

Republic of Botswana

AERIAL CENSUS OF ANIMALS IN BOTSWANA

2012 DRY SEASON



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IN
BOTSWANA
DRY SEASON 2012

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EXECUTIVE SUMMARY

Department of Wildlife and National Parks (DWNP) initiated countrywide aerial surveys in response to a number of wildlife management challenges, including a severe drought in the 1980s which resulted in high wildlife mortalities and rangeland degradation. These challenges required information on wildlife population, abundance and distribution before any informed management decisions can be made. Recent concerns that some species in key wildlife areas were declining further underlined the need for monitoring data.

The DWNP, therefore, carried out a dry season aerial survey from 6th August to 17th November 2012 covering the whole country. This report presents population estimates of animals counted in Botswana's administrative districts and Protected Areas, as well as distribution patterns and population trends for the last 20 years.

The standard methodology for transect sampling developed by Norton-Griffith (1978) was used. The survey area was stratified into 47 strata and divided into parallel transects oriented from North to South. Transects were spaced according to the required sampling intensity, ranging from 1.8% in areas with low wildlife densities to 21.6% in areas with high densities. Two fixed wing aircrafts were used to fly transects at a height of 300 feet above ground and a minimum average strip width of 300 metres. Data analysis was done using Botswana Aerial Survey Information System (BASIS).

Observations were made on 26 animal species including buffalo, duiker, eland, elephant, gemsbok, giraffe, hartebeest, hippo, impala, kudu, lechwe, ostrich, roan, sable, sitatunga, springbok, steenbok, tsessebe, warthog, waterbuck, wildebeest and zebra. The survey also included cattle, donkey, horse, sheep and goats.

As expected, the elephant population has significantly increased. It was estimated at 207 545, with a 297% change between 1992 and 2012. A highly significant upward trend was observed in Chobe National Park and Moremi Game Reserve, while numbers were also building up in Makgadikgadi and Nxai Pans National Parks. Another species with a significant upward trend was hippo, although this species generally tends to be under-counted by aerial surveys and may not yield reliable estimates. There were upward trends for all other species except lechwe; sable; sitatunga; springbok; and tsessebe. Those trends were, however, not statistically significant.

With regards to species that have raised concern, the lechwe declined by 59% between 1992 and 2012 while springbok and tsessebe declined by 71% and 79% respectively for the same period. The decrease in lechwe numbers was highly significant in Moremi Game Reserve, with a similar trend for springbok in Central Kalahari Game Reserve. Although tsessebe numbers decreased throughout its range, the trends in Chobe National Park and Moremi Game Reserve were not statistically significant.

Compared to wildlife, livestock numbers were high throughout the surveyed area and some observations were made inside Wildlife Management Areas. In particular, cattle were estimated at 3 137 477 which was more than all the wildlife numbers combined. The cattle population also represented an increase of 322% between 1992 and 2012.

It is evident that concerns about the possible decline of some wildlife species may be valid, especially that all species except elephant and impala had a population decline in at least one Protected Area. An appropriate management response is, therefore, warranted and this will include further research to

understand the reasons behind the observed downward trends, improved monitoring of wildlife resources in community areas and concessions, improved law enforcement and strengthening of the gains of community based natural resources management.

1.0 INTRODUCTION

Aerial surveys have, throughout the years, remained a major undertaking for the Department of Wildlife and National Parks (DWNP), in recognition of the need for inventory and monitoring of wildlife populations. A country-wide Animal and Range Assessment Project funded by the European Economic Community was implemented from 1978 until 1979, covering the central and southern parts of Kgalagadi which then had large concentrations of wildlife (DHV, 1980). Following that assessment, a number of aerial surveys were conducted in the early 1980s by DWNP, Kalahari Conservation Society and others; mainly covering the northern parts of Botswana. All these surveys, as well as others prior to 1978, were largely *ad hoc* and only covered parts of the country which did not provide a national overview of wildlife numbers (Bonifica, 1992).

The DWNP instituted country-wide aerial surveys in 1986 in response to a number of wildlife management challenges. Botswana experienced a severe drought in the 1980s which resulted in high mortalities of both livestock and wildlife. Some boreholes were later established to provide water for wildlife, particularly in the Central Kalahari Game Reserve. It was also observed that elephants were degrading vegetation over a large part of their range and that their numbers had to be controlled (Bonifica, 1992). Some issues associated with these challenges were, however, contentious and required information before any management decisions could be made. The necessity to consumptively utilize the wildlife resource as part of a sustainable management approach also called for information on distribution and abundance in order to set realistic hunting quotas.

The 2012 dry season aerial survey was carried out from 6th August to 17th November 2012. The survey was conducted amidst concerns that some species in key wildlife areas of Botswana were declining; particularly red lechwe, tsessebe, wildebeest and eland. Despite some limitations, aerial surveys present a representative picture of animal distribution and abundance in the country. It is expected that the survey results presented in this report would stimulate further inventories by different means and specific research projects in order to address questions that cannot be adequately answered by interpreting the results of aerial surveys.

The report presents population estimates of animals counted in Botswana's administrative districts and Protected Areas. Wildlife and livestock species accounts are also presented, showing countrywide distribution patterns and population trends for the last 20 years or more.

2.0 METHODS

2.1 STRATIFICATION

The 2012 survey was stratified as shown on Figure 2.1 below. The rationale behind stratification is to enhance the precision of estimates obtained and also to improve efficiency of the survey. Areas with low wildlife densities were surveyed at lower intensities while those carrying greater numbers were flown at higher intensities. For example the elephant range was flown at intensities ranging from 7% to 21% as opposed to predominantly livestock areas that could be flown at intensities as low as 1.8%.

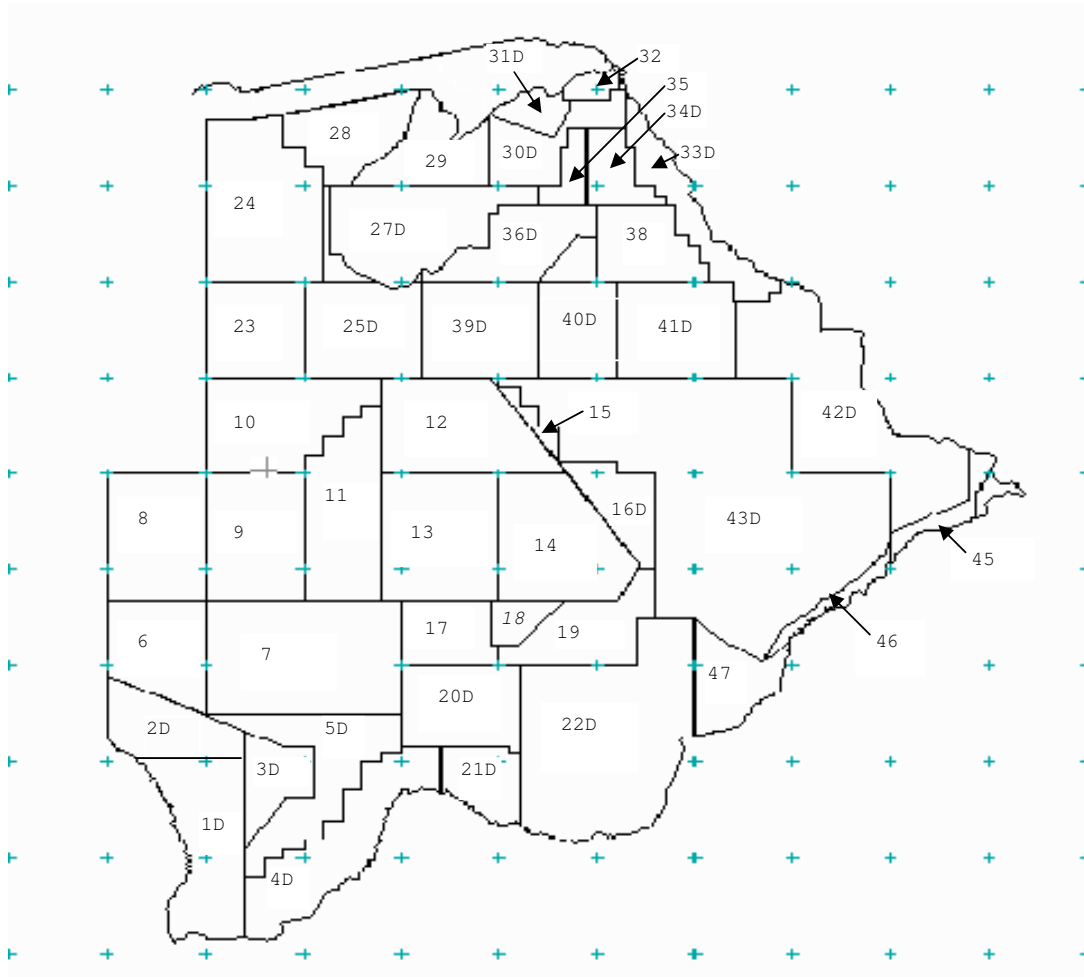


Figure 2.1 Survey strata used in 2012

The stratum numbers in Figure 2.1 refer to strata listed in Table 2.1.

Table 2.1 Key to 2012 dry season strata

Number	Title	Number	Title
1D	01DGNP	25D	25DNGAMI
2D	02DGNP	26D	26DGUMA
3D	03DGNP	27D	27DDELTA
4D	04DKGAL	28	28NGAMI
5	05KGAL	29	29NGAMI
6	06KGAL	30D	30DCHOBE
7	07KGAL	31D	31DENCLV
8	08GHANZI	32	32CHOBEN
9	09GHANZI	33D	33DZIMB
10	10GHANZI	34D	34DCENTR
11	11GHANZI	35	35CHOBES
12	12CKGR	36D	36DNGAMI
13	13CKGR	37	37NXAI
14	14CKGR	38	38CENTR
15	15CENT	39D	39DNGAMI
16D	16DCENT	40D	40DMAKAD
17	17KWEN	41D	41DCENTR
18	18KHUT	42D	42DCENTR
19	19KWEN	43D	43DCENTR
20D	20DSOUT	44	44MASHTU
21D	21DSOUT	45	45TULIE
22D	22DKWEN	46	46TULIW
23	23NGAMI	47	47KATLEN
24	24NGAMI		

Transects were flown at different spacing depending on the level of intensities that had to be achieved. The methods of error estimation used in the survey, however, require that transects data be assigned to grids (or transect subunits), which vary in size according to the spacing of the original transects. The map below displays transects that were flown in 2012 (Figure 2.2).

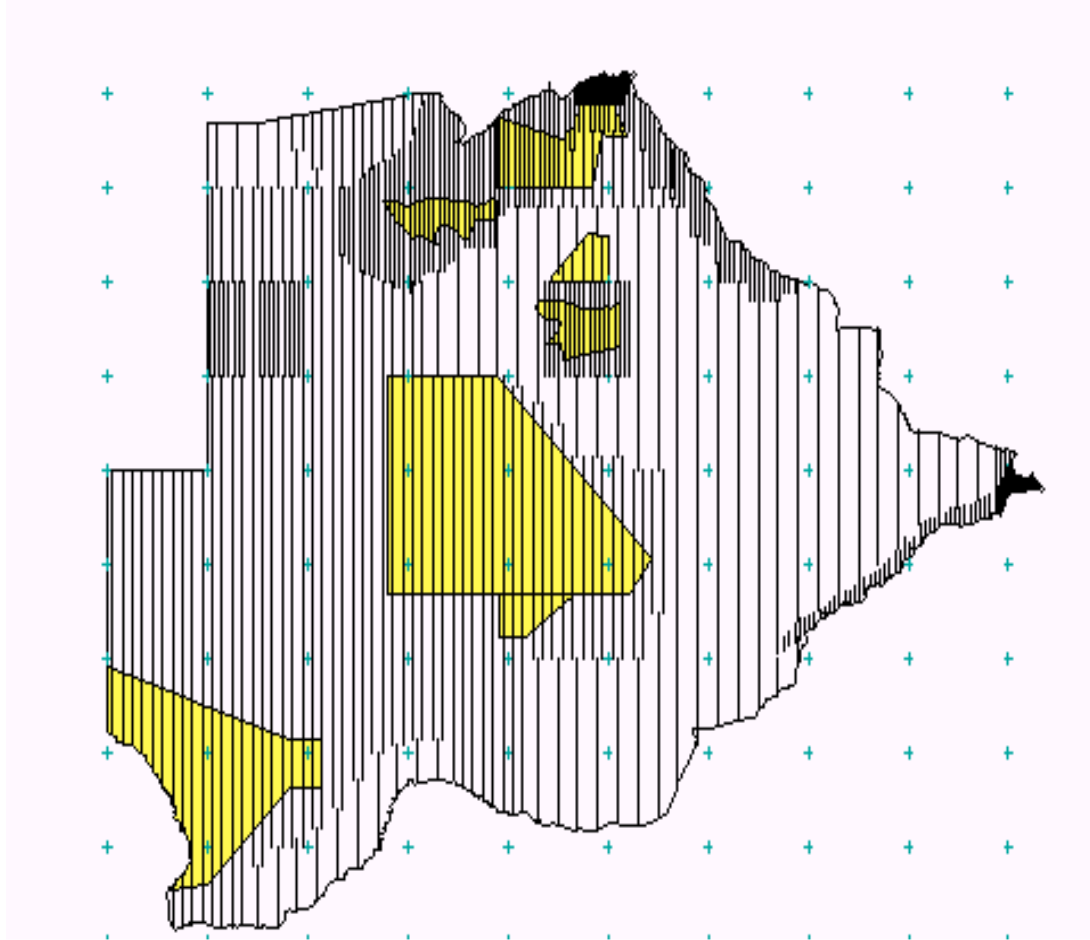


Figure 2.2 Transects flown in 2012

2.2 SAMPLING TECHNIQUES

Stratified systematic transect sampling according to Norton Griffiths (1978) was adopted for the whole survey. Two suitably equipped Cessna 206 were employed and accurate navigation along transects was maintained using Global Positioning Systems fitted in both aircraft. A constant height of 300ft above ground level (a.g.l.) was maintained with the use of radar altimeters.

The aircrafts were flown at a nominal speed of 90 knots and a recorder seated in the front next to the pilot recorded sightings made by observers in the pair of seats in the next row. The position of each sighting was recorded from the GPS. Notes were also made every minute of distance of the height above ground in order to provide a mean height for each transect. This would be used to calculate the sample area.

2.3 CALIBRATION

The boundaries of each strip were delineated by a pair of markers on the lift struts of each aircraft. A rigid rod formed the outer marker while a rope and funnel flying parallel to the rod were used for the inner marker. The position of the strip markers was determined for each observer while the aircraft was on the ground as described by Norton-Griffiths (1978) using trigonometric calculations. This provided an approximation of the strip width but because the inner marker was not rigid and might be aligned at different angles when the aircraft was airborne, it was necessary to check the strip width by airborne calibration. This was also done because the differences in height of individual observers would result in different perspectives of the strips and strip widths.

The aircraft was flown at varying heights and at right angles to an airstrip on which numbers had been painted at 100m intervals. The observers were expected to indicate the outermost and innermost numbers seen within the strip markers. The corrected strip widths for individual observers as well as total strip width at 300 feet are shown on Table 2.2

Table 2.2 Corrected individual and total strip widths

LEFT OBSERVER	CORRECTED STRIP WIDTH	RIGHT OBSERVER	CORRECTED STRIP WIDTH	TOTAL STRIP WIDTH AT 300 FEET
Aircraft: A2-ADN				
Dick Ntamba	167.6	Ntlamelang Sebegu	134.5	302.1
John Kgari	211.2	Mmoloki Lepodise	161.8	373.0
Thuto Ntesang	153.3	Thatayaone Dimakatso	120.2	273.5
John Kgari	187.0	September Tsheboeng	171.1	358.1
Aircraft: A2-AFS				
September Tsheboeng	174.8	Dick Ntamba	134.4	309.2
Mmoloki Lepodise	181.9	John Kgari	165.3	347.2
Thatayaone Dimakatso	123.5	Thuto Ntesang	134.8	258.3

2.4 DATA ANALYSIS

Jolly's (1969) method for sampling blocks of unequal size was used to obtain estimates of density and variance for each species in each stratum as follows:

$$R = \frac{\text{total animals seen}}{\text{total transect area}} = \sum_{i=1}^n y_i \div \sum_{i=1}^n z_i$$

$$\hat{Y} = Z.R$$

$$\sigma_{\hat{Y}}^2 = \frac{N(N-n)}{n} \cdot (\sigma_y^2 - 2.R.Cov_{yz} + R^2 \cdot \sigma_z^2)$$

Where:

- R = density of animals in stratum
- \hat{Y} = estimated number of animals in stratum
- Z = total area of stratum
- y_i = number of animals counted on transect i
- z_i = area of transect i
- N = number of transects possible in stratum
- n = number of transects sampled
- σ_y^2 = variance of numbers of animals seen on transects
- σ_z^2 = variance of area of transects
- Cov_{yz} = covariance between transect area and animals seen
- $\sigma_{\hat{Y}}^2$ = variance of estimated number in stratum
- $\sigma_{\hat{Y}}$ = standard error of estimate

Overall densities and standard errors were obtained from sums of the stratum densities and their variances.

Data were analysed using Botswana Aerial Survey Information System (BASIS, Version II) which was originally released in 2000 and updated in 2007. BASIS II allows for two types of analysis, which are 'Population Estimates' for calculating population statistics for a series of features (CHA's, Districts, etc.) for a single survey; and 'Population Trends' for analysing surveys from several seasons and/or years, for a single selected area (which may be a combination of a number of features). Both utilities provide information for a single animal species at a time.

Change in animal populations between 1992 and 2012 was computed using the following formula:

$$\%Change = \left(\frac{N(2012)}{N(1992)} - 1 \right) \cdot 100\%$$

Where:

- N = population estimate for the specified year

3.0 RESULTS

3.1 COMBINED COUNTRYWIDE ESTIMATES

Countrywide estimates for the 2012 dry season are shown on Table 3.1 below.

Table 3.1 Countrywide estimates for 2012 dry season

Species	Estimated number	Density (animals /sq km)	95% confidence limits	Maximum Estimate	Minimum Estimate
Buffalo	61 105	0.13	38.23	70 725	51 485
Carcass	3 426	0.01	39.77	3 540	3 312
Cattle	3 137 477	6.81	1.63	3 188 617	3 086 336
Donkey	201 481	0.44	10.31	205 400	197 562
Duiker	21 608	0.05	21.07	22 418	20 798
Eland	34 735	0.08	23.13	38 812	30 658
Elephant	207 545	0.45	10.49	212 914	202 176
Gemsbok	133 249	0.29	15.79	139 267	127 231
Giraffe	8 976	0.02	25.93	9 368	8 584
Hartebeest	62 569	0.14	21.28	69 317	55 821
Hippo	3 633	0.01	44.44	4 214	3 052
Horse	72 211	0.16	14.91	75 486	68 936
Impala	114 900	0.25	15.16	120 521	109 279
Kudu	23 038	0.05	19.19	24 666	21 410
Lechwe	26 322	0.06	27.37	28 712	23 932
Ostrich	55 916	0.12	13.39	57 733	54 099
Roan	615	0.00	122.65	792	438
Sable	1 989	0.00	44.17	2 322	1 656
Sheep and goats	1 652 748	3.59	2.35	1 691 537	1 613 958
Sitatunga ¹	63	0.00	409.89	139	-13
Springbok	35 688	0.08	31.83	41 446	29 930
Steenbok	41 531	0.09	13.95	43 196	39 866
Tsessebe	2 138	0.00	68.08	2 557	1 719
Warthog	7 026	0.02	29.61	7 561	6 491
Waterbuck	2 048	0.00	102.51	3 111	985
Wildebeest	53 159	0.12	24.02	59 639	46 679
Zebra	99 077	0.21	40.49	119 274	78 880

¹ The negative value of minimum estimate is the result of basing that estimate on very few sample cases.

3.2 ANIMAL ESTIMATES IN DISTRICTS AND PROTECTED AREAS

The following tables present population statistics for 26 animal species including livestock. The population estimates are presented by administrative district for all animals that were counted; and by Protected Area for all wildlife species. Sheep and goats were not separated as they are difficult to tell apart from the air.

The presented population statistics are described in Table 3.2 below:

Table 3.2 Description of presented population statistics

Short Name	Full Column Name	Description
Estimated	Estimated Population	The estimated population within the analysed grid cells.
Density	Population Density	The calculated animal density within the analysed grid cells.
% JXSE JXSE N JXSE 95CI%	Jolly X (% SE), N, and 95% CI (%)	The percentage Standard Error (SE) of the estimate from the Jolly method assuming east west transects, with the number of transects (N) and the associated 95% Confidence Interval as a %. This applies to the Population and Density estimates.
% JYSE JYSE N JYSE 95CI%	Jolly Y (%SE), N, and 95% CI (%)	The percentage SE of the estimate from the Jolly method assuming north south transects, with the number of transects (N) and the associated 95% Confidence Interval as a %. This applies to the Population and Density estimates.
Max Est.	Upper 95% CI Population	Upper limit of population estimate (as opposed to potential population) calculated 95% Confidence interval based on the lowest of the calculated Standard errors. As all SE's are highly conservative this is permissible.
Min Est.	Lower 95% CI Population	Lower limit of population estimate (as opposed to potential population) calculated 95% Confidence interval based on the lowest of the calculated Standard Errors. As all SE's are highly conservative this is permissible. The confidence interval can include a negative lower confidence limit when the estimate is based on very few sample cases. In such cases, the lower limits can be interpreted as zero.

