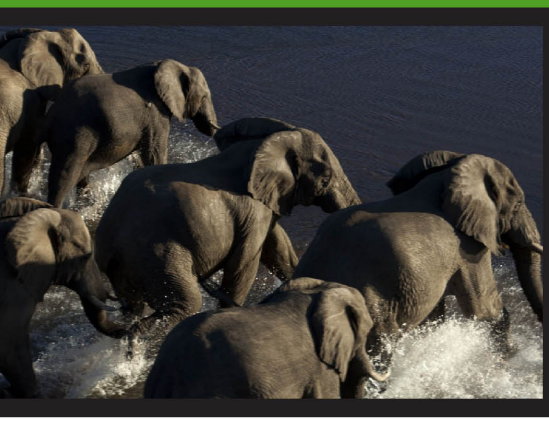
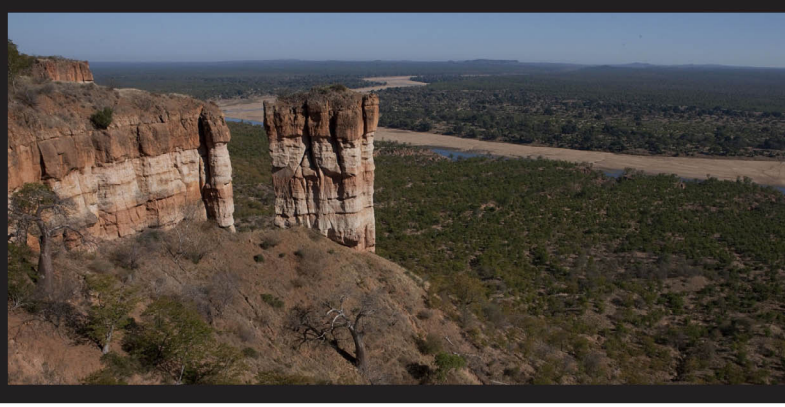
GONAREZHOU CONSERVATION PROJECT

Aerial Survey of Elephants and other Large Herbivores in Gonarezhou National Park (Zimbabwe), Zinave National Park (Mozambique) and surrounds: 2009

K.M. Dunham, E. van der Westhuizen, H.F. van der Westhuizen & E. Gandiwa

February 2010





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Aerial Survey of Elephants and other Large Herbivores in Gonarezhou National Park (Zimbabwe), Zinave National Park (Mozambique) and surrounds: 2009

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February 2010

Frankfurt Zoological Society
Gonarezhou Conservation Project
Gonarezhou National Park, Chiredzi, Zimbabwe

This survey was conducted jointly by the Parks & Wildlife Management Authority (Zimbabwe), the Transfrontier Conservation Areas Co-ordination Unit (Mozambique) and Frankfurt Zoological Society.

Summary

Elephants and other large herbivores, wild and domestic, in Gonarezhou National Park in south-eastern Zimbabwe, Zinave National Park in southern Mozambique and surrounding lands were surveyed from the air during September 2009. The survey area lies within the Great Limpopo Transfrontier Conservation Area. A fixed-wing aircraft was used to conduct a sample survey, flying transects over the area.

The area surveyed totalled 16343 km^2. It included 7112 km^2 in Zimbabwe, including Gonarezhou NP, Malapati Safari Area and adjacent communal lands. In Mozambique, the survey area totalled 9231 km^2 and included Zinave NP, part of Coutada 4 to the north of this park, the area north and south of the Save River between Gonarezhou NP and Zinave NP, and the zone along the Zimbabwe-Mozambique international border (which lies alongside Gonarezhou NP). The survey area was divided into 22 strata. Sampling intensity varied between strata and ranged from 6.3 to 21.1 %. The overall sampling intensity was 15.2 %.

Within the Zimbabwean survey area, the principal objective of the survey was to provide relatively precise and accurate estimates of the number of elephants and other large herbivores in the survey area as a whole, using a technique that could be executed within a reasonable time and at a reasonable cost. Secondary objectives included determination of the spatial distributions of elephants and other large herbivores; and estimation of the number and spatial distribution of elephant carcasses. The methods used were suitable for meeting the survey objectives, repeatable and technically robust. These methods were used for the first time to survey the wildlife populations of Zinave NP. Thus, this survey provides a baseline for monitoring future trends in the numbers and spatial distribution of wildlife and domestic livestock in Zinave NP and its surrounds.

Some large herbivores are not easily seen from the air and their numbers were undoubtedly underestimated. Nonetheless, population estimates are given for these species, because the estimates provide useful indices of abundance (with measures of precision) that can be used to determine spatial distribution, as well as temporal trends in population number. No corrections have been applied to any of the estimates to compensate for any undercounting or missed animals.

The estimated population numbers of the principal large herbivores in the survey area were: elephant 9281 (upper and lower 95% confidence limits ± 20.6 %); impala 6770 (± 34.2 %); buffalo 2742 (± 75.8 %); kudu 2832 (± 25.1 %); zebra 1500 (± 29.5 %); wildebeest 364 (± 81.8 %); giraffe 330 (± 59.5 %); eland 341 (± 112.2 %); nyala 546 (± 39.0 %); cattle 32240 (± 19.7 %); sheep and goats 24484 (± 19.8 %); and donkey 1393 (± 37.5 %).

For most wild species, the majority of the population was in Gonarezhou NP. The estimated population numbers of the principal large herbivores in Gonarezhou NP were: elephant 9123 (upper and lower 95% confidence limits ± 20.8 %); impala 6005 (± 37.4 %); buffalo 2274 (± 88.2 %); kudu 2285 (± 29.7 %); zebra 1385 (± 30.3 %); wildebeest 364 (± 81.8 %); giraffe 251 (± 61.6 %); eland 317 (± 120.2 %); nyala 370 (± 50.8 %); waterbuck 360 (± 85.5 %); cattle 2991 (± 51.3 %); and sheep and goats 452 (± 78.4 %). In the north of the park, the estimated number of huts built by people illegally resident there was 603 (± 55.3 %).

The 2009 estimate of the number of elephants in Gonarezhou NP was the highest estimate of the number of elephants in this park since sample surveys began there during 1975.

Zinave NP contained relatively few large herbivores, compared with Gonarezhou NP. The estimated population numbers of the principal medium and small herbivores in Zinave NP were: common duiker 899 (upper and lower 95% confidence limits ± 24.1 %); impala 150 (± 122.5 %); kudu 235 (± 63.5 %); oribi 254 (± 57.3 %); nyala 143 (± 64.3 %); cattle 620 (± 58.1 %); and sheep and goats 2039 (± 46.3 %). During a special river count along the section of the Save River that forms the northern boundary of Zinave NP, 88 hippopotamus and 38 crocodile were observed. People resident in Zinave NP have built an estimated 5033 huts (± 29.3 %).

The estimated total number of elephant carcasses (152) in the entire survey area represented 1.4 % of the total number of live and dead elephants. The all-carcass 'ratio' (i.e. the 'ratio' for elephant carcasses of all age categories) was also 1.4 % in the Zimbabwean portion of the survey area. In just one stratum was the all-carcass 'ratio' high: it was 18.9 % in the North Border stratum, on the Mozambican side of the Zimbabwe-Mozambique international border. No fresh (age category 1) or recent (age category 2) carcasses of elephants were seen in the search strips and so the 1+2 carcass 'ratio' was 0 % in the entire survey area and in both the Zimbabwean and Mozambican portions of it.

The area along the Save River between Gonarezhou NP and Zinave NP was occupied by relatively high densities of people and domestic livestock. Fields and commercial logging were common there. Hence, there appears to be no potential for this area to serve as a corridor for the movement of large animals between Gonarezhou NP and Zinave NP. The area of Sengwe communal land northwards of the Zimbabwe/Mozambique international border was also occupied by relatively high densities of people and domestic livestock and there appears to be no potential for this area to serve as a corridor for the movement of large animals between Gonarezhou NP and Kruger NP. However, within this area, a minefield that occupies a strip of land approximately 3 km wide, runs parallel to the international border and is unsettled by people, could perhaps serve as a wildlife corridor after the landmines have been cleared.

This survey was the seventh aerial survey of the wildlife populations of Gonarezhou NP since the severe drought of 1991/92. A trend analysis of the results of these surveys revealed that the estimated numbers of all elephants, elephants in cow herds, buffalo, eland, kudu, waterbuck and zebra have all increased significantly since that drought. The numbers of elephant bulls, giraffe and impala did not show statistically significant trends.

A trend analysis of survey results from before the drought was less successful, because some species were not included in all pre-drought surveys, while for other species the time series of population estimates was probably too short to determine a trend reliably. For elephant, the time series was longer and with more population estimates: overall, the number of elephants in the park did not increase during the decade before the drought, presumably as a consequence of elephant culling. Only zebra number increased significantly in the years before the drought. It then declined during the drought by approximately 50 %.

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Introduction

Large wild and domestic herbivores were censused in Gonarezhou National Park (south-eastern Zimbabwe), Zinave National Park (southern Mozambique) and in areas surrounding these parks (Maps 1 to 5). The survey area is part of the Great Limpopo Transfrontier Conservation Area (GLTFCA). The survey of Gonarezhou NP was part of a continuing study to monitor the numbers of elephants and other wildlife in the Parks & Wild Life Estate of Zimbabwe. Adjacent to the north of Gonarezhou NP is Malilangwe Estate and to the north of that is Save Valley Conservancy. Both areas contain resident elephants and are fenced or partially fenced, but the fences hinder rather than prevent the movements of elephants. The survey area was extended during 2009 to include communal lands adjacent to Gonarezhou NP. These communal lands included part of the Sengwe communal land to the south of Gonarezhou NP, land that is viewed as a potential corridor for wildlife movements between Gonarezhou NP and Kruger NP in South Africa.

The extent of movement by wildlife in this region across the Zimbabwe-Mozambique international border is not known. Hence, the survey area included the area of Mozambique adjacent to Gonarezhou NP. The Save River forms the north-east boundary of Gonarezhou NP and, after leaving Zimbabwe, flows eastwards to the Indian Ocean. Along the way, it forms the northern boundary of Zinave NP. The wildlife populations of Zinave NP were partially surveyed during 2007, when blocks covering 7.9 % of the park were surveyed from a helicopter (Stalmans 2007).

For the 2009 survey, the study area included land lying both between the two National Parks and to the north and south of the Save River, in order to access its potential to serve as a corridor for the movement of large animals between Gonarezhou NP and Zinave NP. Land to the north of Zinave NP forms part of Coutada 4 and the portion immediately north of Zinave NP was also surveyed.

The methods used during this survey were similar to those used during previous surveys of the wildlife populations of the Gonarezhou region of Zimbabwe. Within the Zimbabwean portion of the survey area, the principal objective of the survey was to provide relatively precise and accurate estimates of the number of elephants and other large herbivores in the survey area as a whole, using a technique that could be executed within a reasonable time and at a reasonable cost. Secondary objectives included determination of the spatial distributions of elephants and other large herbivores; and estimation of the number and spatial distribution of elephant carcasses. The methods used were suitable for meeting the survey objectives, repeatable and technically robust. These methods were used for the first time to survey the wildlife populations of Zinave NP, although such methods have been used previously during surveys elsewhere in Mozambique. Thus, this survey provides a solid baseline for monitoring future trends in the numbers and spatial distribution of wildlife and domestic livestock in Zinave NP and its surrounds.

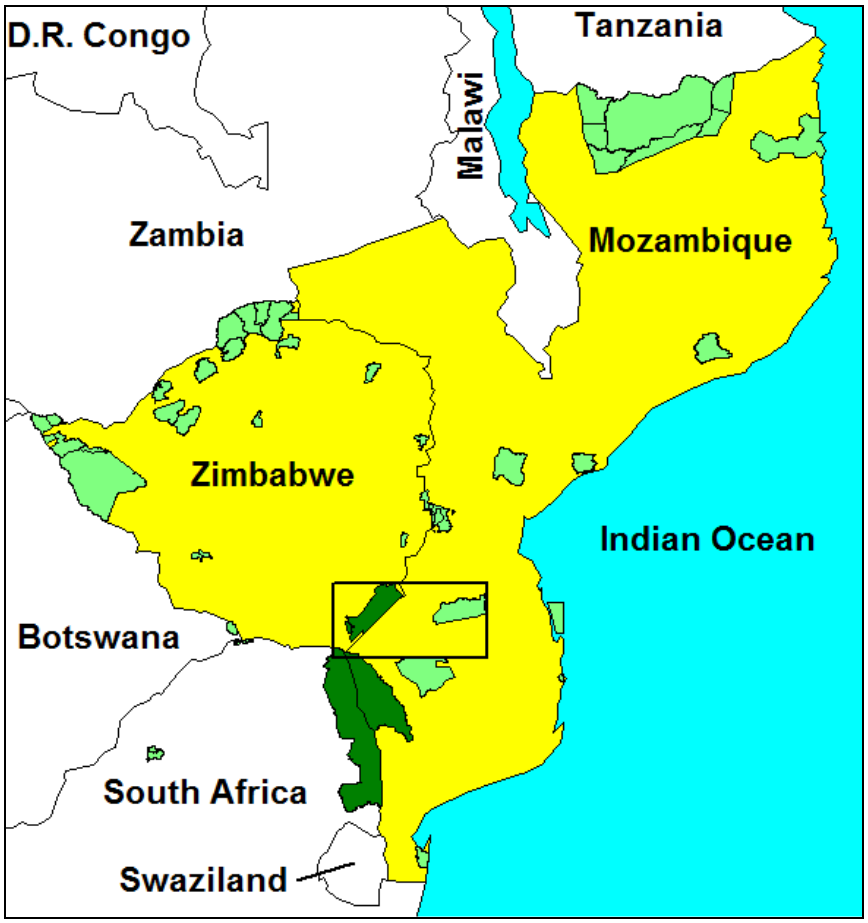
Although regular aerial surveys of Gonarezhou NP have been executed during the last three decades, this survey is the first attempt to provide an integrated assessment of elephant and wildlife numbers in the larger ecosystem, inclusive of the land and National Parks to the east of Gonarezhou within Mozambique. Little information is available on the extent of transboundary movements by elephants in the northern part of the GLTFCA. The game fence, erected for veterinary purposes, that used to be in place between Zimbabwe and Mozambique is no longer functional, allowing animals the opportunity to move freely across the international border.

