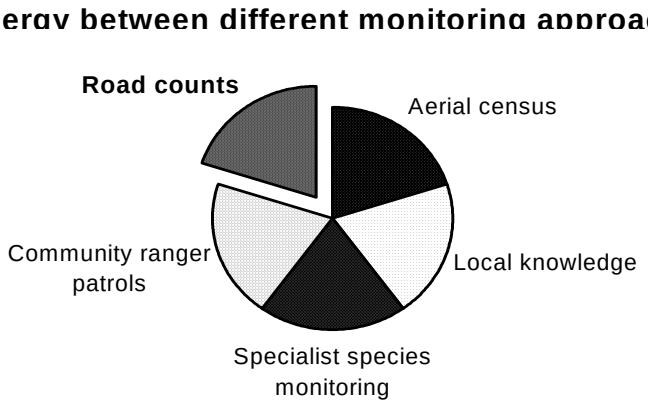
The table below presents the reasons why game counts are conducted on the NamibRand Nature Reserve.

Objective	Reasons why information is needed
1. Estimate the Numbers of game on the NamibRand Nature Reserve. [How many?]	It is important to know how many animals there are so that: • reasonable hunting (or capture) quotas can be set; • the stocking rate is known so as to minimize competition between wildlife species and to protect veld; and • the asset base of the wildlife can be ascertained.
2. Produce Game Distribution maps. [Where are they?]	To facilitate proper land-use planning (Zonation), it is important to know game distribution, especially areas of high game concentrations. Also these distributions can change in future years in reaction to rainfall or other factors such as water distribution or human settlement and it is important to know this.
3. Monitoring Population Change over time (trends). [Is wildlife increasing or decreasing?]	With successive game counts, graphs can eventually be drawn showing population fluctuations of each species (e.g. are springbok increasing or decreasing). This will tell Reserve management whether or not they are achieving their goals with respect to game numbers and consequently if it is necessary to change their management strategies.

Trying to meet all of these objectives with one count necessitates a number of compromise decisions. For example' using binoculars would greatly improve the accuracy of the count (i.e. determining Numbers). However, because binoculars will not always be available for successive counts, these have been banned because their intermittent use would diminish precision - making it more difficult to detect population Trends.

Methods

A vehicle-based road count method is being used. It is recognized that this method will not yield good results for all species; especially smaller secretive animals, nocturnal animals, and animals in mountainous areas where roads are often non-existent. It is also recognized that other monitoring methods (e.g. aerial census, specialist species monitoring) and local knowledge are also important sources of data. Consequently, the philosophy is that the road counts will augment rather than replace or compete with these other methods and initiatives.



Our road count methodology has been specifically designed to be simple and inexpensive so that we can continue to implement this survey. This is essential for long term sustainability!

Technical Issues and Data Analysis

The philosophy behind this approach is it's simplicity and the ability for us to analyze the results in-house.

However, it is also important that the count results be scientifically robust and as accurate as possible. To achieve scientific accuracy, the road-count is conducted in a manner that allows the data to be analysed in two different ways:

1. using the conventional **Strip-Count** approach; and
2. the more accurate but more sophisticated "***Distance***" approach.

The Strip-Count approach is intended to provide a quick field based estimate of population numbers while the Distance approach is an attempt to determine more accurate estimates. Both methods essentially attempt to develop correction factors that adjust the numbers of animals actually counted to produce an estimate of the population (Objective 1).

A brief explanation of each of the two approaches follows.

The Strip-Count approach

Basically, the Strip-Count method involves counting all animals in a given strip and then estimating how many times the strip will 'fit' into the larger area. Estimating the size of the strip is a function of its length and its width (i.e. how far from the road can all animals be seen). While the length of the strip is easy to measure, the width is more problematic because it depends on which species (e.g. steenbok vs zebra) is being monitored and what the terrain is like (e.g. thick bush vs. open plains).

In this survey all the routes have the same strip width of 1km. We have established that the average distance at which animals can accurately be counted on the Reserve is 500m on each side of the vehicle. We have therefore standardized the strip with for each route to 2 x 500m = 1km.

It is acknowledged that this strip width estimate could be greatly improved, particularly to account for different species and differing seasonal conditions. In time, these improvements could be made but the real improvement will come about through the use of the 'Distance' method (described in the following section).

The length of each route is measured using the vehicle's odometer and driving time. Where a route follows a fenced boundary, only one side of the route is counted and the distance of the route along the fence is halved. All of these data are captured in Table 1.

Table 1

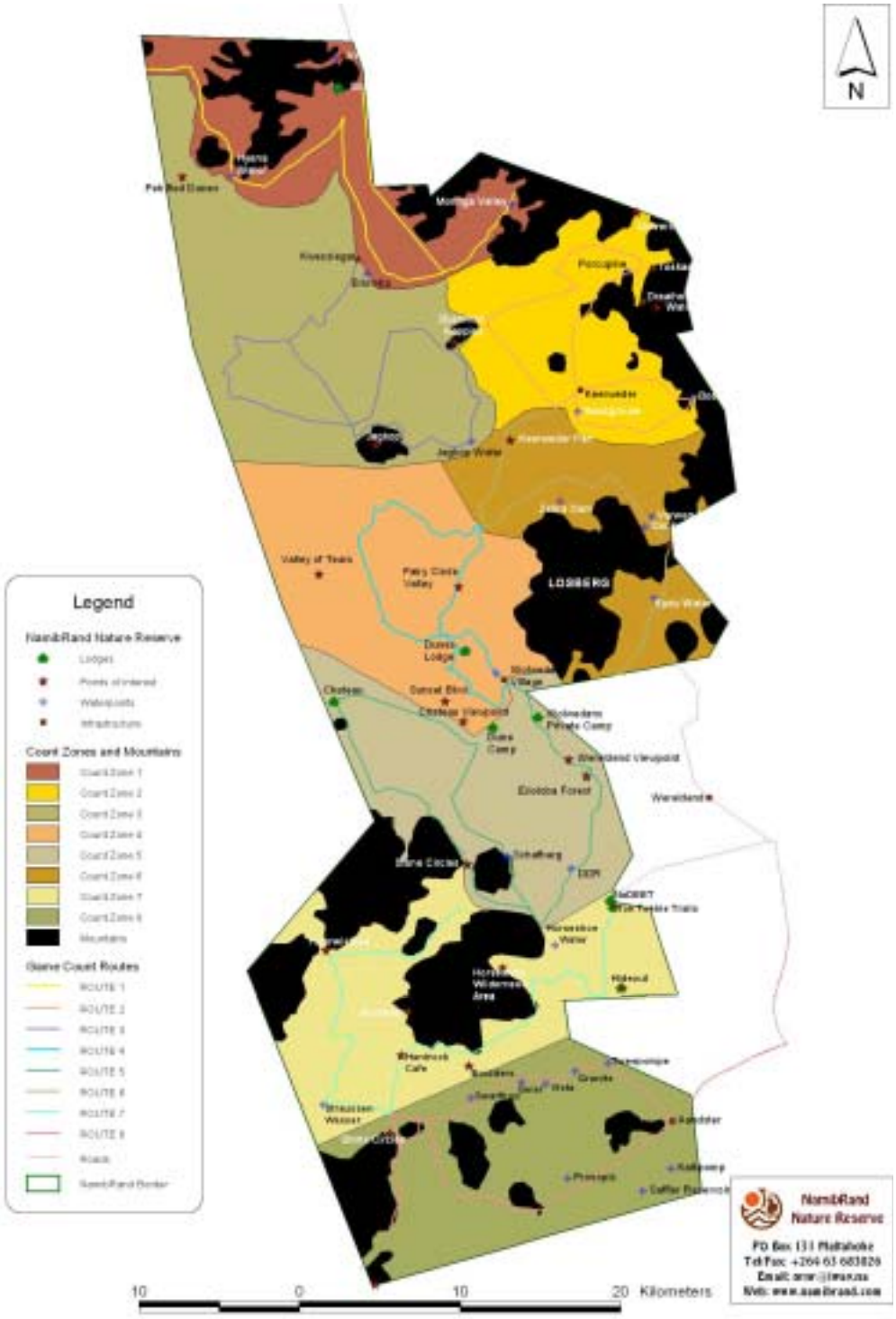
ROUTE STATISTICS (Road Count)				
ROUTE	**HECTARES - ha**	**AREA - km2**	**Distance km**	**Correction factor**
Route 1	16100	161.00	55.8	2.89
Route 2	16330	163.30	53.8	3.04
Route 3	24110	241.10	65.2	3.70
Route 4	18780	187.80	50.2	3.74
Route 5	16120	161.20	70	2.30
Route 6	17270	172.70	34.5	5.01
Route 7	25380	253.80	51.7	4.91
Route 8	20190	201.90	54	3.74
Mountains	18220	182.20		
TOTAL	172500	1725.00	435.2	3.96

