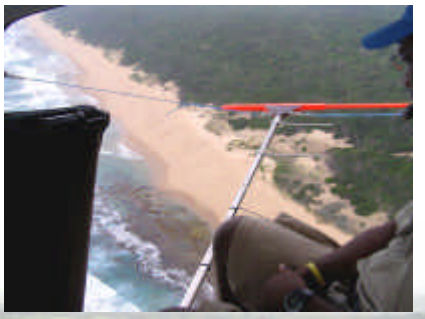
Aerial survey report for Maputo Special Reserve



November 2006

AERIAL SURVEY REPORT FOR MAPUTO SPECIAL RESERVE

NOVEMBER 2006

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I. INTRODUCTION

This is one of the first comprehensive aerial census undertaken of large herbivores occurring in Maputo Special Reserve. The aerial census was undertaken during the beginning of November 2006, although late in the season very little rain had fallen. The overall aim of the census was to derive current status of the most important large herbivore populations in Maputo Special Reserve, which could be useful in management decisions and would stand as a record of abundance for future trend analyses. In addition, the survey undertaken aims to record the spatial distribution of the most important herbivores with emphasis on the elephant population so as to gain a better understanding of their habitat relations, but also to gain an understanding of the relative abundance of these herbivores in the Maputo Special Reserve and part of the adjacent Futi Corridor.

This census builds on the recommendations of Matthews 2000. The methods used; were the same as those used in 2000, which were a refined and improved version of those used in 1994. Two methods were used to estimate numbers in each of the large herbivore populations. These were (i) total area aerial counts and (ii) transect distance sampling counts. Midday water hole counts for elephant were not undertaken this year.

The transect aerial census was undertaken by Glenton Combes (pilot), Wayne Matthews (co-ordinator and recorder) with Momade Nemane and Brent Whittington (observers). Derek Potter, Clint Halkett-Siddall and James Lefler helped with all field logistics.

The aerial census was made possible due to the generosity and support of Paul Tudor Jones of Tudor Investment Corporation in the USA. Thanks also go to Trish Parsons of Parsons Aviation for the co-ordination of the donation of the helicopter.

II. METHODS

Aerial Counts

a) Total Aerial Count

1. A helicopter containing four people (pilot and recorder (front) and two observers (back) was flown on pre-determined, parallel east west orientated transects situated 1 km apart and arranged systematically to cover the whole census area. (See appendix 2 for Transect specifics).
2. The helicopter was flown at 90 m (300 ft) above the ground and at an air speed of approximately 30 – 40 kts. Transects were flown morning and afternoon, for periods of up to a maximum of 3 hrs at a time, this resulted in three survey sessions as depicted in Figure 1. The hottest part of the day was avoided as far as possible, as animals tended to rest under shade in the heat of the day and as a consequence are more difficult to spot.
3. Devices were fitted to both sides of the helicopter which, when flying at a height of 90m, demarcated a distance of 500m on each side of the helicopter. All individuals of all large herbivore species were recorded in the 1 km wide belt.
4. Where large groups of elephant, hippo etc. was spotted, the helicopter deviated from the traverse line, a total count of the group was undertaken, the locality captured and then returned to continue the count from the point of departure.

5. All data were captured on a notebook computer using Cartalinx v 1.1 (Clark Labs, Clark University, 1999) which, when connected to the onboard GPS allowed the simultaneous collection of flight path information, animal numbers (as way points) and the number of the transect being traversed.

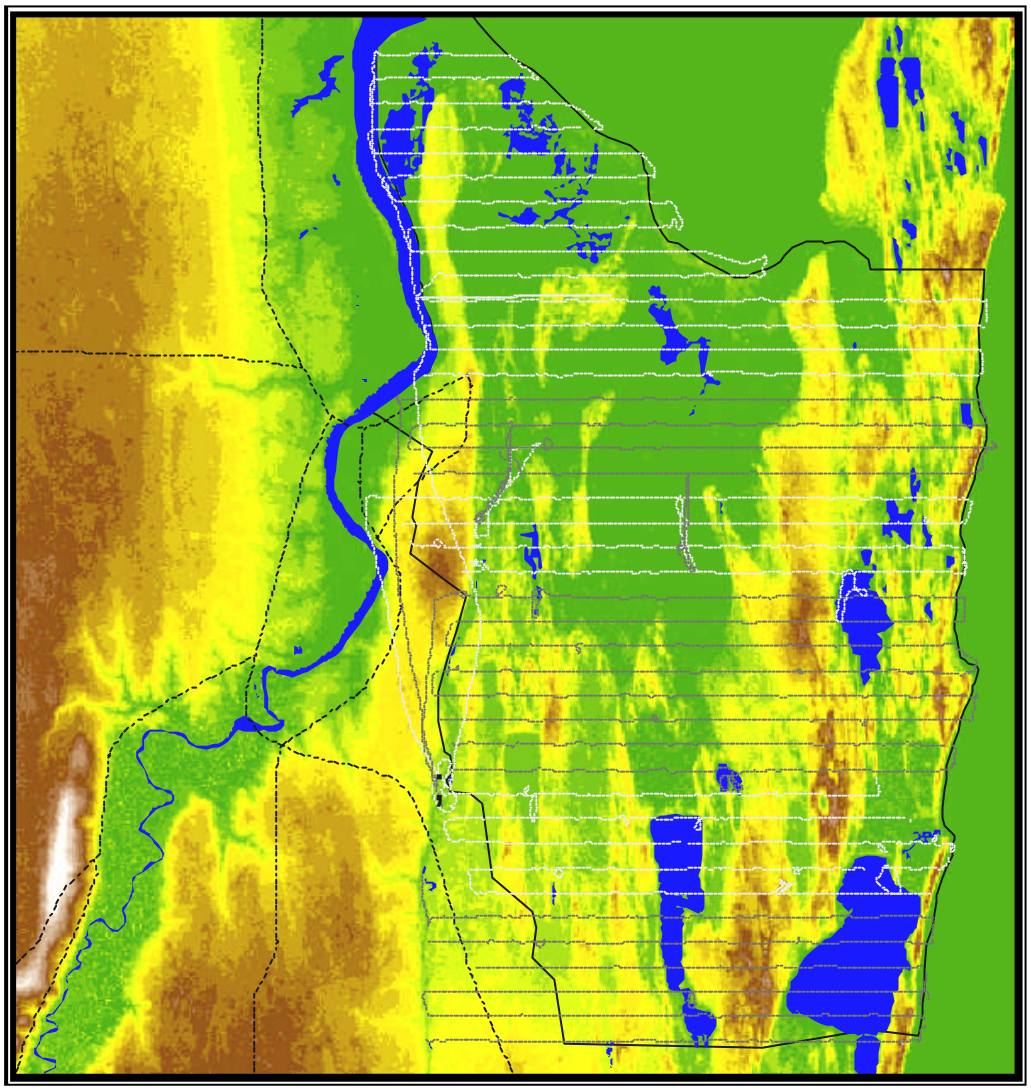

Figure 1. Census flight path based on the defined transects (see appendix 2) for the game census. Each flight session is depicted in different colours, starting in the north.

6. Plotting of distributions by species was done by importing the Cartalinx data into Arcview, these in cases where the number of sightings and their distribution allowed visualisation.

b) Distance Sampling

1. Data were collected for the distance sampling analysis at the same time as for the total count.
2. Devices were fitted to both sides of the helicopter which, when flying at a height of 90m, demarcated distance classes on each side of the traverse (transect) line with the following intervals: 0 – 90 m, 91 – 200 m, 201 – 350 m and 351 – 500 m. Whenever an individual or group of individuals were observed they were recorded as occurring in one of the distance sectors.
3. Animal observations recorded during the aerial census were edited and then exported directly to Distance 4 from the Microsoft Access database constructed whilst entering the data using Cartalinx. Where the number of observations allowed, density along each transect, and from this population size, was estimated using the statistical routines in Distance 4 release 1 (Thomas *et al.* 2001).
4. A statistically robust estimate can only be derived for species within the region of 60 sightings. Although species having as low as 30 observations were analysed with Distance, these estimates

should not be considered reliable (in all instances, the confidence intervals indicate this), but rather as best estimates of population size in species that have been under sampled.