For Gonarezhou NP, the results of all aerial surveys of wildlife both before and after the severe 1991/92 drought are examined to determine what, in any, trends occurred in the numbers of the major wildlife species during the pre- and post- drought periods.

Survey Area

The study area included those areas covered during the 2001 and 2007 surveys of the Gonarezhou region (Dunham 2002, Dunham *et al*. 2007). It included all strata surveyed during 2001 and again stratum 6 (Mabalauta) was subdivided during data analysis into Mabalauta (NP) and Malapati. On the Zimbabwean side of the international border, the survey area covered 7112 km^2 and included Gonarezhou NP, Malapati Safari Area, Mahenye communal land and areas of communal land along the western and southern borders of Gonarezhou NP and Malapati SA , as well as parts of Sengwe communal land lying between Gonarezhou NP and the Limpopo River, which here forms the northern boundary of South Africa's Kruger NP (Map 2). Part of the Sengwe communal land were surveyed during 1996 (Mackie 1997) and the Chingwesi and Matibi strata, alongside the western border of Gonarezhou NP, were surveyed during 1994 (Mackie 1994).

On the Mozambican side of the international border, the survey area included: Zinave NP; the land lying immediately north of this park and within approximately 10 km of the Save River (this land forming part of Coutada 4); the land alongside the Save River (within 5 km to the north and within 15 km to the south) between the international border and the western boundary of Zinave NP; and a strip of land about 15 km wide, lying immediately to the east of the international border (much of which is also the boundary of Gonarezhou NP) and stretching from the Save River to the Limpopo River.



Map 1. The location of the survey area in south-eastern Zimbabwe and southern Mozambique

National Parks (Mozambique and Zimbabwe), Safari Areas (Zimbabwe) and National Reserves (Mozambique) are shown (pale or dark green). The box highlights the survey area, which is shown in more detail in Maps 2 to 4. The Great Limpopo Transfrontier Park includes three national parks (dark green, from top in clockwise order), Gonarezhou NP (Zimbabwe), Limpopo NP (Mozambique) and Kruger NP (South Africa). The Great Limpopo Transfrontier Conservation Area does not have a formal boundary, but includes these three parks, Zinave NP (east of Gonarezhou NP), Banhine NP (east of Limpopo NP) and communal lands lying between these five parks.

Methods

Transect Surveys

Survey design

The procedures used followed those well established for aerial surveys of African large herbivores (Norton-Griffiths 1978) and utilised during earlier surveys of large herbivores in Mozambique and Zimbabwe (e.g. Craig 2006, Dunham *et al*. 2007). The survey area was divided into 20 strata, with two strata (Mabalauta and Zinave NP) flown as single strata, but subdivided prior to data analysis (see below).

Systematic, parallel transects were positioned across each stratum, with the position of the first transect in a stratum determined randomly. Transects were arranged at right angles to the principal environmental feature within a stratum (see Map 7 and Table 4 for transect orientations).

In order to maximise the precision of the estimate of the total number of elephants in the area covered by the 2001 survey (namely Gonarezhou NP, Malapati SA and Mahenye communal land), the sampling intensity varied between strata. Hence, the distance between adjacent transects varied between strata, according to the planned sampling intensity in each stratum. Overall sampling intensity in this area was planned to be 20 %, with a transect width (i.e. combined width of the two search strips) of 300 m. The planned sampling intensity in each stratum was determined by using the mean of the elephant densities in each stratum during 1998, 2001 and 2007 (Dunham 2002, Dunham *et al*. 2007, Mackie 1999) as the predicted elephant densities in equation 1 of Gibson (1989a). As a consequence, those strata expected to contain high densities of elephants were sampled more intensively than strata expected to contain few elephants. In practice, the transect spacing varied from 1.5 km in strata expected to contain numerous elephants, to 2.9 km in strata expected to contain few elephants (Table 4).

Elsewhere within the Zimbabwean part of the 2009 survey area, planned sampling intensity was 12 %. In the communal lands to the west and south of Gonarezhou NP, the survey was intended to provide not only estimates of the numbers of large wild animals, but also information on the numbers and spatial distribution of human settlements and human activities.

Within the Mozambican part of the survey area, planned sampling intensity varied from 6 % (in one strata that was relatively distant from the Save River, Gonarezhou NP and Zinave NP), through 12 % (along the Save River and the international border adjacent to Gonarezhou NP), to 15 % (in Zinave NP and in the area of Coutada 4 immediately north of Zinave NP). Generally, the planned sampling intensity was greater in areas where wildlife was expected to be more numerous.

The survey was designed using WWF-SARPO's custom software (AIRDESW, version dated 29/05/97). Given a stratum boundary in the form of an ATLAS GIS bna format file, and the transect orientation and spacing, this software generates flight lines (the transects), with the first flight line offset from the end of the stratum by an entered random number. The start and end points for each transect (Appendix 3) were transferred as waypoints to a Global Positioning System (GPS) receiver in the plane prior to flying each stratum.

Flight procedures

All strata were surveyed during the period 3 to 19 September 2009 (Table 1).

The aircraft used for the survey was a Cessna 185. It was fitted with a radar altimeter and a Garmin GPSmap 296 GPS receiver. During the survey, the aircraft was flown at approximately 160 km per hour at about 300 feet above ground level. Waypoints denoting the start and end points of transects were entered into the GPS receiver and used to form

routes. Navigation along the transects was undertaken by the pilot, with reference to the GPS receiver. The track of the aircraft was recorded using the track log facility of the GPS receiver, which noted the aircraft's location at intervals of 20 seconds (of time).

The aircraft crew included a pilot (Hugo van der Westhuizen), a recorder (Edson Gandiwa) who sat next to the pilot, and two observers who sat behind the pilot and recorder. All four crew members could talk to one another through an intercom system. The two observers were Julius Shimbani and Ezekiel Mungoni. Prior to this survey, Mr Shimbani had previous experience of observing during aerial surveys, having served as an observer during helicopter surveys, but Mr Mungoni had no previous experience as a survey observer.

All animals seen by the observers within the search strips (see section *Strip Width and Calibration* below) were called to the recorder, who wrote down the species, the number of individuals of the group that were within the strip, and the GPS location against the time (to the nearest 30 seconds) after the start of the transect. Locations were recorded as waypoints using a Garmin GPS 60 GPS receiver. (Occasionally, the GPS receiver malfunctioned – probably because it was not receiving signals from a sufficient number of satellites – and on these occasions locations were determined from the flying time along the transect.) During the survey, the actual height of the plane above ground level (agl) was recorded by the recorder, from the radar altimeter, every 30 seconds (of time) while flying along the transects. Later the mean height above ground level for each transect was calculated. The recorder used the stopwatch function of the GPS receiver to record the time (to the nearest second) taken to fly each transect.

Occasionally, the aircraft left a transect to circle for a few minutes over a object of potential interest – when this happened, the stopwatch was stopped until the aircraft returned to the transect line and the survey resumed. The pilot used the aircraft's GPS receiver to ensure that the transect stopped and restarted at the same point on the transect.

Observations

As during previous surveys of this region, the observers were instructed to search for elephants but to count also other wild large herbivores and domestic livestock (cattle, goats, sheep and donkeys). Sheep and goats are not readily distinguished during aerial surveys and so both were recorded as 'shoats'. If any animal group was too large for all the individuals within it to be counted, group size was estimated by the observer. Groups of elephant bulls were differentiated from elephant cow herds (i.e. herds containing calves), although the latter may have included some bulls. The observers were instructed to note any carcasses seen. All elephant carcasses noted were classified using four age categories as follows:

Carcass category	Definition
1	**Fresh** Carcass still had flesh, giving the body a rounded appearance. Vultures were probably present and the ground was still moist from body fluids. (Likely to have died within the past month).
2	**Recent** Rot patch and skin still present. Skeleton not scattered. (Likely to have died within the past year).
3	**Old** Clean bones; skin usually absent; vegetation regrown in rot patch. (Likely to have died more than 1 year ago).
4	**Very Old** Bones scattered and turning grey. (Likely to have died within the last 10 years).

These carcass categories are those used by Douglas-Hamilton & Hillman (1981) and now recommended by MIKE for elephant surveys (Craig undated). MIKE (Monitoring the Illegal Killing of Elephants) is a CITES programme that uses aerial and ground surveys of elephant populations, and data collected by law-enforcement patrols, to monitor the illegal killing of elephants at representative sites across Africa and Asia. Carcasses that could not be identified as elephant carcasses were recorded as 'unknown carcasses'.

Ground hornbills are large and conspicuous birds and any seen were counted, as were ostriches and poachers' camps. Poachers' camps were identified by the presence of a relatively large and rectangular pattern of fire ash (suggesting that the fire was used to dry meat or fish and that it was not simply a camp fire). Huts, built by people in the communal lands and in Gonarezhou NP and Zinave NP, were also recorded, as were brick buildings. The presence of brick buildings suggests that a settlement is more permanent than one consisting of huts constructed of timber and thatch. The numbers and distribution of huts and buildings provide information on human settlement patterns adjacent to and inside the national parks. Other human activities (e.g. tree cutting, commercial logging) were recorded when they were observed. Fields were also recorded, but because fields are large relative to the width of the search strips, this survey cannot be used to calculate a reliable density of fields. Pans with water, i.e. potential sources of drinking water for wildlife, were also noted.

Strip width and calibration

Two fishing rods were attached with custom brackets to each wing strut of the aircraft, so that the rods pointed backwards and parallel to the ground during level flight. The distance between the rods on each strut was arranged so that, when the aircraft was flying at 300 feet agl, this distance represented a strip about 150 m wide on the ground. Each outer rod was marked with a small piece of tape to provide the observers with a "decision point" (it was at this point that the observer decided whether an animal was inside his search strip). When deciding whether animals were inside or outside the strip, the observer moved his eye so as to align the tape on the outer rod with a small piece of tape on his window, thereby ensuring that all his decisions were made at the same viewing angle.

Prior to and during the survey, the strip widths were calibrated by flying the aircraft at right angles across an airstrip that had two sets of large-sized numbers (from 0 to 35) arranged at 10-meter intervals along the side of the airstrip. The numbers were arranged as 35 34 33….2 1 0 1 2…..33 34 35, with 0 near the centre of the airstrip. Each observer noted the largest and smallest number within his strip and the recorder noted the aircraft's height above ground level, as recorded by the radar altimeter. For each flight passing over the calibration numbers, the combined strip width (in meters) was adjusted to 300 feet above ground level as follows:

$$\text{Combined strip width at 300 feet} = \frac{\text{Actual combined strip width} \times 300}{\text{Actual flying height}}$$

The combined strip widths, after adjustment to 300 feet above ground level, were then averaged to give the nominal (calibrated) combined strip width at 300 feet. This was 304.0 m (Appendix 1).

Hippopotamus and Crocodile Count

At the request of Transfrontier Conservation Areas Co-ordination Unit of the Ministry of Tourism in Mozambique, a special survey was conducted of the hippos and large crocodiles in the stretch of the Save River that forms the northern boundary of Zinave NP. The methods

used to execute this survey and analyse the data collected differ from those for transect surveys and so this river count is reported separately (see Appendix 6).

Data Analysis

Transect surveys

Two strata (Mabalauta and Zinave NP) were both flown as single strata, but subdivided prior to data analysis. Mabalauta stratum was divided into areas of national park and safari area, substrata named Mabalauta NP and Malapati respectively. Zinave NP was subdivided into western and eastern strata, because the results of a 2007 survey of the park suggested that densities of some species (e.g. kudu, nyala, impala, warthog) may be less in the west (where the landscape is dominated by *Colophospermum mopane* woodland and *Guibourtia* sandveld) than in the east (where the landscape is dominated by miombo woodland and *Acacia nigrescens* woodland) (Stalmans 2007).

Population estimates and 95 % confidence limits for individual strata were calculated with WWF-SARPO's custom software (AIRSURVW, version dated 22/05/97). This software uses Jolly's (1969) method 2 for unequal-sized sample units. Given the mean combined strip width when the plane was flying at 300 feet (i.e. the calibrated strip width), and the mean flying height for each transect, the software determines the actual combined strip width for each transect. The actual combined strip width is the product of the nominal strip width at 300 ft and the mean height for the transect, divided by 300. The area of each transect is calculated as the product of the actual combined strip width and the transect length. Transect lengths were provided by the survey design software (Appendix 3).

Transects near the boundary of a stratum were sometimes broken into two or more sections, with land outside the stratum between the sections. For the purposes of analysis, data for all sections of the same transect were combined and entered into the software as one transect. Calculation of the variance of a population estimate required the calculation of N, an integer that is the total number of transects that could have been used in the survey of a stratum. The value of N for a stratum was found by dividing the baseline length by the overall mean actual strip width for that stratum.

Thus, for each stratum, N was calculated as:

$$N = \frac{\text{Baseline length} \times 1000 \times 300}{\text{Nominal strip width} \times \text{Average flying height}}$$

where:

Baseline length = length (in km) of a straight line aligned at right angles to the orientation of the transects, and running from one end of the stratum to the far end;

Nominal strip width = calibrated combined strip width (in m) when flying at 300 feet agl; and

Average flying height = Mean of the mean flying heights (in feet) for all transects in the stratum.

The calculated value of N was rounded to the nearest integer. The value of Student's *t* used to calculate the 95 % confidence limits of a population estimate was t_{n-1} for $P = 0.05$ (Rohlf & Sokal 1981), where n = number of surveyed transects in stratum. The WWF-SARPO software AIRSURVW calculates the 95 % confidence *interval* as the difference between the mean population estimate and the upper (or lower) 95 % confidence *limit*. The software displays the lower 95 % confidence limit as zero if the calculated value is negative.

Entire survey area and land units within it

Population estimates for the entire survey area and for various land units within it were calculated as the sum of the estimates for the individual strata within the survey area or land unit. The upper and lower 95% confidence limits for population estimates for the entire survey area or land unit were calculated as:

Population estimate ± [t_v x Square root of (Sum of Variances for individual strata)]

where:

v = the degrees of freedom estimated by Satterthwaite's rule (Snedecor & Cochran 1980, Gasaway *et al*. 1986).

v was an integer, calculated using the formula:

$$v = \frac{(\text{Sum of Variances for individual strata})^2}{\text{Sum of } [(\text{Variance for individual stratum})^2 / (n-1)]}$$

with the outcome of this formula rounded down to the nearest integer. t_v was calculated using the EXCEL function TINV(0.05, v).