3.2.1 ANIMAL ESTIMATES BY DISTRICT

3.2.1.1 Buffalo

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	9 111	0.82	26.974	83	54.291	28.595	83	56.932	11569	6653
Ngamiland	53 424	0.71	34.18	37	68.44	30.323	37	61.506	68208	38640
Central	222	0	102.5	52	205.46	106.1	52	213.13	361	83

3.2.1.2 Cattle

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	9 800	0.88	32.442	74	65.586	28.731	74	57.306	11000	8600
Ngamiland	422 365	5.63	3.176	80	6.305	8.82	80	17.57	435779	408951
Central	1 251 792	9.73	0.878	121	1.737	0.626	121	1.24		
North east	31 307	5.88	35.087	4	86.099	64.246	4	179.51	42292	20322
Ghanzi	359 256	4.43	8.466	54	17.533	14.97	54	30.043	389671	328841
Kweneng	361 253	10.26	-99	35	-99	4.149	35	8.431	376241	346265
Kgalagadi	243 408	2.74	12.951	50	26.096	11.763	50	23.651	266685	220131
Kgatleng	109 677	16.18	-99	5	-99	14.78	5	38.144	116376	102978
Southern	326 363	12.48	7.051	18	14.966	8.88	18	18.679	349375	303351
South east	20 421	12.02	55.042	2	153.79	-99	2	-99	31661	9181

3.2.1.3 Donkey

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Ngamiland	34 634	0.46	7.776	80	15.437	15.53	80	30.936	36056	33212
Central	63 261	0.49	7.709	95	15.295	12.586	95	25.011	67391	59131
North east	9 366	1.76	28.643	4	70.286	35.555	4	99.347	12049	6683
Ghanzi	7 536	0.09	19.934	54	41.282	26.304	54	52.791	8977	6095
Kweneng	29 514	0.84	14.222	35	29.529	6.171	35	12.542	31290	27738
Kgalagadi	11 906	0.13	17.732	50	35.729	16.526	50	33.228	12533	11279
Kgatleng	6 543	0.97	49.46	5	127.64	64.268	5	165.85	7829	5257
Southern	32 190	1.23	7.314	18	15.524	17.668	18	37.163	34163	30217
South east	4 076	2.4	92.553	2	258.6	23.712	2	106.39	5043	3109

3.2.1.4 Duiker

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Ngamiland	771	0.01	46.44	67	92.368	52.121	67	104.14	861	681
Central	2 077	0.02	53.006	43	106.47	63.596	43	128.38	2480	1674
Ghanzi	10 804	0.13	14.161	54	29.326	20.073	54	40.284	11593	10015
Kweneng	1 345	0.04	60.436	35	125.47	24.089	35	48.955	1577	1113
Kgalagadi	5 272	0.06	24.31	50	48.984	25.901	50	52.077	5769	4775
Kgatleng	220	0.03	124.77	5	322	137.84	5	355.73	454	-14
Southern	1 083	0.04	31.115	18	66.042	24.628	18	51.803	1282	884

3.2.1.5 Eland

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	602	0.05	25.668	74	51.89	33.574	74	66.964	696	508
Ngamiland	909	0.01	39.046	80	77.516	41.563	80	82.797	972	846
Central	741	0.01	15.473	96	30.675	21.227	96	42.177	831	651
Ghanzi	14 239	0.18	35.813	54	74.168	43.438	54	87.177	17664	10814
Kweneng	0	0	0	0	0	0	0	0	0	0
Kgalagadi	18 041	0.2	21.547	50	43.416	24.379	50	49.017	21903	14179

3.2.1.6 Elephant

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	71 227	6.41	7.399	83	14.892	9.746	83	19.404	76497	65957
Ngamiland	126 474	1.69	2.786	80	5.531	7.619	80	15.177	129998	122950
Central	10 697	0.08	14.377	121	28.452	17.113	121	33.914	11694	9700

3.2.1.7 Gemsbok

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	201	0.02	55.327	48	113.45	69.248	48	139.37	214	188
Ngamiland	6 192	0.08	17.092	80	33.931	17.082	80	34.029	6456	5928
Central	2 282	0.02	24.219	95	48.05	25.12	95	49.919	2464	2100
Ghanzi	29 930	0.37	14.187	54	29.381	20.454	54	41.049	32292	27568
Kweneng	2 353	0.07	56.516	35	117.33	31.705	35	64.432	2652	2054
Kgalagadi	90 777	1.02	10.608	50	21.374	15.164	50	30.49	98013	83541
Southern	450	0.02	70.796	18	150.26	58.506	18	123.06	528	372

3.2.1.8 Giraffe

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	1 071	0.1	16.571	83	33.352	18.297	83	36.428	1195	947
Ngamiland	5 041	0.07	18.086	80	35.905	15.942	80	31.757	5549	4533
Central	1 285	0.01	21.473	121	42.495	24.784	121	49.115	1405	1165
Ghanzi	923	0.01	54.885	54	113.66	70.846	54	142.18	957	889
Kweneng	348	0.01	171.57	26	368.47	92.062	26	189.44	369	327
Kgalagadi	272	0	126.3	12	281.85	136.96	12	298.83	415	129
Southern	59	0	218	7	516.65	140.01	7	331.82	77	41

3.2.1.9 Hartebeest

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Ngamiland	1 691	0.02	51.783	67	102.99	46.228	67	92.364	2390	992
Central	6 767	0.05	24.855	95	49.311	35.158	95	69.868	8449	5085
Ghanzi	10 906	0.13	28.926	54	59.905	27.946	54	56.086	12131	9681
Kweneng	1 314	0.04	71.323	35	148.08	40.028	35	81.346	1643	985
Kgalagadi	40 347	0.45	21.03	50	42.375	20.976	50	42.176	48810	31884
Southern	1 036	0.04	47.336	18	100.47	39.419	18	82.914	1152	920

3.2.1.10 Hippo

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	186	0.02	62.97	74	127.3	70.544	74	140.7	231	141
Ngamiland	3 473	0.05	26.531	67	52.769	22.184	67	44.324	4164	2782

3.2.1.11 Horse

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Ngamiland	12 952	0.17	12.093	80	24.007	13.506	80	26.905	14347	11557
Central	25 008	0.19	15.4	95	30.553	17.022	95	33.827	28580	21436
North east	61	0.01	125.57	4	308.14	195.57	4	546.46	112	10
Ghanzi	10 082	0.12	21.268	54	44.046	26.092	54	52.365	12038	8126
Kweneng	8 645	0.25	23.45	35	48.687	12.491	35	25.384	9692	7598
Kgalagadi	8 043	0.09	20.895	50	42.103	20.866	50	41.954	8920	7166
Kgatleng	113	0.02	185.49	5	478.71	202.38	5	522.29	323	-97
Southern	7 103	0.27	18.166	18	38.558	15.864	18	33.369	8160	6046
South east	250	0.15	99.254	2	277.32	129.49	2	581.03	498	2

3.2.1.12 Impala

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	2 681	0.24	23.367	74	47.239	34.659	74	69.13	3307	2055
Ngamiland	69 898	0.93	14.09	37	28.213	14.984	37	30.393	78582	61214
Central	29 995	0.23	13.805	121	27.32	14.861	121	29.451	33332	26658
North east	1 408	0.26	103.55	4	254.1	91.145	4	254.67	2691	125
Kweneng	638	0.02	95.028	35	197.29	54.935	35	111.64	729	547
Kgatleng	2 886	0.43	96.116	5	248.04	120.08	5	309.91	5660	112
Southern	176	0.01	153.21	7	363.1	112.57	7	266.8	231	121
South east	6 369	3.75	99.254	2	277.32	142.68	2	640.24	12690	48

3.2.1.13 Kudu

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	299	0.03	33.837	74	68.406	40.715	74	81.208	336	262
Ngamiland	5 624	0.08	18.104	80	35.941	16.575	80	33.018	6164	5084
Central	3 614	0.03	21.78	121	43.103	25.311	121	50.16	4030	3198
North east	122	0.02	118.06	4	289.7	153.56	4	429.09	224	20
Ghanzi	7 504	0.09	30.402	54	62.962	29.076	54	58.353	9686	5322
Kweneng	1 516	0.04	60.226	35	125.04	33.413	35	67.904	2023	1009
Kgalagadi	3 021	0.03	31.922	50	64.321	33.728	50	67.814	3326	2716
Kgatleng	998	0.15	79.286	5	204.61	96.593	5	249.27	1192	804
Southern	262	0.01	100.65	7	238.54	69.198	7	163.99	443	81

3.2.1.14 Lechwe

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	19	0	123.12	35	257.11	100.37	35	203.99	38	0
Ngamiland	26 344	0.35	14.37	67	28.581	11.928	67	23.833	29486	23202

3.2.1.15 Ostrich

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	239	0.02	39.436	74	79.726	45.201	74	90.155	324	154
Ngamiland	5 485	0.07	16.416	80	32.589	16.233	80	32.337	5924	5046
Central	13 427	0.1	14.386	121	28.47	16.391	121	32.482	14868	11986
North east	47	0.01	139.8	4	343.07	212.3	4	593.2	113	-19
Ghanzi	8 537	0.11	19.239	54	39.842	20.172	54	40.485	9596	7478
Kweneng	2 999	0.09	39.67	35	82.362	20.19	35	41.031	3325	2673
Kgalagadi	20 136	0.23	13.975	50	28.158	15.352	50	30.867	21700	18572
Kgatleng	946	0.14	69.863	5	180.29	71.53	5	184.59	1373	519
Southern	3 792	0.15	23.758	18	50.426	26.019	18	54.728	4485	3099

3.2.1.16 Roan

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	477	0.04	43.879	74	88.708	50.13	74	99.986	655	299
Ngamiland	142	0	148.25	37	296.84	121.7	37	246.85	189	95

3.2.1.17 Sable

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	1 413	0.13	17.663	74	35.708	23.122	74	46.118	1663	1163
Ngamiland	592	0.01	65.626	80	130.28	53.524	80	106.62	909	275

3.2.1.18 Sheep and goats

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	1 691	0.15	40.4	74	81.675	44.401	74	88.56	1692	1690
Ngamiland	124 838	1.66	7.59	80	15.067	11.305	80	22.521	133116	116560
Central	596 678	4.64	2.355	121	4.661	5.328	121	10.559	610730	582626
North east	22 328	4.19	36.197	4	88.822	37.672	4	105.26	29821	14835
Ghanzi	98 921	1.22	22.164	54	45.9	29.147	54	58.497	120846	76996
Kweneng	246 147	6.99	4.308	35	8.944	4.431	35	9.005	256751	235543
Kgalagadi	210 624	2.37	11.632	50	23.438	12.179	50	24.488	235124	186124
Kgatleng	65 799	9.71	19.246	5	49.668	-99	5	-99	78463	53135
Southern	262 013	10.02	4.91	18	10.422	16.015	18	33.685	274878	249148
South east	11 544	6.79	59.591	2	166.5	-99	2	-99	18423	4665

3.2.1.19 Sitatunga

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Ngamiland	63	0	213.7	37	427.9	171.44	37	347.75	129	-3

3.2.1.20 Springbok

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	15	0	185.13	39	385.43	248.3	39	502.75	43	-13
Ngamiland	91	0	130.01	67	258.59	121.71	67	243.18	105	77
Ghanzi	4 923	0.06	46.158	54	95.591	48.493	54	97.323	7195	2651
Kweneng	474	0.01	163.6	26	351.35	104.44	26	214.92	969	-21
Kgalagadi	29 704	0.33	23.351	50	47.052	25.543	50	51.358	36640	22768

3.2.1.21 Steenbok

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	75	0.01	48.717	83	98.054	56.847	83	113.18	81	69
Ngamiland	2 956	0.04	21.831	80	43.34	23.557	80	46.927	3342	2570
Central	4 425	0.03	25.897	95	51.378	29.707	95	59.035	4878	3972
North east	47	0.01	139.8	4	343.07	212.3	4	593.2	113	-19
Ghanzi	11 046	0.14	12.529	54	25.948	18.009	54	36.143	11893	10199
Kweneng	2 403	0.07	43.894	35	91.132	19.694	35	40.022	2750	2056
Kgalagadi	18 537	0.21	13.65	50	27.504	14.96	50	30.079	20503	16571
Kgatleng	350	0.05	106.33	5	274.42	106.28	5	274.28	562	138
Southern	1 492	0.06	25.839	18	54.844	21.699	18	45.642	1645	1339

3.2.1.22 Tsessebe

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	393	0.04	70.585	74	142.69	70.097	74	139.81	417	369
Ngamiland	1 750	0.02	45.244	37	90.593	39.353	37	79.82	2207	1293

3.2.1.23 Warthog

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	569	0.05	30.443	74	61.545	41.921	74	83.614	599	539
Ngamiland	1 558	0.02	32.161	80	63.847	27.433	80	54.649	1793	1323
Central	728	0.01	25.667	78	51.06	28.624	78	57.043	910	546
Ghanzi	2 723	0.03	31.803	54	65.863	37.839	54	75.94	3415	2031
Kweneng	154	0	237.11	26	509.21	85.336	26	175.6	191	117
Kgalagadi	812	0.01	79.504	38	161.41	82.798	38	167.79	1026	598
Kgatleng	190	0.03	135.25	5	349.04	162.98	5	420.61	447	-67
Southern	238	0.01	69.517	18	147.54	59.664	18	125.49	285	191
South east	51	0.03	99.254	2	277.32	320.13	2	1436.4	102	0

3.2.1.24 Waterbuck

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Ngamiland	18	0	386.23	37	773.37	304.54	37	617.7	26	10
Central	580	0	54.533	52	109.31	58.944	52	118.4	605	555
Ghanzi	1 448	0.02	103.31	54	213.95	107.71	54	216.18	2944	-48

3.2.1.25 Wildebeest

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	1 952	0.18	75.682	39	157.56	77.22	39	156.35	3429	475
Ngamiland	13 876	0.19	40.514	67	80.582	50.396	67	100.69	16455	11297
Central	13 321	0.1	13.885	121	27.479	15.572	121	30.86	14647	11995
North east	986	0.19	74.816	4	183.58	94.078	4	262.86	1724	248
Ghanzi	8 931	0.11	33.727	54	69.846	40.788	54	81.858	11816	6046
Kweneng	376	0.01	161.61	26	347.07	105.28	26	216.65	521	231
Kgalagadi	9 527	0.11	33.22	50	66.937	34.964	50	70.299	11600	7454
Southern	3 870	0.15	73.007	7	173.02	72.784	7	172.49	6687	1053

3.2.1.26 Zebra

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe	8 319	0.75	20.55	83	41.361	22.94	83	45.673	9882	6756
Ngamiland	62 956	0.84	27.975	80	55.536	33.995	80	67.721	71825	54087
Central	22 630	0.18	20.566	96	40.771	23.228	96	46.153	27284	17976
North east	986	0.19	104.18	4	255.64	94.078	4	262.86	1914	58
Ghanzi	4 288	0.05	56.066	54	116.11	48.804	54	97.947	5830	2746
Southern	414	0.02	119.71	7	283.71	106.04	7	251.33	543	285

3.2.2 ANIMAL ESTIMATES BY PROTECTED AREA

3.2.2.1 Buffalo

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe National Park	5 830	1.06	33.042	49	66.904	36.388	49	73.199	7756	3904
Moremi Game Reserve	4 178	0.9	43.148	28	95.106	48.817	28	100.1	5981	2375

3.2.2.2 Duiker

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Nxai Pan National Park	105	0.09	115.11	4	282.48	121.72	4	340.10	226	-16
Central Kalahari Game Reserve	2 202	0.07	24.715	26	51.183	43.795	26	90.121	2488	1916
Khutse Game Reserve	170	0.09	88.705	7	228.92	92.376	7	218.92	200	140
Gemsbok National Park	2 045	0.1	37.56	18	77.605	39.57	18	83.232	2344	1746
Mabuasehube Game Reserve	55	0.03	102.4	4	264.26	112.11	4	313.25	111	-1

3.2.2.3 Eland

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe National Park	234	0.04	31.168	49	63.109	42.157	49	84.805	307	161
Nxai Pan National Park	30	0.04	129.45	3	334.09	168.59	3	543.63	69	-9
Central Kalahari Game Reserve	8 981	0.3	51.61	26	106.88	55.948	26	115.12	11332	6630
Gemsbok National Park	11 898	0.56	25.448	18	52.58	27.255	18	57.328	14828	8968
Mabuasehube Game Reserve	27	0.02	116.55	4	300.79	140.35	4	392.17	39	15

3.2.2.4 Elephant

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe National Park	26 134	4.73	7.513	55	15.168	8.712	55	17.477	27922	24346
Moremi Game Reserve	17 149	3.69	14.738	28	32.486	15.497	28	31.778	19676	14622
Nxai Pan National Park	185	0.26	69.523	3	179.41	68.744	3	221.67	312	58

3.2.2.5 Gemsbok

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Nxai Pan National Park	30	0.04	129.45	3	334.09	168.59	3	543.63	69	-9
Central Kalahari Game Reserve	22 650	0.77	12.58	26	26.053	17.961	26	36.959	25057	20243
Khutse Game Reserve	1 718	0.89	44.962	7	116.03	36.336	7	86.115	2246	1190
Gemsbok National Park	58 567	2.75	6.865	18	14.184	19.633	18	41.297	62588	54546
Mabuasehube Game Reserve	1 568	0.87	37.295	4	96.248	29.67	4	82.902	1735	1401

3.2.2.6 Giraffe

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe National Park	545	0.1	23.792	55	48.031	22.67	55	45.478	644	446
Moremi Game Reserve	1 047	0.23	39.867	28	87.876	33.939	28	69.596	1402	692
Nxai Pan National Park	93	0.13	112.07	3	289.22	104.73	3	337.7	190	-4
Central Kalahari Game Reserve	923	0.03	52.586	26	108.9	73.728	26	151.71	979	867
Khutse Game Reserve	348	0.18	85.768	7	221.34	100.25	7	237.6	390	306

3.2.2.7 Hartebeest

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Moremi Game Reserve	548	0.12	103.57	28	228.3	98.146	28	201.26	1086	10
Central Kalahari Game Reserve	5 429	0.18	41.494	26	85.932	47.228	26	97.185	5941	4917
Khutse Game Reserve	511	0.27	89.046	7	229.8	114.21	7	270.69	966	56
Gemsbok National Park	18 594	0.87	32.033	18	66.186	25.737	18	54.134	23380	13808
Mabuasehube Game Reserve	534	0.3	42.969	4	110.88	54.344	4	151.84	662	406

3.2.2.8 Hippo

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe National Park	35	0.01	109.86	27	229.42	86.267	27	177.19	44	26
Moremi Game Reserve	958	0.21	41.355	28	91.154	37.138	28	76.156	1314	602

3.2.2.9 Impala

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe National Park	2 303	0.42	23.215	49	47.006	36.323	49	73.068	2811	1795
Moremi Game Reserve	39 298	8.46	13.983	28	30.821	17.199	28	35.269	44793	33803

3.2.2.10 Kudu

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe National Park	132	0.02	32.702	49	66.216	35.715	49	71.845	149	115
Moremi Game Reserve	842	0.18	44.441	28	97.956	40.324	28	82.69	1067	617
Central Kalahari Game Reserve	2 000	0.07	28.835	26	59.717	45.546	26	93.724	2339	1661
Khutse Game Reserve	104	0.05	113.04	7	291.72	121.23	7	287.32	172	36
Gemsbok National Park	120	0.01	175.34	18	362.29	180.64	18	379.95	281	-41

3.2.2.11 Lechwe

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe National Park	19	0	122.12	27	255.03	100.33	27	206.09	38	0
Moremi Game Reserve	13 779	2.97	12.805	28	28.225	19.002	28	38.967	15543	12015

3.2.2.12 Ostrich

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe National Park	128	0.02	44.519	49	90.141	51.87	49	104.34	185	71
Moremi Game Reserve	31	0.01	206.43	28	455.01	131.72	28	270.1	60	2
Nxai Pan National Park	93	0.13	76.288	3	196.87	87.94	3	283.57	164	22
Central Kalahari Game Reserve	2 618	0.09	28.459	26	58.938	37.755	26	77.691	3003	2233
Khutse Game Reserve	290	0.15	56.43	7	145.62	60.009	7	142.22	383	197
Gemsbok National Park	6 101	0.29	26.332	18	54.406	30.763	18	64.706	7254	4948
Mabuasehube Game Reserve	169	0.09	58.087	4	149.9	42.11	4	117.66	228	110

3.2.2.13 Roan

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe National Park	161	0.03	60.505	49	122.51	66.287	49	133.34	258	64
Moremi Game Reserve	18	0	271.02	28	597.39	176.91	28	362.78	42	-6

3.2.2.14 Sable

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe National Park	939	0.17	21.353	49	43.235	31.487	49	63.34	1116	762

3.2.2.15 Springbok

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Central Kalahari Game Reserve	303	0.01	84.908	26	175.84	125.67	26	258.61	560	46
Khutse Game Reserve	475	0.25	89.267	7	230.37	108.74	7	257.71	899	51
Gemsbok National Park	13 898	0.65	46.543	18	96.165	43.106	18	90.668	19889	7907

3.2.2.16 Steenbok

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe National Park	40	0.01	61.41	49	124.34	88.322	49	177.67	47	33
Moremi Game Reserve	19	0	268.78	28	592.46	176.79	28	362.52	25	13
Nxai Pan National Park	93	0.13	76.288	3	196.87	87.94	3	283.57	164	22
Central Kalahari Game Reserve	2 536	0.09	19.674	26	40.744	36.806	26	75.738	2887	2185
Gemsbok National Park	7 479	0.35	21.909	18	45.268	26.821	18	56.416	9118	5840
Mabuasehube Game Reserve	277	0.15	33.57	4	86.635	36.662	4	102.43	370	184

3.2.2.17 Tsessebe

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe National Park	41	0.01	69.004	49	139.71	81.359	49	163.66	61	21
Moremi Game Reserve	713	0.15	44.57	28	98.24	44.195	28	90.626	910	516

3.2.2.18 Warthog

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe National Park	91	0.02	46.32	49	93.788	62.815	49	126.36	99	83
Moremi Game Reserve	380	0.08	68.546	28	151.08	58.638	28	120.24	466	294
Central Kalahari Game Reserve	171	0.01	84.392	26	174.77	149.24	26	307.1	233	109

3.2.2.19 Wildebeest

District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe National Park	1 951	0.35	72.896	22	152.75	75.641	22	157.04	3373	529
Moremi Game Reserve	194	0.04	104.19	28	229.66	71.313	28	146.23	332	56
Central Kalahari Game Reserve	997	0.03	71.585	26	148.25	91.832	26	188.96	1249	745
Gemsbok National Park	5 424	0.25	52.248	18	107.95	47.638	18	100.2	7083	3765

3.2.2.20 Zebra

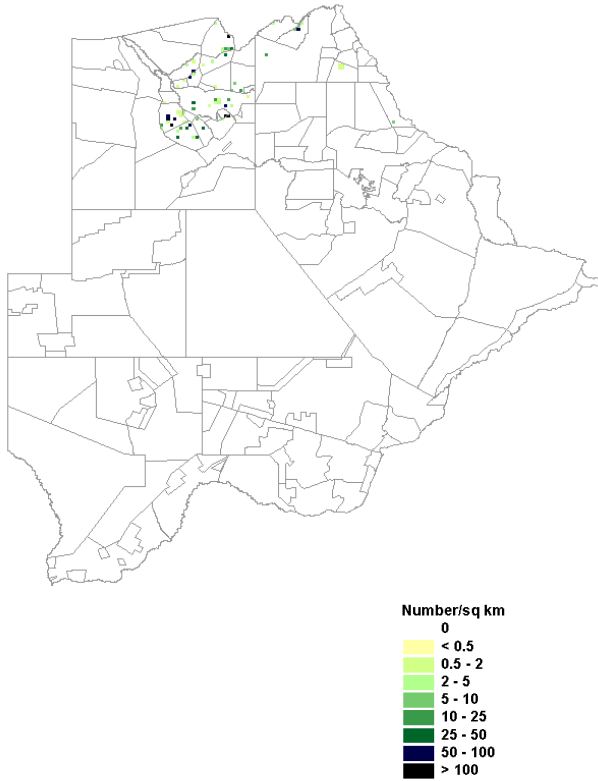
District	Estimated	Density	% JXSE	JXSE N	JX95CI %	% JYSE	JYSE N	JY95CI %	Max Est.	Min Est.
Chobe National Park	596	0.11	63.221	27	132.02	65.437	27	134.41	749	443
Moremi Game Reserve	3 668	0.79	37.567	28	82.804	29.607	28	60.712	4324	3012

3.3 WILDLIFE DISTRIBUTION AND TRENDS

In this section an account of the distribution and abundance of wildlife species is presented. Each species account shows the distribution pattern derived from animal sightings, displaying density in numbers per square kilometres; and a brief descriptive text accompanies each map. A population trend for a 20 year period from 1992 to 2012 is also presented. For convenience, the countrywide estimate for each species is indicated as well as the proportion found per district during the 2012 aerial survey. The direction and magnitude (% change) of population trends is also indicated.