III. RESULTS

Aerial Counts

The complete aerial survey of the entire reserve (79 594 ha) and the southern portion of the Futi (3 120 ha) linking with the Park, took three days (18 hours) to complete, as per sessions set out in Table 1. This was done in three – (two sessions per day), so as to allow for refuelling and resting out the hot midday periods.

Table 1. Aerial survey flight sessions.

Session *(start time)*	**Time (hrs)**
day 1 – 1 *(6am)*	3.6
day 1 – 2 *(10am)*	2.5
day 1 – 3 *(3.30pm)*	2.6
day 2 – 1 *(6.15am)*	3.4
day 2 – 2 *(3.00pm)*	3
day 3 – 1 *(6.45am)*	2.6

Conditions during the census were good. The weather was dominated by partly cloudy, generally calm, warm to hot conditions. The woody plant leaf flush was only partially developed, as no meaningful rains had yet fallen in the Maputo Special Reserve area, and game visibility conditions were fair to good.

a) Total Aerial Count and Distance Analysis

The total number of groups and animals counted for each species during the census is shown in Table 4. The final estimate of each species is given in Table 3. The distribution of sightings for the larger abundant and more significant species is presented in Appendix 1. With respect to distance sampling, bushpig, reedbuck, red duiker and grey duiker had reasonable or close to 60 or more sightings, and could therefore be analysed reasonable reliably with distance (Table 2). The number of groups and the total number of animals physically counted in Maputo Special Reserve for 2006 and past info is summarised in Table 4.

b) Midday Waterhole Counts of Elephants

No midday water hole counts were undertaken this year, as emphasis was placed on completing all transects.

Best Estimate of Numbers

Acceptable estimates (Table 3) for 7 species namely; elephant, reedbuck, hippo and to some degree red duiker, grey duiker and bushpig. For most, species counts were more than was expected, and confirmation was made of particular species still being present in the reserve, such as waterbuck and kudu.

For Distance sampling; for most species, the numbers of sightings for a single repetition were way below or marginal for a confident result, but some were analysed so as to have some indication of possible population sizes. Sample based estimates were made for four species namely, reedbuck, red duiker, grey duiker and bushpig. The final estimate used was based on the number of observations, best confidence levels, taking into consideration observer fatigue for the different repetitions

sessions and transect data sets confidence levels.

Table 2.Large herbivore population estimates from distance sampling, 2006. *(* unreliable)*

Species	Aerial Distance sampling estimates for 2006	
	Est.	95% C
Bushbuck	*	
Bushpig	188	*118-299 / 23%*
Elephant	n/a	
Grey Duiker	111	*77-159 / 18.1%*
Hippo	n/a	
Kudu	*	
Nyala	*	
Red Duiker	278	*193-400 / 18.2%*
Reedbuck	1147	*854-1541 / 14.74%*
Side st jackal	*	
Steenbok	*	
Suni	*	
Waterbuck	*	

The population size of reedbuck was estimated at 1147 from a sample of 463 sightings, this is the most abundant species in the reserve. The population was distributed throughout most of the reserve with most sightings in the more open central areas (Figure 5). As reedbuck are found in the more open areas, the statistical analysis result could be biased and the total count could be quite reliable. No comparable past estimates were found for the reedbuck population.

The population of hippo was estimated at 179 made up of 32 groups, which were spread between the different water bodies (Figure 8). Lake Piti having the highest number. The hippo's population estimate is down compared to the 1972 figure of 272.

The red duiker population is estimated at 278, this was determined from 105 observations, this is the fourth highest abundant species in the Reserve. The distribution of red duiker is spread throughout the western portion of the park with concentrations in the south western section, including areas outside the reserve, going into the Futi (Figure 4). Note; with small antelope (eg. suni, red & grey duiker), this type of result can be expected – the true population size could be much larger.

The grey duiker population is estimated as 111, this was determined from 38 observations, although this estimate is felt is unreliable. The distribution of grey duiker seems to be spread throughout most of the park in the grassland and more open woodland areas (Figure 3).

The bushpig population is estimated at 188, this was determined from 38 observations, the fifth most abundant species in the reserve. The distribution of bushpig shows no clear pattern and seems to be spread more consistently in the central areas of the Reserve (Figure 7).

The population estimated of nyala could not be estimated reliable, 15 sightings were made totalling 47 animals. The number could be much higher considering the thick canopy cover of the habitat within which the nyala were sighted and experience from Tembe Elephant Park's counts. The distribution of nyala seems to be concentrated in the south western corner, the area linking to the Futi corridor (Figure 6).

The population estimated of bushbuck could also not be estimated reliable, 25 sightings were made totalling 30 animals. The number could be higher considering the thick vegetation habitat within which the bushbuck was found. The distribution of bushbuck seems to be concentrated in the south western corner, the area linking to the Futi corridor, including a fair amount of sightings been made outside the Reserve in the linking Futi area (Figure 9). The presence of bushbuck along the Futi was

confirmed with the aerial census done last year in the Futi corridor, which bushbuck were found to be the second most abundant animal in this area.

The population estimates for kudu, steenbok, suni and waterbuck is considered not reliable. What can be said for these species (except for suni), is that they are present, but in quite low numbers. Suni is different in that it could be occurring in relatively high numbers but the ability for the aerial survey technique to detect them in thick canopy cover is very difficult. This happens to be the preferred habitat for suni eg. Sand Forest. The distribution of the species of low encounter rate is shown in Figure 2, and these species seems to be distributed more in the south western areas.

Table 3. Final estimates for 2005.
Estimation Method: 1 – Known Group, 2 – Total Area Count, 3 – Distance Sample, 4 – Informed Guess 5–Field ranger encounter rates. *(* unreliable)*

	Total Count	Distance Sample	*Final Estimate*
Bushbuck	30		50 [4*]
Bushpig	102	*118-299 / 23%*	188 [2,3]
Elephant	329		329-350 [2,4]
Grey Duiker	40	*77-159 / 18.1%*	111 [2,3*]
Hippo	179		180 [2]
Kudu	6		-*
Nyala	47		100 [4*]
Red Duiker	113	*193-400 / 18.2%*	278 [2,3]
Reedbuck	797	*854-1541 / 14.74%*	1147 [2,3]
Side st jackal	4		-*
Steenbok	3		-*
Suni	7		-*
Waterbuck	4		-*

Elephant Numbers

The total number of elephant counted during all transect counts was 470, (see Table 5), although this number includes repeat groups. After excluding any possible repeats the total number was estimated at **minimum of 329** elephant. This was one of the highest numbers of elephant encountered during a survey of the reserve. The number of elephant counted in each session is shown in table 5. It is interesting to note that the sessions' transects which covered the middle of the day (10 -12.30 & 3.30 – 5.55pm) on the same day, alone yielded 355 elephant (this did include repeat groups). Most of the animals were seen during the middle of the day portion of the sessions transects, with most of the animals encountered were found in the reed beds centred in the Reserve (see Figures 14 & 15). The bulls were fairly widely distributed over Maputo Special Reserve while the family groups on a whole were found closer to water, (Figures 14 & 15). This is very similar to what has been the case with the Tembe Elephant Park aerial transects surveys (Matthews 2005a).