ROUTE 1-8	154280	ha
MOUNTAINS	18220	ha

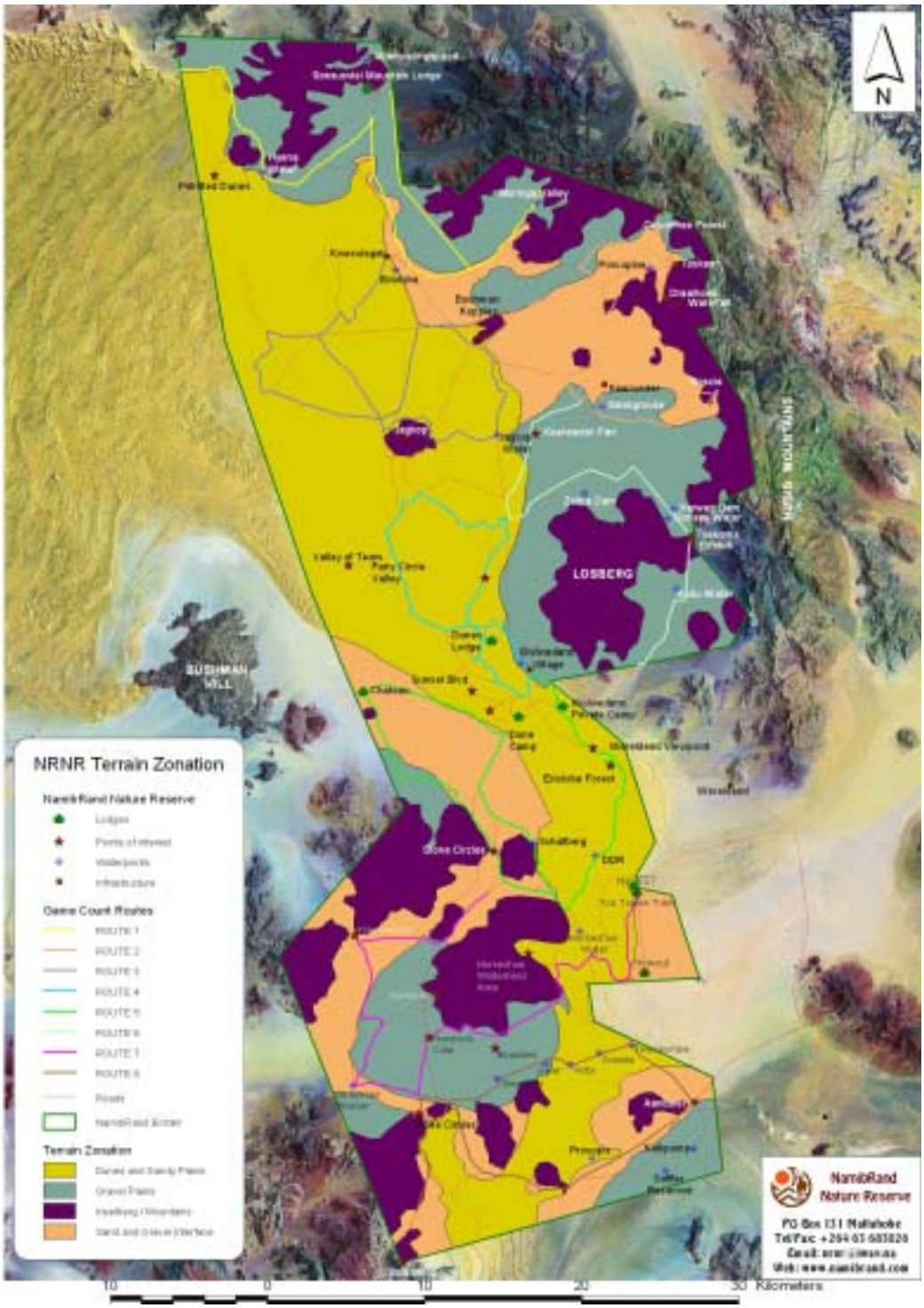
The area is also divided up into count zones, where each route represents a particular zone. The zonation (or stratification) is based on ensuring that the route reasonably and accurately represents expected game densities within the specified zone. Certain areas that are not adequately represented by roads (e.g. mountains) are excluded entirely (see the table above) and no

estimate is made for these areas – implying there is an under-estimate of the final figures. Count zones are not the same as terrain or habitat zones. Multiple terrains can be found within one count zone as long as the route traverses each of the terrains in equal proportion. The zonation for both count zones and terrain zones was completed using satellite imagery.

Map 1: *Route zonation or count zones for the NamibRand Nature Reserve*



Map 2: *Terrain or habitat zonation for the NamibRand Nature Reserve*



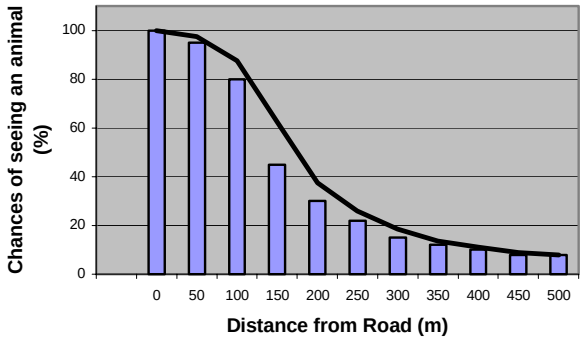
From the estimated strip-width, the length of the route and the zonation, an area correction factor for each route or count zone is calculated (Table 1), this represents the sampling intensity for each route. These correction factors are used to convert numbers of animal seen along the routes into population estimates.