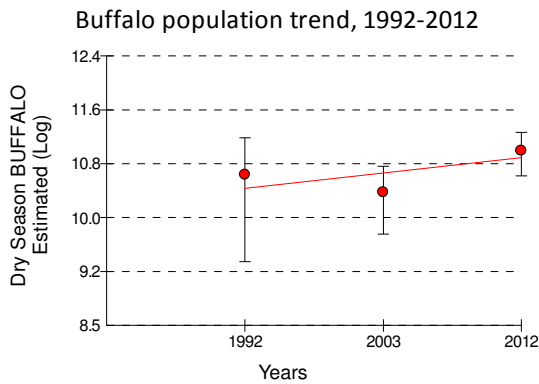
Buffalo

Distribution and abundance

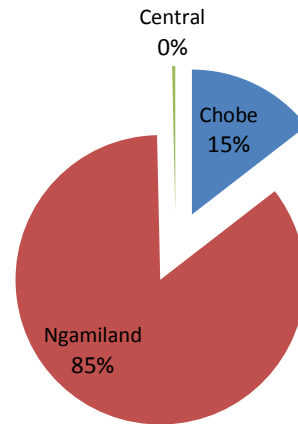


The species only occurred in the north of Botswana and was mainly found in the Okavango Delta, extending eastwards to the Chobe riverfront in Chobe National Park. Some animals were also counted along the Zimbabwe border.

Buffalo estimate, 2012	% Change, 1992-2012
61 105	42 (Not significant)

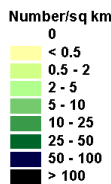
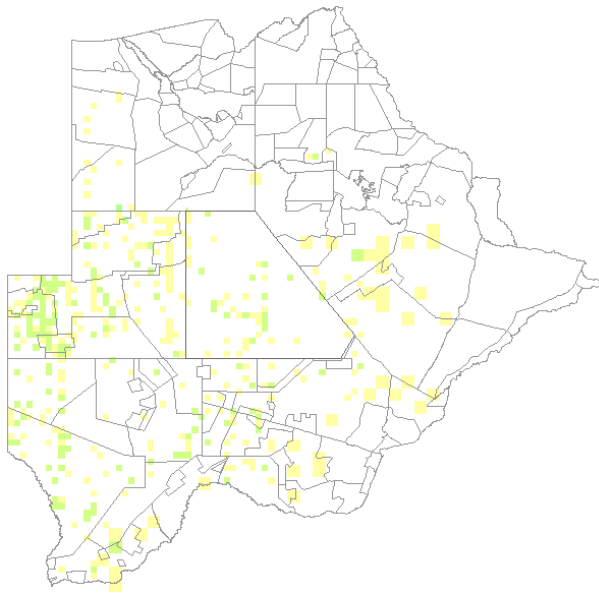


Proportion of population by District



Duiker

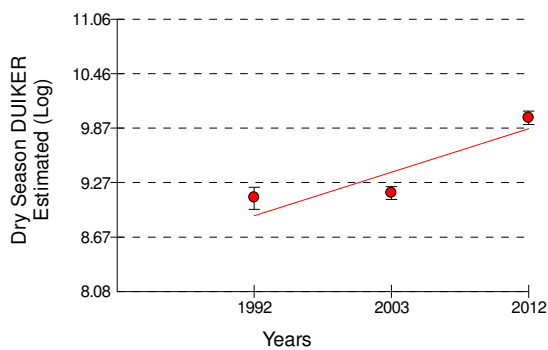
Distribution and abundance



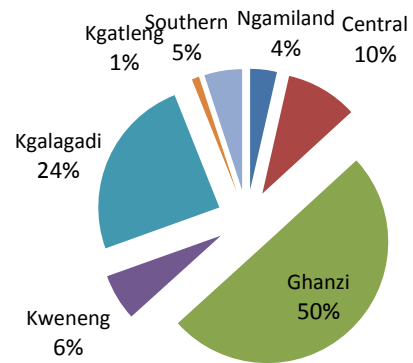
Duiker occurred throughout the country, mainly in the Kalahari ecosystem especially the western parts of Ghanzi District. It is, however, generally difficult to observe duiker from the air as sightability of this species may be affected by variation in vegetation as well as consistency among observers.

Duiker estimate, 2012	% Change, 1992-2012
21 608	140 (Not Significant)

Duiker population trend, 1992-2012

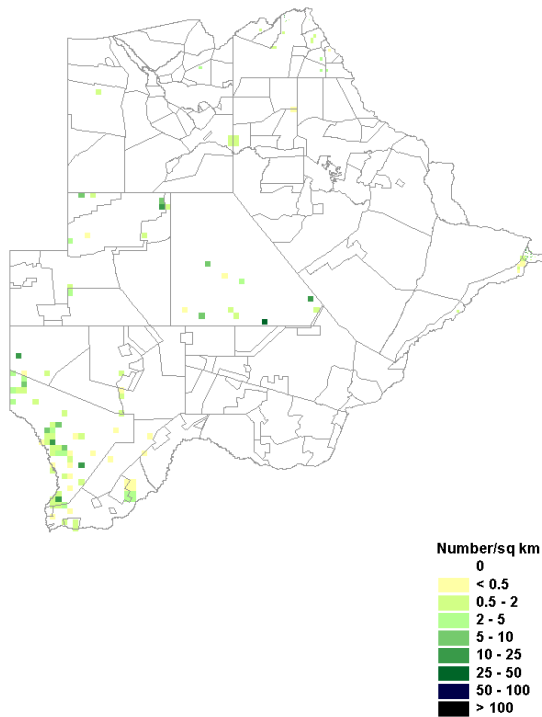


Proportion of population by District



Eland

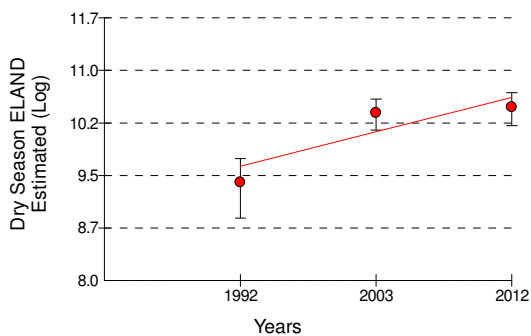
Distribution and abundance



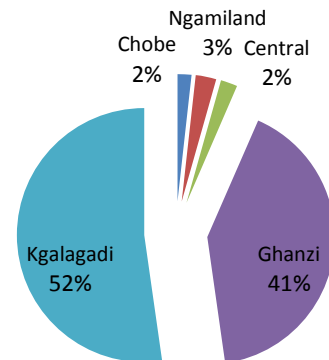
Most of the elands were found in and around Gemsbok National Park, Central Kalahari Game Reserve and other parts of Ghanzi District. Small populations occurred in Chobe District, Ngamiland and Northern Tuli Game Reserve.

Eland estimate, 2012	% Change, 1992-2012
34 735	191 (Not Significant)

Eland population trend, 1992-2012

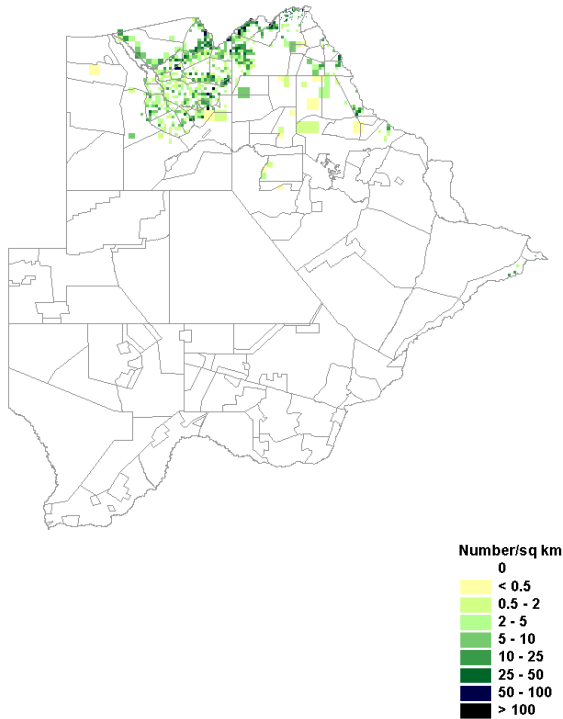


Proportion of population by District



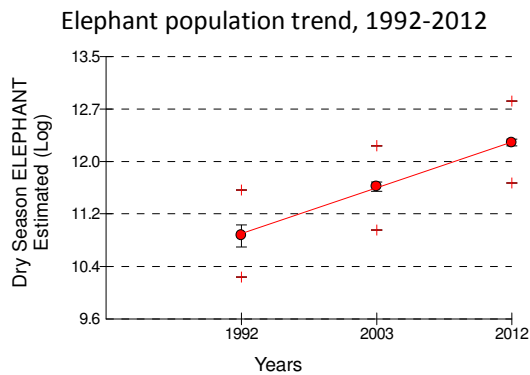
Elephant

Distribution and abundance

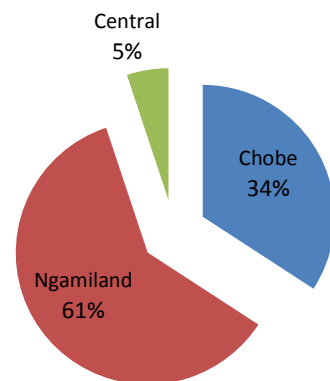


Elephants occurred in northern Botswana with strongholds in Ngamiland and Chobe. Historically, elephants in northern Botswana were never found south of the 20th parallel. During the 2012 survey, however, some herds were sighted in Makgadikgadi Pans National Park. Another elephant population was found in northern Tuli Block, although the number there is relatively small.

Elephant estimate, 2012	% Change, 1992-2012
207 545	297 (Significant)

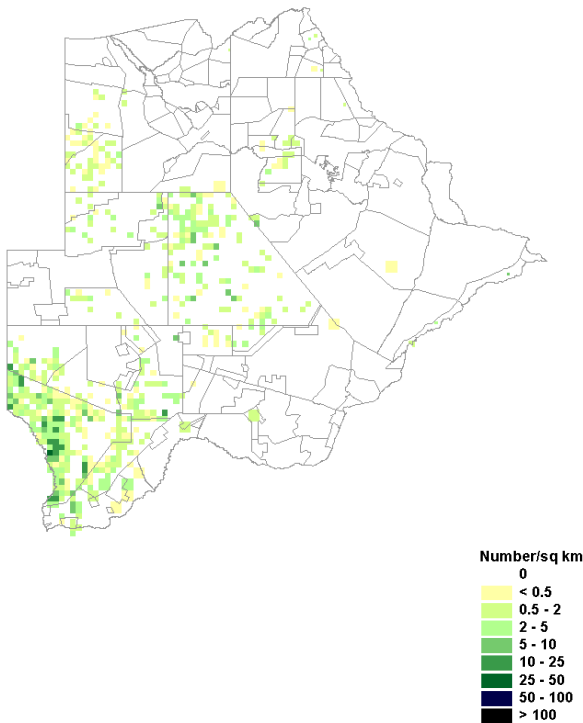


Proportion of population by District



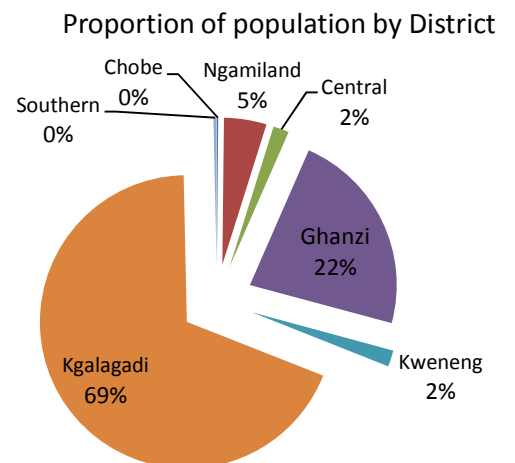
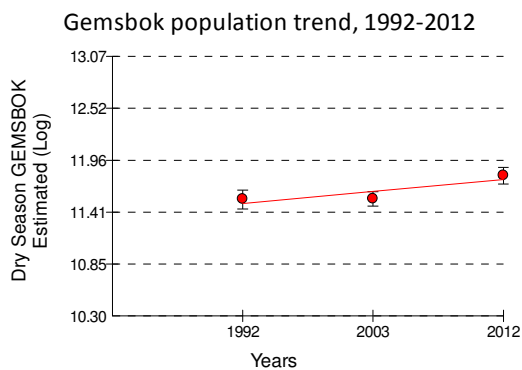
Gemsbok

Distribution and abundance



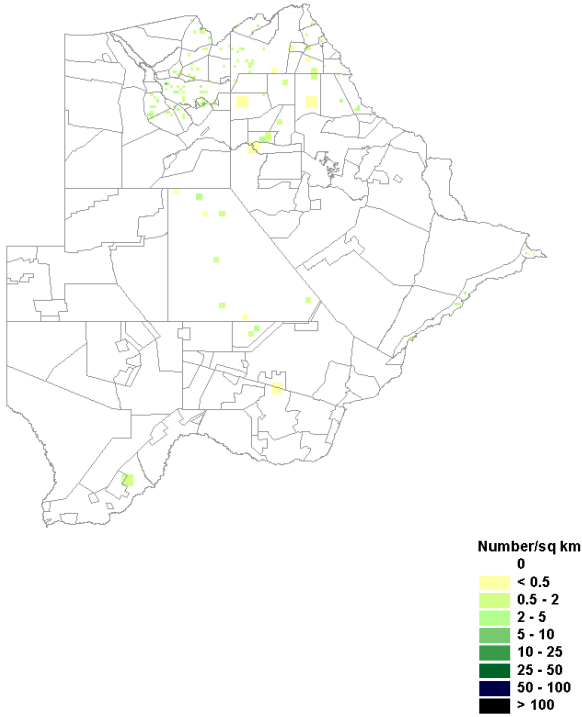
Gemsboks were distributed throughout the Kalahari ecosystem with relatively high concentrations in Gemsbok National Park and Central Kalahari Game Reserve. Other populations occurred in south western Ngamiland and inside Makgadikgadi and Nxai Pans National Parks. Small isolated populations were found in a few Forest Reserves in Chobe.

Gemsbok estimate, 2012	% Change, 1992-2012
133 249	29 (Not Significant)



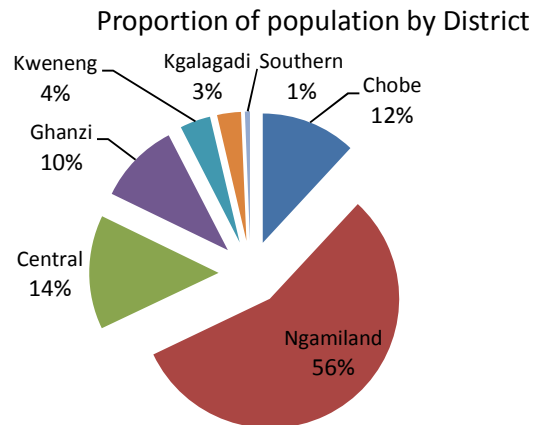
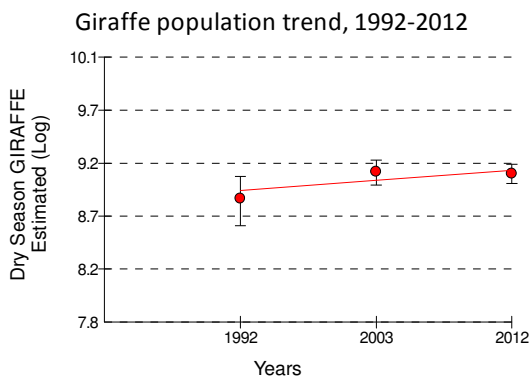
Giraffe

Distribution and abundance



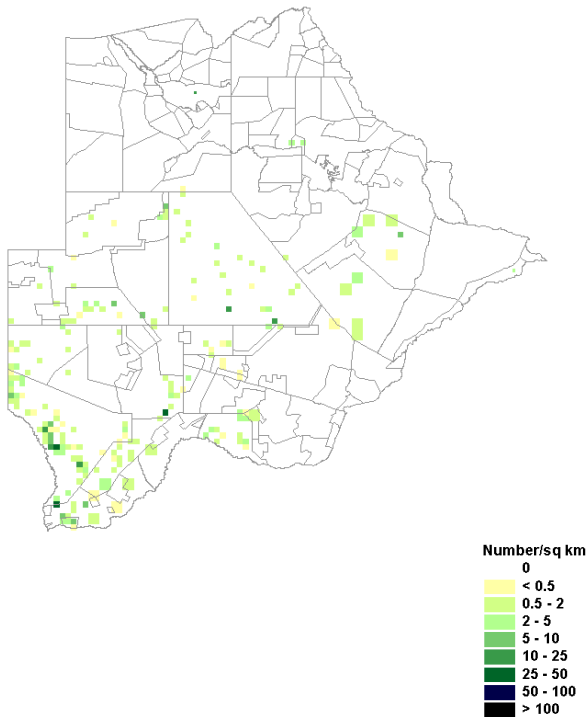
Giraffe was distributed from the Okavango Delta spreading eastwards to the Zimbabwe border. They were also found in the Central Kalahari and Khutse Game Reserves, as well as Tuli Block. Some outliers were spotted in ranches bordering Khawa Wildlife Management Area and along the border between Kweneng and Southern Districts.

Giraffe estimate, 2012	% Change, 1992-2012
8 976	25 (Not Significant)



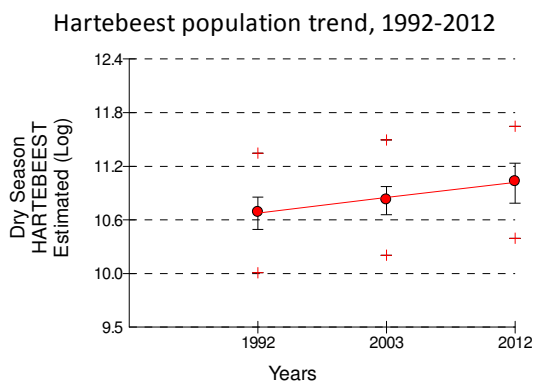
Hartebeest

Distribution and abundance

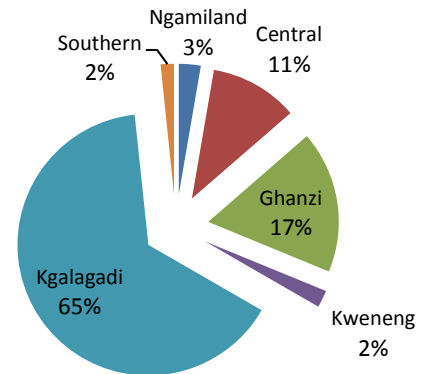


Hartebeests were distributed throughout the Kalahari ecosystem but extending eastwards into parts of the Central District. Some animals were also found inside Moremi Game Reserve and an area adjacent to Makgadikgadi and Nxai Pans National Parks.