Elephant carcasses

The elephant carcass "ratio" *sensu* Douglas-Hamilton & Burrill (1991) - although it is a percentage, not a ratio - was calculated as the estimated number of all elephant carcasses (i.e. age categories 1, 2, 3 and 4 summed) as a percentage of the estimated number of all elephants (i.e. live + dead). Because these carcass ratios are based on all elephant carcasses, regardless of age category, the elephant carcass ratios and densities given here are directly comparable with the ratios and densities from previous surveys of this region.

When interpreting the results of this survey, it is reasonable to assume that all category 1 or 2 carcasses represent elephants that died during 2009. Hence, the 1+2 carcass ratio provides an index of elephant mortality (both natural and anthropogenic) during 2009 and it was calculated as the estimated number of elephant carcasses in age categories 1 or 2 as a percentage of the sum of the estimated number of live elephants and the estimated number of carcasses in age categories 1 or 2.

Search Effort

The greater the time spent searching each square kilometre of a transect, the greater the probability that the observer saw all the animals that were there. Search effort (in minutes per square kilometre) for a stratum was defined as the total time spent flying all transects within that stratum, divided by the total area of those same transects.

Even the largest herbivores are not easily seen from the air and the numbers of all species were probably underestimated, with the degree of underestimation greater for small or cryptic species than for large species. However, population estimates are given for all species, because the estimates provide useful indices of abundance (with measures of precision) that can be used to determine spatial distribution, as well as temporal trends in population number. No corrections have been applied to any of the estimates to compensate for any undercounting or missed animals.

Results

Search Effort

Search effort averaged 1.18 minutes km^{-2} for the entire survey area (Table 4).

Animal Numbers

The estimated numbers of elephants, elephant bulls in bull groups, elephants in cow herds, elephant carcasses (age categories 3 and 4), unidentified carcasses, buffalo, eland, giraffe, impala, kudu, nyala, waterbuck, zebra, wildebeest, warthog, common duiker, grysbok, oribi, reedbuck, steinbuck, bushpig, cattle, sheep and goats, donkey, ostrich, ground hornbill, crocodile and hippopotamus are given in Tables 5 to 33 respectively. Estimates are given for each stratum, for various land units within the survey area and for the entire survey area.

In addition, separate summary tables are provided for the two national parks, Gonarezhou NP (Table 1) and Zinave NP (Table 2).

The columns in these tables give (from left to right):

- the name of the **stratum**;
- the **estimate** of the number of animals of that species (or of carcasses, camps, etc.) in that stratum, in other words the population estimate;
- the number of individuals of that species seen (**No. seen**) *inside the search strips* during the survey of that stratum;
- the **variance** of the estimated number of animals in that stratum;
- the 95 % confidence interval of the population estimate for that species in the stratum, as a percentage of the population estimate for that stratum (**% CI**);
- the lower 95 % confidence limit of the population estimate (**Lower CL**); and
- the upper 95 % confidence limit of the population estimate (**Upper CL**).

The last row of each table gives the same measures for the entire survey area and additional rows give subtotals for various land units within the survey area. There may appear to be small arithmetic errors in some tables, but these are simply rounding errors: all numbers in the tables were calculated to three decimal places before they were rounded to the required number of decimal places. If the number of individuals seen (**No. seen**) is greater than the lower confidence limit (**Lower CL**), then it is biologically meaningful to replace the calculated lower confidence limit with the number seen.

For practical purposes, it can be assumed that the number of a given species in a given land unit lies between the lower and upper confidence limits, with the 'estimate' providing the best estimate of the number there. For example, from Table 1, one can say that there were between 7221 and 11025 elephants in Gonarezhou NP, with 9123 being the best estimate of the number of elephants in the park. For practical purposes, one might say that there were between 7000 and 11000 elephants in Gonarezhou NP during the late dry season of 2009, with 9000 being the best estimate of the number of elephants there.

Small numbers of bushbuck (eight in northern Gonarezhou NP, two in Zinave NP and two in Malapati SA), roan antelope (one individual inside the search strips in the Chilojo B stratum), klipspringer (eight in Chipinda Pools, Chilojo A and Sengwe strata), jackal (one in Chilojo B stratum), lion (three in Mabalauta NP stratum), vervet monkey (one in Save Corridor stratum), and hyaena (one in Sengwe stratum) were seen during the survey, but no attempt has been made to estimate the numbers of these species.

No sable antelope were seen inside the search strips during the survey, but one group of 18 animals was observed outside the strips in Chipinda Pools stratum and one group of 22 animals outside the strips in the Chilojo A stratum.

Table 1. Population estimates and statistics for major wildlife species, domestic livestock, elephant carcasses and huts in Gonarezhou NP during September 2009

Species	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
Elephant	9123	1763	917825	20.8	7221	11025	1.84
Elephant bulls	757	142	9567	25.8	561	952	0.15
Elephant cows	8366	1621	908258	22.6	6474	10258	1.69
Elephant carcass 3	72	15	275	45.8	39	105	0.015
Elephant carcass 4	56	10	365	68.8	17	94	0.011
Unidentified carcass	209	38	1649	39.6	126	291	0.042
Buffalo	2274	464	867866	85.2	337	4212	0.46
Eland	317	66	35461	120.2	0	698	0.06
Giraffe	251	51	5880	61.6	96	405	0.05
Impala	6005	1157	1281788	37.4	3756	8254	1.21
Kudu	2285	452	115905	29.7	1607	2963	0.46
Nyala	370	77	8770	50.8	182	558	0.07
Waterbuck	360	75	23120	85.5	52	668	0.07
Zebra	1385	278	44675	30.3	965	1804	0.28
Wildebeest	364	76	22489	81.8	66	663	0.07
Warthog	267	53	10994	79.4	55	478	0.05
Duiker	159	28	835	36.4	101	217	0.03
Grysbok	24	5	87	76.6	6	43	0.005
Steinbuck	97	18	684	53.7	45	150	0.02
Ostrich	46	9	341	80.3	9	83	0.01
Ground hornbill	325	67	5314	44.4	181	470	0.07
Crocodile	293	61	15466	85.8	42	544	0.06
Hippopotamus	277	58	19824	102.2	0	560	0.06
Cattle	2991	624	573057	51.3	1457	4525	0.60
Sheep and Goat	452	94	30847	78.4	98	806	0.09
Donkey	53	11	2306	184.7	0	150	0.01
Poachers' camp	53	11	280	64.0	19	87	0.01
Hut	707	147	30987	50.1	352	1061	0.14
Building	68	14	884	87.6	8	128	0.01

Table 2. Population estimates and statistics for major wildlife species, domestic livestock and huts in Zinave NP during September 2009

Species	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
Impala	150	23	8165	122.5	0	334	0.04
Kudu	235	36	5455	63.5	86	384	0.06
Nyala	143	22	2103	64.3	51	236	0.04
Warthog	46	7	908	132.9	0	106	0.011
Duiker common	899	138	11650	24.1	682	1116	0.22
Grysbok	39	6	262	84.1	6	72	0.010
Oribi	254	39	5176	57.3	109	400	0.06
Reedbuck	32	5	431	132.6	0	76	0.01
Steinbuck	241	37	1405	31.3	166	316	0.06
Bushpig	180	27	4967	85.4	26	333	0.01
Ostrich	7	1	38	193.5	0	19	0.002
Ground hornbill	332	51	6557	49.1	169	495	0.08
Crocodile	13 [a]	2	68	131.5	0	30	0.003
Hippopotamus	[b]						
Cattle	620	95	32124	58.1	259	980	0.16
Sheep and Goats	2039	313	219490	46.3	1095	2983	0.51
Unidentified carcass	13	2	73	131.6	0	30	0.003
Poachers' camp	13	2	70	131.6	0	30	0.003
Hut	5033	773	537931	29.3	3560	6507	1.26
Building	52	8	528	89.7	5	99	0.01

[a] During a total count along the river, 38 crocodiles were seen in the stretch of the Save River that separated Zinave NP and the North Zinave stratum (see Appendix 6)

[b] During the same total count along the river, 88 hippos were seen in the stretch of the Save River that separated Zinave NP and the North Zinave stratum (see Appendix 6)

No fresh or recent carcasses of elephants (i.e. age categories 1 or 2) were recorded in the search strips during the survey and hence the 1+2 carcass ratio was 0 in all strata. Just one fresh carcass and one recent carcass of elephant were seen outside the search strips, both in the Chilojo B stratum of Gonarezhou NP. The elephant carcass ratios for all carcasses are given in Table 9.

Animal Distributions

The spatial distribution of the principal wild herbivores is shown in Maps 8 to 10 and 12 to 21. On most maps, the distribution is shown in two ways. First, each stratum is shaded to represent the average density of the given species in that stratum. Secondly, the locations of sightings of groups of the given species are shown, together with an indication of the size of the group. For the strata sampled with transects – which were systematically arranged - maps of the locations of animal sightings provide information on the spatial distribution of the animal groups. However, it must be remembered that the recorded number of groups of any species was determined by both group density and the sampling intensity – which, by design, varied between strata (Table 4).

The spatial distribution of elephant carcasses of age categories 3 and 4 is shown in Map 11.

The spatial distribution within Zinave NP of some small or cryptic species that are hard to survey from the air (baboon, bushpig, common duiker, grysbok, oribi and steinbuck) are shown in Map 22. Even though these species are not easily surveyed from the air, this map is included here for possible comparison with the distribution maps from the earlier aerial survey of Zinave NP, which did survey small or cryptic species.

Human Activities

The estimated number of poachers' camps in the survey area is given in Table 34 and the numbers of huts and brick buildings are given in Table 35 and 36 respectively. The spatial distributions of huts and domestic livestock are shown in Maps 23 - 25. The spatial distributions of fields and commercial logging in the Mozambican strata along the Save River are shown in Map 26.

Comparison of Observers

A comparison of the numbers of animals seen by the two observers (Appendix 5) suggested that generally they saw similar numbers of groups of animals, but the right observer counted more individual animals. However, it is not possible from the survey results to determine which observer counted most accurately.

Trends in Animal Numbers in Gonarezhou NP

Sixteen aerial surveys of the elephant population of Gonarezhou NP have been conducted since 1980 (Coulson 1980, 1981; Sharp 1982, 1983, 1984, 1986, 1987; Gibson 1989b; Jones 1991; Bowler 1995; Davies 1996; Davies *et al*. 1996; Mackie 1999; Dunham 2002; Dunham *et al*. 2007; and this survey). The surveys before 1984 reported only elephants. From 1984, a range of large mammal species (but not all) were included in the survey reports. But for some species it was not clear if animals were not seen, or seen but not reported. Since 1993, reporting has been more consistent in terms of the species covered.

The time series of population estimates were graphed and then examined visually to see if there appeared to be any trends in the estimates. During 1991/92, there was a severe drought in south-east Zimbabwe and many wild animals in Gonarezhou NP died, or were captured. Hence, for each species, separate pre-drought and post-drought time series were examined.

The impala was not recorded during surveys before the drought. For eland, kudu and waterbuck, two of five pre-drought surveys did not report population estimates: either no animals were seen (in which case the population estimate = 0), or some were seen but not reported (in which case the population estimate is unknown). Because of these gaps in the data sets, no attempt was made to examine further pre-drought population trends for these species. There were five pre-drought population estimates for buffalo, giraffe and zebra (during 1984 to 1991), and eight for elephant (during 1980 to 1991).

Approximately 600 elephants were captured in Gonarezhou NP during 1993 and the aerial survey that year occurred while the capture programme was in progress. Therefore, the post-drought time series for elephant was for the years 1995 to 2009. Separate estimates of the numbers of elephants in cow herds and in bull groups were also available for these years. The impala was not included in the 1993 survey and so their post-drought trend was also examined for the 14-year period 1995 to 2009. For other major species, the post-drought trends in numbers were examined for the 16-year period 1993 to 2009.

Trends in animal numbers in Gonarezhou NP were determined assuming that an exponential model was appropriate for estimating the rate of population change for any given species. The exponential rate of population change per annum (r) was calculated using Gasaway *et al.*'s (1986) method based on weighted regression. The variance of r is based on the sampling variances of the population estimates. This method yields different results from the linear regression of $\log_e$ [population estimate] on year: the variance of an estimate of r derived from this linear regression is based on the deviations of the population estimates from the fitted regression line.

The rate of population change per annum as a percentage was calculated as: % change = $100 \times (e^r - 1)$. Population number was considered to have increased significantly if both the lower confidence limit (LCL) and upper confidence limit (UCL) of r were positive, or to have declined significantly if both the lower and upper confidence limits of r were negative. The absence of a statistically significant trend does not necessarily mean that there was no trend.

The estimated number of elephants in Gonarezhou NP declined noticeably after the 1983 cull of >2000 animals (Fig. 1), but overall during the 1980s the number of elephants appears not to have declined despite the culls, but then neither did it increase: r during the pre-drought period was close to zero (Table 3). Presumably the culls achieved their aim of preventing an increase in elephant number. After the 1992 drought and the 1993 capture, the estimated number of elephants did increase (Fig. 1).

Only for zebra was there a statistically significant trend (an increase) in the pre-drought population (Table 3, Fig. 5), although an apparent increase in buffalo number before the drought was almost significant (Table 3, Fig. 6).

Table 3. Analysis of the trends in the numbers of the major wildlife species in Gonarezhou NP both before and after the 1992 drought

Pre-drought trends were examined using data from surveys during 1980 to 1991, and post-drought trends using surveys during 1993 to 2009. For elephants, the post-drought trends are those since the elephant captures during 1993.