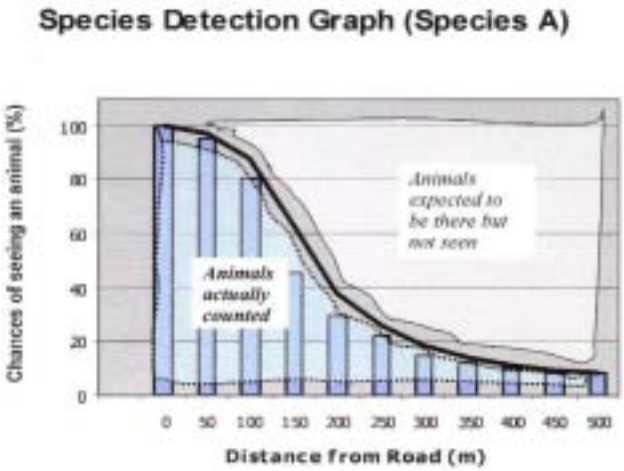
The Distance approach

The Distance approach is an attempt to determine more accurate population estimates. It is similar to the Strip-Count approach in that it attempts to estimate populations by applying a correction factor to the animals actually counted along the route. The essential difference is that the Distance approach develops a unique correction factor for each species. This is because it is obviously easier to see a large animal at 500m than a smaller animal at the same distance – implying that the 'strip width' for zebra would be very different to that for steenbok. Animal size is not the only issue to consider when determining a species-specific correction factor. Its colour, secretiveness, flight distance, etc., all influence how easy it is to see a particular species. The Distance approach uses rather complicated calculations to determine these 'species correction factors'.

To use the Distance approach in the field, however, does not require significant changes, except that the perpendicular distance from the road to the animal sighted (or to the center of the group, if more than one animal was sighted) must be recorded. These 'distance' measurements can be represented as graphs.

Species Detection Graph





Each species will have its own "detection graph" and from this one can calculate a "detection function" (the black line in the graph above). In conceptual terms, the computer looks at the area under the black line (i.e. the actual number of animals counted) and compares it with the area above the black line (i.e. the numbers of animals not seen). It essentially develops a

ratio between animals seen and animals not seen. This ratio (or formula) is then used to arrive at the population estimate.

For our purposes we are using average species detection ratios or species correction factors appropriate to arid, open areas. Once more information has been collected on the distances at which animals are seen, these figures can be adjusted to our specific environment on the Reserve.

Merging the Results from Different Methods

In order to get an accurate survey results we need to merge the Strip-width and the Distance methods together. In order to do this the following two key assumptions must be made:

1) Not all the animals in the zone have been counted as we only counted what was seen within our 1km strip. Therefore we need a route correction factor.
2) Not all the animals within the routes' strip width (with in the 500m on each side) have been counted. Some animal may have been lying down, hiding behind a bush or were obscured from view in some other way. Therefore we need a species correction factor.

Ultimately this mean that to reach a population estimate, the actual number of animals seen are multiplied with the route correction factor and then by the species correction factor.

Note: Overall results for the population estimates are presented in the RESULTS section.

Remembering The Other Objectives

So far we have only discussed how to arrive at a population estimate. It is also important at this stage that we do not forget about our other two objectives:

(2) Produce game distribution maps [where is the game and how is it moving?]; and

(3) Monitoring population change over time [is wildlife increasing or decreasing?].

These two objectives are also achieved during the road counts by making a number of minor modifications to the field-work. This is explained in the following section.

Game Distribution

Fieldwork

During the count the operators keep track of where all animals were sighted. The specific instructions to the count teams are:

1. Constantly, as you drive the route locate yourselves on the map. If no features are available then use the route odometer (or GPS) to estimate your location (each grid is 2km).
2. Record the location of every sighting on the datasheet using the 2km x 2km grid square map.

Analysis

The objective of the analysis is to produce maps showing where the game was seen and eventually to compare game distribution maps over time. This is achieved using GIS (ArcView software at Keerweder) and can be done by producing maps of game density (animals sighted per 100km driven) per count zone or management area. It is important to note that the data used here is taken from actual sightings and not from population estimates.

To produce the maps, the animal distribution data is attached to each different count zones.

Note: Wildlife distribution maps are presented in the RESULTS section.

Population Trend

Fieldwork

A number of rules have been designed to ensure that 'sampling effort' on each successive count is as similar as practically possible. The following field rules have been devised to facilitate this as follows:

1. Use the same fixed routes each year.
2. Do not use binoculars (yes, this will lead to underestimating game numbers and so this is a compromise between objectives [1] and [3]).
3. Start each successive count at the same time of day, e.g. 7am.
4. Always count from the back of a bakkie while standing.
5. Never drive faster than 35km, even on good open roads as wind speed makes looking forward almost impossible.

Analysis

When the count teams hand in their data, trend tables (Table 2) are filled in with numbers of animals seen on each route.

Table 2

	Number of animals seen on Route 1 on successive count dates							
SPECIES	**4 June 2005**	**30 November 2005**	**2 June 2006**	**Etc.**				
Springbok	20	54	73					
Gemsbok	12	22	30					
Zebra	-	4	6					
Kudu	5	5	8					

Using data from successive game count trend charts can then be drawn up and used to determine if wildlife numbers are going up or down.

Note: Population tends are presented in the RESULTS section.

Results

This section of the documents presents the results of the June 2005 bi-annual game count.

Game Count Routes

In order to sample the entire Reserve, the area was divided up into eight count zones (Map 1). Each zone is traversed by one route, making eight game count routes.

Correction Factors

The table below lists correction factors used during the June 2005 Game Count.

Table 3

Correction Factors used for the NamibRand Nature Reserve

Route	Area Correction Factor
1	2.89
2	3.04
3	3.7
4	3.74
5	2.30
6	5.01
7	4.91
8	3.74

Species	Species' Correction Factor
Gemsbok	2.4
Springbok	2.9
Kudu	2.6
Steenbok	10.0
Burchells Zebra	2.0
Ostrich	2.1
Red Hartebeest	2.5

Route Results

Tables 4-11 list the data collected on each route which was then analysed. Numbers seen within the strip width (under 500m) have been multiplied by the relevant correction factor for each route. See Table 3 for the relevant correction factor for each route.