Hartebeest estimate, 2012	% Change, 1992-2012
62 569	40 (Not Significant)

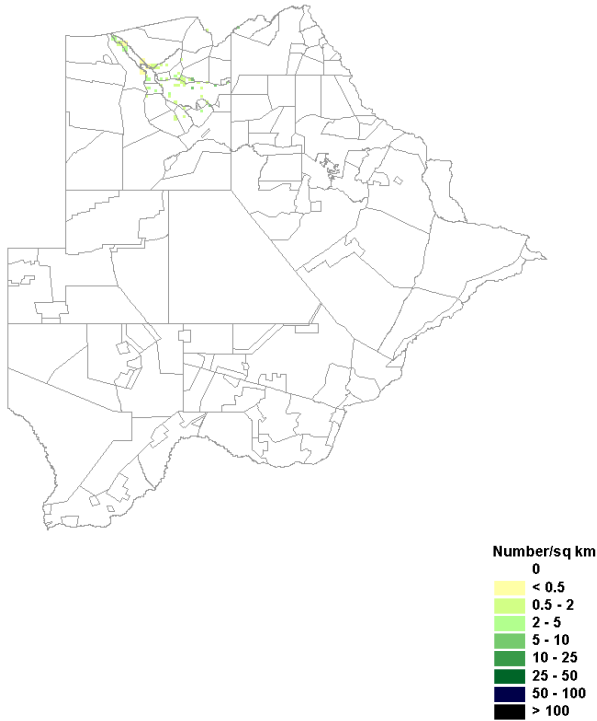


Proportion of population by District



Hippo

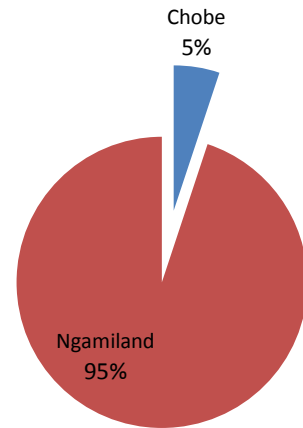
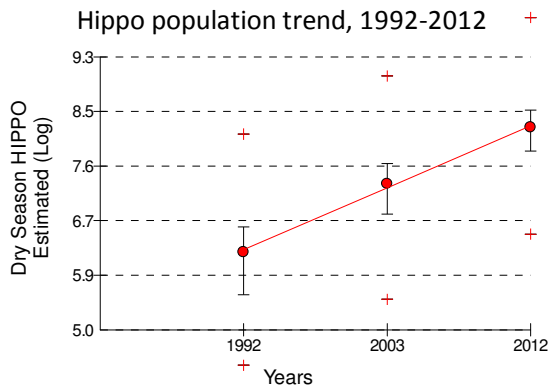
Distribution and abundance



Although Hippos were only observed in the Okavango river and delta, they also occur in the Chobe-Linyanti-Kwando river system. They tend to be under-counted by aerial surveys due to their aquatic habits.

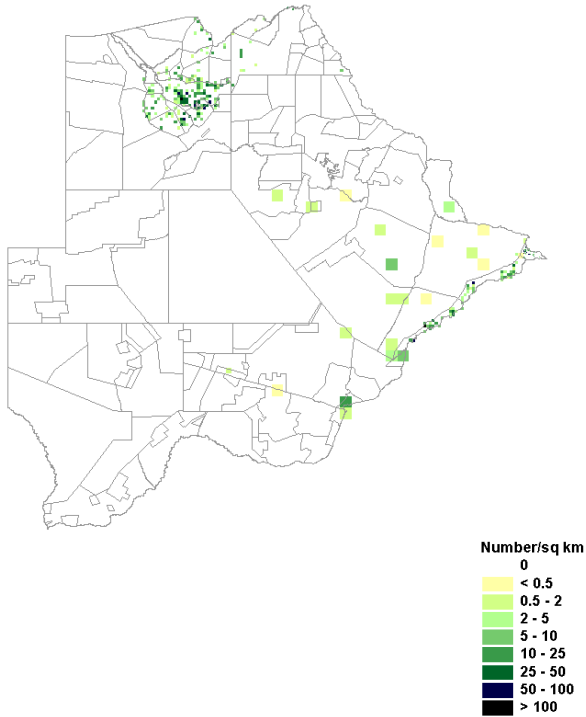
Hippo estimate, 2012	% Change, 1992-2012
3 633	627 (Significant)

Proportion of population by District



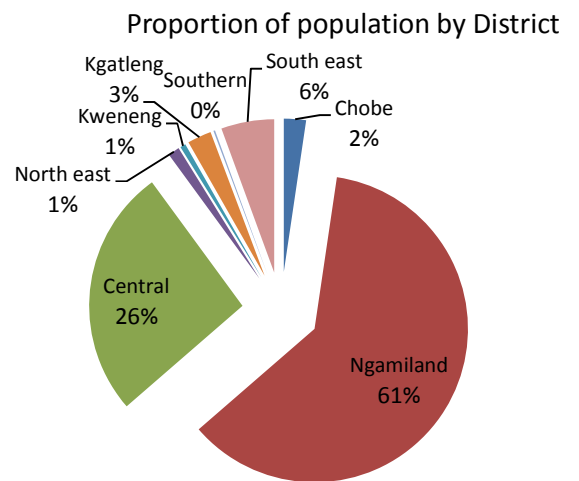
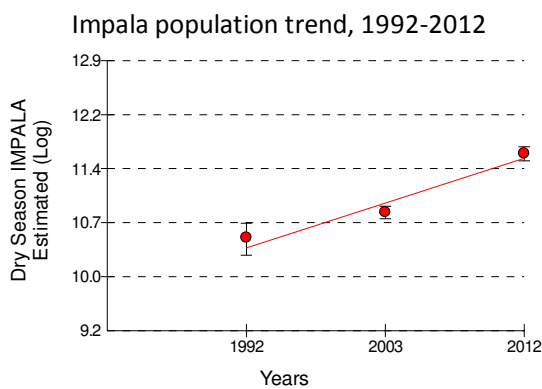
Impala

Distribution and abundance



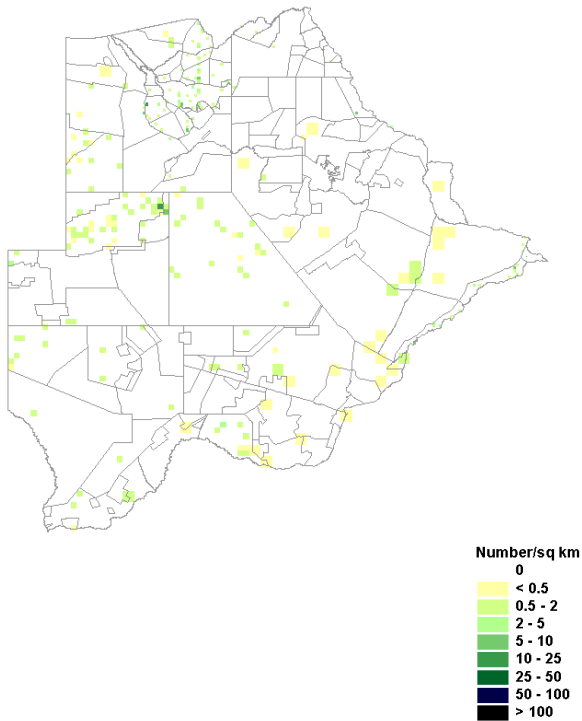
Impala were distributed in the north and east of the country. Most of the animals in the north were concentrated in the Okavango Delta, while those in the east mainly occurred in Tuli Block. The rest were thinly distributed in the North East District and across the Central District. Other populations were found in Kweneng, Kgatleng, Southern and South East Districts.

Impala estimate, 2012	% Change, 1992-2012
114 900	216 (Not Significant)



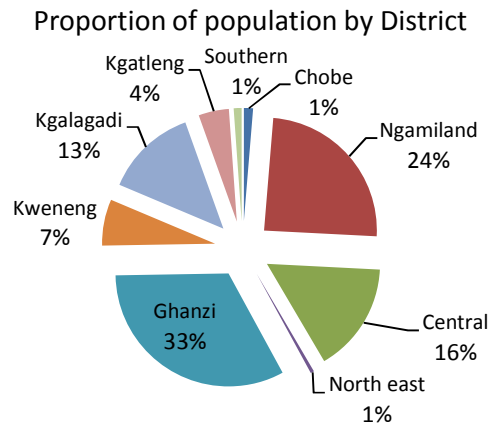
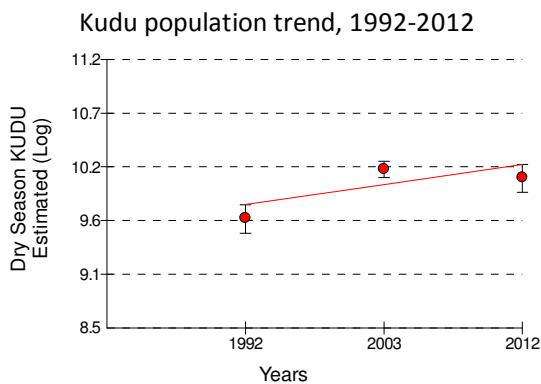
Kudu

Distribution and abundance



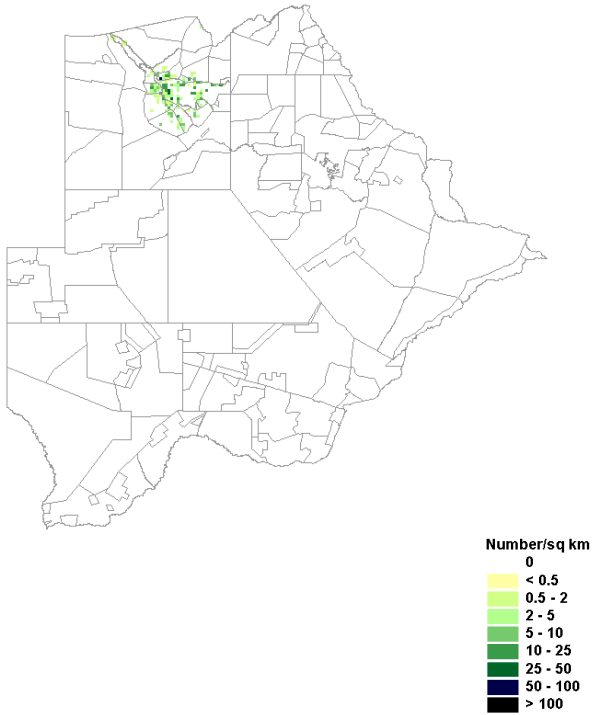
Kudu were almost evenly distributed throughout Botswana. The species, however, tends to be under-estimated as it is cryptic and difficult to spot from the air.

Kudu estimate, 2012	% Change, 1992-2012
23 038	50 (Not Significant)



Lechwe

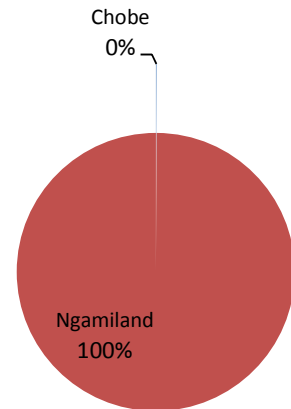
Distribution and abundance



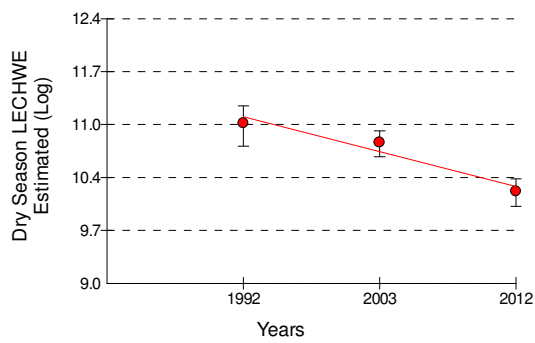
Lechwe was only observed in the Okavango Delta although the species also occurs in the Chobe-Linyanti-Kwando river system.

Lechwe estimate, 2012	% Change, 1992-2012
26 322	-59 (Not Significant)

Proportion of population by District

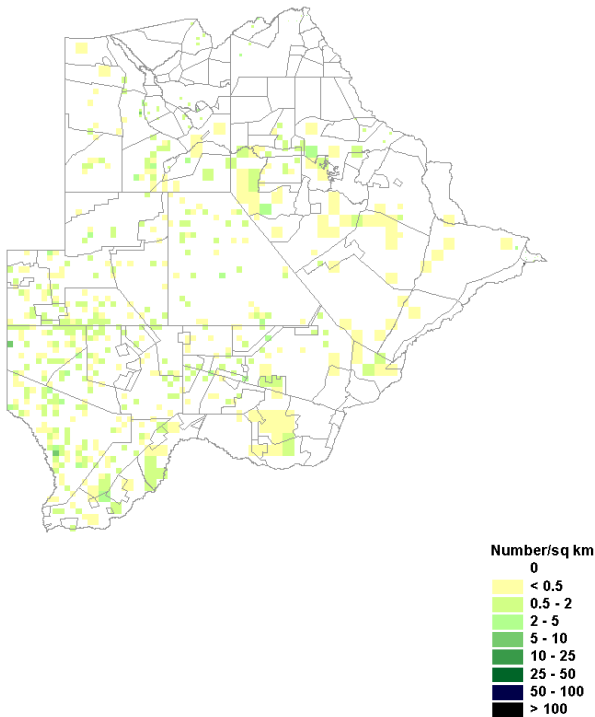


Lechwe population trend, 1992-2012



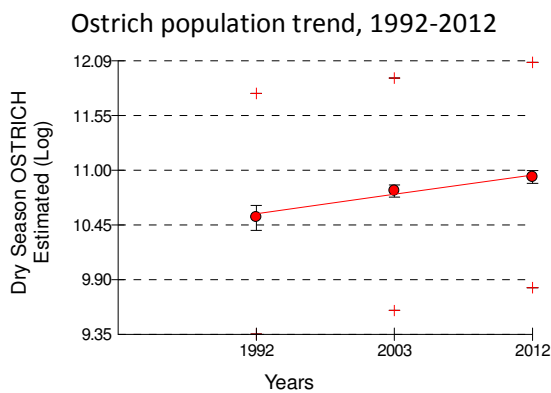
Ostrich

Distribution and abundance

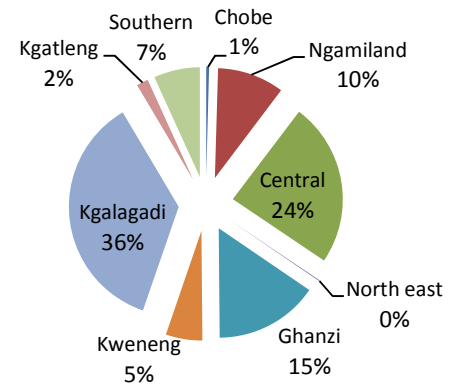


Ostrich were distributed throughout Botswana, with the exception of the northern parts including Chobe District and parts of Ngamiland District where they were not so common.

Ostrich estimate, 2012	% Change, 1992-2012
55 916	50 (Not Significant)

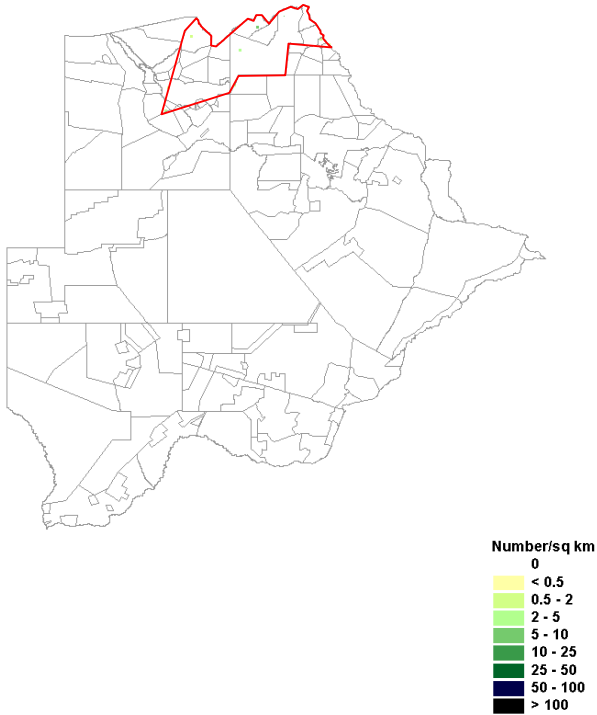


Proportion of population by District



Roan

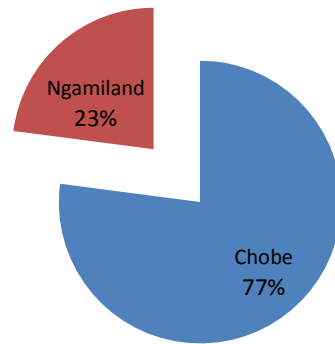
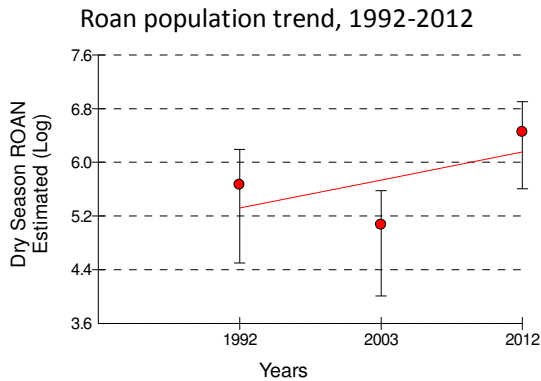
Distribution and abundance



This species was distributed within its known range of northern Ngamiland and Chobe District. Roan is a protected species and occurs in low numbers.

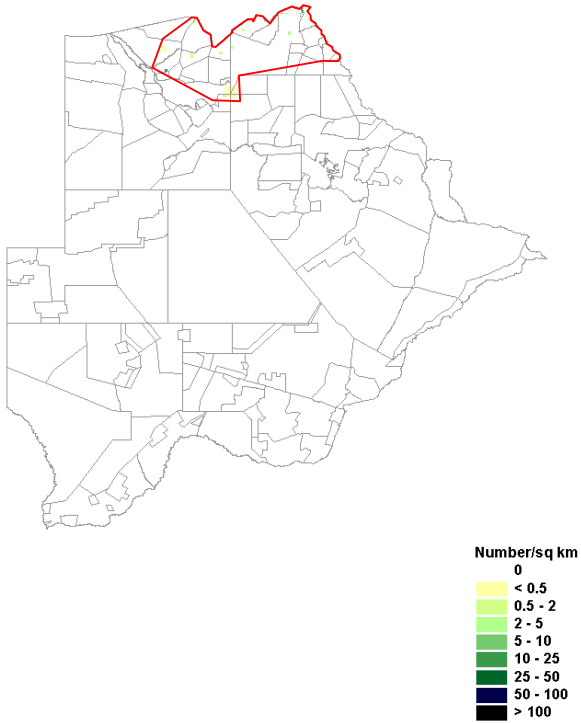
Roan estimate, 2012	% Change, 1992-2012
615	117 (Not Significant)

Proportion of population by District



Sable

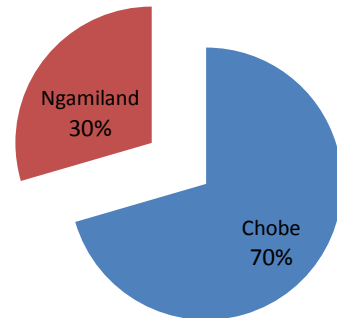
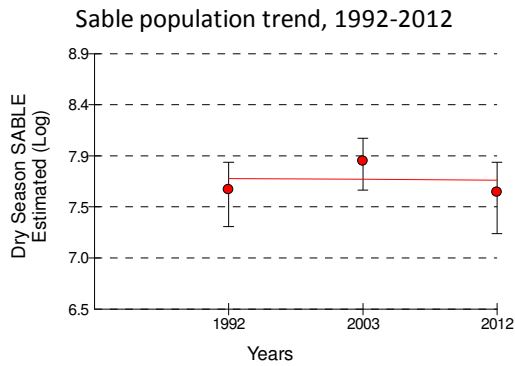
Distribution and abundance



Sable had a more or less similar distribution to roan but was sighted in more numbers.

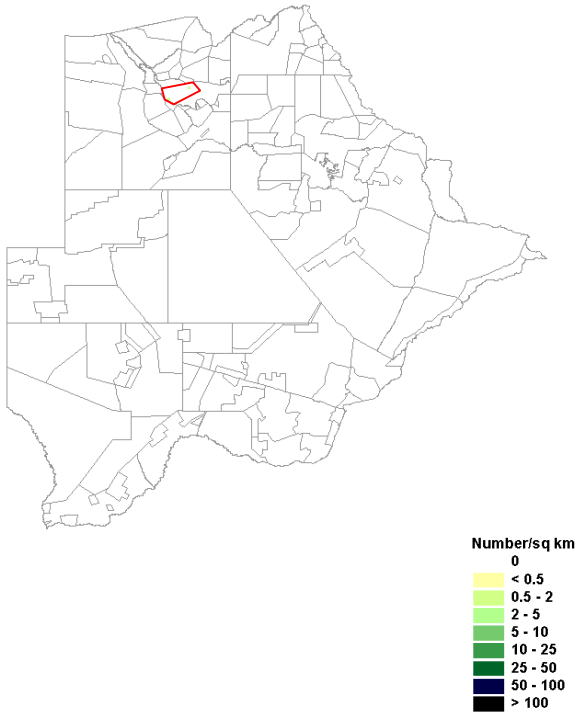
Sable estimate, 2012	% Change, 1992-2012
1 989	-2 (Not Significant)

Proportion of population by District



Sitatunga

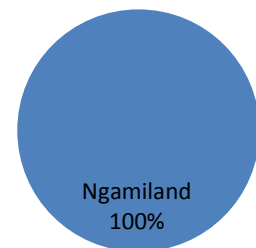
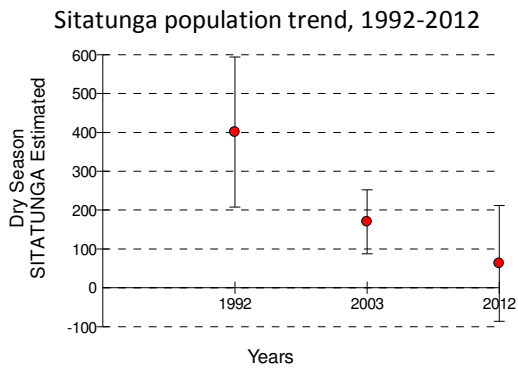
Distribution and abundance



Sitatunga were restricted to the Okavango Delta with only 63 individuals counted in 2012. It has been demonstrated that this species tends to be underestimated in aerial surveys (Bonifica, 1992).