Species	Period relative to 1992 drought	Years	Number of surveys	*r*	% change (per annum)	LCL *r*	UCL *r*	Trend [a]
Elephant	Pre	1980-1991	8	0.002	0.19	-0.028	0.032	ns
Elephant	Post	1995-2009	6	0.060	6.20	0.039	0.082	+
Elephant bulls	Post	1995-2009	6	-0.005	-0.46	-0.028	0.019	ns
Elephant cows	Post	1995-2009	6	0.070	7.29	0.046	0.095	+
Buffalo	Pre	1984-1991	5	0.081	8.40	-0.067	0.229	ns
Buffalo	Post	1993-2009	7	0.250	28.41	0.180	0.320	+
Eland	Post	1993-2009	7	0.125	13.28	0.051	0.199	+
Giraffe	Pre	1984-1991	5	0.116	12.36	-0.068	0.301	ns
Giraffe	Post	1993-2009	7	0.036	3.63	-0.008	0.079	ns
Impala	Post	1995-2009	6	0.009	0.85	-0.019	0.036	ns
Kudu	Post	1993-2009	7	0.092	9.69	0.066	0.119	+
Waterbuck	Post	1993-2009	7	0.183	20.03	0.116	0.249	+
Zebra	Pre	1984-1991	5	0.126	13.45	0.004	0.248	+
Zebra	Post	1993-2009	7	0.076	7.88	0.047	0.105	+

[a] ns = no statistically significant trend; + = significant increase in population number

After the drought, the numbers of all elephants, elephants in cow herds, buffalo, eland, kudu, waterbuck and zebra in Gonarezhou NP all increased significantly (Table 3, Figs 1 to 7). The number of giraffe appeared to have increased (Fig. 9), but the increase was not statistically significant. There was no obvious trend in the number of impala after 1995 (Fig. 10).

The number of elephant bulls did not change significantly after 1995 (Fig. 8), but elephant bulls were the only 'species' of those examined during the post-drought period to have a mean estimate of *r* that was negative. The absence of any overlap in the confidence intervals of *r* for elephant cows and elephant bulls (Table 3) does indicate that the rate of change in the number of elephant bulls (even if not negative) was significantly less than the rate of increase in the number of elephant cows.

For all elephants, elephants in cow herds, eland, waterbuck and zebra, the exponential model appeared (from visual inspection) to be a suitable model for the observed change in population number after the drought The same was true for zebra before the drought. For buffalo and kudu after the drought, the exponential model may not be the most suitable model. The post-drought population estimates for buffalo suggest that the population number may have increased immediately after the drought, but that it may have levelled off since the 2001 survey (Fig. 6). Such a pattern is typical of the logistic growth curve, with the rate of

increase of a population declining as population number reaches a limit set by some limiting factor, such as the population's food supply. It is noticeable that recent estimates of the number of buffalo in the park are broadly similar to the pre-drought estimates (Fig. 6). The population trend for kudu is more complex, with the post-drought population increasing initially, then apparently levelling off and then again increasing (Fig. 7).

The analyst's prize for the neatest population trend goes to zebra (Fig. 5). The number of zebra in Gonarezhou NP was increasing exponentially before the 1992 drought, declined by some 50 % during (and presumably as a consequence of) the 1992 drought, and then again increased exponentially after the drought.

This analysis has emphasised the value of aerial sample surveys for monitoring trends in animal numbers, even though the surveys are often designed to monitor one particular species (elephant), the data on other species (e.g. zebra) are collected only incidentally, and some of the species monitored are difficult to see from the air (e.g. kudu). Furthermore, a trend in population number can be detected even if a dataset initially appears unpromising. For example, the variances of the post-drought population estimates for eland were so high that, statistically speaking, the lower confidence limits are usually negative, but it was still possible to detect a statistically significant trend in population number.

Any time-series analysis depends on the use of similar (ideally identical) methods during successive surveys, so that any observed differences in population number can confidently be assumed to be genuine and not simply a consequence of changing methods. Given the difficulty of ensuring that methods are identical (e.g. the same observers are often not available for successive surveys), the application of high and consistent standards during the execution of surveys is important.

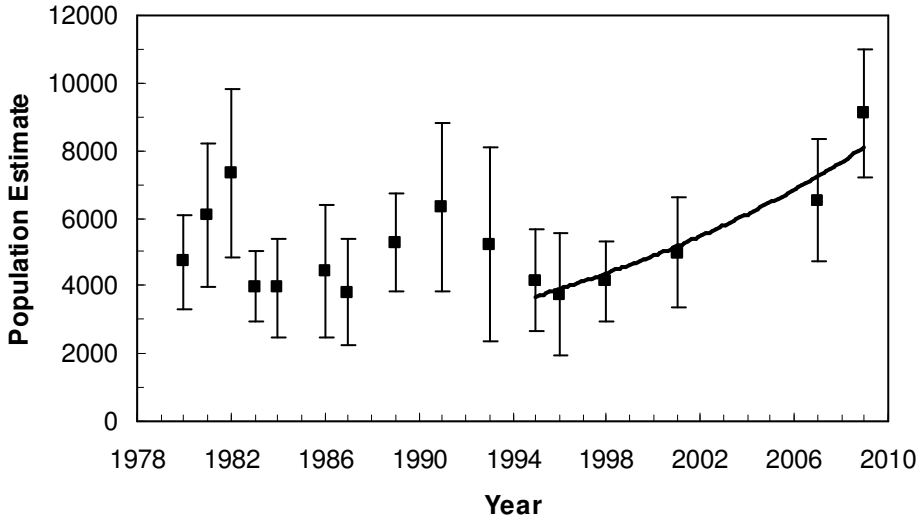


Fig. 1. Trend in the number of elephant in Gonarezhou NP since 1980

Mean population estimates and 95% confidence intervals shown. Elephants were culled (killed or captured) in Gonarezhou NP during 1983, 1986, 1992 and 1993 (DNPWM 1997?; but see also Booth *et al*. 1997). The bold line indicates the trend in the number of elephant in the park since the 1993 elephant capture.

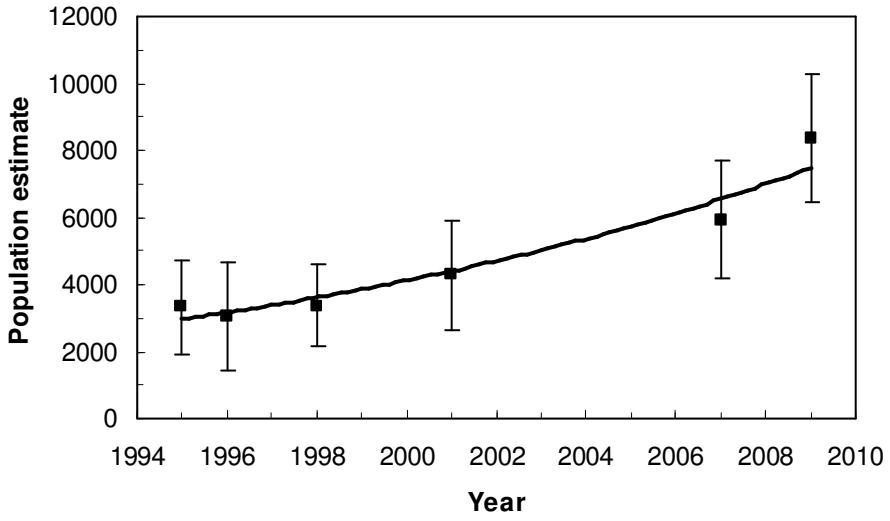


Fig. 2. Trend in the number of elephants in cow herds in Gonarezhou NP since the 1993 elephant capture

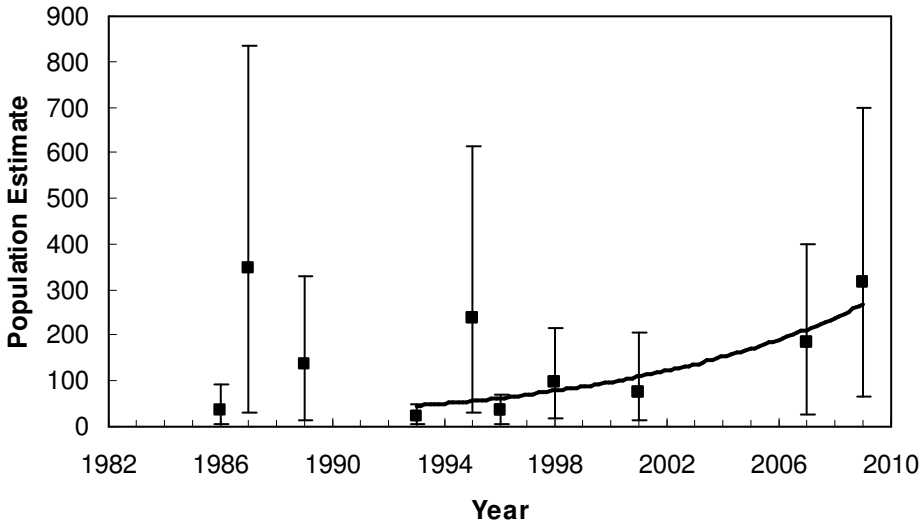


Fig. 3. Trend in the number of eland in Gonarezhou NP since 1986

No eland population estimates were given for the 1984 and 1991 surveys: it is not clear if none were seen (in which case the population estimate = 0); or if some were seen but not reported. The bold line indicates the trend in the number of eland in the park since the 1992 drought. The lower 95% confidence limit is displayed as the number of animals seen in the sample strips, if this number exceeds the calculated lower confidence limit.

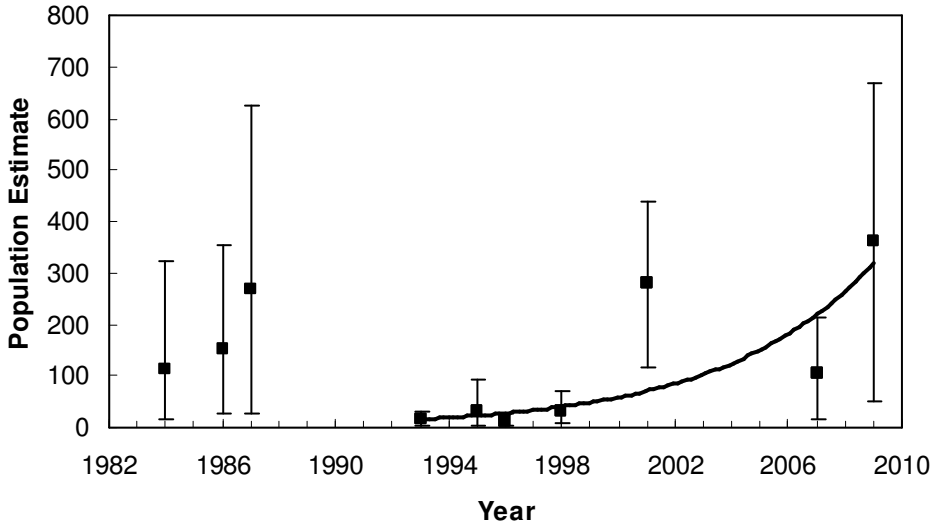


Fig. 4. Trend in the number of waterbuck in Gonarezhou NP since 1984

No waterbuck population estimates were given for the 1989 and 1991 surveys: it is not clear if none were seen (in which case the population estimate = 0); or if some were seen but not reported. The bold line indicates the trend in the number of waterbuck in the park since the 1992 drought.

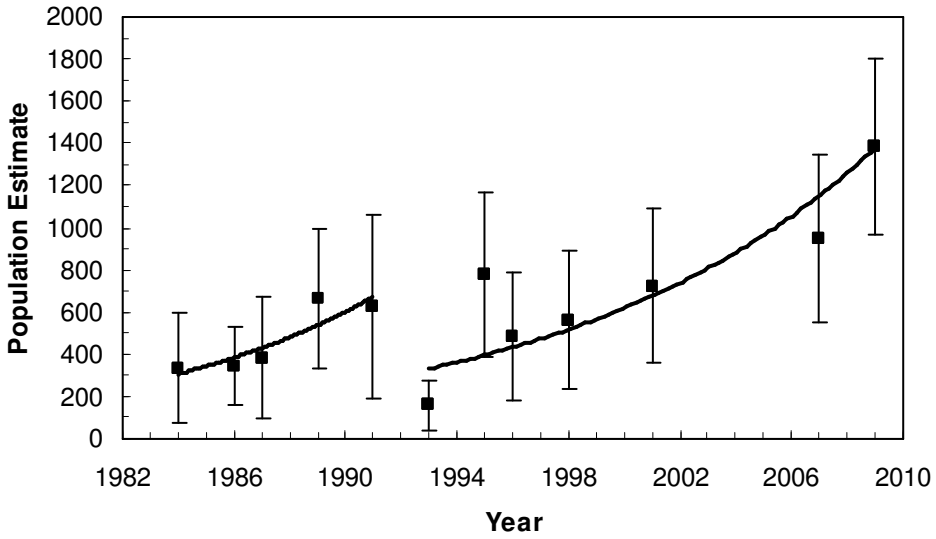


Fig. 5. Trend in the number of zebra in Gonarezhou NP since 1984

The bold lines indicates the trends in the number of zebra in the park before (left line) and after (right line) the 1992 drought. The trend line suggest that the number of zebra declined by approximately 50 % during the drought.