Table 5. Elephant sightings per survey sessions.

Session *(start time)*	**sightings**	**number**
day 1 – 1 *(6am)*	-	0
day 1 – 2 *(10am)*	9	147
day 1 – 3 *(3.30pm)*	14	208
day 2 – 1 *(6.15am)*	7	25
day 2 – 2 *(3.00pm)*	10	83
day 3 – 1*(6.45am)*	2	7

Table 4. Summary of large herbivore counts (minimum number) for Maputo Special Reserve, 1972, 1995 & 2006. 2006 count based on systematic flight grids as described. (*large crocodiles; estimated at greater than 3m in length).
[v – recorded as present although not quantified]

Species	Tello report - 1972	Hutton report - 1995	Aerial Census – 2006	
			No. Groups	No. Counted
Buffalo	-	-	-	-
Bushbuck	v	v	*25*	30
Bushpig	v	v	*38*	102
C Reedbuck	v	22	*463*	797
Cheetah	v	0	*0*	0
Elephant	350	v	*32*	329
Grey Duiker	v	12	*38*	40
Hippo	272	5	*32*	179
Kudu	-	-	*1*	6
Leopard	v	v	-	-
Nyala	v	1	*15*	47
Red Duiker	v	14	*105*	113
Serval	v	-	-	-
Side st jackal	v	-	*2*	4
Steenbuck	v	1	*3*	3
Suni	v	5	*7*	7
Warthog	-	-	-	-
Waterbuck	-	-	*1*	4
White rhino	40	-	*0*	0
Crocodile*	v	1	*11*	24

It is the opinion of the authors that a high proportion of all the family units were encountered during the census (Table 6), and that the total number of animals in family units is approximately 296. The number of free roaming bulls seen was 33 but it is quite possible that animals were missed or were included in the counts of the family group; this is supported by Morley & Van Aarde (2002) who says, the aerial surveys as done in Tembe Elephant Park constantly underestimate the true size of the population. Based on this, it could mean that the population size for elephant in Maputo Elephant Reserve could be between 329 – 350 animals, based on minimum count and a percentage error.

Current estimates compared to past estimates (Table 6) seem to show a stable to increasing population. This is substantiated by the number of infants encountered during this years survey (Table 6). Currently from Morley *et al.* 2002 based on their demographic estimates, the population in the Maputo Elephant Reserve was found to be increasing at 2.28% per annum, though the data they analysed based on counts conducted between 1979 and 1999 suggest an increase of 4.4%, thus an estimated growth rate of between 2.28 - 4.4 %. This is below the average growth rate figures (7-10%) as calculated over a sweep of reserves for elephant by Slotow *et al.* 2005.

Elephant Population Structure[1]

The number of different family units (groups) observed was 18. It is quite possible that this is in the right region for the number of family units in Maputo Elephant Reserve, this is the highest number of family units encountered although the Tello 1972 estimate of 14, is similar. The number of animals recorded in family groups during this survey, was 296 compared to only 33 free roaming bulls. It is quite possible that a few adult free roaming bulls were included in the count of the family groups, but these would be very few as effort was made to distinguish and exclude them. If we assume that 2/3 of the number of animals in family units are sexually mature females, this would give 195 adult females. This gives an approx sex ratio of 1 male to 5 females (1:4 if half are adult females). This is quite different to the ratios found in Tembe Elephant Park of 1 male to 1.2 females. Morley *et al.* 2002 also found this bias towards free roaming adult bulls in Tembe Elephant Park, although not to this extent.

Table 6. Summary of population estimates of elephant for Maputo Special Reserve based on information extracted from published and unpublished papers and reports. (Source of info [1]- Van Aarde *et al.* 2004; [2]- Morley & Fairall 2002; [3]- Ntumi & Van Aarde 1999; [4]- De Boer *et al.* 2000; [5]- Ostrosky & Matthews 1995; [6]- Klingelhoeffer 1987; [7]- Tello 1973; 2006 data based on systematic flight grids as described by Matthews, 1994 & 2000). [% - refers to percentage of the total population composition].

Count	Total	Free roaming Bulls	Family group Total	Young (<1-2 yrs)	Family group adults & Unclassified	Family groups
2006 (transects – Helic.)	329	33	296	42	254	18
%		11%	89%	12%	77%	
Past counts						
Count	Total	Free roaming Bulls	Adult Females	Young (<1-4 yrs)	Sub-adults & Unclassified	Family groups
2004 (transects-MicroL)[1]	81	4	34	18	25	-
2002 (transects-MicroL)[2]	141	31	35	25	50	6
1999 (transects-Helic.)[3]	205	19	114	11	61	-
1998 (count-Helicopter)[4]	180	-	-	-	-	-
1995 ((count-Helicopter)[5]	150	-	-	-	-	-
1979 (Educated guess)[6]	80	-	-	-	-	-
1972 (Educated guess)[6]	269	-	-	-	-	-
1970 (ground survey)[7]	350	27	119	5	199	14

[1] Survey use of the following terms: young referred to animals born in the last year and up to two years; Sub adults & unclassified, any animal older than three years but not of adult size. Free Roaming Bulls, those males that are not attached to a family group.

IV. Human Activity

The surveyed area of Maputo Special Reserve still contains many people with various signs of human activity. Most of the human activity was in the north east section of the reserve (Appendix 1, Figure 13). The majority of human activity encountered in the survey area was in the form of homesteads and cultivation (Table 7). A total of 282 active homesteads were counted. Based on the work of Els *et al.* 2002 which gives an average of 5 people per homestead an estimate of the number of people living inside the reserve could be as high as 1 410 people. It must be assumed that most of these people will be subsistence farmers and consequently making use (harvesting) of the reserves' natural resources (Els *et al.* 2002). No sign of harvesting of large Pod Mahogany (*Afzelia quanzensis*) trees, as is taking place in the Futi area (Mathews 2005b) was seen although in one place in the southern portion of the reserve, a whole section of forest is been cleared for agriculture. Quite a few livestock were counted which included many goats; this could be of concern if game management is given priority, as the species mix within Maputo Special Reserve will have veterinary implications, especially as part of the bigger Transfrontier area which links to South Africa.

Table 7. Current human activity recorded during survey.

Human activity	Count	No. units
Homestead	*33*	122
Homestead with cultivation	*23*	160
Total Homesteads	***56***	**282**
Cultivation	*26*	30
Goats	*16*	387
Cattle	*4*	119
Forest clearing (tree felling)	*1*	1
Reed harvesting	*3*	3

Other human activities encountered in the survey area include fishing and the construction of large fish Kraals in the tidal areas of Maputo Bay (See plate 1).

Plate. 1. The unique (Kloppers *pers. comm.*) Tidal Fish Kraals – Maputo Bay – Maputo Special Reserve.

V. Conclusions

Census conditions were on the whole very good. The two methods employed namely total area counts and distance based sample estimates, produced generally satisfactory population estimates. For most, species counts were more than was expected, and confirmation was made of some species occurring in the reserve, such as waterbuck and kudu.

Current elephant estimates compared to past estimates seem to show a stable to increasing populations, although this needs to be treated with caution as many past survey's were not comprehensive.

The species found to be the most abundant in Maputo Special Reserve are reedbuck, elephant, hippo, red duiker and bushpig.

The comparison of the elephant population structure between Maputo Special Reserve and Tembe Elephant Park is quite different with Family units dominating in Maputo Special Reserve while free roaming bulls dominate in Tembe Elephant Park.

Quite a few domestic live stock were counted during the survey. The veterinary implications of this needs to be investigated, if the reserve is to be managed with game, especially in light of the Transfrontier initiatives with South Africa.