Table 4

Route 1			
Species	**Numbers seen - Total**	**Numbers seen under 500m**	**No. Corrected For Area 2005**
Gemsbok	140	129	372
Springbok	193	188	542
Kudu	5	5	14
Steenbok			-
Burchells Zebra			
Ostrich	1	0	-
Blesbok			
Red Hartebeest			-
Giraffe			-
Total		**322**	**929**

Table 5

Route 2			
Species	**Numbers seen - Total**	**Numbers seen under 500m**	**No. Corrected For Area 2005**
Gemsbok	60	54	164
Springbok	705	431	1,308
Kudu			-
Steenbok	1	1	3
Burchells Zebra			-
Ostrich	36	23	70
Blesbok			-
Red Hartebeest	2	2	
Giraffe			
Total	**804**	**511**	**1,545**

Table 6

Route 3			
Species	**Numbers seen - Total**	**Numbers seen under 500m**	**No. Corrected For Area 2005**
Gemsbok	198	133	492
Springbok	28	17	63
Kudu			-
Steenbok			-
Burchells Zebra	26	0	-
Ostrich			-
Blesbok			-
Red Hartebeest			
Giraffe			
Total		**150**	**555**

Table 7

Route 4			
Species	**Numbers seen - Total**	**Numbers seen under 500m**	**No. Corrected For Area 2005**
Gemsbok	83	68	254
Springbok	6	5	19
Kudu			-
Steenbok			-
Burchells Zebra			-
Ostrich	31	18	67
Blesbok			-
Red Hartebeest			
Giraffe			
Total		**91**	**340**

Table 8

Route 5			
Species	**Numbers seen - Total**	**Numbers seen under 500m**	**No. Corrected For Area 2005**
Gemsbok	95	94	216
Springbok	229	229	527
Kudu	1	1	2
Steenbok	1	1	2
Burchells Zebra			-
Ostrich	10	2	5
Blesbok			-
Red Hartebeest			
Giraffe			
Total		**327**	**753**

Table 9

Route 6			
Species	**Numbers seen - Total**	**Numbers seen under 500m**	**No. Corrected For Area 2005**
Gemsbok	17	10	50
Springbok	133	128	641
Kudu	21	16	80
Steenbok			-
Burchells Zebra	76	29	145
Ostrich	55	40	200
Blesbok	10	10	50
Red Hartebeest	25	1	
Giraffe			
Total	**337**	**234**	**1,166**

Table 10

Route 7			
Species	**Numbers seen - Total**	**Numbers seen under 500m**	**No. Corrected For Area 2005**
Gemsbok	207	183	898
Springbok	142	115	565
Kudu	2	2	10
Steenbok			-
Burchells Zebra			-
Ostrich	18	6	29
Blesbok			-
Red Hartebeest			
Giraffe			
Total		**306**	**1,502**

Table 11

Route 8			
Species	**Numbers seen - Total**	**Numbers seen under 500m**	**No. Corrected For Area 2005**
Gemsbok	176	130	638
Springbok	259	238	1,168
Kudu	1	1	5
Steenbok			-
Burchells Zebra			-
Ostrich	8	0	-
Blesbok			-
Red Hartebeest			
Giraffe			
Total		**369**	**1,811**

Population estimate

Table 12 presents the total population estimate for plains game on the NamibRand Nature Reserve. Final figures have been determined by multiplying all sightings under 500m by both the area and species correction factors.

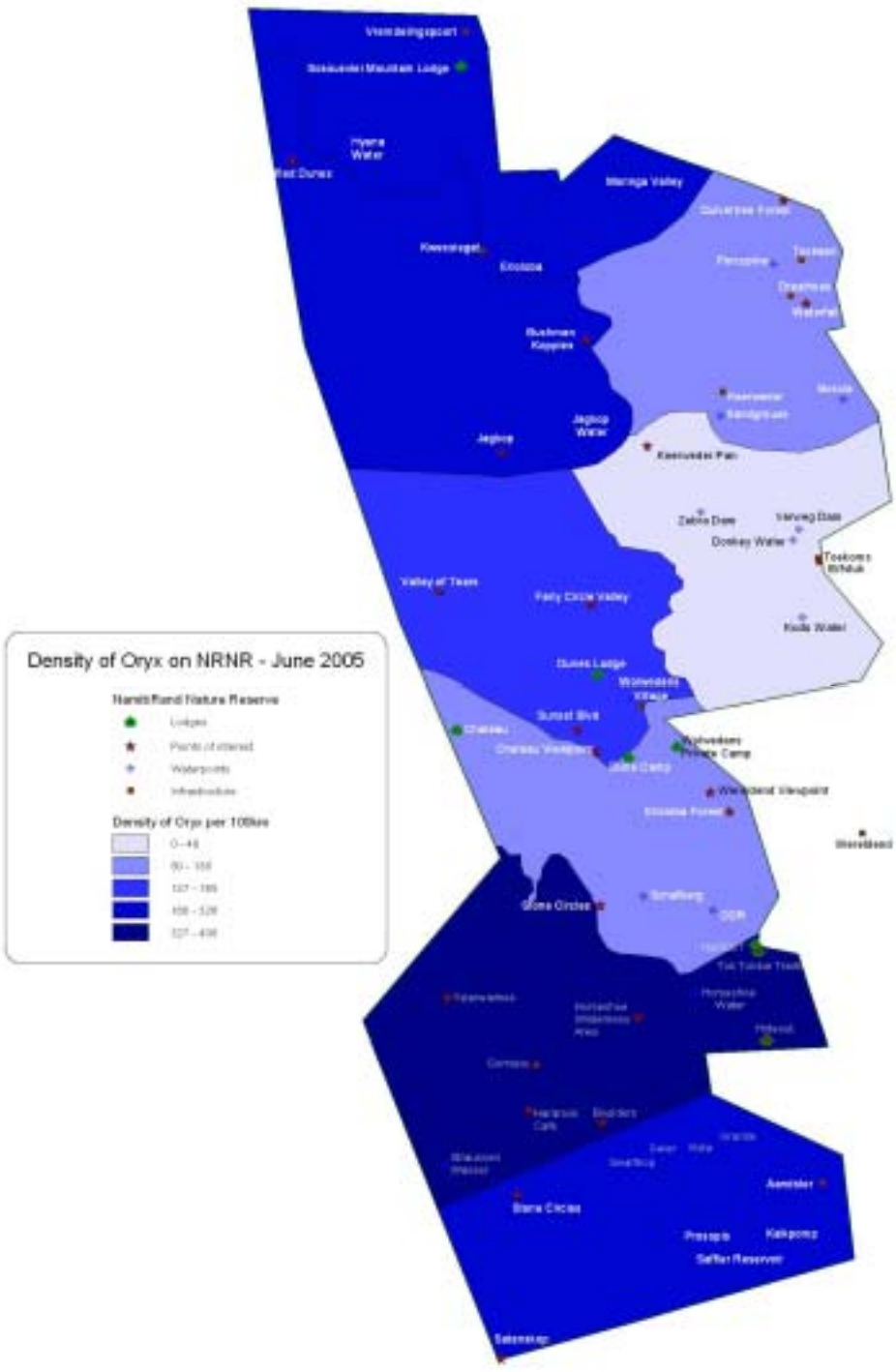
Table 12

Total Numbers Of Game			
Species	**No. Seen under 500m**	**No. Corrected For Area**	**Total No. Corrected For Species 2004**
Gemsbok	801	3,085	7,405
Springbok	1,351	4,833	14,016
Kudu	25	112	290
Steenbok	2	5	53
Burchells Zebra	29	145	290
Ostrich	89	371	780
Blesbok	10	50	15
Red Hartebeest	3	-	50
Giraffe	-	-	3
			-
Total	**2,310**	**8,602**	**22,903**