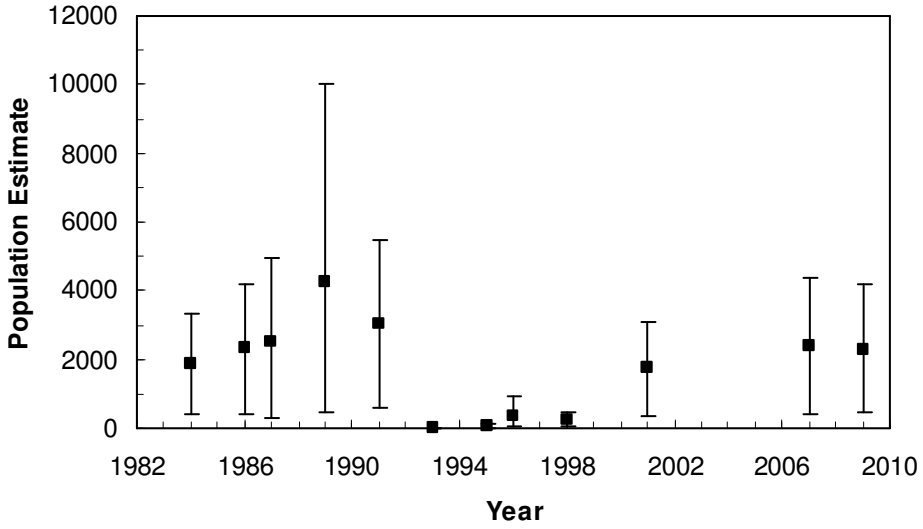


Fig. 6. Trend in the number of buffalo in Gonarezhou NP since the 1984

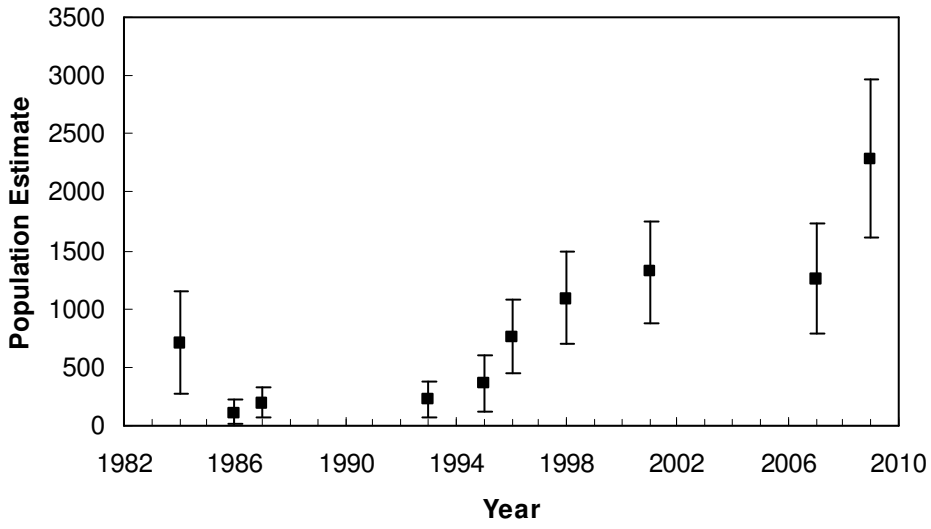


Fig. 7. Trend in the number of kudu in Gonarezhou NP since 1984

No kudu population estimates were given for the 1989 and 1991 surveys: it is not clear if none were seen (in which case the population estimate = 0); or if some were seen but not reported.

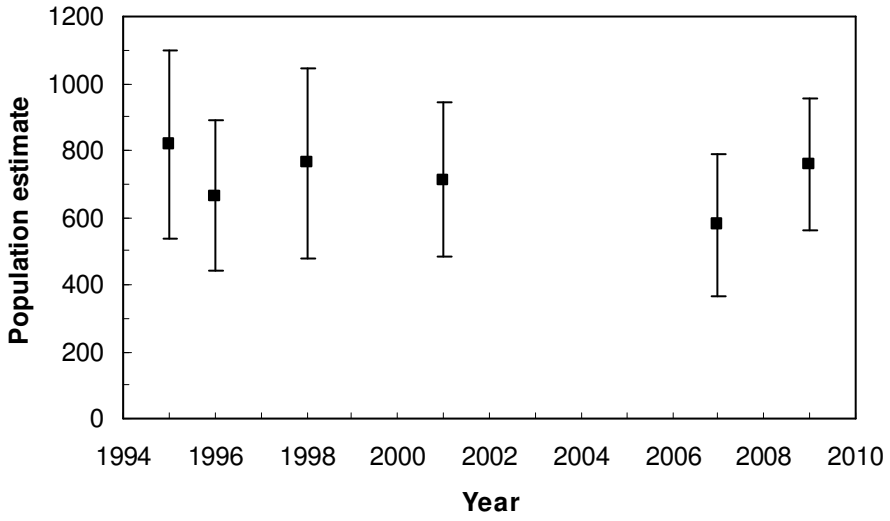


Fig. 8. Number of elephant bulls estimated to be in Gonarezhou NP since the 1993 elephant capture

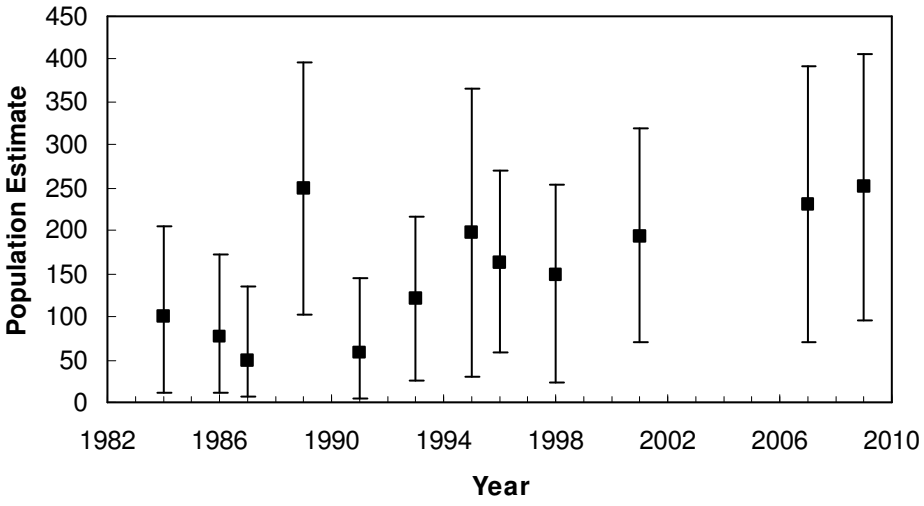


Fig. 9. Number of giraffe estimated to be in Gonarezhou NP since 1984

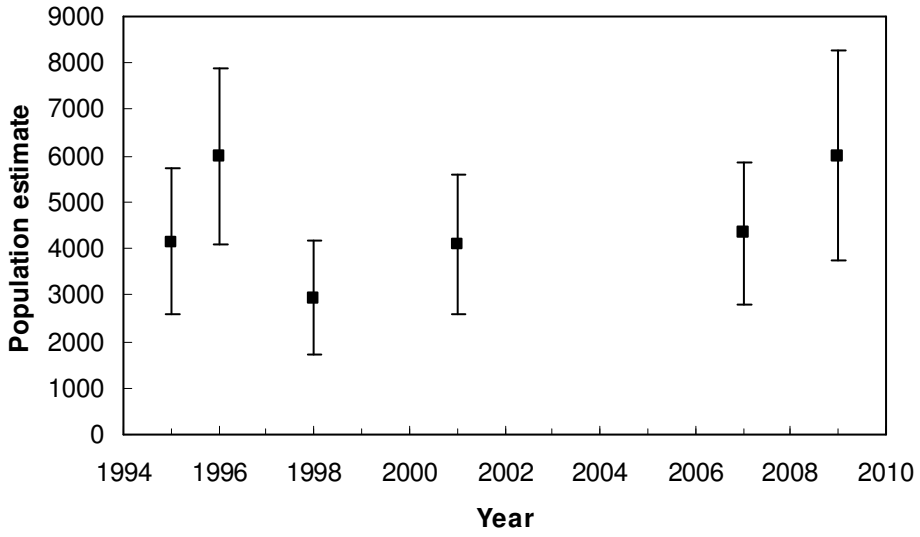


Fig. 10. Number of impala estimated to be in Gonarezhou NP since 1995

The 1995 survey was the first aerial survey to provide an estimate of the number of impala in the park.

Discussion

Elephants

There were estimated to be 9123 (+/- 1898) elephants in Gonarezhou NP during 2009. This is the greatest ever estimate for the number of elephants in this park. The previous highest estimate was 7315 (+/- CI 2268) elephants during 1982 (Sharp 1982) and that survey was followed by a cull of >2000 elephants during the following year.

Taken with the results of other aerial surveys conducted since completion of the 1993 capture operation for elephants, the 2009 estimate of 9123 implies that the number of elephants in Gonarezhou NP has increased at a mean annual rate of 6.2 % (lower and upper confidence limits 3.9 % and 8.5 %) during the past 16 years. The number of elephants in cow herds has increased at a faster rate than the number of elephants in bull groups. The latter number may have increased slightly, remained constant, or declined.

The aerial survey data provide no indication as to why elephant cows and elephant bulls in Gonarezhou NP show different population trends. However, while there has been little legal hunting of elephant cows in this region during recent years, some elephant bulls are killed legally each year by sport hunters in Malapati Safari Area and in the Zimbabwean communal lands that border Gonarezhou NP. But without detailed information on the offtakes, it is not possible to determine if the different population trends might be a consequence of differing rates of exploitation.

More than 98 % of the estimated number of elephants in the survey area were in Gonarezhou NP and just 1.5 % were in Mozambique, in areas close to the Zimbabwe/Mozambique international border (Table 5). The low density of elephants in the Zimbabwean communal lands bordering Gonarezhou NP confirms the results of previous surveys of some of these lands (Mackie 1994, 1997).

Elephant Carcasses

The estimated total number of elephant carcasses (152) in the survey area during 2009 represented 1.4 % of the estimated total number of live and dead elephants. This all-carcass 'ratio' (which reflects the mortality rate of elephants during the several years preceding the survey) compares with an estimate of 8.4 % in the same area during 2007 (Dunham *et al*. 2007). The 1+2 carcass ratio (which reflects the mortality rate of elephants during the survey year) was 0 % during 2009, compared with 0.15 % during 2007.

The low all-carcass ratio during 2009 may be at least partly a result of the apparent difference between the observers in their ability to detect elephant carcasses (Appendix 5). However, the absence of fresh or recent carcasses of elephants in the search strips does suggest that, for the elephant population was a whole, the mortality rate during 2009 was relatively low. This observation is in line with the results of the other surveys conducted since 1993, during which the number of fresh or recent carcasses of elephants seen inside the search strips ranged from zero to just two (Davies 1996, Davies *et al*. 1996, Dunham 2001, Dunham *et al* 2006, Mackie 1999). The implication from the carcass data that the elephant mortality rate is generally low is consistent with the relatively high mean rate of increase observed in the number of live elephants during the past 16 years.

Other Species in Gonarezhou NP

The trend analysis revealed that the numbers of buffalo, eland, kudu, waterbuck and zebra in Gonarezhou NP have all increased since the 1991/92 drought, when many animals died or were captured. Results from future surveys may well reveal that the number of giraffe has also increased – current results show an apparent increase, but one that is statistically non-

significant. Of the species with sufficient data for trend analysis, only for impala is there no suggestion of any consistent trend in the population number since the drought.

Zinave NP

This survey appears to be the first ever survey of this park that was conducted in a manner that was robust and repeatable, and provided park-wide estimates of population number, together with measures of precision for the estimates. The analysis of trends in the numbers of large herbivores in Gonarezhou NP that is presented in this report shows the value of the techniques used here if the methods are applied consistently and to a high standard over a number of years.

Generally, the densities of large and medium-sized wild herbivores in Zinave NP were not high (Table 2). It is hard not to believe that the low densities of wildlife species are a consequence of the greater densities of people and domestic livestock (see below).

Encroachment on the National Parks

Coincident with the occupation of Zimbabwean commercial farms during 2000, the Chitsa people illegally occupied land in the north of Gonarezhou NP. Their action stemmed from dissatisfaction dating from when they (or their ancestors) were removed from the area of the current national park when the land that they then occupied was incorporated into a hunting area, established possibly as part of a programme to control tsetse flies and trypanosomiasis. During 2009, the estimated number of huts (603) built by people illegally resident in the north of Gonarezhou NP is similar to the number estimated during 2007 (855). The estimated numbers of cattle (2859) and sheep and goats (378) in the north of the park were also similar to the numbers estimated during 2007 (cattle 3145; sheep and goats 352).

During the 1980s, fences were built along the northern, western and southern sides of Gonarezhou NP. The fences – built as part of foot-and-mouth-disease control measures - were designed to prevent the movement of buffalo and cattle. They did not exactly follow the park boundary and some parts of the park were fenced out of the buffalo area (which covered most of the park) and some communal land was fenced in the buffalo area. After the fences was completed, they (rather than the legal boundaries of the park) were often used as strata boundaries during aerial surveys. Consequently, cattle or huts seen on the boundaries of Mabalauta NP stratum cannot be assumed to be inside the national park. But neither can such sightings be assumed to be outside the park - sometimes encroachment on the national park has occurred when local people have used the fences as the *de facto* boundaries of the park. The huts and domestic livestock observed in the northwest of the Mabalauta NP stratum are in a section of the park that the communal land neighbours have been allowed to occupy (map 2b of Department of National Parks & Wildlife Management 1997?). But further investigation is required to establish exactly where are the huts and domestic livestock observed in the southwest of the Mabalauta NP stratum in relation to the park boundary and the fence lines.

The estimated number of huts in Zinave NP was 5033 and the people that occupy these were accompanied by an estimated 2039 sheep and goats and 620 cattle. Subsistence agriculture and commercial logging were occurring in Zinave NP (Map 26).

Potential Corridors for Wildlife Movements

The Sengwe, Save Corridor and Southern Corridor strata were surveyed (the latter two for the first time) to provide a current assessment of the potential of these areas to serve as corridors for the movements of large animals, including elephants, between national parks in the GLTFCA: between Gonarezhou NP and Kruger NP in the case of the Sengwe stratum;

and between Gonarezhou NP and Zinave NP in the case of the Save Corridor and Southern Corridor strata.

This survey has revealed that the area along the Save River between Gonarezhou NP and Zinave NP is occupied by relatively high densities of people (as indexed by hut density) and domestic livestock such as cattle and sheep/goats. Agriculture (as indexed by sightings of fields) and commercial logging are also common here (Map 26). The obvious conclusion is that currently there is no potential for this area to serve as a corridor for the movement of large animals between Gonarezhou NP and Zinave NP.

This survey has revealed that the area of Sengwe communal land northwards of the Zimbabwe/Mozambique international border is also occupied by relatively high densities of people, cattle and sheep/goats. A similar observation was made during the 1994 survey of this area (Mackie 1994). Again there is an obvious conclusion, that currently there is no potential for this area to serve as a corridor for the movement of large animals between Gonarezhou NP and Kruger NP. However, detailed examination of the sighting data for the Sengwe stratum revealed that one transect was empty of people and domestic livestock (Appendix 4). This transect was parallel to the international border and approximately 2.5 km northwards of it and probably covered part of a minefield established during Zimbabwe's pre-independence war and so far cleared of mines only in parts. Once cleared of mines, the current danger zone (which runs approximately parallel to the international border and stretches from the Limpopo River northwards to the railway) might serve as a corridor for wildlife movements. But the current danger zone – and thus the potential corridor - is just 3 km wide.