The slower speed that we flew in the helicopter had a positive impact on the sightings, although there is a time cost involved.

VI. Recommendations

It was felt that the 2006 census effort was a success following on the approach used in Tembe Elephant Park (Matthews 2000), although some recommendations can be made and should be incorporated into the 2007 census programme.

1. When possible the large herbivore population census for Maputo Special Reserve should continue to be undertaken using the methods described here and reported upon.
2. The next census should be conducted between the end of September and up to the middle of November, vegetation flush pending, with the same equipment and software used in the past census, using the same sample transect lines. However, in order to improve the precision of the sample estimates, at least 60 sightings of each target species should tried to be obtained.
3. Try to complete census at a flight speed of around 30kts, making sure though that flying is not done during the midday period and that all transects can be completed before nightfall.
4. In case of the centre section of the reserve, as far as possible these areas are covered towards the middle of the day – so as to increase the probability of finding the elephant in the reed bed areas.
5. Graphical analyses of the trends of the more important species should continue to be undertaken.
6. Other counts to be undertaken to supplement counts for smaller herbivores, such as suni.

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Appendix 1. Distributions of sightings of the most prominent large herbivores seen during the November 2006 census. (The symbol size is an indication of group size).

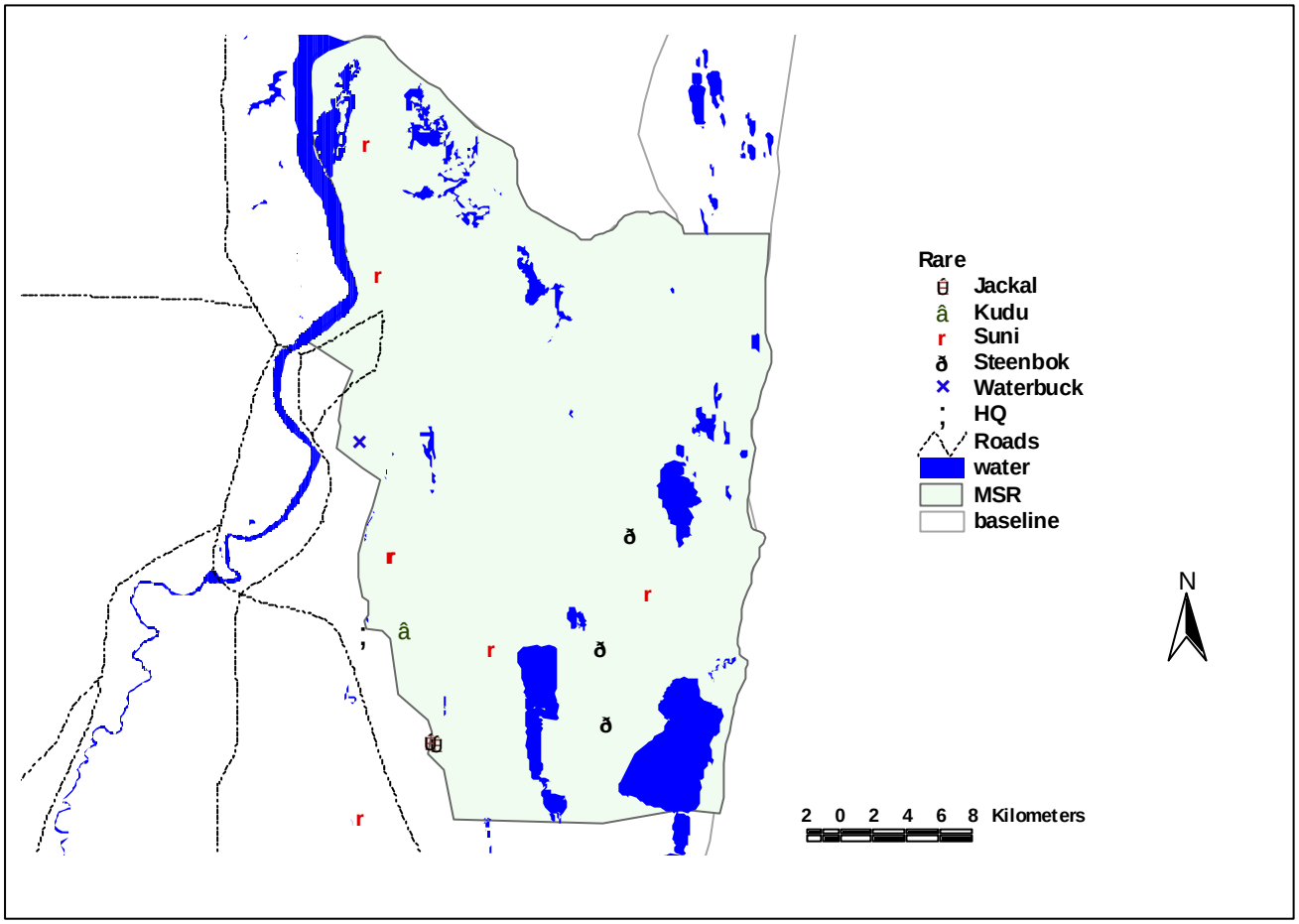

Figure 2. Distribution of the few sightings of suni, side-striped jackal, steenbok, kudu and waterbuck.