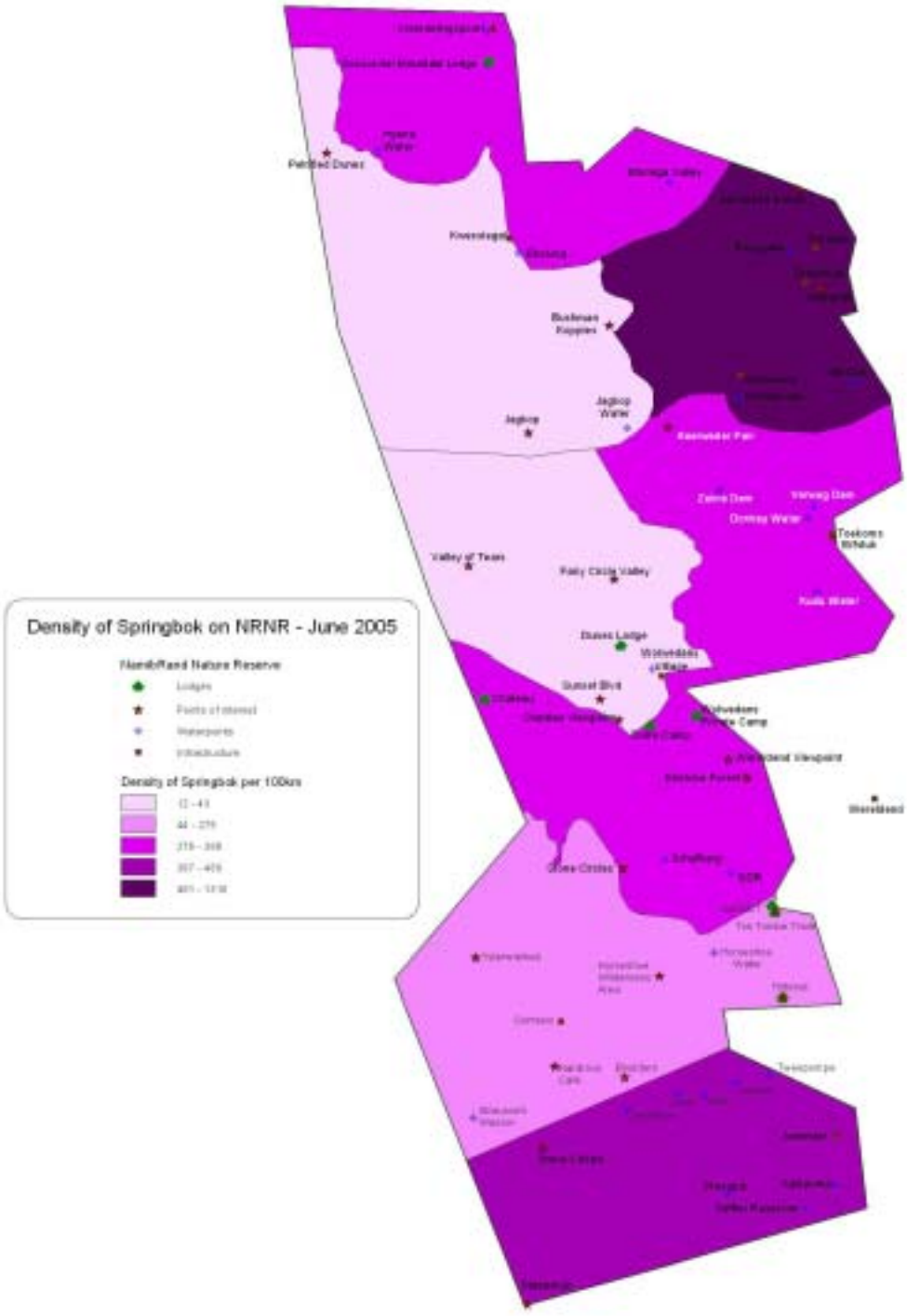
Wildlife Distribution

The following section presents distributing maps for the following species: oryx, springbok, kudu, Burchell's zebra and ostrich.