Acknowledgements

The survey of Gonarezhou NP and adjacent areas within Zimbabwe was funded by the U.S. Fish & Wildlife Service African Elephant Conservation Fund, with additional support from the Parks & Wildlife Management Authority and Frankfurt Zoological Society. The survey of Zinave NP and adjacent areas within Mozambique was funded, through the Government of Mozambique, by a credit from the International Development Association, a grant from Global Environment Facility, and a Policy and Human Resources Development grant from the Government of Japan, towards the costs of the Trans-frontier Conservation Areas and Tourism Development Project. Additional support was provided by the Transfrontier Conservation Areas Co-ordination Unit of the Ministry of Tourism. The section of this report about the trends in animal numbers in Gonarezhou NP is based largely on an independent analysis undertaken by KMD prior to the 2009 survey. The USFWS funds have not been used to feed, clothe, house, equip, supply, pay, or train Zimbabwe government employees.

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Table 4. Sampling statistics for the 2009 aerial survey of large herbivores in Gonarezhou NP, Zinave NP and adjacent areas

Stratum name	Stratum area (km^2)	Transect spacing (km)	Transect orientation (°)	Number of transects [= n]	Percent of stratum sampled	Time and date sampled	Flying time (hours) [a]			Search effort (minutes km^{-2})
							Transect	Stratum	Total	
Gonarezhou National Park										
Chipinda Pools	1167	1.5	0	38	20.9	am & pm 4 Sept am 5 Sept	4.88	5.70	6.02 [e]	1.20
Chilojo A	460	1.5	45	17	20.4	am 7 Sept	1.88	2.47	2.83	1.20
Chilojo B	602	1.5	-48 (132)	32	21.1	am 5 Sept	2.34	2.92	3.82 [e]	1.11
Naivasha	884	1.5	-48 (132)	27	20.3	am & pm 8 Sept	3.60	4.45	6.45 [f]	1.20
Chefu	1017	2.5	42	14	12.2	am 9 Sept	2.31	2.58	3.22	1.11
Mabalauta NP [c]	820	1.5	90	30	20.3	am & pm 11 Sept	4.21 [g]	4.82 [g]	6.47 [g, h]	1.25 [g]
Subtotal / mean	**4950**				**19.0 [b]**					**1.18**
Malapati Safari Area										
Malapati [c]	175	1.5	90	21	20.5	am & pm 11 Sept	- [g]	- [g]	- [g]	- [g]
Communal lands (Zimbabwe)										
Mahenye	221	2.9	90	8	10.8	pm 3 Sept	0.46	0.68	1.28	1.16
Chingwesi	221	2.5	90	13	12.3	am 3 Sept	0.68	1.00	1.28	1.51
Matibi	247	2.5	90	9	12.3	pm 8 Sept	0.58	0.78	- [f]	1.16
Gonakudzingwa	122	2.5	0	11	11.7	am 12 Sept	0.33	0.55	1.12	1.40
Masukwe	204	2.5	90	17	13.0	pm 11 Sept	0.57	0.90	- [h]	1.29
Sengwe	972	2.5	42	10	13.5	am 10 Sept	2.60	2.93	3.28	1.19
Subtotal / mean	**1987**				**12.8 [b]**					**1.28**

Stratum name	Stratum area (km^2)	Transect spacing (km)	Transect orientation (°)	Number of transects [= n]	Percent of stratum sampled	Time and date sampled	Flying time (hours) [a]			Search effort (minutes km^{-2})
							Transect	Stratum	Total	
ZIMBABWE TOTALS	**7112**				**17.2** [b]		**24.46**	**29.78**	**35.77**	**1.23**
International Border (Mozambique)										
North Border	661	2.5	132 (-48)	19	12.6	am 6 Sept	1.66	2.07	2.88	1.20
Border Maunge	417	2.5	42	6	12.5	pm 7 Sept	0.94	1.12	1.70	1.08
Border Chefu	594	2.5	42	6	12.7	pm 9 Sept	1.32	1.40	2.22	1.06
Border Limpopo	614	2.5	42	7	12.5	pm 10 Sept	1.48	1.63	2.23	1.16
Subtotal / mean	**2286**				**12.6** [b]					**1.12**
Save River										
Save corridor	1111	2.5	25	34	13.0	am 18 Sept	2.69	3.48	4.75	1.12
Southern corridor	681	5.0	25	14	6.3	am 19 Sept	0.72	1.15	2.25	1.00
Subtotal / mean	**1792**				**10.4** [b]					**1.06**
Zinave National Park										
Zinave NP east [d]	1800	2.0	0	23	15.4	am & pm 15 Sept am 16 Sept	12.47	13.65	14.13 [i]	1.22
Zinave NP west [d]	2194	2.0	0	29	15.3	am & pm 16 Sept pm 17 Sept				
Subtotal / mean	**3994**				**15.4**					
Coutada 4										
North Zinave	1159	2.0	0	46	15.8	am & pm 17 Sept	3.65	4.42	7.55 [i]	1.20
MOZAMBIQUE TOTALS	**9231**				**13.8**		**24.93**	**28.92**	**37.72**	**1.13**

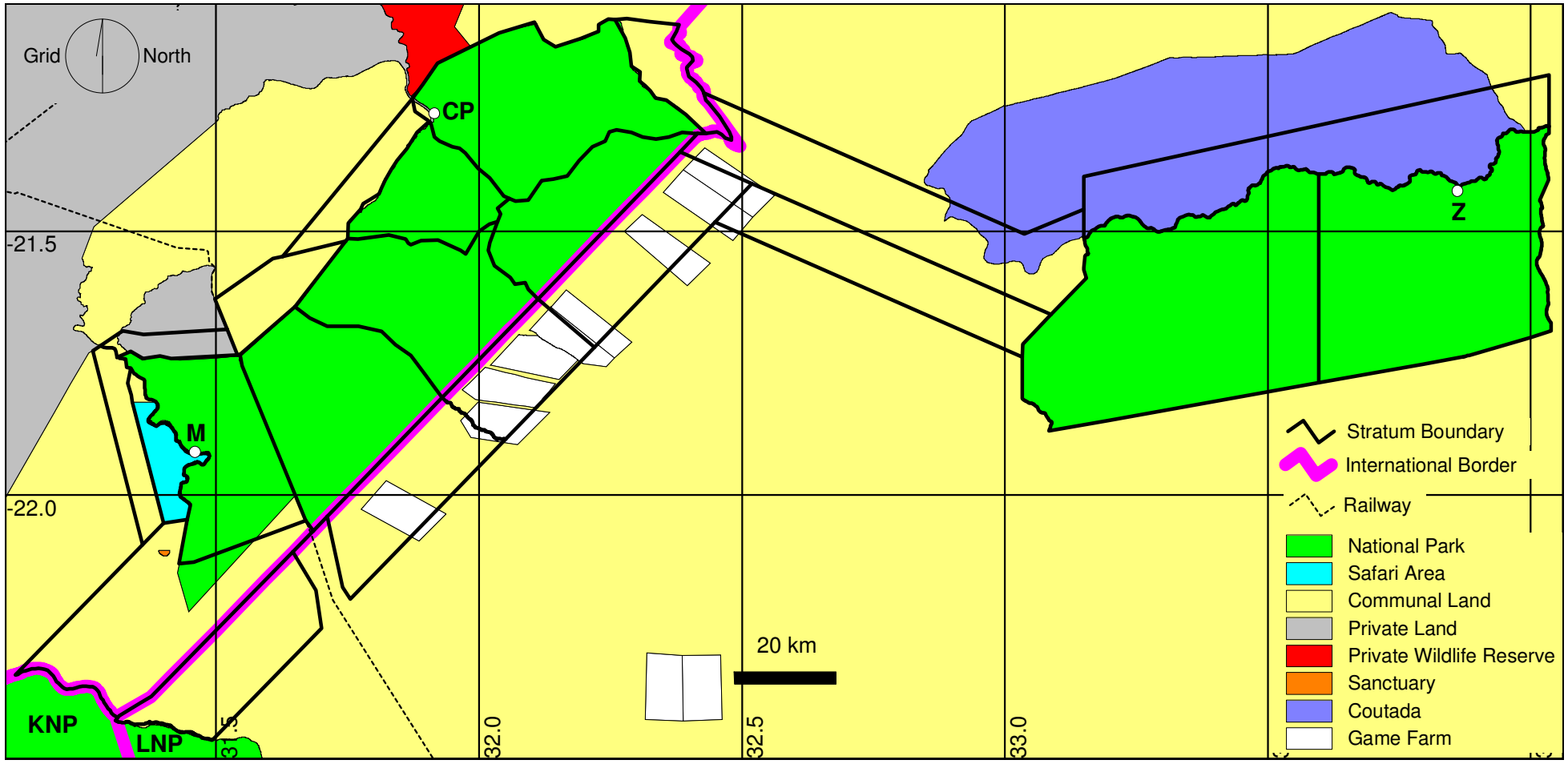
Stratum name	Stratum area (km^2)	Transect spacing (km)	Transect orientation (°)	Number of transects [= n]	Percent of stratum sampled	Time and date sampled	Flying time (hours) [a]			Search effort (minutes km^{-2})
							Transect	Stratum	Total	
OVERALL TOTALS / MEAN	**16 343 km^2**			**Overall**	**15.3 [b] %**		**49.39**	**58.70**	**73.49**	**1.18**

[a] Transect time is the time spent searching the transects; stratum time is the transect time, plus the time spent travelling between transects in the same stratum; and total time is the stratum time, plus the time spent travelling between the stratum and the airstrip

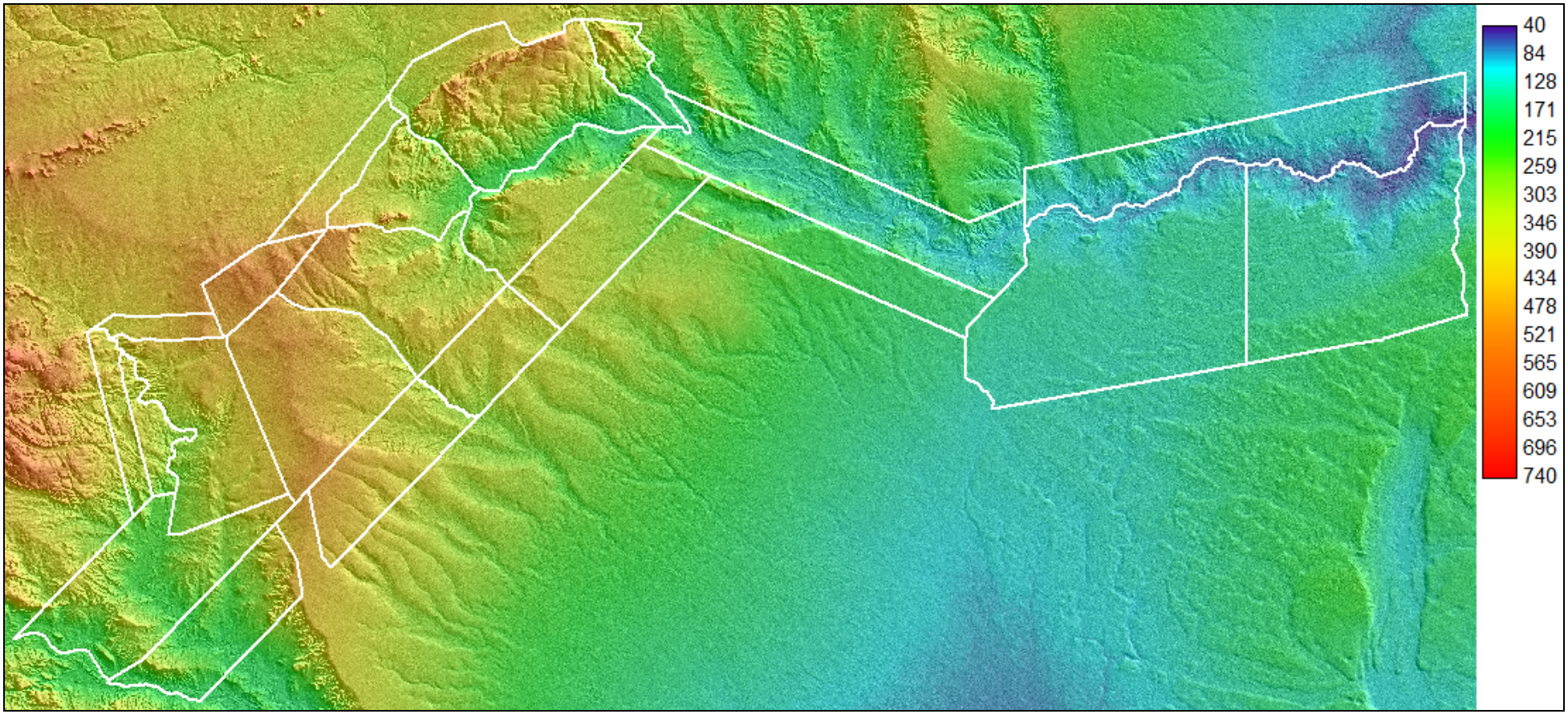
[b] Weighted mean, with stratum area as a proportion of the total area as weight

[c, d] Strata with the same superscript were treated as a single stratum during survey execution, but treated as two strata during the analysis