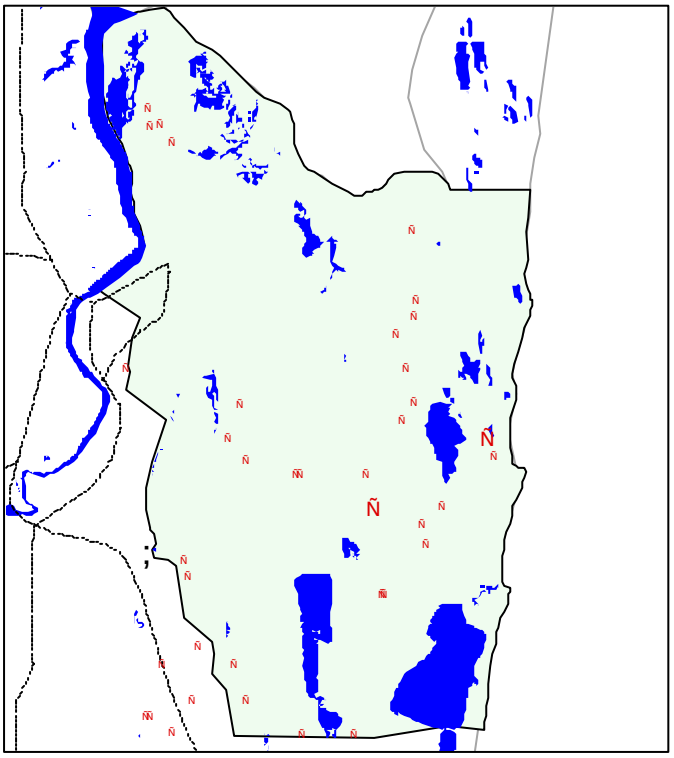

Figure 3. Distribution and group sizes of grey duiker

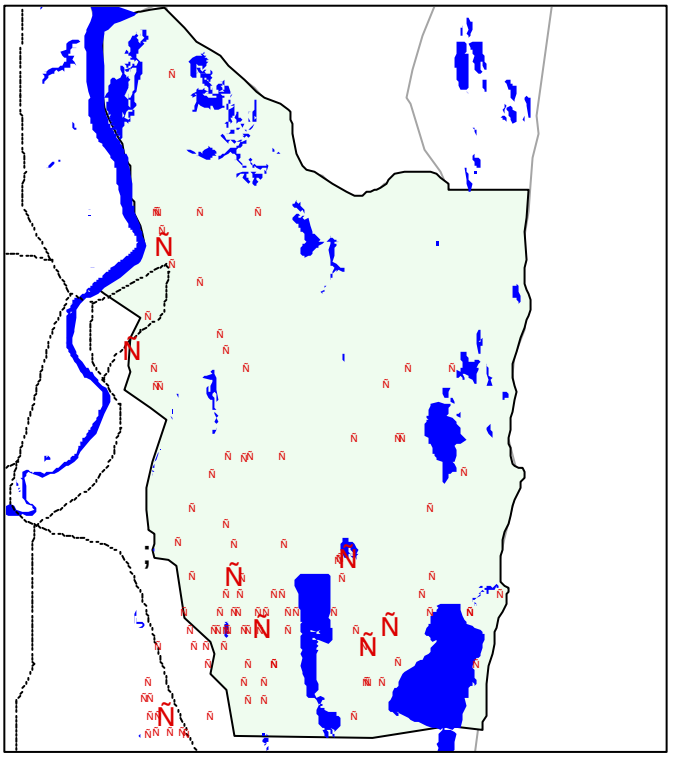

Figure. 4. Distribution and group sizes of red duiker

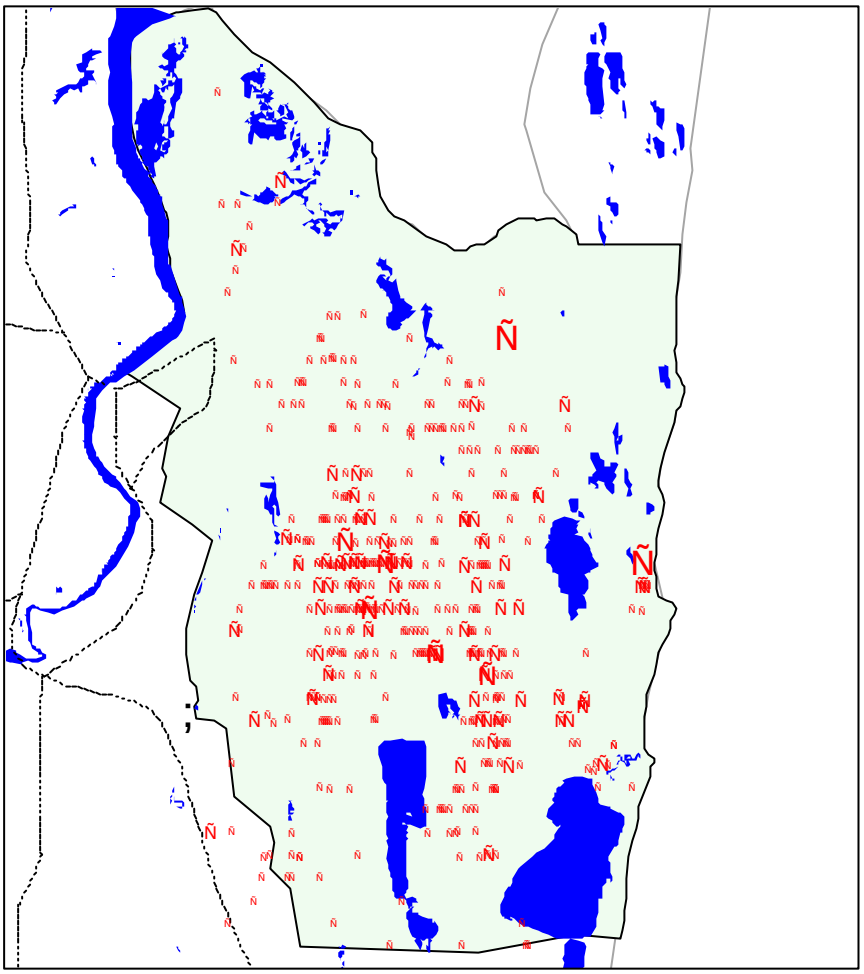

Figure 5. Distribution and group sizes of reedbuck

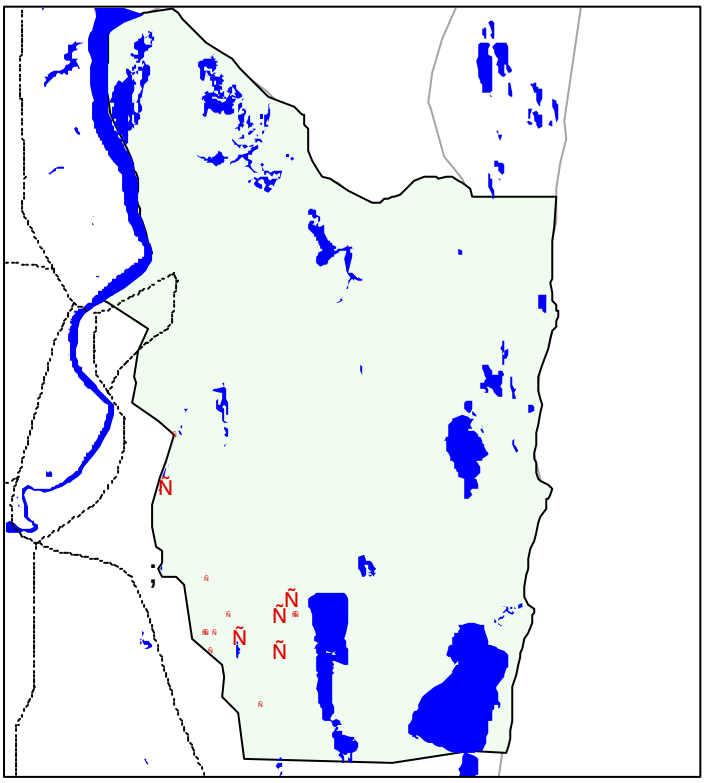

Figure 6. Distribution and group sizes of Nyala

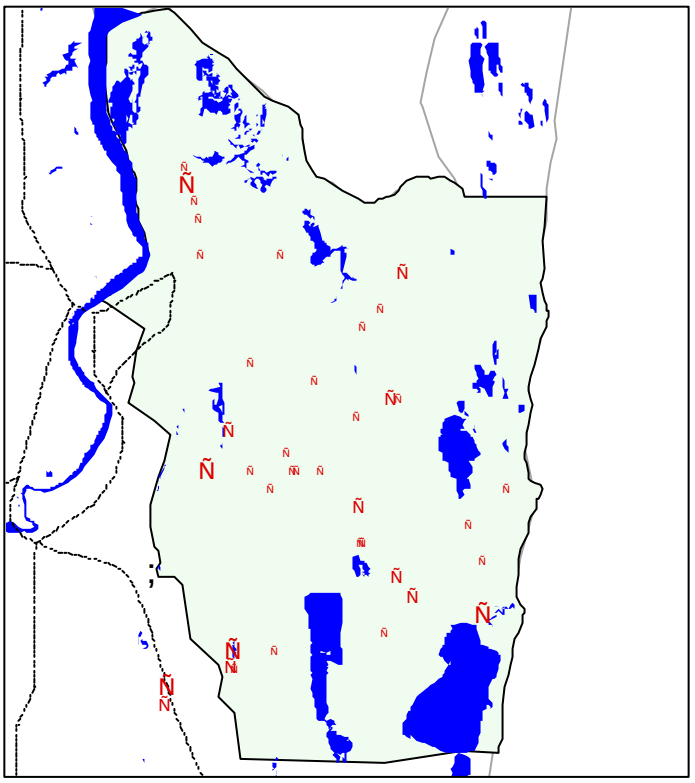