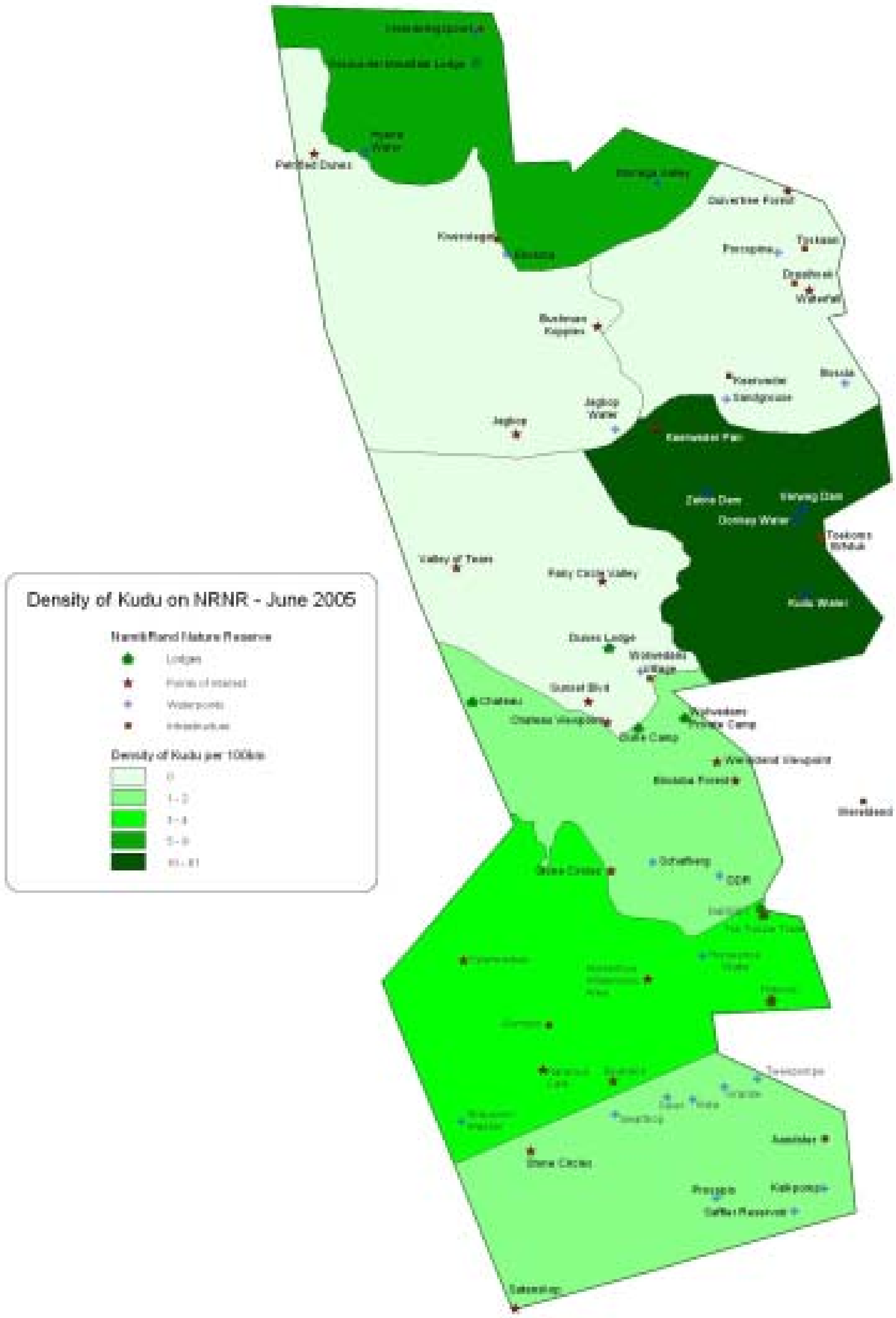
Map 3: *Distribution of Oryx*



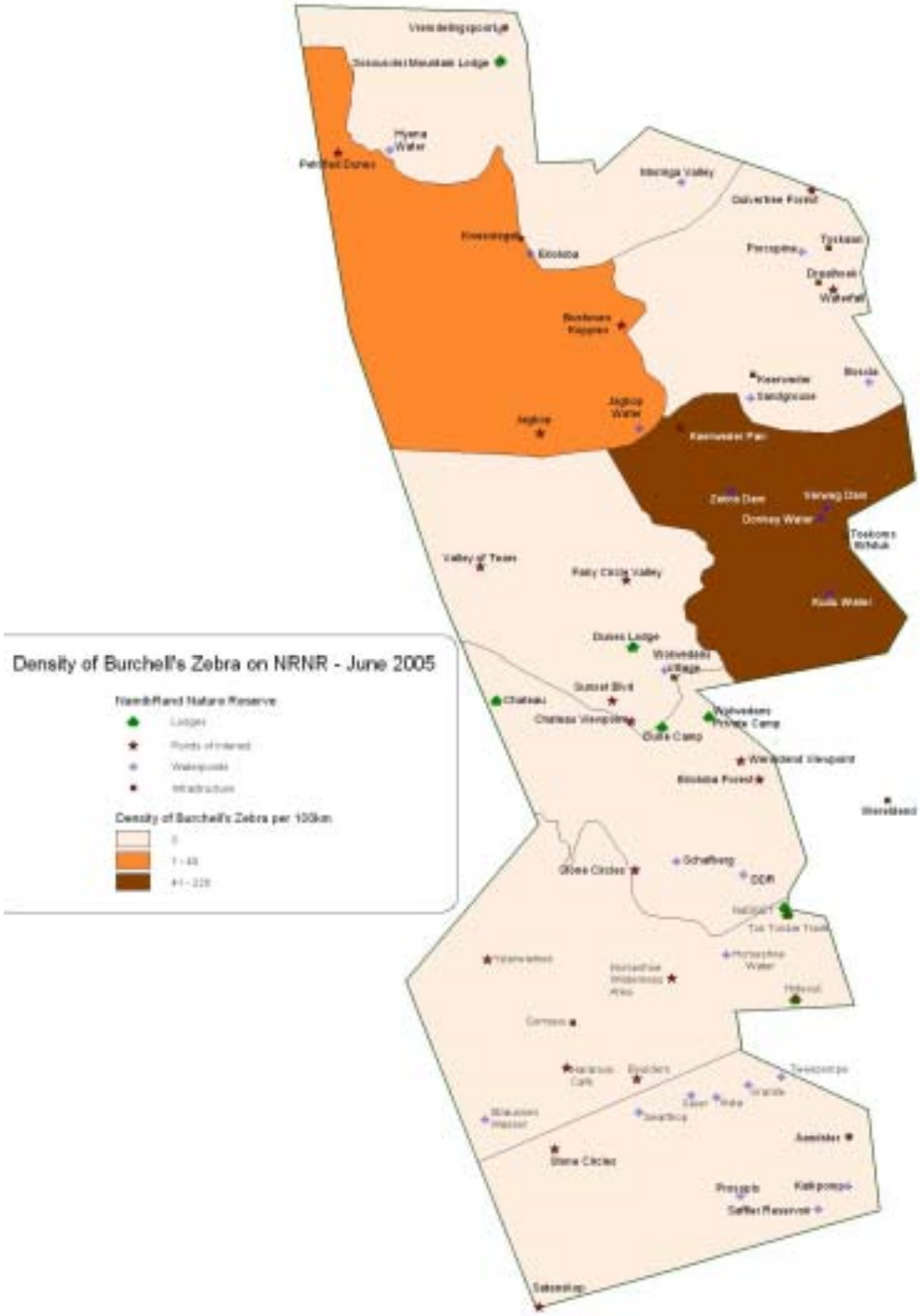
Map 4: *Distribution of Springbok*



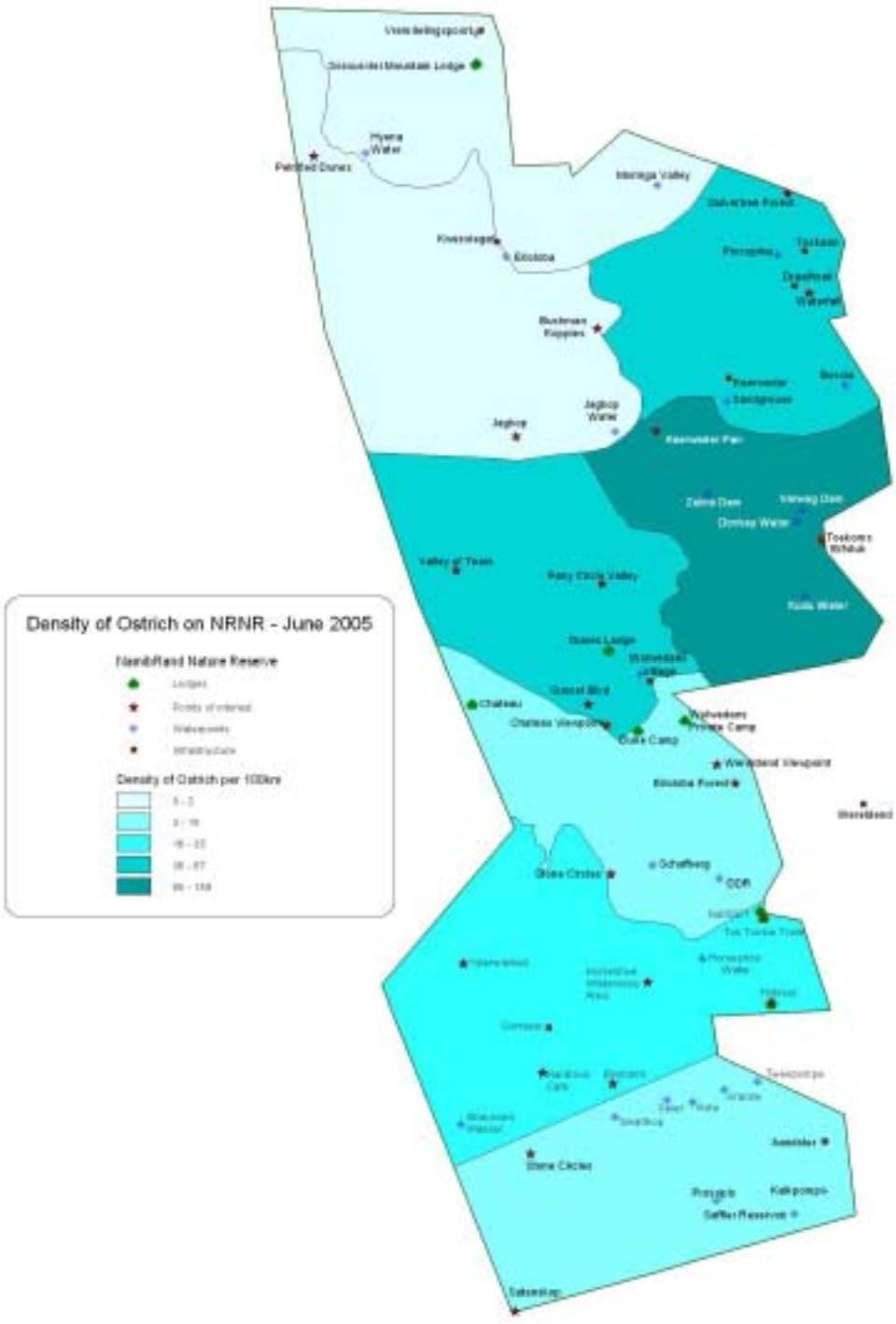
Map 5: *Distribution of Kudu*



Map 6: *Distribution of Zebra*



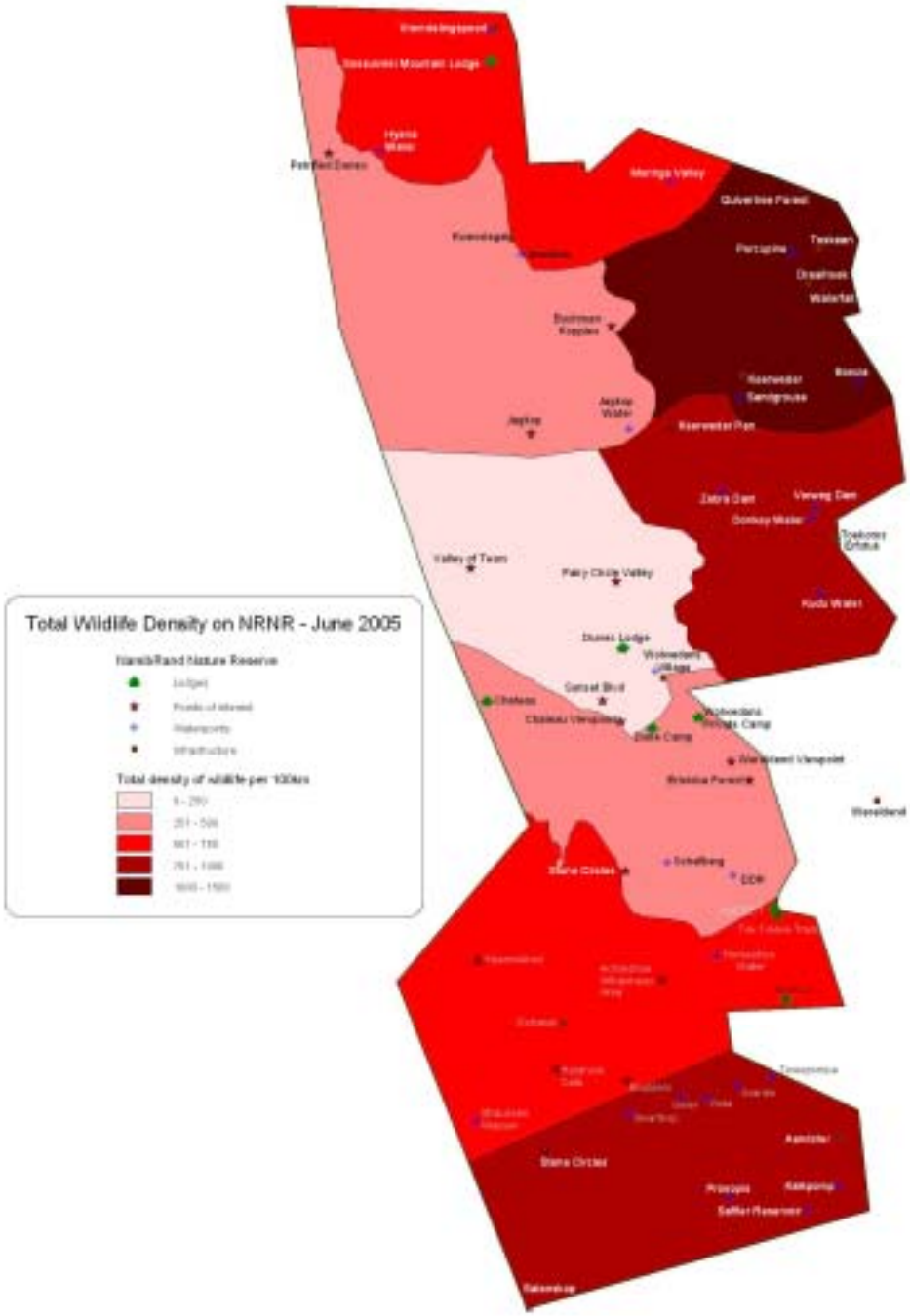
Map 7: *Distribution of Ostrich*



Total wildlife density

Map 8 illustrates the total density of wildlife on the NamibRand Nature Reserve on 4 June 2005. From this map it can be deduced that the highest wildlife numbers occurred in the east of the Reserve on Toskaan, Draaihoek and Keerweder, while wildlife numbers in the western, or dune areas of the Reserve, are lower.