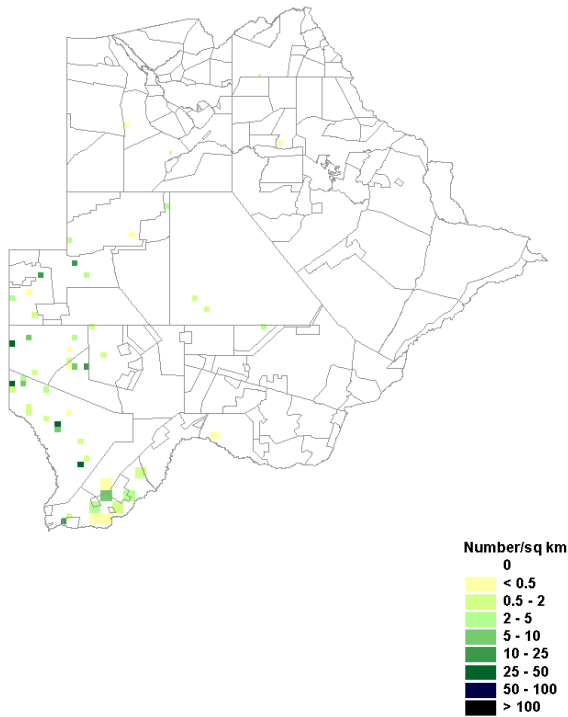
Sitatunga estimate, 2012	% Change, 1992-2012
63	-84

Proportion of population by District



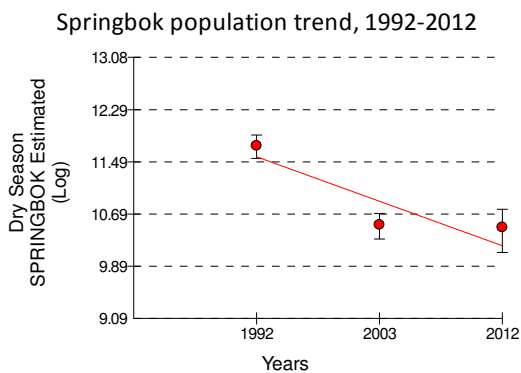
Springbok

Distribution and abundance

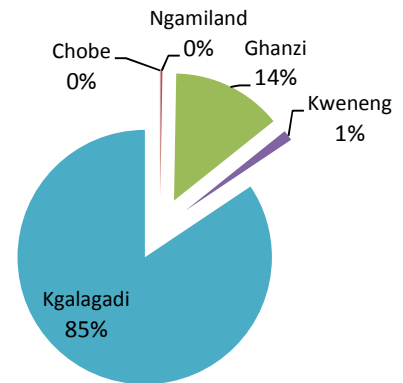


Springbok distribution was almost entirely restricted to Kgalagadi and Ghanzi Districts, unlike in the previous country-wide survey, when the species was also found in Southern; central; and some parts of Ngamiland District.

Springbok estimate, 2012	% Change, 1992-2012
35 688	-71 (Not Significant)

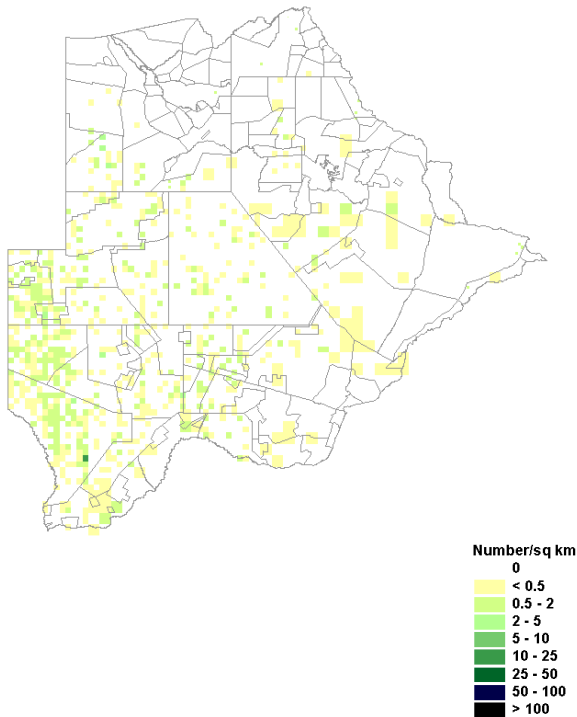


Proportion of population by District



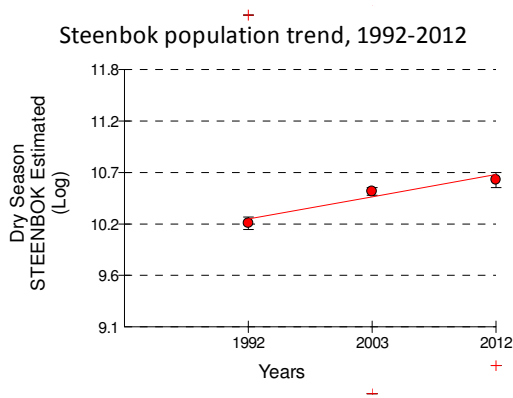
Steenbok

Distribution and abundance

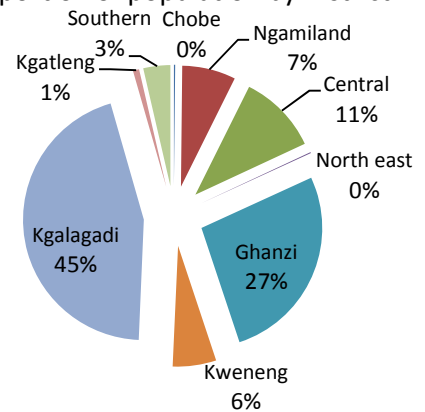


Steenbok were found throughout the country but mostly in the Kalahari ecosystem. They were less commonly found in the eastern and northern parts of the country. Like duiker, this species is difficult to count from the air due to their small size and tendency to take refuge in vegetation and burrows during the course of a survey.

Steenbok estimate, 2012	% Change, 1992-2012
41 531	57 (Not Significant)

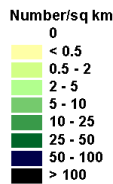
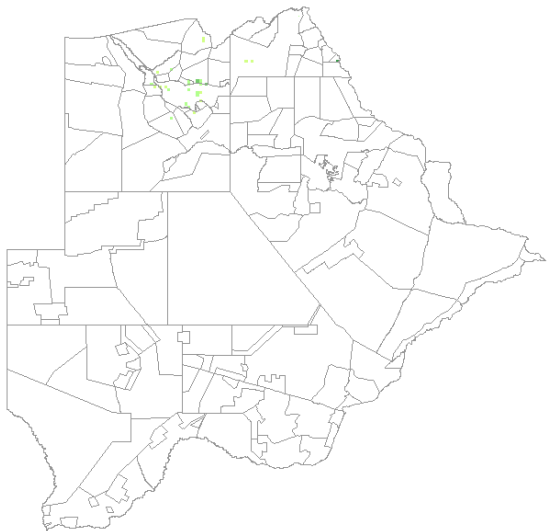


Proportion of population by District



Tsessebe

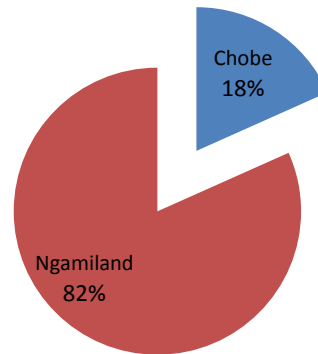
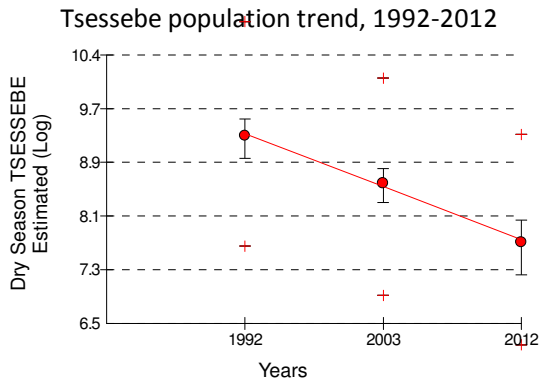
Distribution and abundance



Tsessebe were found in the Okavango Delta, Linyanti-Kwando system and Savuti area in Chobe National Park. Most of the animals were concentrated inside Moremi Game Reserve.

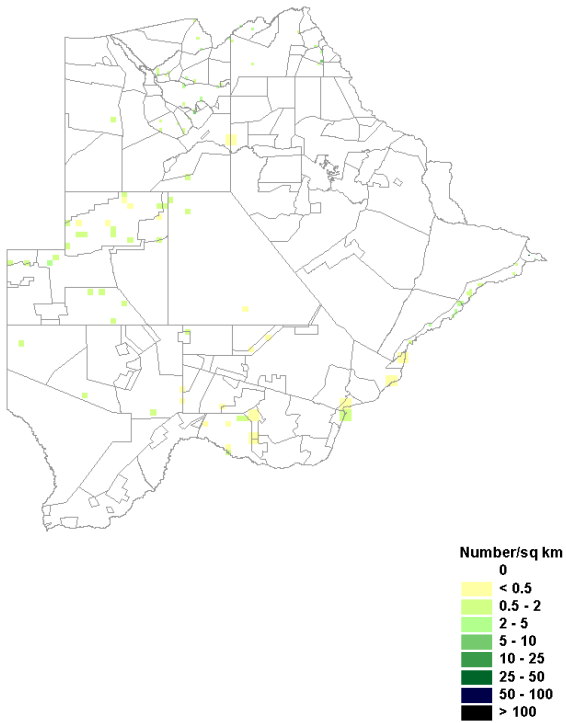
Tsessebe estimate, 2012	% Change, 1992-2012
2 138	-79 (Significant)

Proportion of population by District



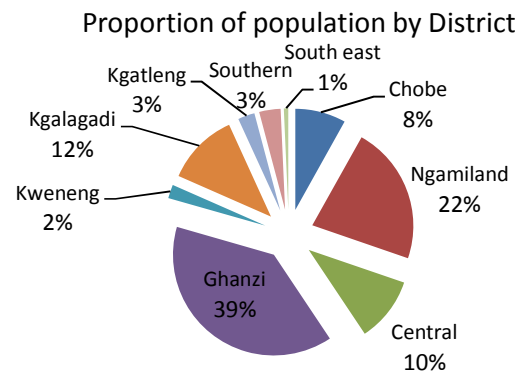
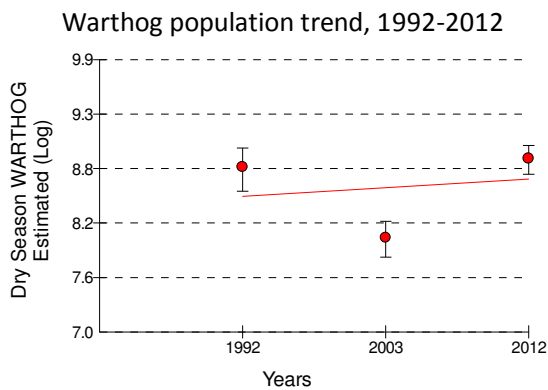
Warthog

Distribution and abundance



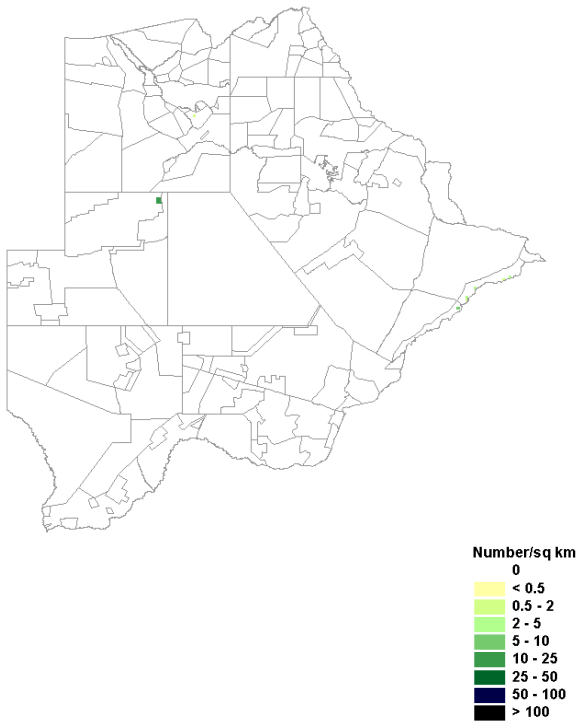
Warthog was sparsely distributed in Ghanzi, Ngamiland and Kgalagadi Districts. They also occurred in Tuli Block and South East District. The stronghold for this species appeared to be the Ghanzi District, unlike in the past when they also occurred in the Okavango Delta in relatively large numbers.

Warthog estimate, 2012	% Change, 1992-2012
7 026	9 (Not Significant)



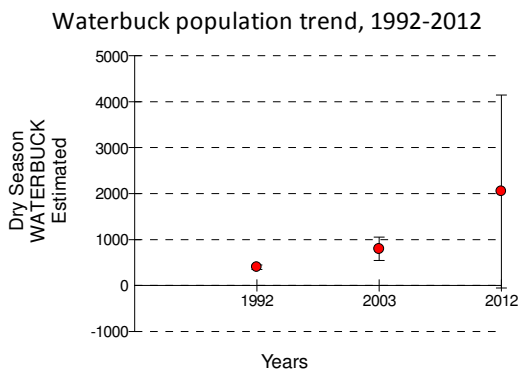
Waterbuck

Distribution and abundance

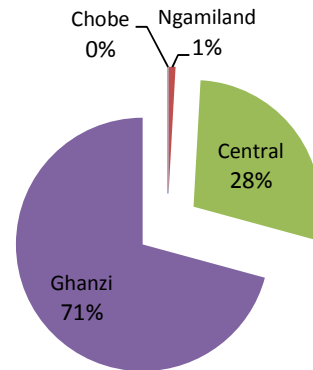


A relatively large concentration of waterbuck was found in the north eastern part of Ghanzi farms. The rest were mostly found in the Tuli Block along Limpopo River and a few at the edge of the Okavango Delta. The species does occur along the Chobe River in northern Botswana but was not sighted during the 2012 aerial survey.

Waterbuck estimate, 2012	% Change, 1992-2012
2 048	416

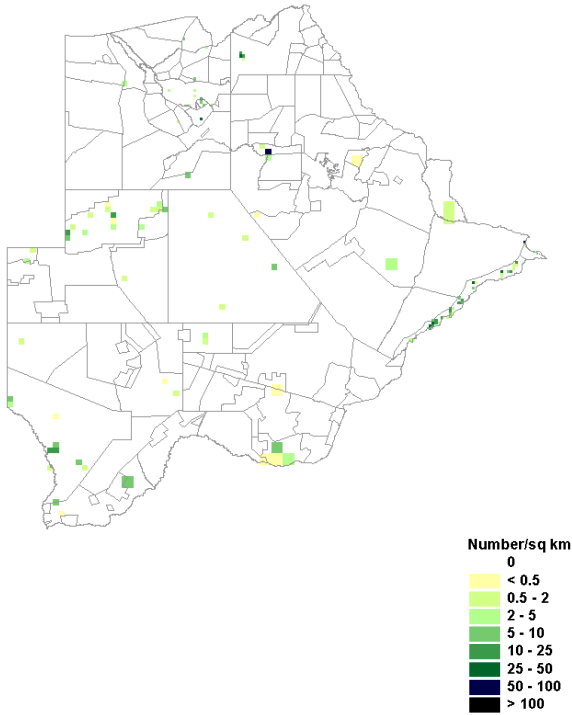


Proportion of population by District



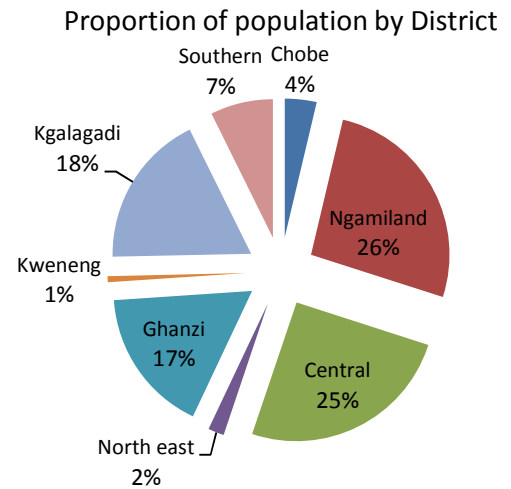
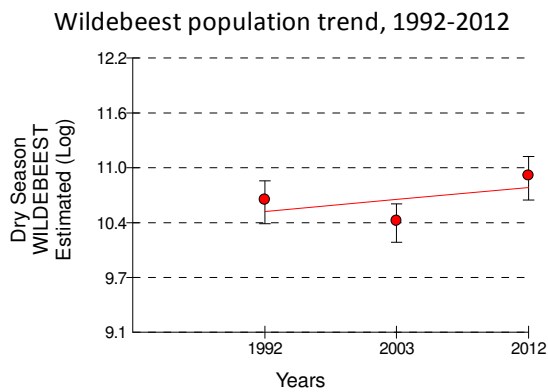
Wildebeest

Distribution and abundance



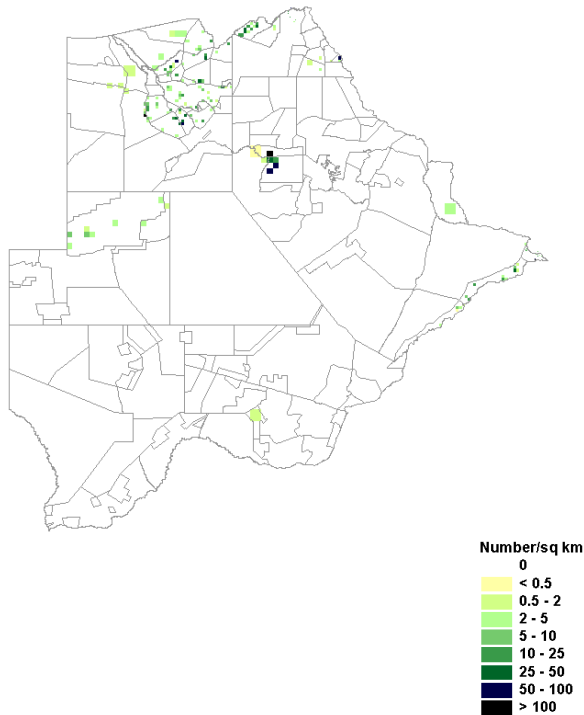
Wildebeest were distributed throughout the Kalahari ecosystem as well as Makgadikgadi Pans, Ngamiland, Central, North East and Chobe Districts. The population in the Central District was concentrated in Tuli Block.

Wildebeest estimate, 2012	% Change, 1992-2012
53 159	31 (Not Significant)



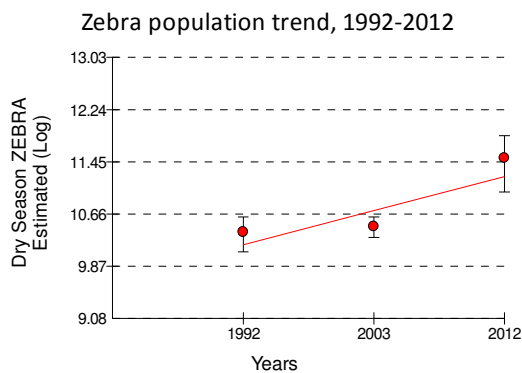
Zebra

Distribution and abundance

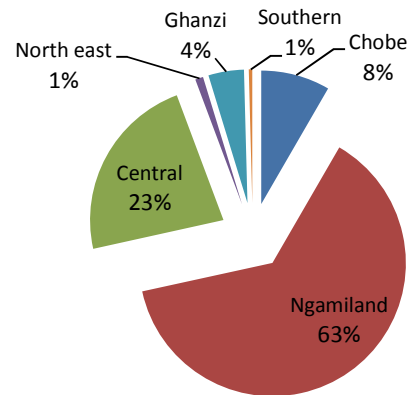


Zebras occurred in the north of the country, with the main distribution stretching from the Okavango Delta towards Chobe District. The zebras in the east of Chobe were found towards the Zimbabwe border while a large concentration occurred in Makgadikgadi Pans National Park. The species also occurred in Tuli Block and a few were found in North East and Southern Districts as well as some in Ghanzi farms.

Zebra estimate, 2012	% Change, 1992-2012
99 077	207 (Not Significant)



Proportion of population by District

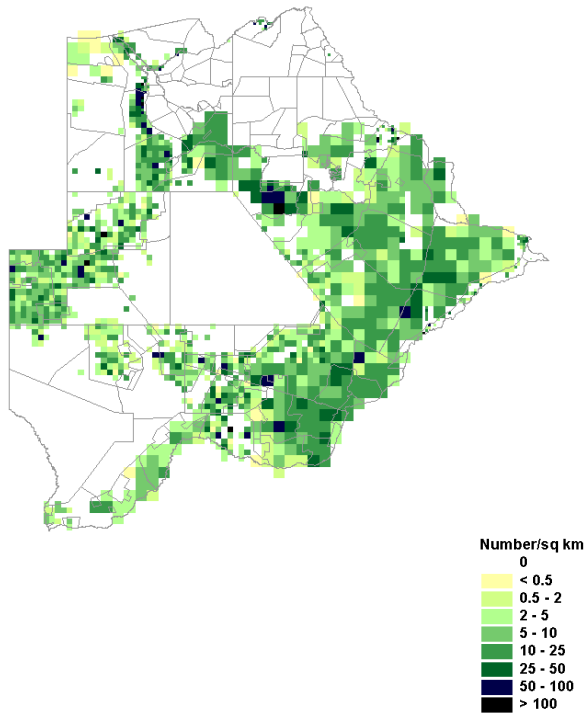


3.4 LIVESTOCK DISTRIBUTION AND TRENDS

Livestock constitutes most of the herbivore biomass in Botswana and this section gives an account of the distribution and abundance of cattle, donkey, horse, as well as sheep and goats. The countrywide estimates, population trends and proportions for each administrative district are also presented, adopting the same format used for wildlife species.