Figure 7. Distribution and group sizes of Bushpig

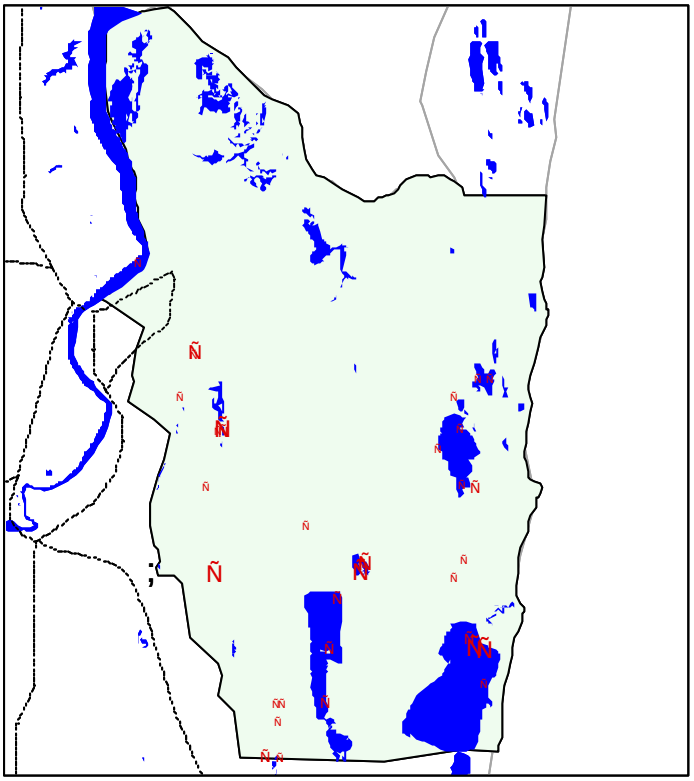

Figure. 8. Distribution and group sizes of hippo

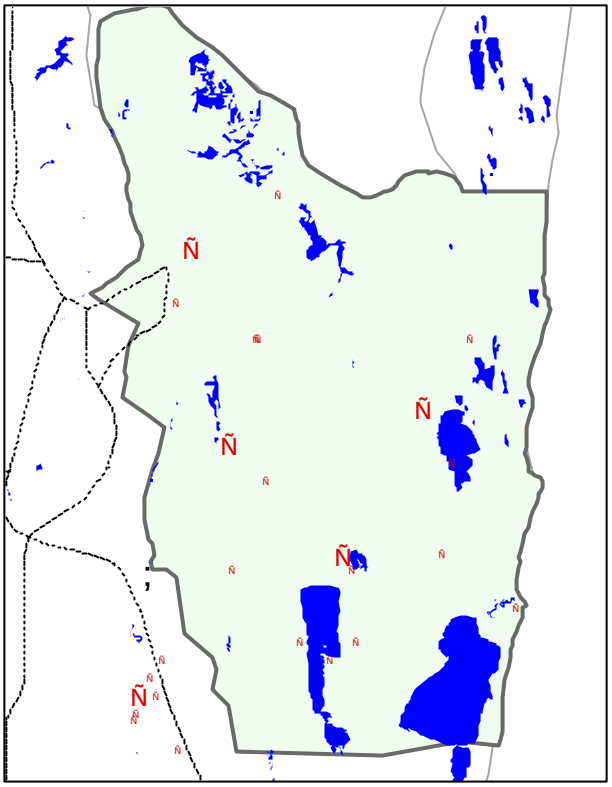

Figure. 9. Distribution and group sizes of bushbuck

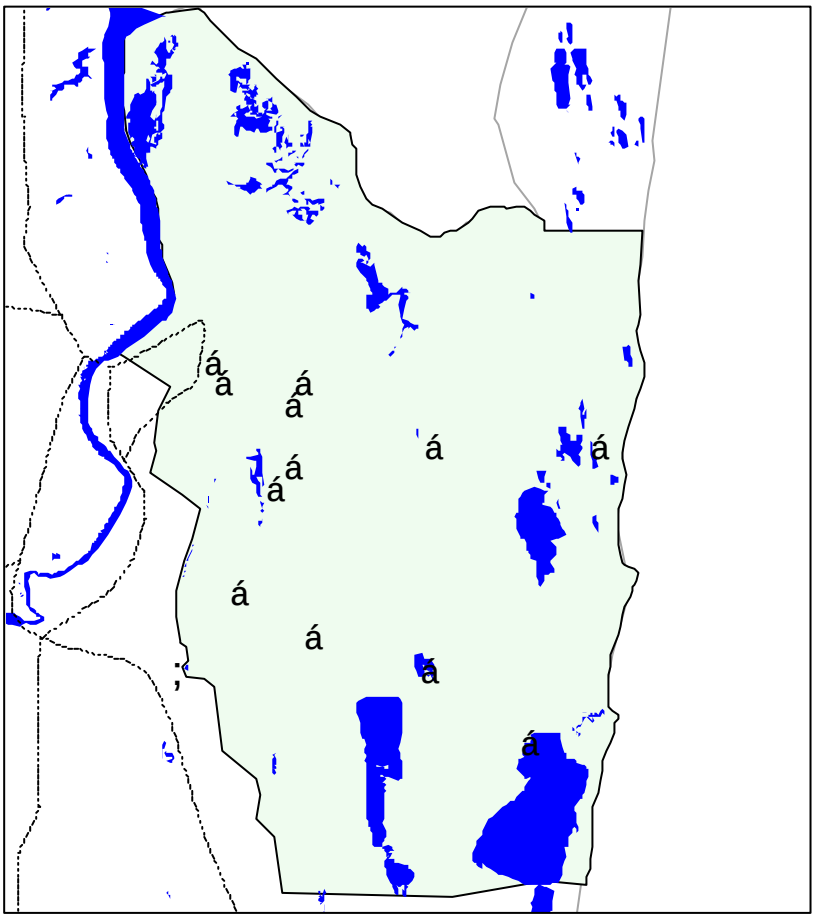

Figure. 10. Distribution of old elephant carcasses.

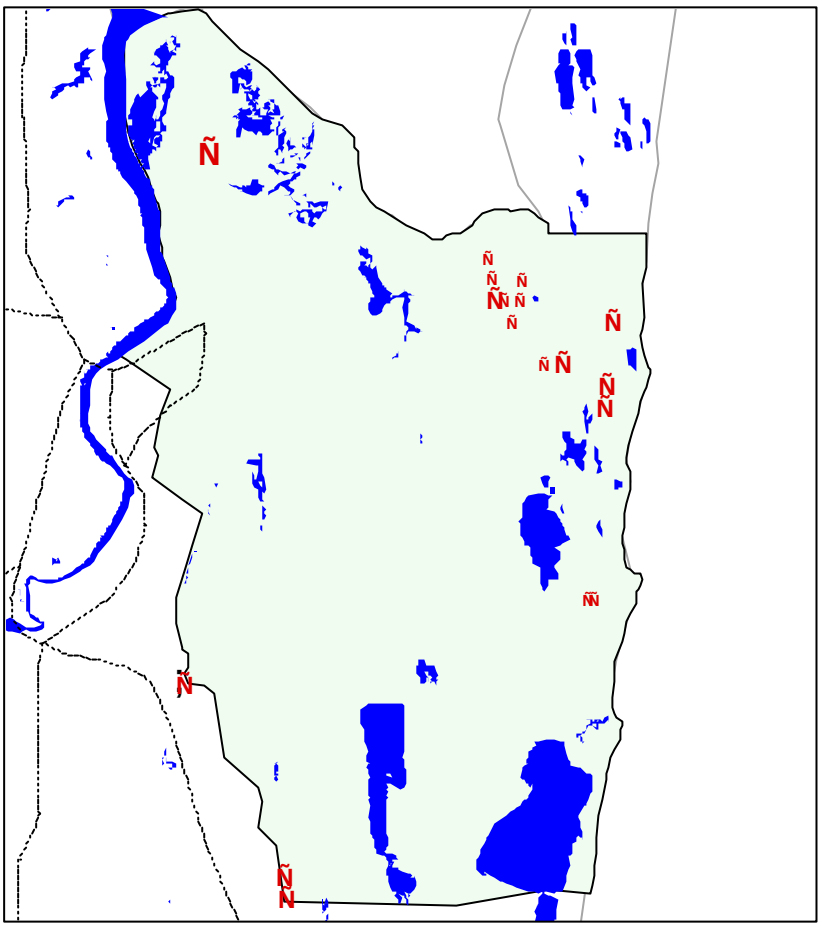

Figure. 11. Distribution and group sizes of goats.