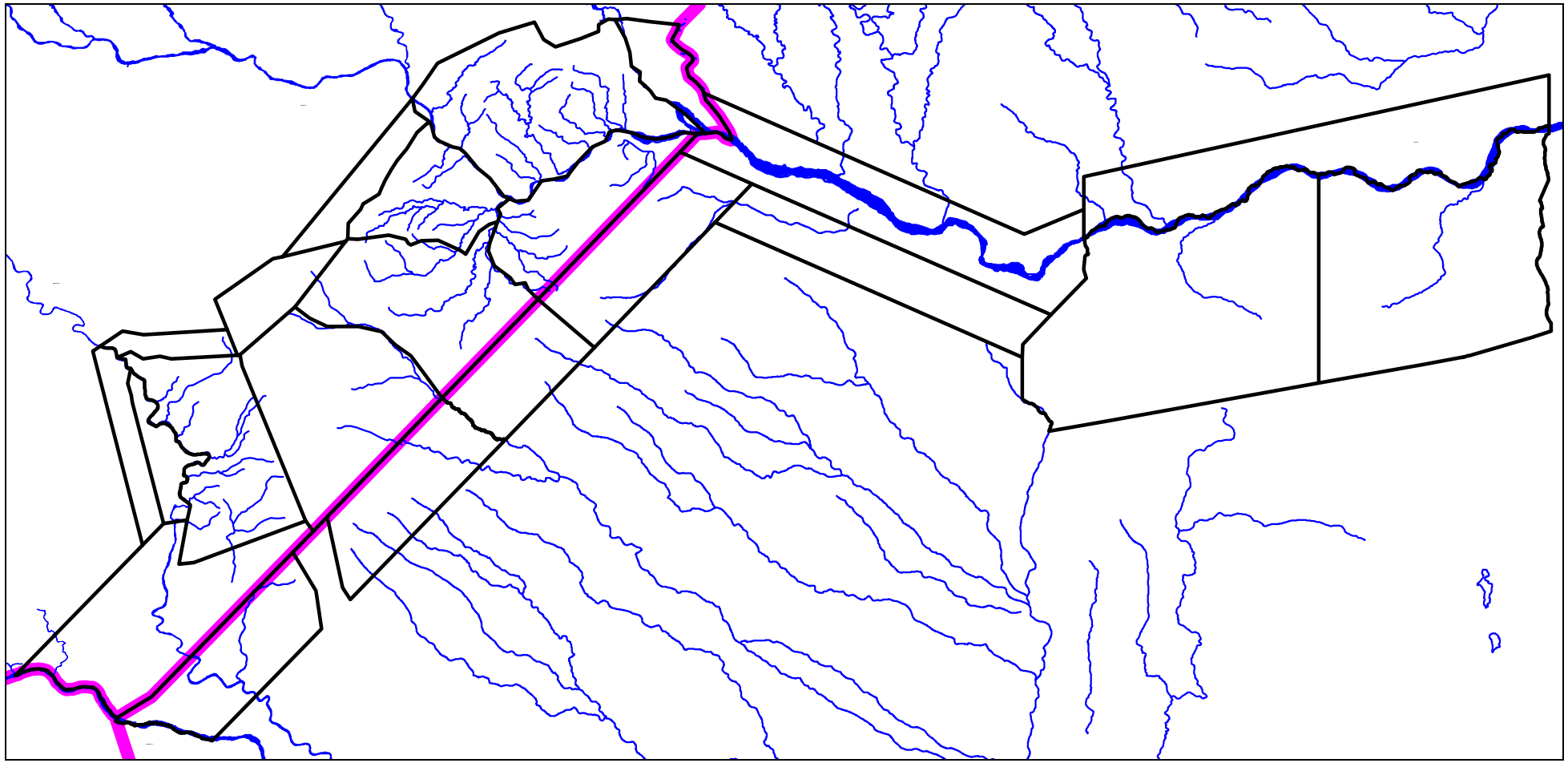
[e, f, g, h, i] Strata with the same superscript (or parts of those strata) were surveyed during the same flight



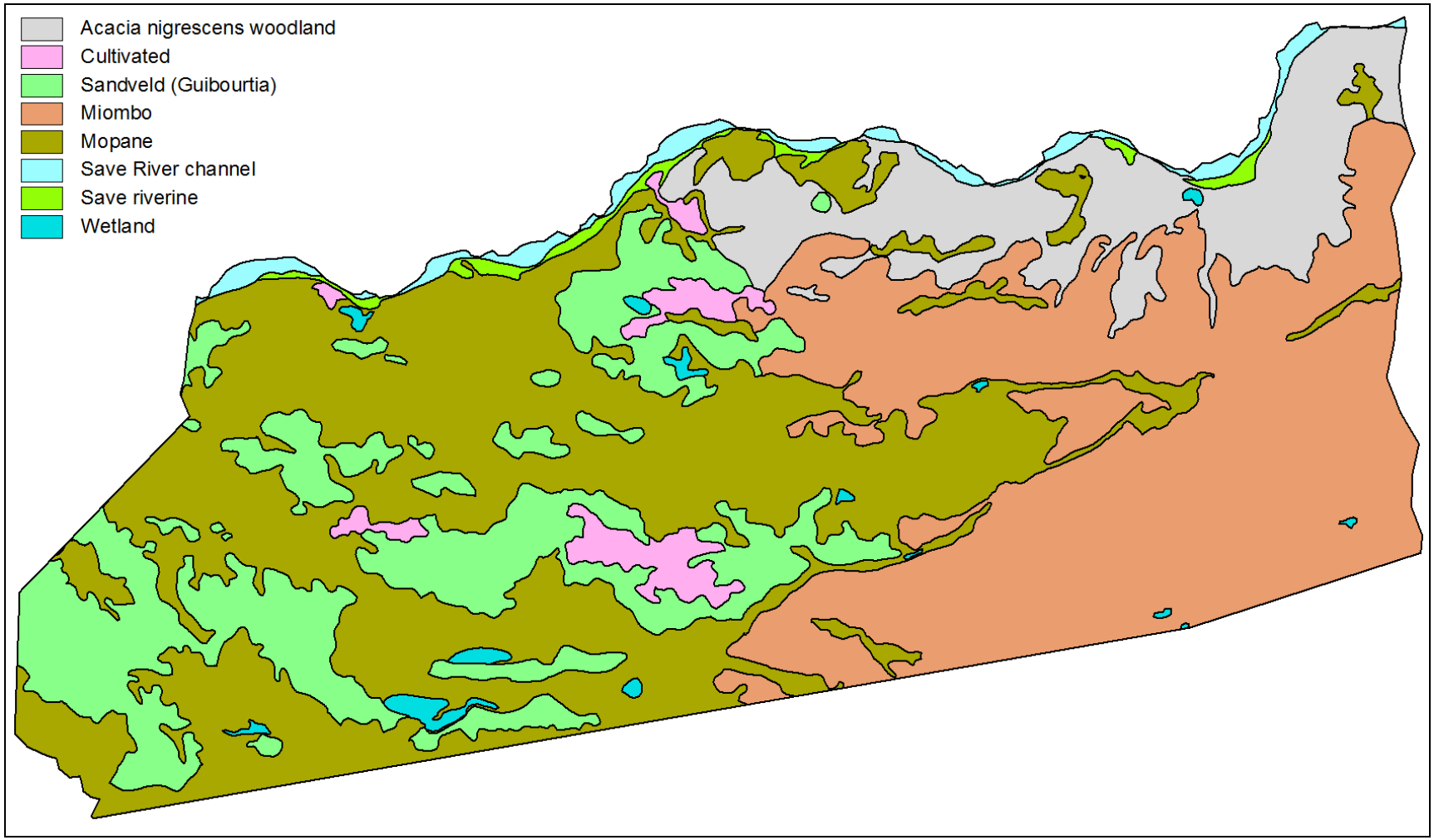
Map 2. Land use in and adjacent to the 2009 Gonarezhou and Zinave survey area
Gonarezhou NP (Zimbabwe) is in the west and Zinave NP (Mozambique) in the east, with Kruger NP (KNP, South Africa) and Limpopo NP (LNP, Mozambique) in the south-west. The stations of the Gonarezhou and Zinave national park authorities are also shown (CP, Chipinda Pools; M, Mabalauta; Z, Zinave).



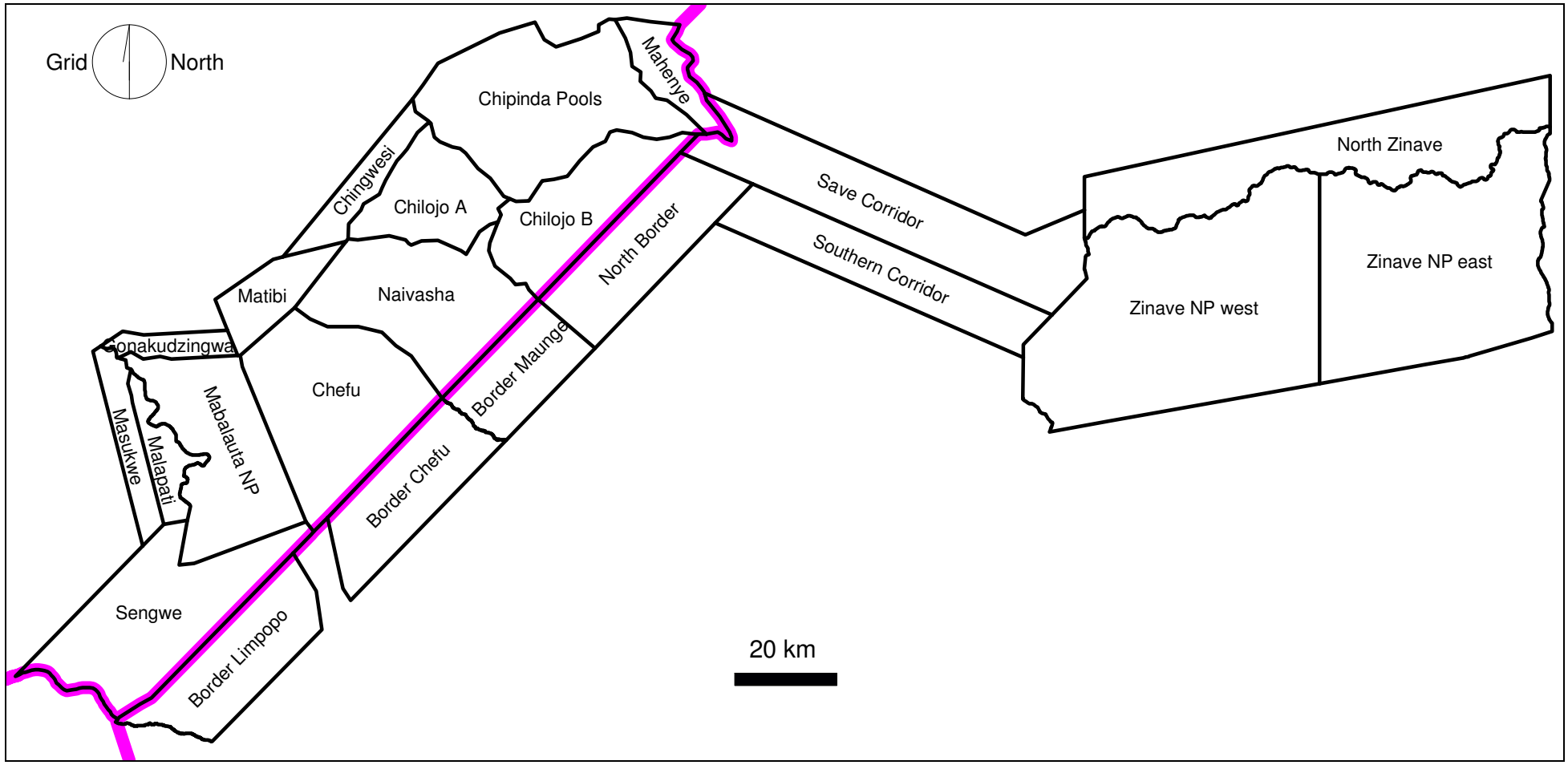
Map 3. Digital elevation model of the 2009 Gonarezhou and Zinave survey area and surrounds
Altitude is in meters. Bold white lines indicate strata boundaries.



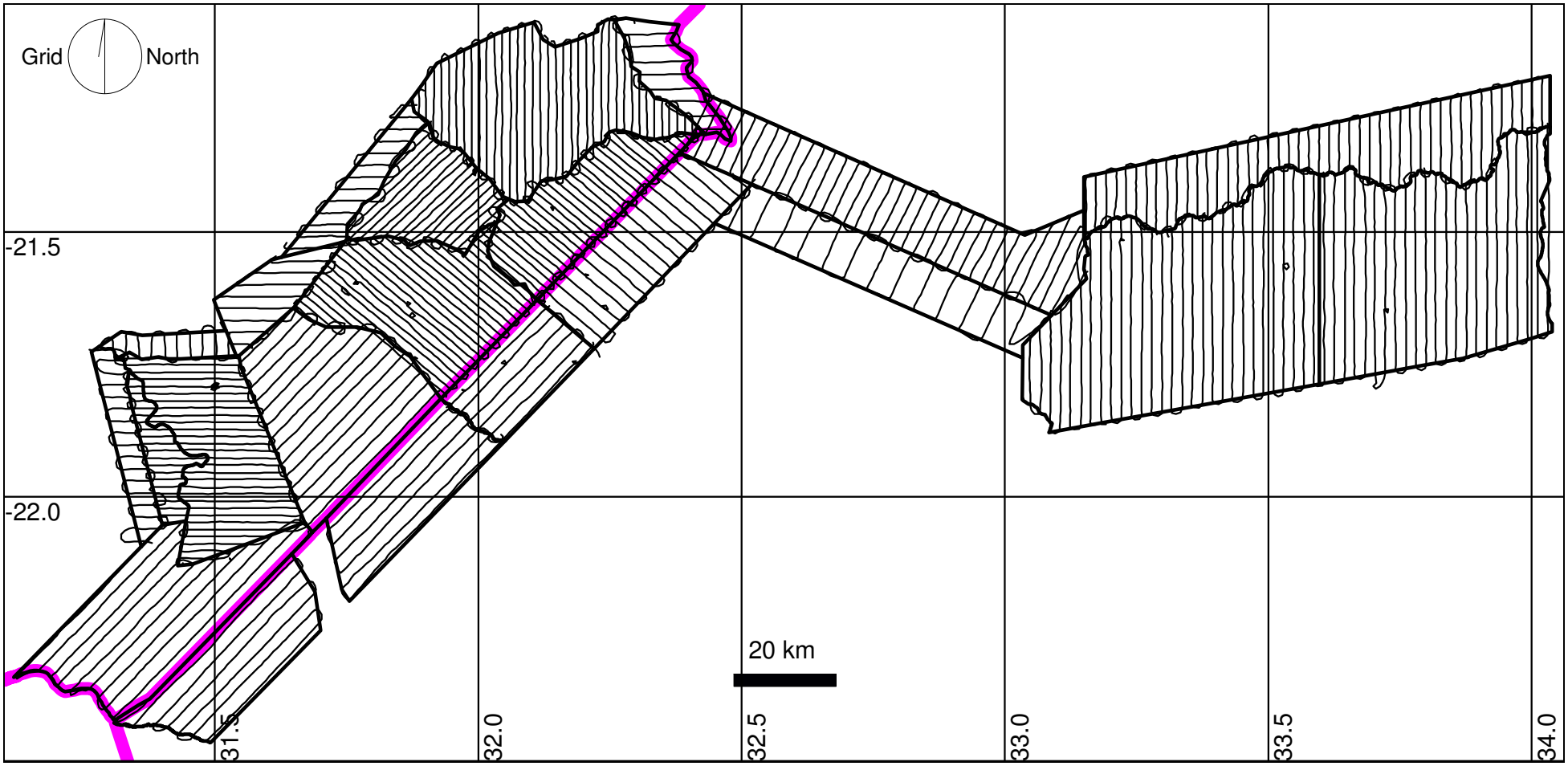
Map 4. River systems in and adjacent to the 2009 Gonarezhou and Zinave survey area
The Runde, Save, Mwenezi and Limpopo Rivers are perennial, but water flow is seasonal in the other rivers. Bold black lines indicate strata boundaries. Mauve lines indicates the international borders, with Zimbabwe in the west, Mozambique in the east and South Africa in the south-west corner.