Cattle

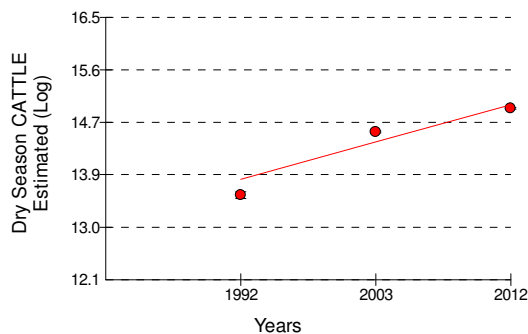
Distribution and abundance



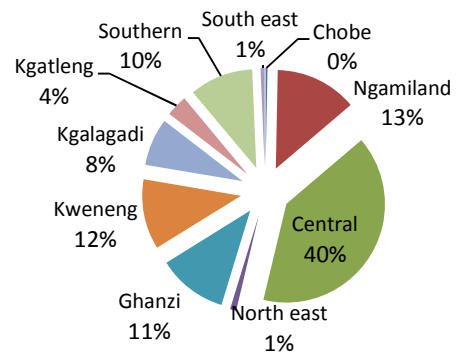
Cattle were widespread in Central, North East, Southern, Kweneng and Kgatleng Districts. In Kgalagadi they were concentrated around Matsheng villages and along the Trans-Kalahari road in the north; but were mainly distributed along the South African border in the south. In Ghanzi, cattle were concentrated in the Ghanzi farms, Xanagas farms and were also distributed along the Namibian border to Ncojane. For Ngamiland, cattle were mainly distributed to the south and west of Maun; with some concentrations along Maun-Ghanzi, Maun-Shakawe and Maun-Nata roads. In Chobe, cattle were only found in the Chobe Enclave and one or two areas in the east. Most of the Chobe District was, however, almost devoid of any cattle.

Cattle estimate, 2012	% Change, 1992-2012
3 137 477	322 (Not Significant)

Cattle population trend, 1992-2012

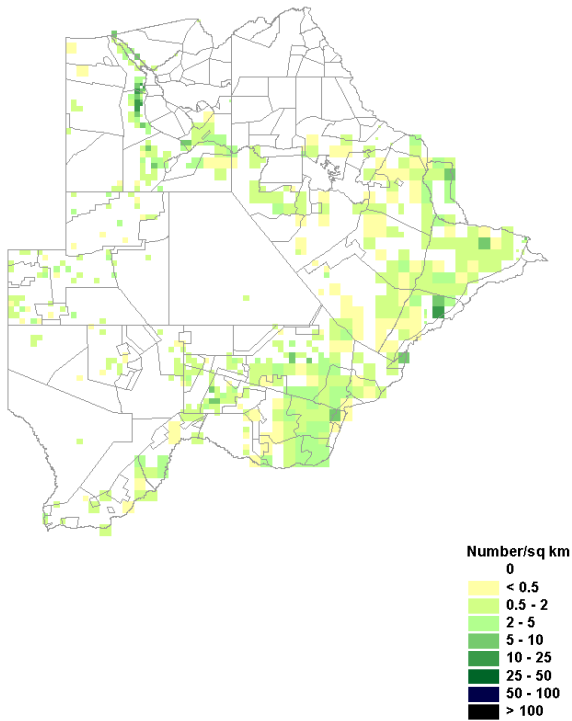


Proportion of population by District



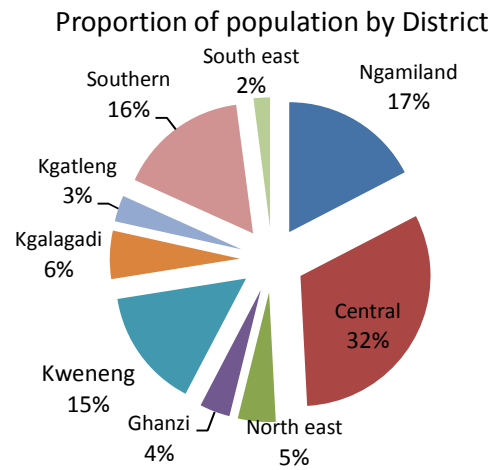
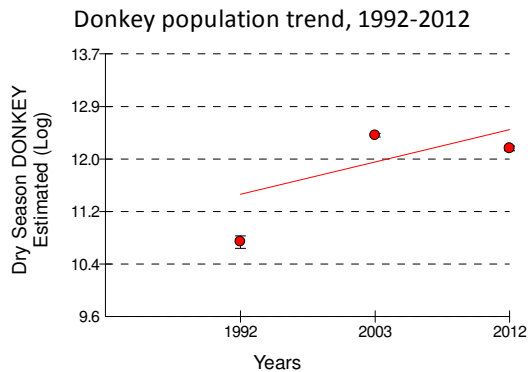
Donkey

Distribution and abundance



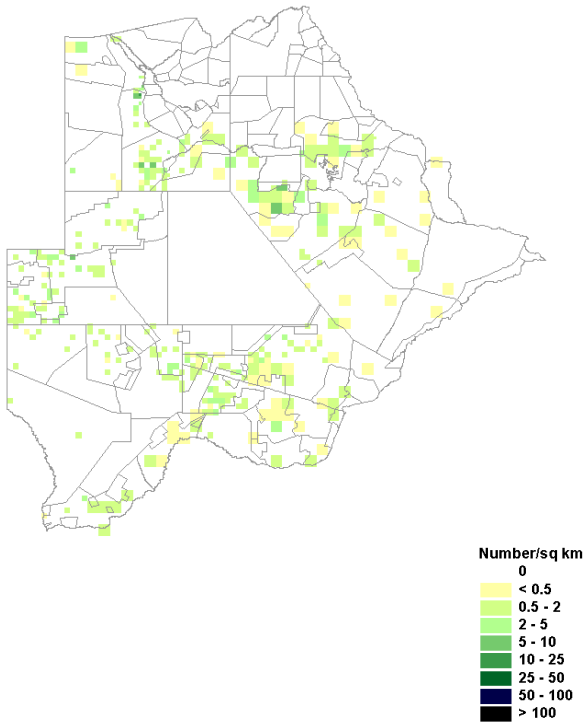
Donkey distribution was broadly similar to that of cattle.

Donkey estimate, 2012	% Change, 1992-2012
201 481	330 (Not Significant)



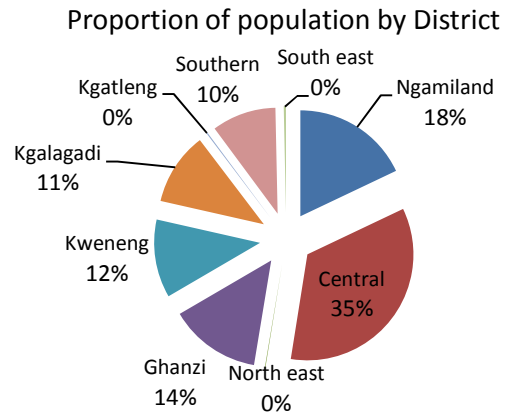
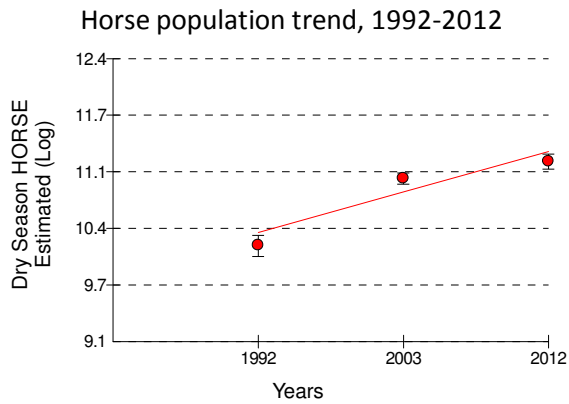
Horse

Distribution and abundance



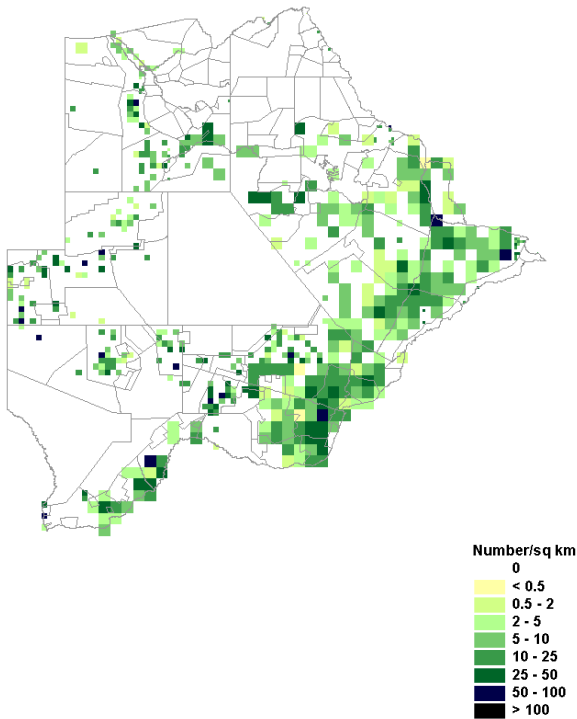
Horses were generally found within the limits of cattle distribution, but numbers were smaller in the eastern parts of the country.

Horse estimate, 2012	% Change, 1992-2012
72 211	171 (Not Significant)



Sheep and goats

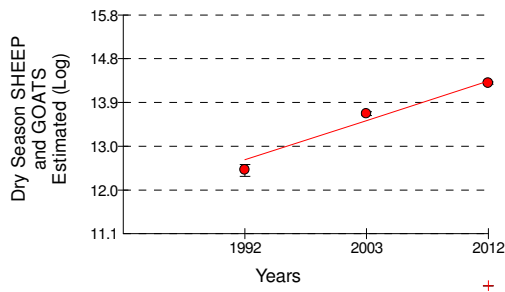
Distribution and abundance



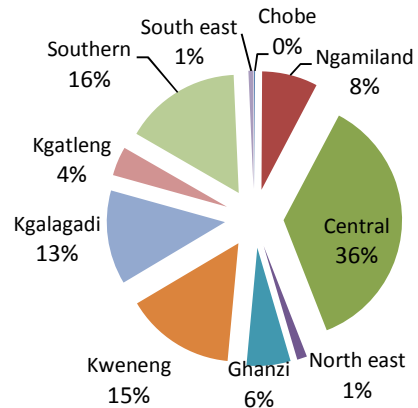
The distribution of sheep and goats was similar to that of cattle. The main concentration was, however, in the eastern parts of the country.

Sheep and Goats estimate, 2012	% Change, 1992-2012
1 652 748	545 (Not Significant)

Sheep and goats⁺ population trend, 1992-2012



Proportion of population by District

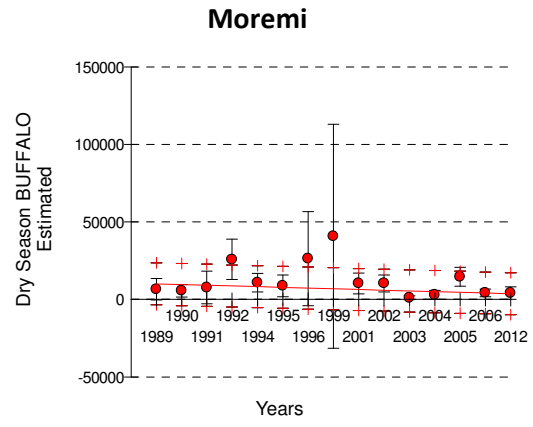
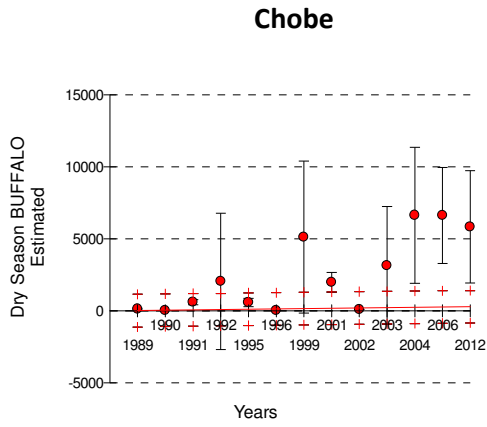


4.0 POPULATION TRENDS OF SELECTED WILDLIFE SPECIES IN PROTECTED AREAS

This section presents population trends for some wildlife species in Botswana's Protected Areas. The population trends were derived from aerial survey data dating back to 1987 and charts were plotted with each year's estimate and its 95% Confidence Interval. A statistically recommended trend line was generated using a Weighted Least Squares (WLS) fitting procedure. The WLS method was adopted because it can efficiently use small data sets and handle regression situations in which the data points are of varying quality (NIST/SEMATECH e-Handbook of Statistical Methods, 2013). Hence, less influence was attached to wildlife estimates having a larger degree of uncertainty.

Buffalo

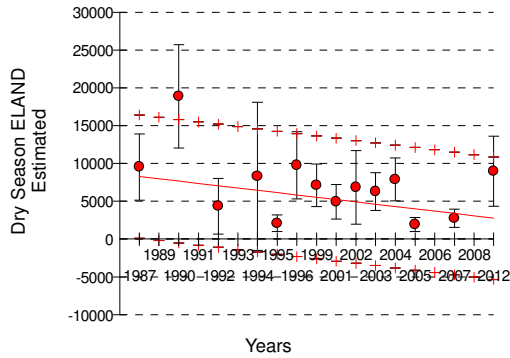
Buffalo numbers significantly increased in Chobe National Park but decreased in Moremi Game Reserve. The latter trend was not significant.



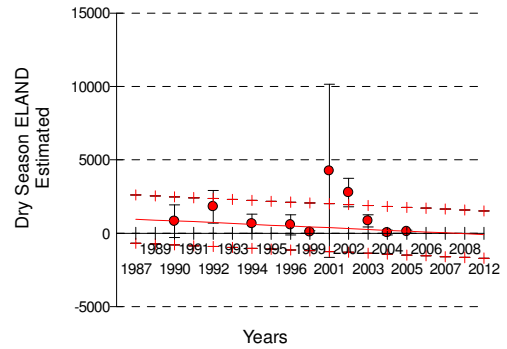
Eland

Eland populations showed a downward trend in CKGR, Khutse and Mabuasehube but increased in Gemsbok National Park and Chobe National Park. None of the trends was, however, significant.

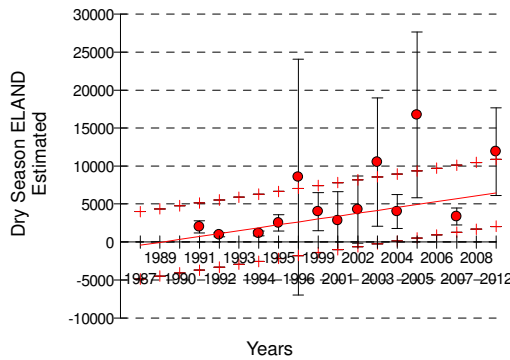
CKGR



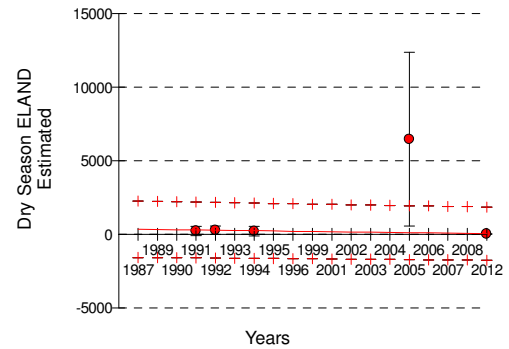
Khutse



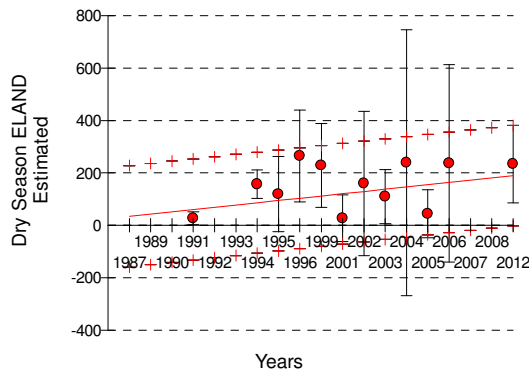
Gemsbok NP



Mabuasehube

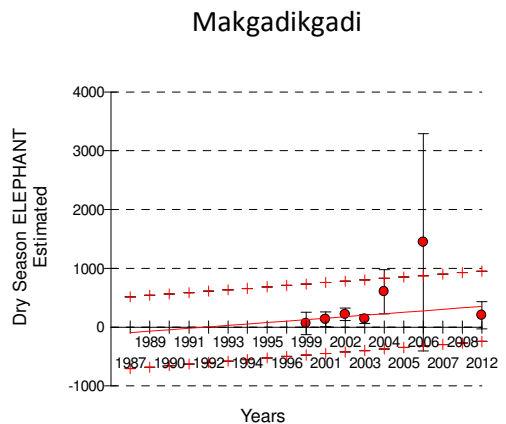
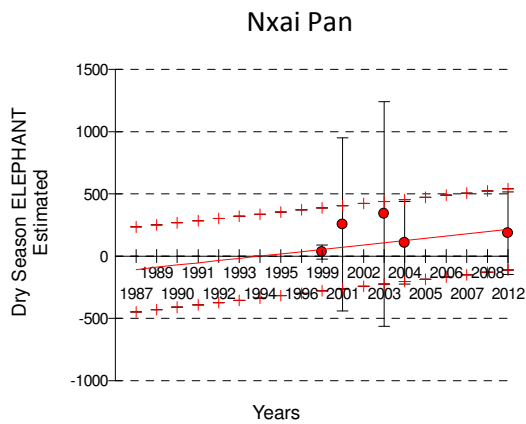
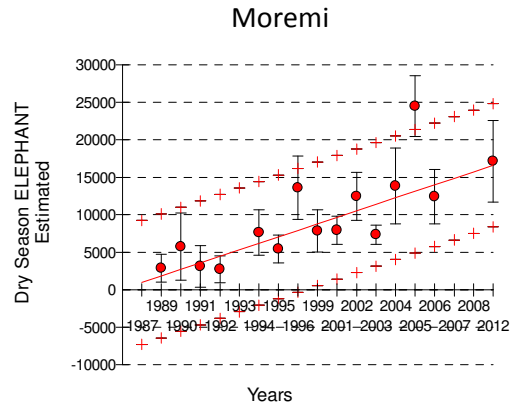
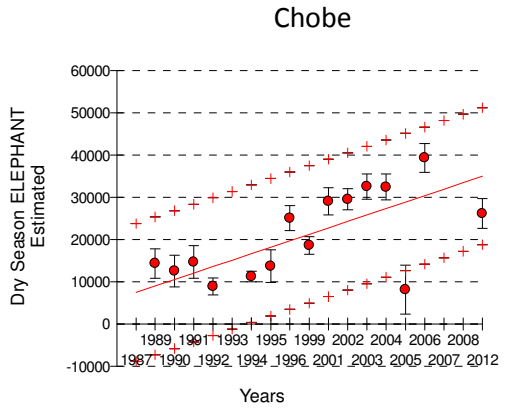


Chobe



Elephant

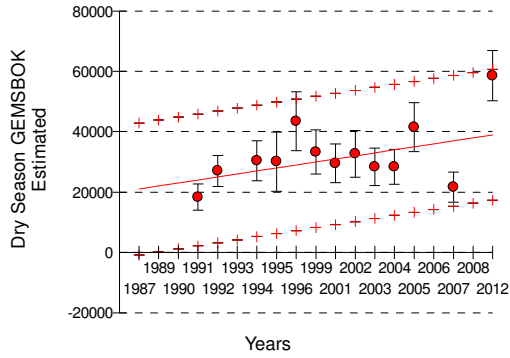
A highly significant trend was observed in Chobe National Park and Moremi Game Reserve. The numbers were also building up in Makgadikgadi and Nxai Pans National Parks but the increases were not significant.



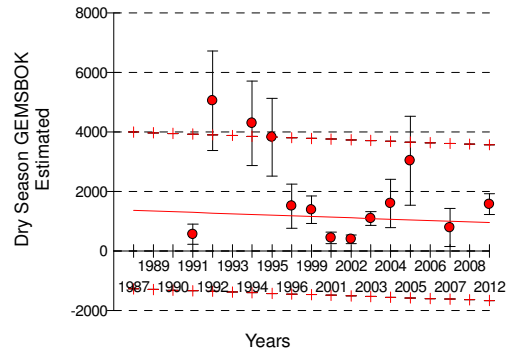
Gemsbok

A non-significant trend was observed for gemsbok populations in all Protected Areas except Khutse Game Reserve where the numbers significantly increased.