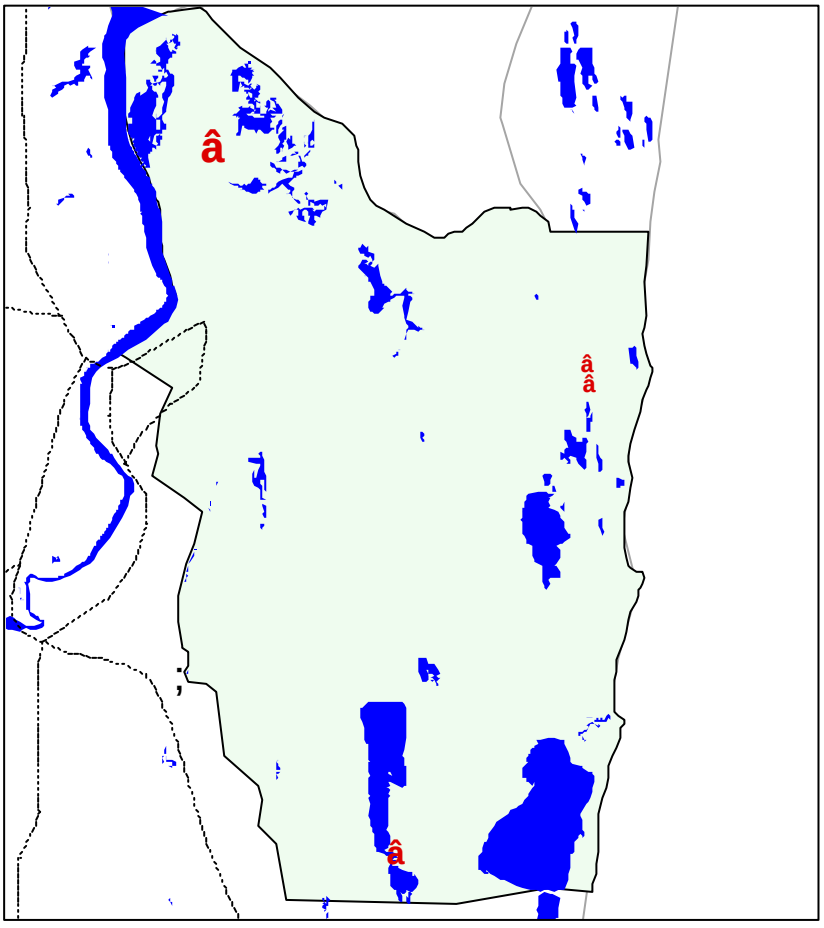

Figure. 12. Distribution and group sizes of cattle.

Figure 13. Distribution human activities from transect aerial survey, November 2006.

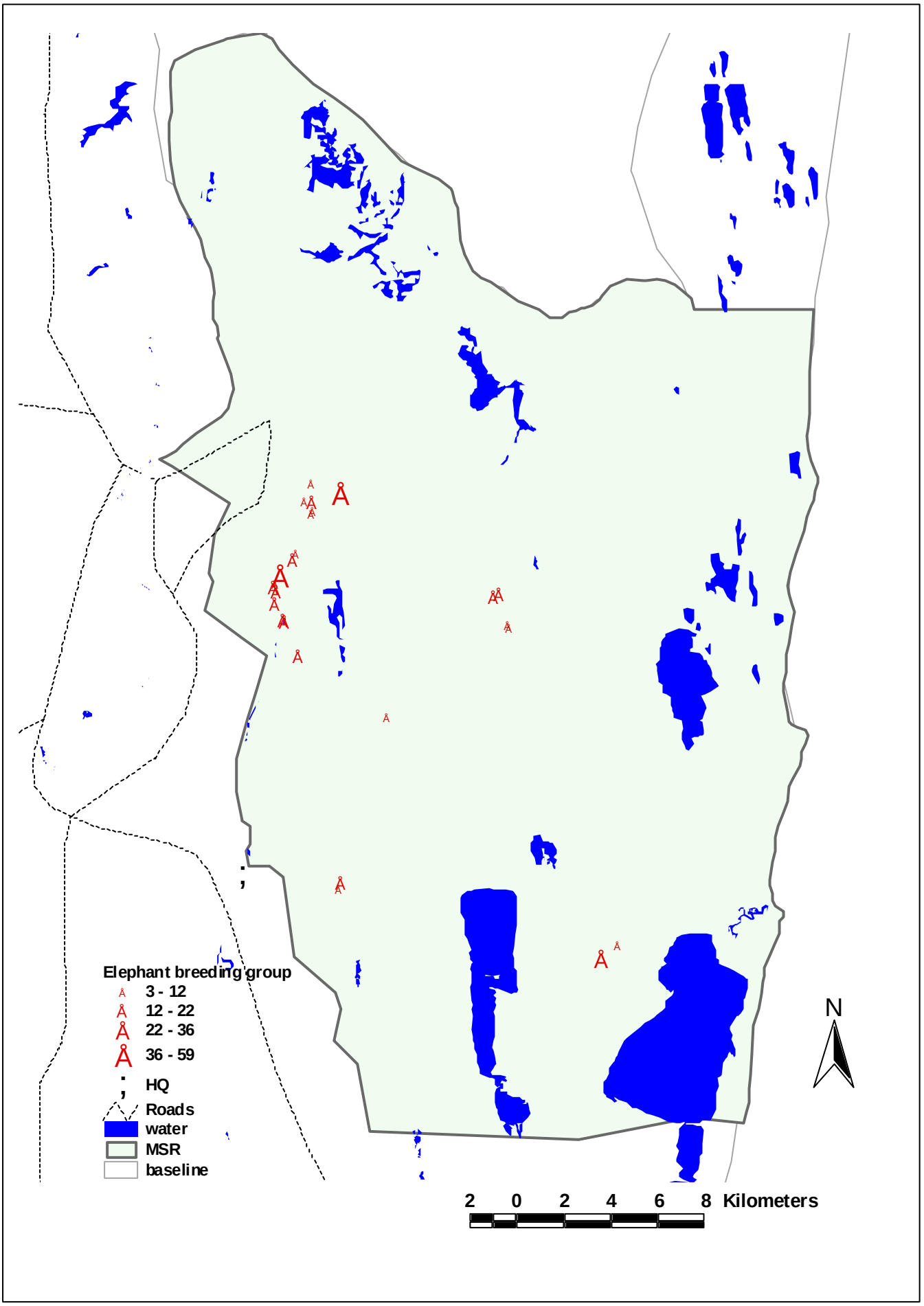

Figure 14. Distribution and group sizes of elephant family units [numbers – juveniles] from transect counts for the November 2006 census.