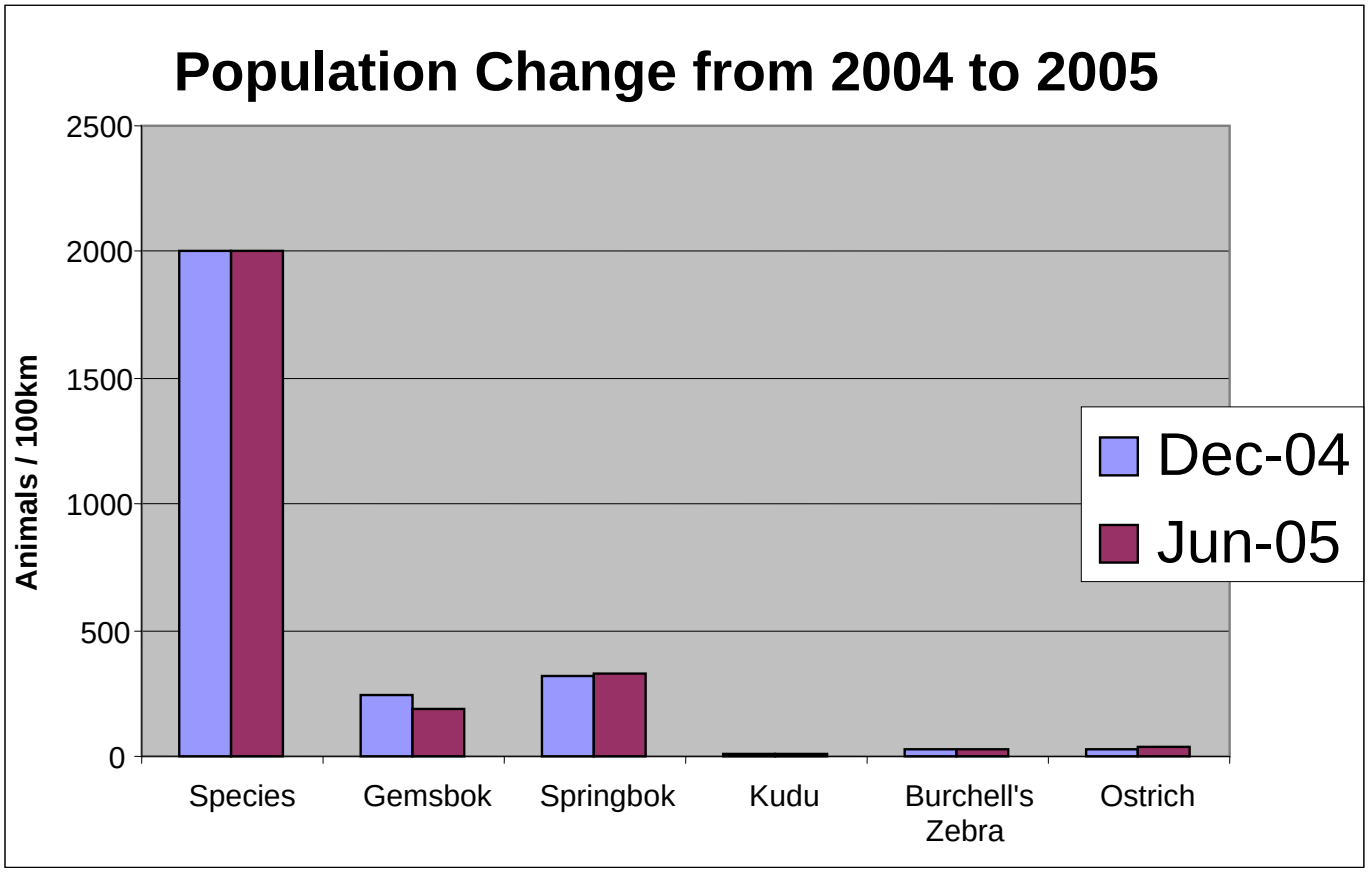
Map 8: *Total Wildlife Distribution*



Wildlife Trend

While inconsistencies in the results from the first game count conducted in December 2004 mean that we can not compare population estimates, we can compare the trend data. This is because of the fact that trend data is based on actual sightings and not on estimates.

The graph below compares wildlife numbers from December 2004 to June 2005.



Conclusions

We are extremely pleased with results of the game count and are confident that we now have a “fine-tuned” census system which is easy to understand and implement. This system delivers good and reliable results.

The game count held in December 2004 can be seen as a pilot to this year’s successful count. We were able to learn from our mistakes and improve and adapt the survey methodology to suit our needs.

Some stakeholders find the large numbers obtained for certain species difficult to accept. Bear in mind that we are dealing with Namibia’s largest private nature reserve and that it is no easy feat to account for all the wildlife

on 180,000ha! It often helps to break the large numbers down into more manageable, or “bite size” chunks to comprehend the scale of the numbers.

This count estimates the population of plain game as follows:

- Oryx: 7,405
- Springbok: 14,016
- Kudu and Burchell’s Zebra: 290 (each)
- Ostrich: 780

If we were to applying these numbers to an average size farm in Namibia, of 5000ha, and maintain the same density levels, we would end up with the following wildlife numbers:

- Oryx: 206
- Springbok: 389
- Kudu and Burchell’s Zebra: 8 (each)
- Ostrich: 22

These game numbers would not be deemed excessive on an average-sized Namibian farm.

Table 13 presents a breakdown of the number of animals one could expect to see per 100km driven on the Reserve.

Table 13

Animals seen per 100km driven in June2005

Route	Length Of Route (km)	Species												TOTAL
		Gemsbok		Springbok		Kudu		Steenbok		B.Zebra		Ostrich		
		No	P/ 100km	No	P/ 100km	No	P/ 100km	No	P/ 100km	No	P/ 100km	No	P/ 100km	P/ 100km
1	55.8	140	251	193	346	5	9	0	0	0	0	1	2	608
2	53.8	60	112	705	1310	0	0	1	2	0	0	36	67	1491
3	65.2	198	304	28	43	0	0	0	0	26	40	0	0	387
4	50.2	83	165	6	12	0	0	0	0	0	0	31	62	239
5	70	95	136	229	327	1	1	1	1	0	0	10	14	480
6	34.5	17	49	133	386	21	61	0	0	76	220	55	159	875
7	51.7	207	400	142	275	2	4	0	0	0	0	18	35	714
8	54	176	326	259	480	1	2	0	0	0	0	8	15	822
Total	**435.2**	**800**	**184**	**1436**	**330**	**29**	**7**	**2**	**0**	**102**	**23**	**151**	**35**	**5615**

Effective conservation can not be undertaken unless the environment which we are trying to protect is fully understood. Bi-annual game counts are an effective tool for the managers of the Reserve to use in their continued efforts to manage the NamibRand Nature Reserve holistically.

Acknowledgements

We would like to extent our special thanks to all those who helped to make this event a success. Without the enthusiastic support from land owners and concessionaires on the Reserve we would not have been able to do this census.

Dr. Chris Brown from the Namibia Nature Foundation offered his services and expertise to us free of charge. His guidance and input was instrumental toward making this event a success.

Peter Dunning and his staff from the Sossusvlei Mountain Lodge deserve special thanks for hosting us, feeding us and for so excellently taking care of us!