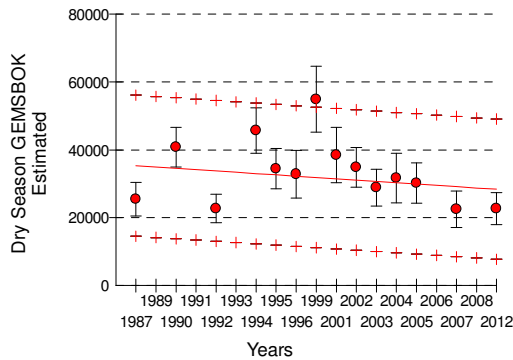
Gemsbok NP



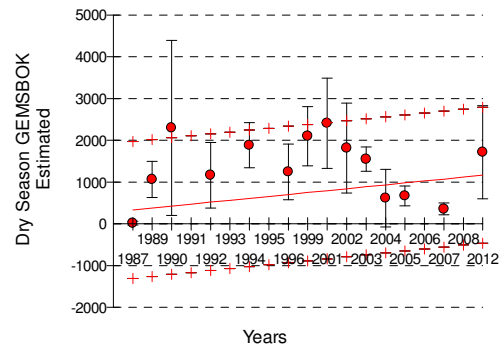
Mabuasehube



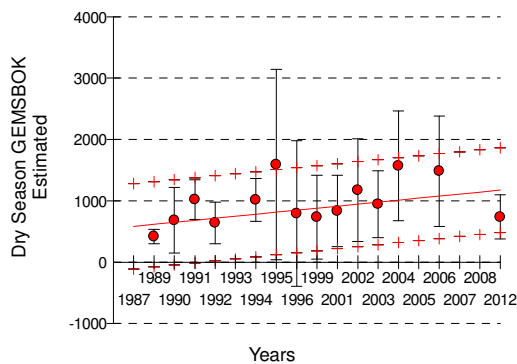
CKGR



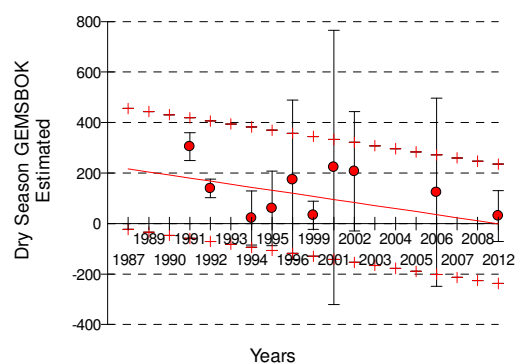
Khutse



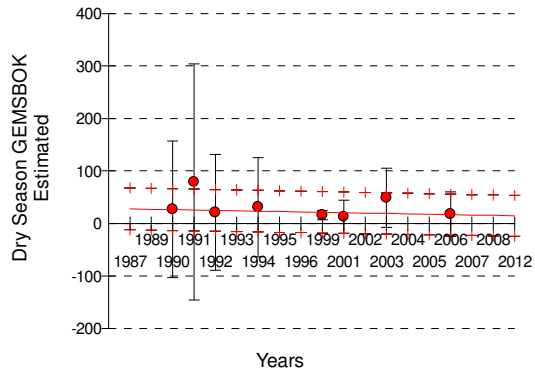
Makgadikgadi Pans



Nxai Pan

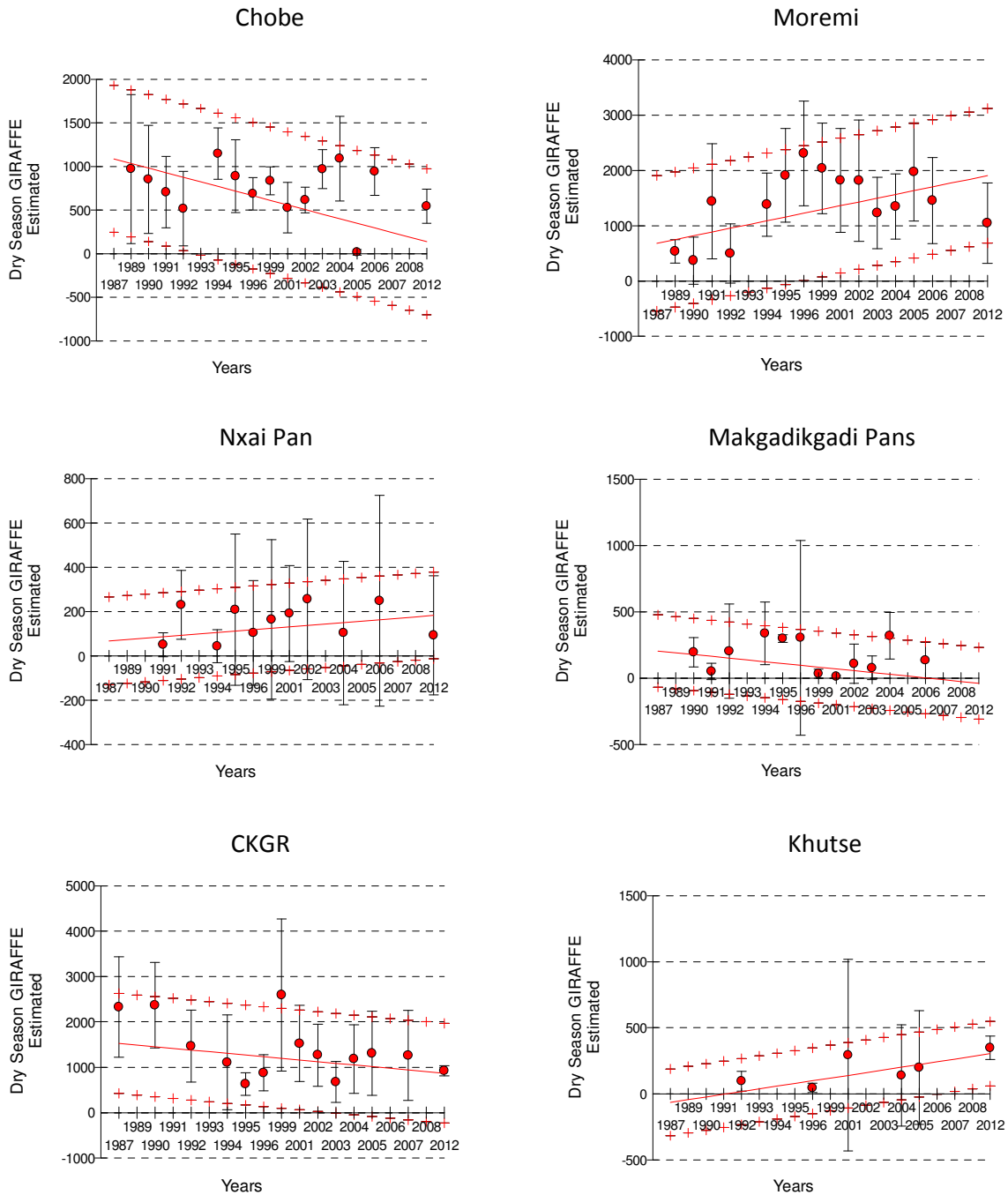


Chobe



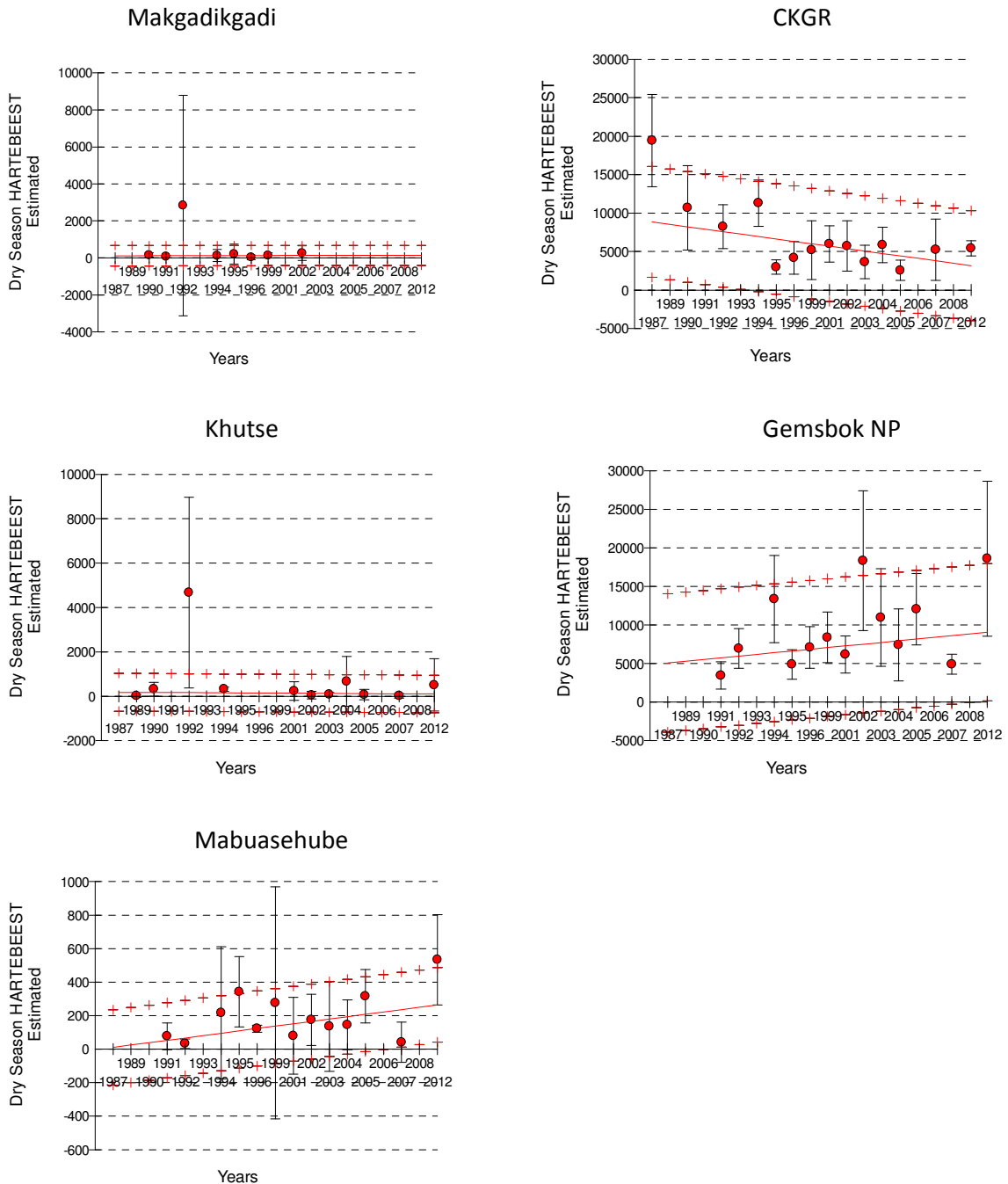
Giraffe

Giraffe numbers significantly decreased in Chobe National Park while significantly increasing in Moremi Game Reserve. For other Protected Areas, the species numbers increased in Nxai Pan National Park and Khutse Game Reserve but decreased in Makgadikgadi National Park and CKGR. These trends were, however, not significant.



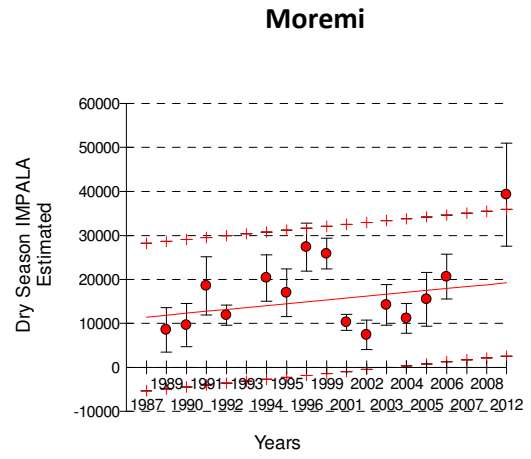
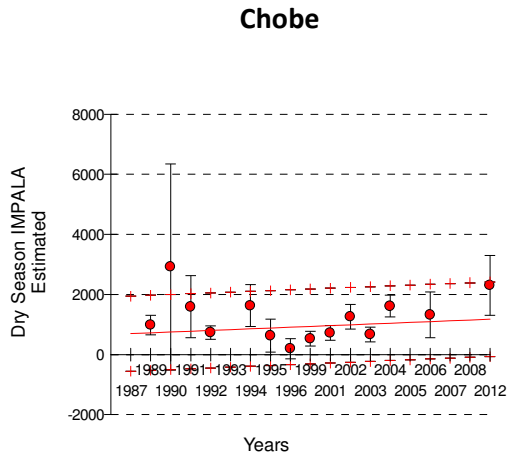
Hartebeest

Hartebeest numbers remained more or less constant in Makgadikgadi Pans National Park and Khutse Game Reserve. The numbers increased in Gemsbok National Park and Mabuasehube Game Reserve but decreased in Central Kalahari Game Reserve. All trends were, however, not significant.



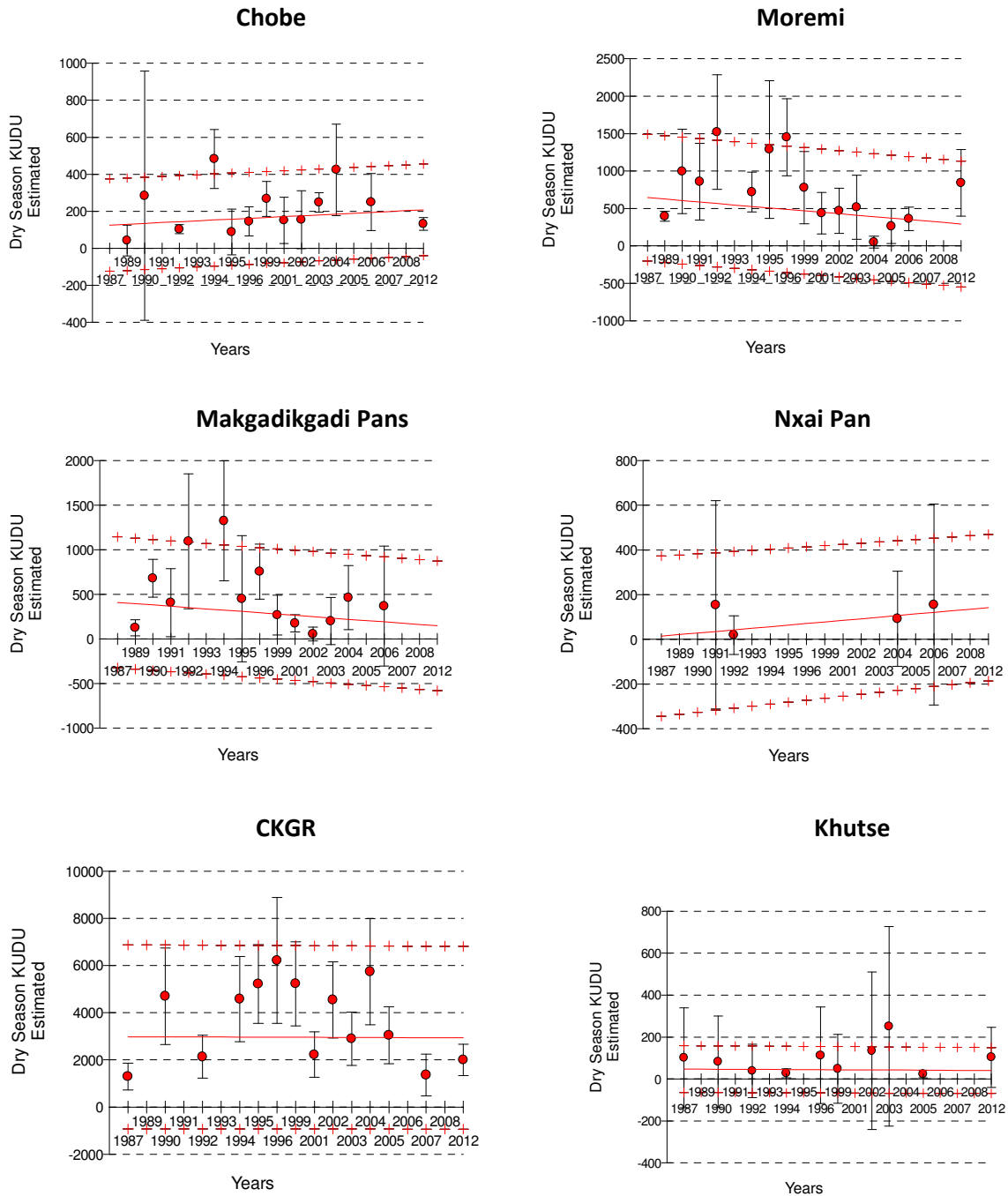
Impala

Trends for impala populations in both Chobe National Park and Moremi Game Reserve were upward but not significant.

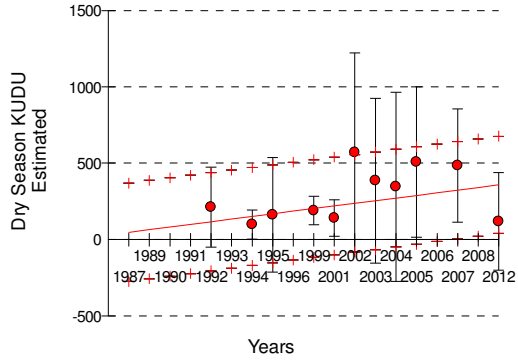


Kudu

Downward trends were observed in Moremi Game Reserve, Makgadikgadi Pans National Park, Central Kalahari Game Reserve and Khutse Game Reserve while the reverse was observed in Chobe National Park, Nxai Pan National Park and Gemsbok National Park. All trends were not significant.

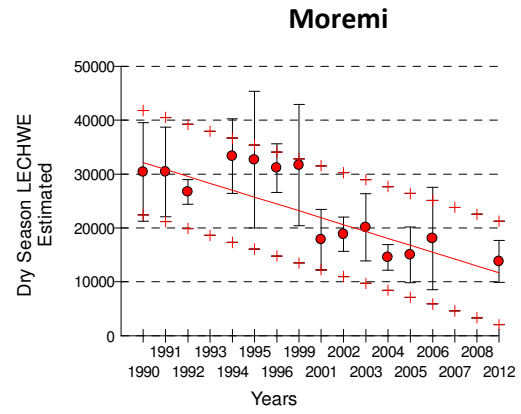
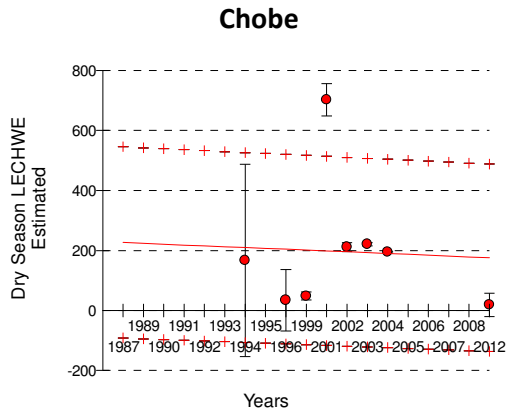


Gemsbok NP



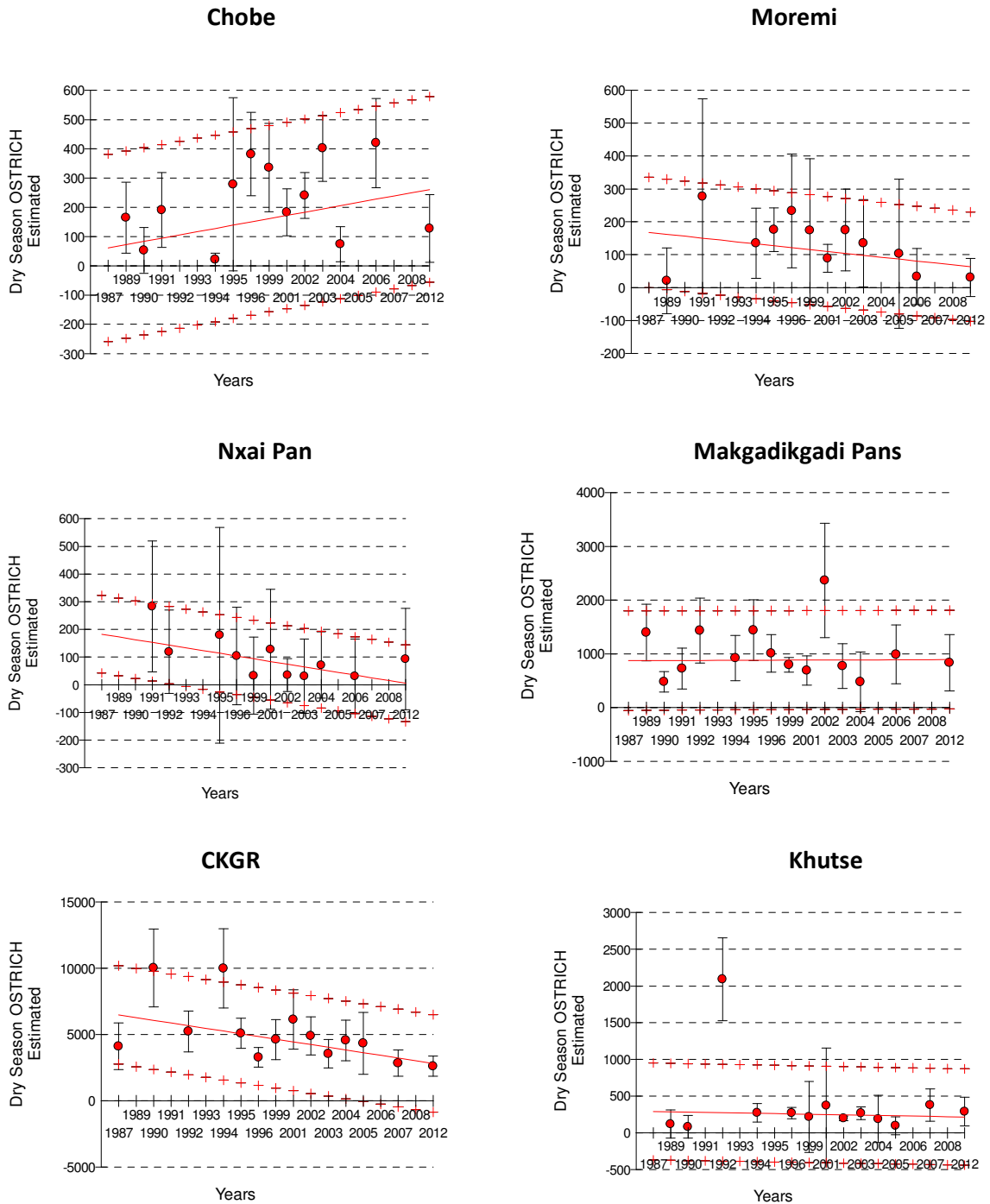
Lechwe

Downward trends were observed in Chobe National Park and Moremi Game Reserve with the latter trend being very highly significant.