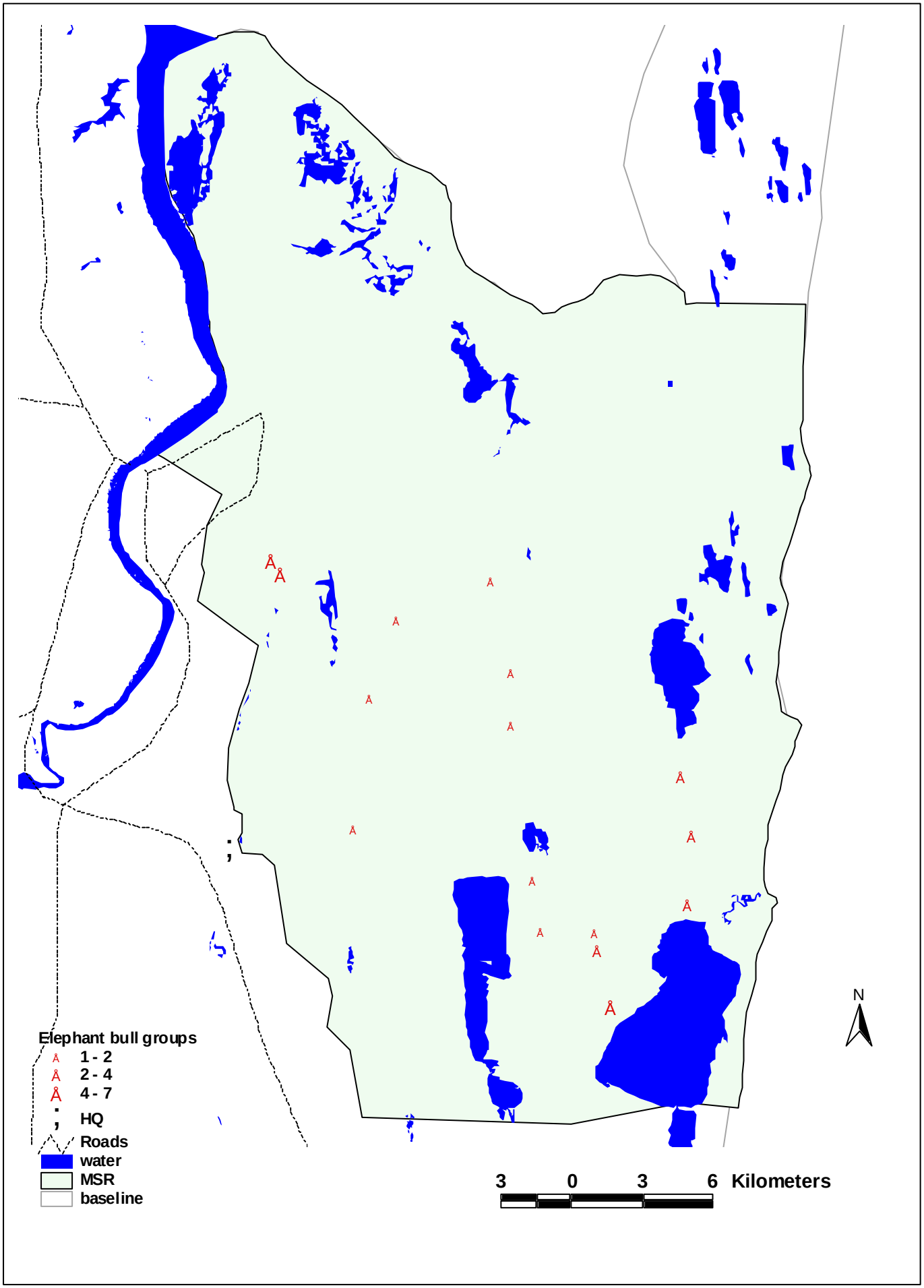

Figure 15. Distribution and group sizes of elephant bull units from transect counts for the November 2006 census.

Appendix. 2

Sequence no.	Lat long grid point	Session
1	S26.19000 E32.81000	MC36
2	S26.19000 E32.68000	MC35
3	S26.20000 E32.68000	MC34
4	S26.20000 E32.81000	MC33
5	S26.21000 E32.81000	MC32
6	S26.21000 E32.68000	MC31
7	S26.22000 E32.68000	MC30
8	S26.22000 E32.81000	MC29
9	S26.23000 E32.81000	MC28
10	S26.23000 E32.68000	MC27
11	S26.24000 E32.68000	MC26
12	S26.24000 E32.81000	MC25
13	S26.25000 E32.81000	MC24
14	S26.25000 E32.68000	MC23
15	S26.26000 E32.68000	MC22
16	S26.26000 E32.81000	MC21
17	S26.27000 E32.81000	MC20
18	S26.27000 E32.68000	MC19
19	S26.28000 E32.68000	MC18
20	S26.28000 E32.94000	MC17
21	S26.29000 E32.94000	MC16
22	S26.29000 E32.68000	MC15
23	S26.30000 E32.68000	MC14
24	S26.30000 E32.94000	MC13
25	S26.31000 E32.94000	MC12
26	S26.31000 E32.68000	MC11
27	S26.32000 E32.68000	MC10
28	S26.32000 E32.94000	MC9
29	S26.33000 E32.94000	MC8
30	S26.33000 E32.68000	MC7
31	S26.34000 E32.68000	MC6
32	S26.34000 E32.94000	MC5
33	S26.35000 E32.94000	MC4
34	S26.36000 E32.68000	MC2
35	S26.35000 E32.68000	MC3
36	S26.36000 E32.94000	MC1
37	S26.37000 E32.94000	MB30
38	S26.37000 E32.68000	MB29
39	S26.38000 E32.68000	MB28
40	S26.38000 E32.94000	MB27
41	S26.39000 E32.94000	MB26
42	S26.39000 E32.68000	MB25
43	S26.40000 E32.68000	MB24
44	S26.40000 E32.94000	MB23
45	S26.41000 E32.94000	MB22
46	S26.41000 E32.68000	MB21
47	S26.42000 E32.68000	MB20
48	S26.42000 E32.94000	MB19
49	S26.43000 E32.94000	MB18

50	S26.43000 E32.68000	MB17
51	S26.44000 E32.68000	MB16
52	S26.44000 E32.94000	MB15
53	S26.45000 E32.94000	MB14
54	S26.45000 E32.68000	MB13
55	S26.46000 E32.68000	MB12
56	S26.46000 E32.94000	MB11
57	S26.47000 E32.94000	MB10
58	S26.47000 E32.68000	MB9
59	S26.48000 E32.68000	MB8
60	S26.48000 E32.94000	MB7
61	S26.49000 E32.94000	MB6
62	S26.49000 E32.68000	MB5
63	S26.50000 E32.68000	MB4
64	S26.50000 E32.94000	MB3
65	S26.51000 E32.94000	MB2
66	S26.51000 E32.68000	MB1
67	S26.52000 E32.68000	MA30
68	S26.52000 E32.94000	MA29
69	S26.53000 E32.94000	MA28
70	S26.53000 E32.68000	MA27
71	S26.54000 E32.68000	MA26
72	S26.54000 E32.94000	MA25
73	S26.55000 E32.94000	MA24
74	S26.55000 E32.68000	MA23
75	S26.56000 E32.68000	MA22
76	S26.56000 E32.94000	MA21
77	S26.57000 E32.94000	MA20
78	S26.57000 E32.68000	MA19
79	S26.58000 E32.68000	MA18
80	S26.58000 E32.94000	MA17
81	S26.59000 E32.94000	MA16
82	S26.59000 E32.68000	MA15
83	S26.60000 E32.68000	MA14
84	S26.60000 E32.94000	MA13
85	S26.61000 E32.94000	MA12
86	S26.61000 E32.68000	MA11
87	S26.62000 E32.75000	MA10
88	S26.62000 E32.94000	MA9