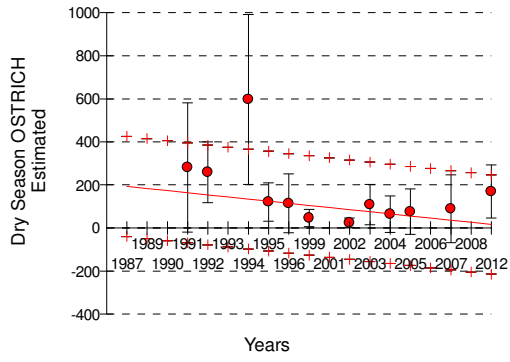


Ostrich

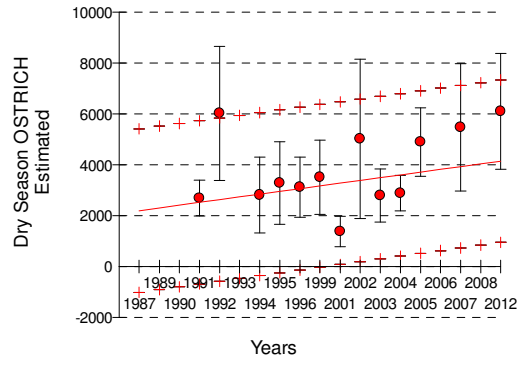
Downward trends were observed in Moremi Game Reserve, Nxai Pan National Park, Central Kalahari Game Reserve and Mabuasehube Game Reserve. The trend in Nxai Pan was significant. The populations in Chobe National Park and Gemsbok National Park increased but both were not significant, while those in Makgadikgadi Pans National Park and Khutse Game Reserve remained more or less constant.



Mabuasehube

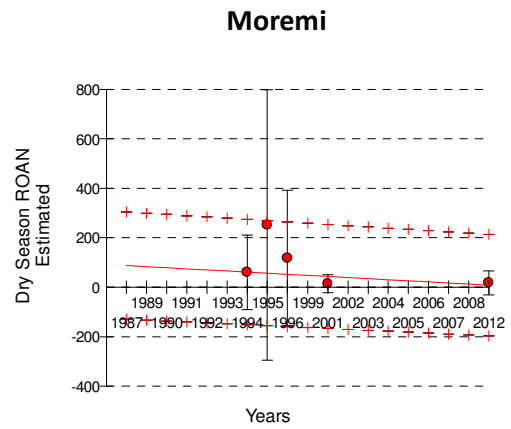
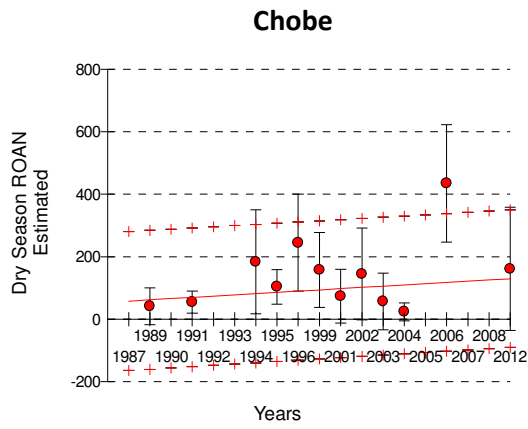


Gemsbok NP



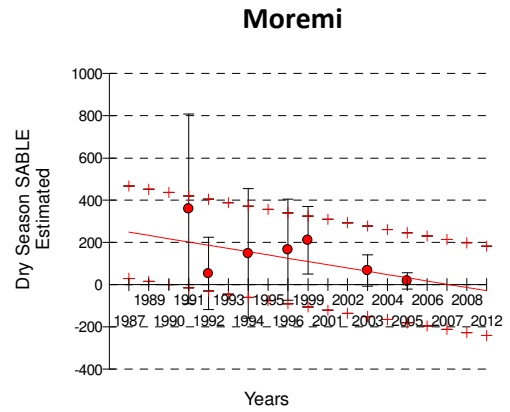
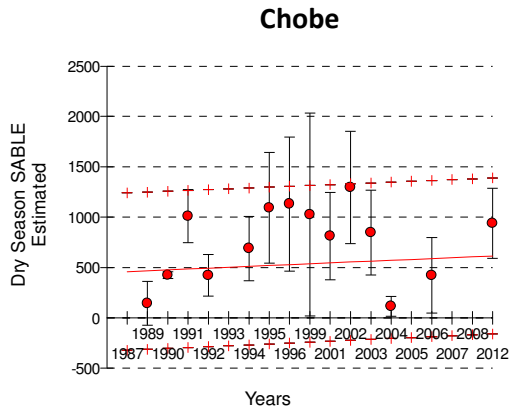
Roan

No significant trends were observed for roan antelope in both Chobe National Park and Moremi Game Reserve.



Sable

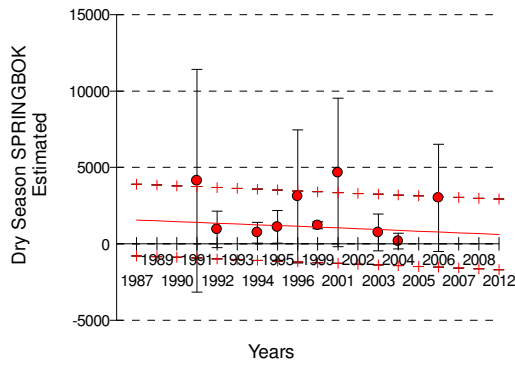
Trends for sable antelope were not significant although a marked downward trend was observed in Moremi.



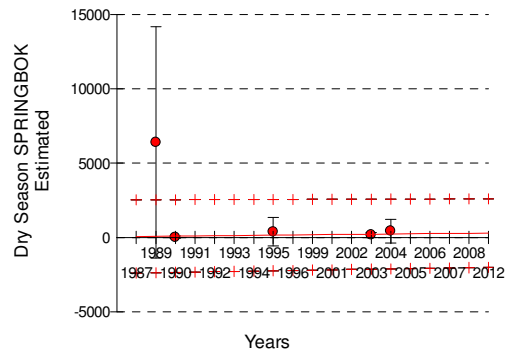
Springbok

This species has generally declined in Protected Areas within its range and the downward trend in Central Kalahari Game Reserve was highly significant.

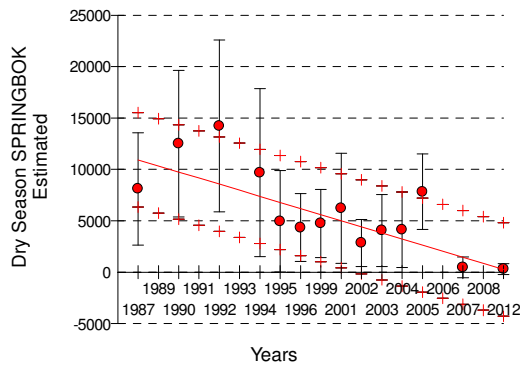
Nxai Pan



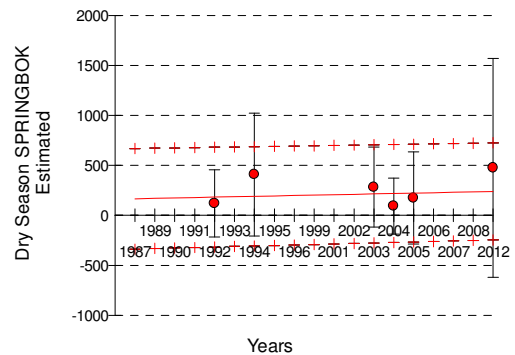
Makgadikgadi Pans



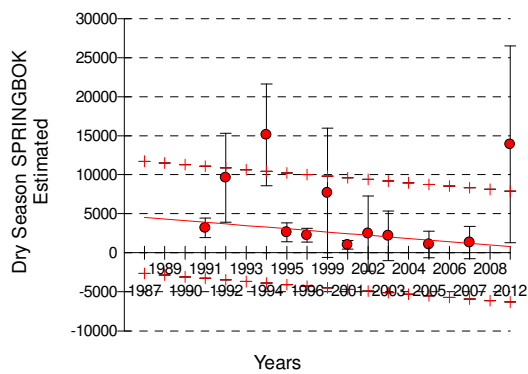
CKGR



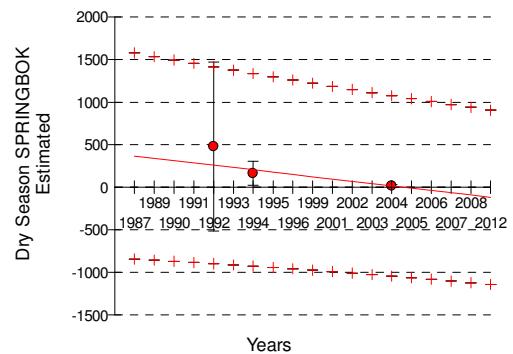
Khutse



Gemsbok NP

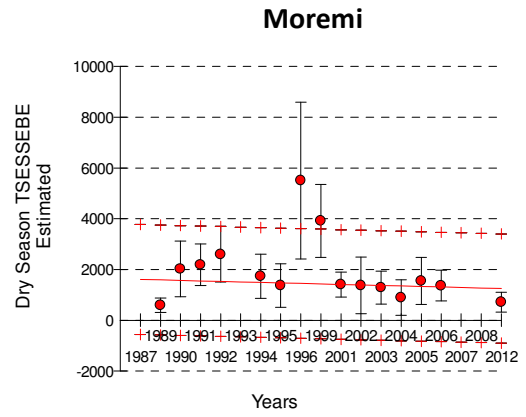
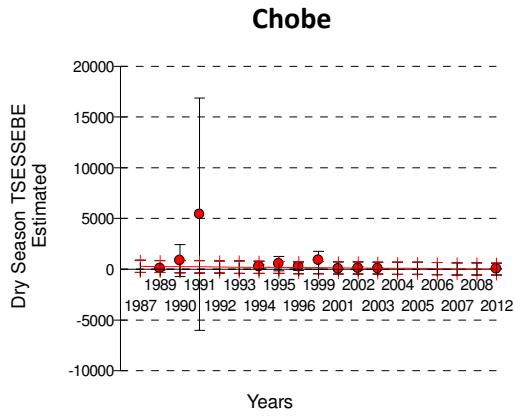


Mabuasehube



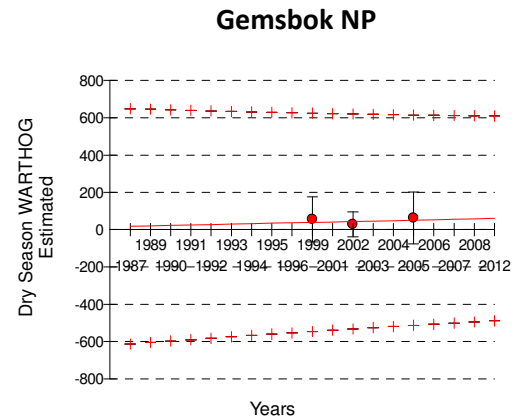
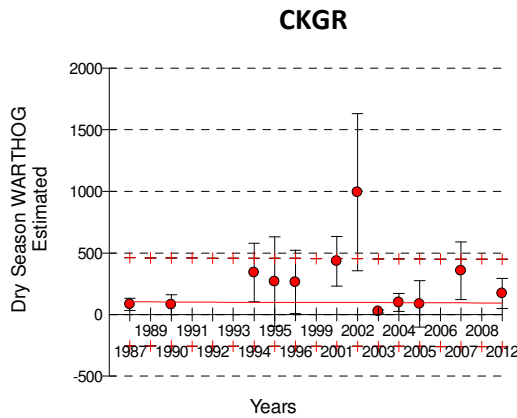
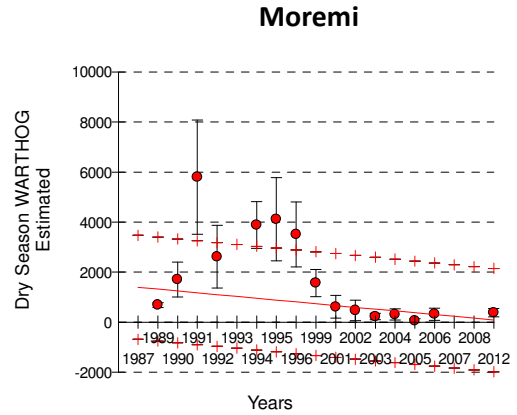
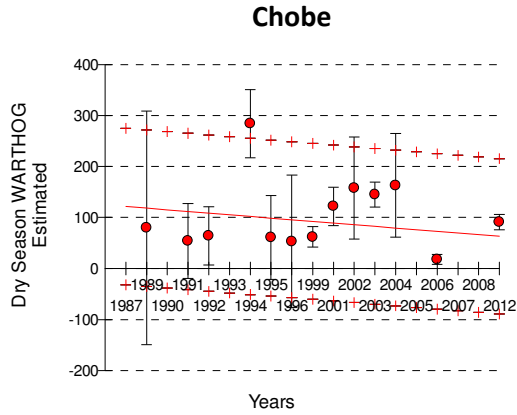
Tsessebe

Although tsessebe numbers significantly decreased throughout the species range, the trends in Chobe National Park and Moremi Game Reserve were not significant.



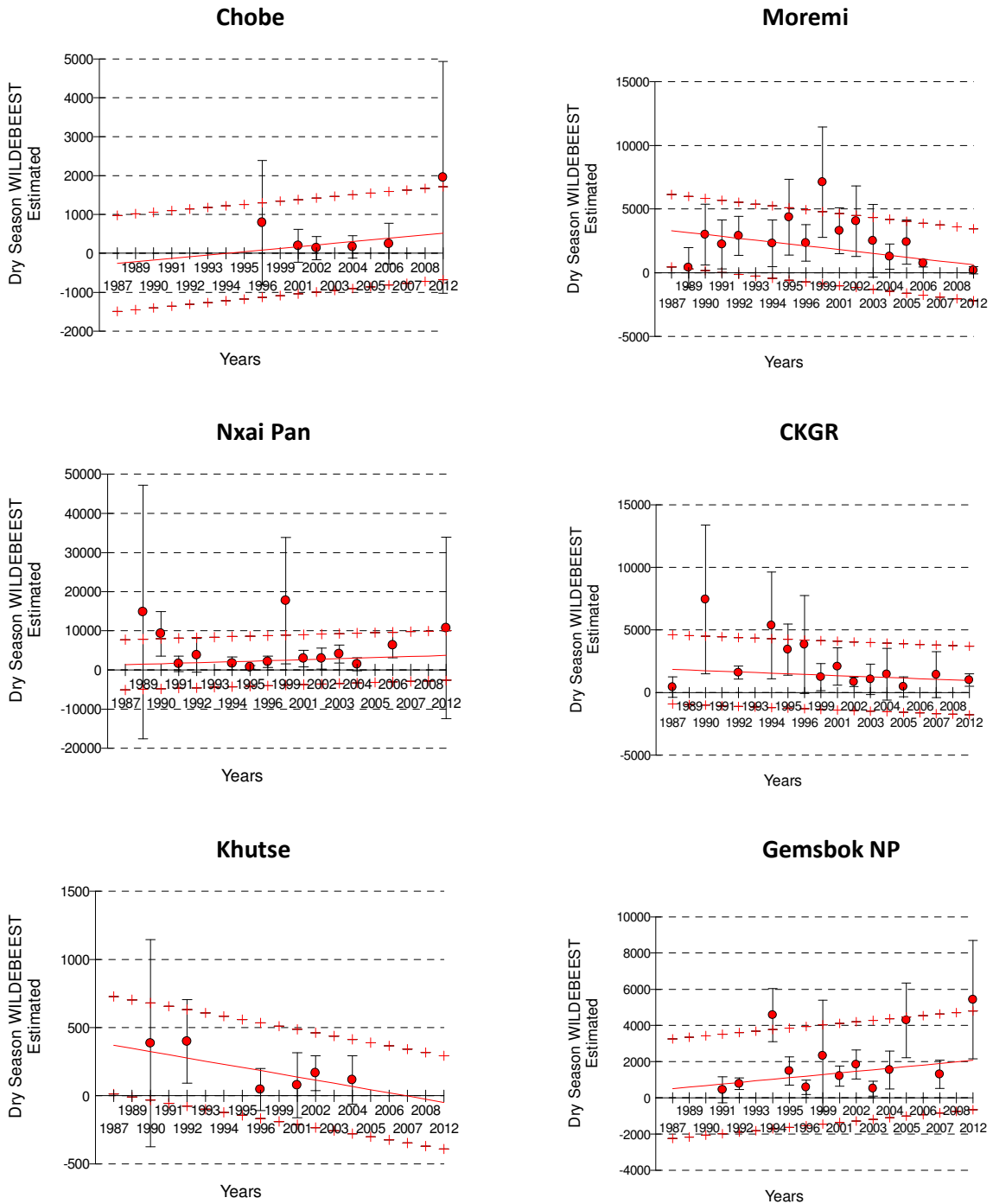
Warthog

Warthog numbers have declined in Chobe National Park and Moremi Game Reserve, while the populations in Central Kalahari Game Reserve and Gemsbok National Park have remained more or less constant.



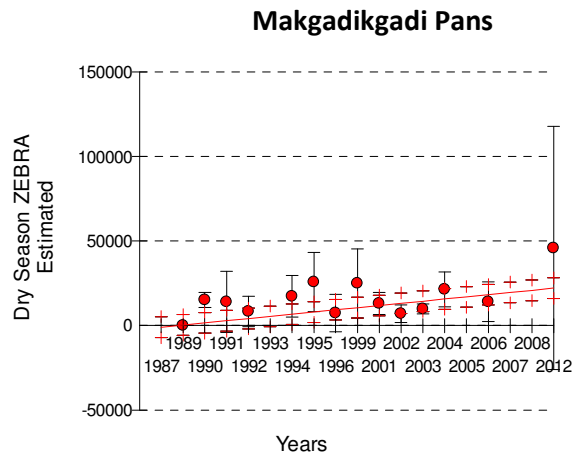
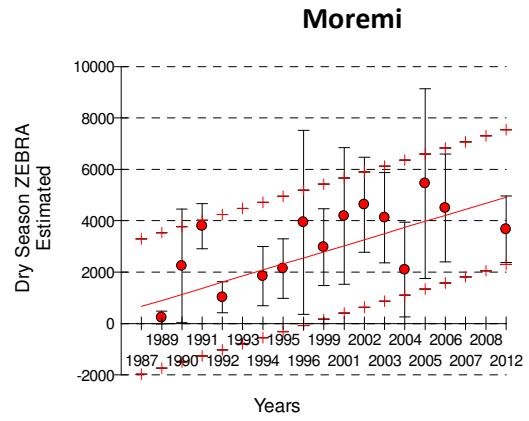
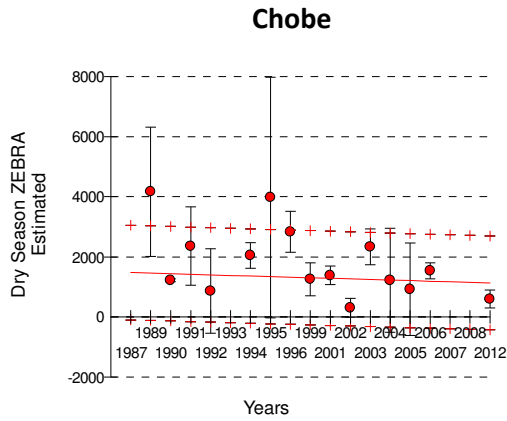
Wildebceest

Wildebceest populations decreased in Moremi Game Reserve, Central Kalahari Game Reserve and Khutse Game Reserve, while increasing in Chobe National Park and Gemsbok National Park. The population in Nxai Pan National Park was more or less constant. All trends were, however, not significant.



Zebra

Although a downward trend was observed in Chobe National Park, the population increase for zebra was significant in Makgadikgadi Pans National Park and highly significant in Moremi Game Reserve.



5.0 DISCUSSION

This aerial survey report, like previous ones, has provided information on animal numbers, distribution and other systematically collected aerial survey information in order to guide decision makers and wildlife managers. No interpretation of the results is provided as it falls outside the scope of the aerial survey programme.

There is need, however, to highlight some trends which emerged from the survey. It is evident that concerns about the possible terminal decline of some wildlife species may be valid. In particular, tsessebe population has significantly decreased since 1992; while sitatunga numbers also appear to be declining although this species is difficult to assess through aerial surveys. Other species with overall downward trends are lechwe and springbok. Whether significant or not a downward trend should elicit an appropriate management response as it is not always possible to back up survey results with information from other sources. In all cases, the precautionary principle should prevail.

It is noteworthy that all wildlife species except elephant and impala showed a population decline in at least one Protected Area, and some of the declines were statistically significant. As suggested by Western, Russel and Cuthill (2009), there is a need to quantify the performance of conservation policies and promote integrated landscape practices that combine Protected Areas with private and community-based measures. This is likely to become imperative given that significant wildlife population declines have been reported in other major Protected Areas in Africa, including Masai-Mara National Reserve in Kenya, Etosha National Park in Namibia and Kruger National Park in South Africa.

As expected, the elephant population continued to increase and current trends are very significant. Although elephants are considered to play a pivotal role in development and maintenance of African ecosystems, a localized overabundance of this keystone species could impact negatively on biodiversity conservation. The challenge therefore remains to determine an optimum number of elephants in any particular part of their range; in order to balance the elephants' role as a contributor to the maintenance of biodiversity on the one hand, and ecosystem degradation on the other (DWNP, 2011).

6.0 REFERENCES

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