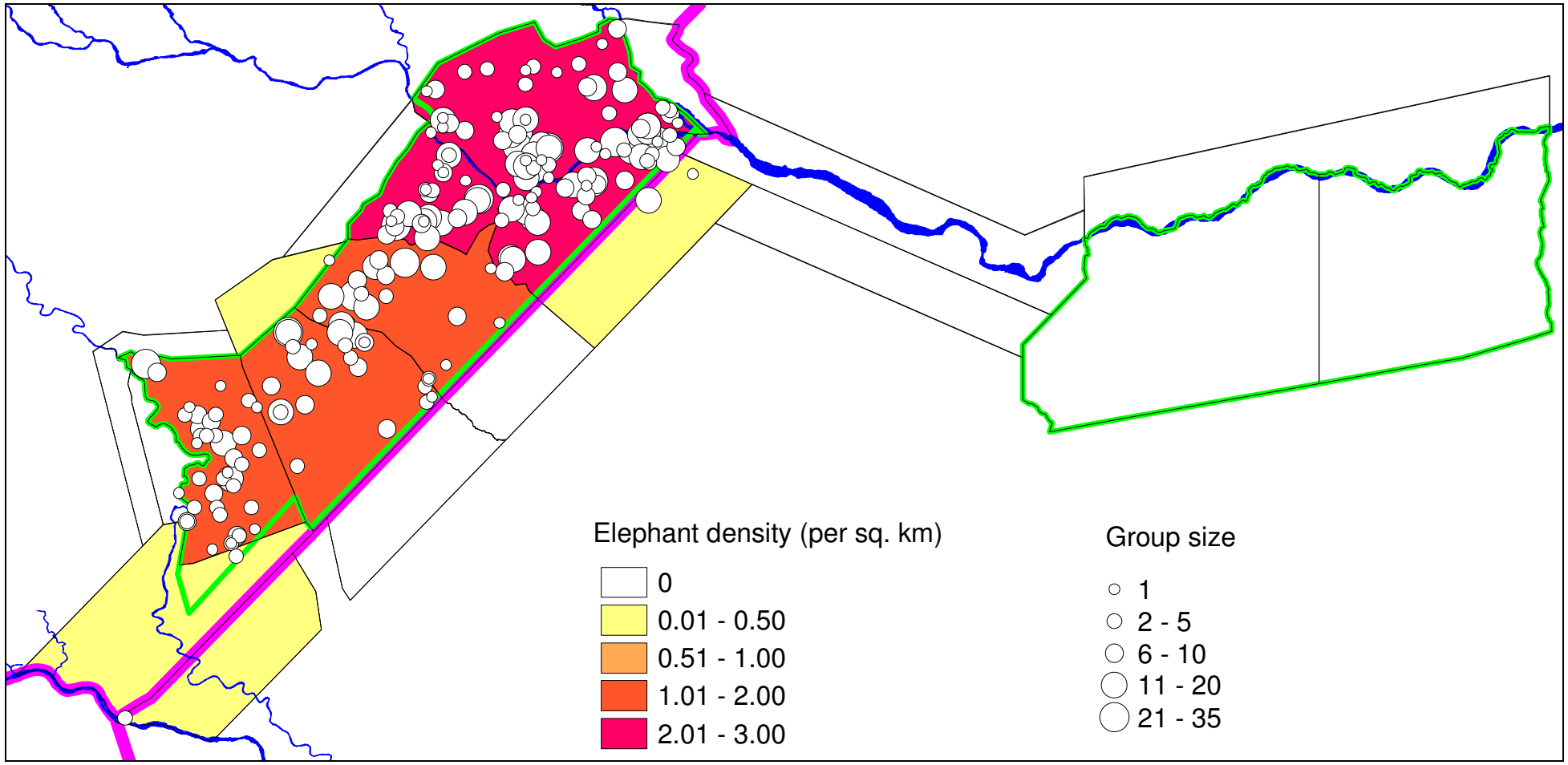
Map 5. Landscapes of Zinave National Park
Map of landscapes of Zinave NP provided by Transfrontier Conservation Areas Co-ordination Unit of the Ministry of Tourism, Mozambique.
No map of the landscapes in the remainder of the survey area is available – the vegetation map of Gonarezhou NP is out of date.



Map 6. Strata used during the 2009 aerial survey of Gonarezhou NP, Zinave NP and surrounds
Bold lines indicate strata boundaries and labels give strata names. Mauve lines indicates the international borders, with Zimbabwe in the west, Mozambique in the east and South Africa in the south-west corner.

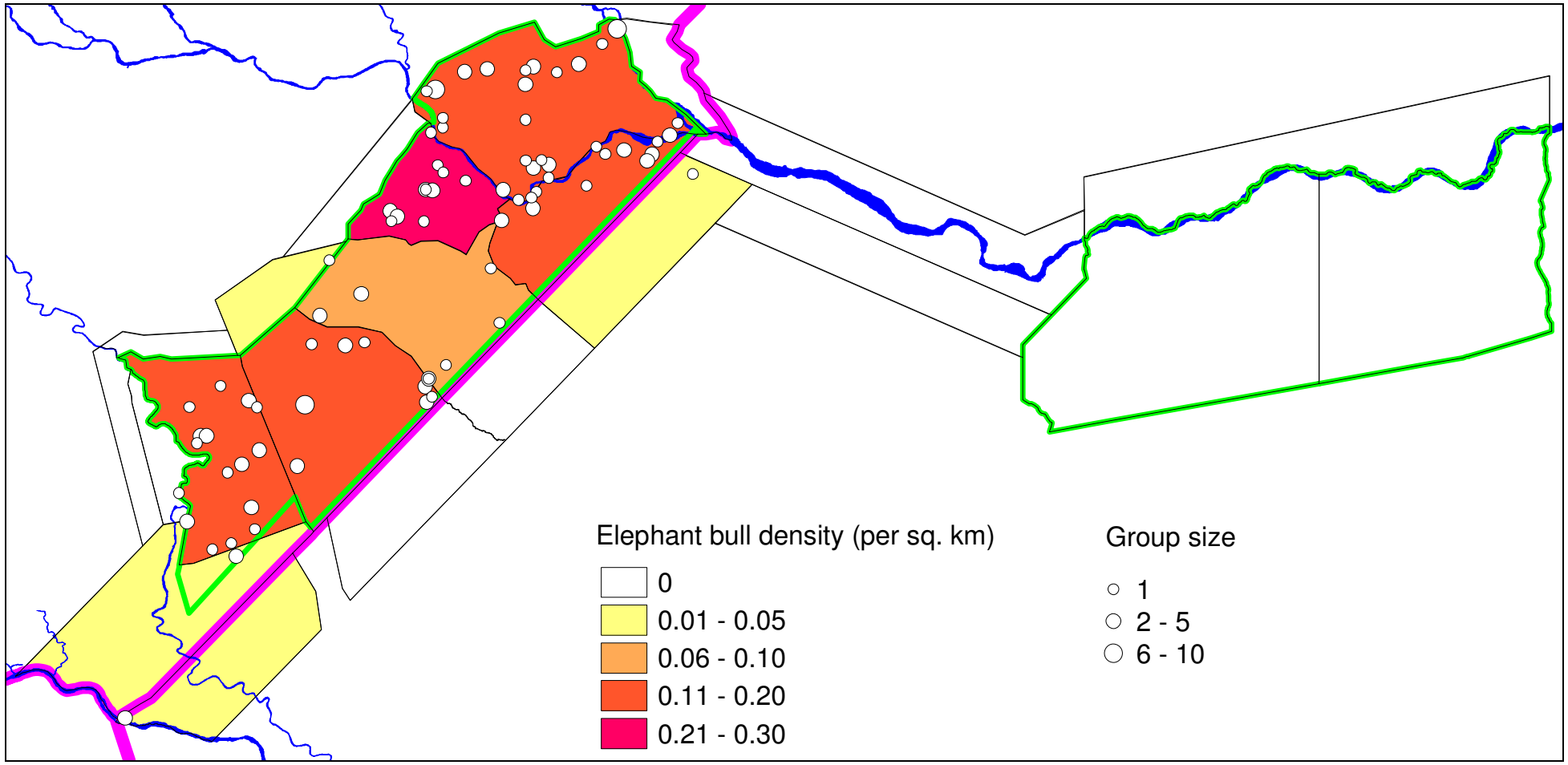


Map 7. Tracklogs (flight lines) indicating the transects used during the 2009 aerial survey of Gonarezhou NP, Zinave NP and surrounds
Bold lines indicate strata boundaries. Thin parallel lines indicate flight lines along the transects. Mauve lines indicates the international borders, with Zimbabwe in the west, Mozambique in the east and South Africa in the south-west corner.

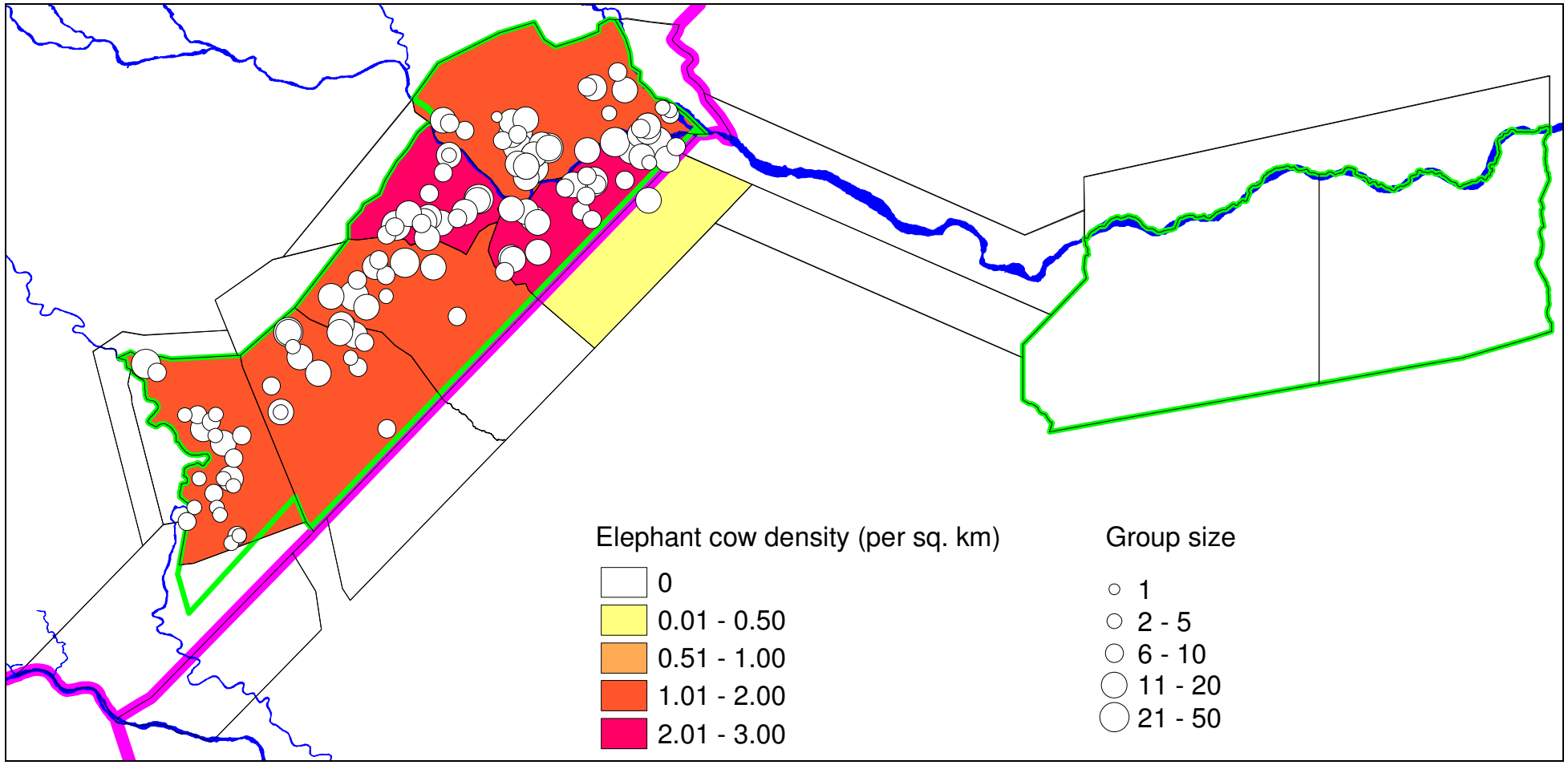


Map 8. Distribution of elephant in Gonarezhou NP and surrounds during 2009

Colouring indicates the mean density of elephants within each stratum. The dots indicate the locations of elephants seen *within the search strips*, together with an indication of the size of each group. Small dots overlaying large dots indicate two or more groups of elephants in close proximity. Variation in dot density between strata reflects differences between strata in *both* the density of elephant groups *and* the sampling intensity (given in Table 4). The rivers shown are the Save and Runde (with their confluence near the top centre of the map) and the Mwenezi and Limpopo in the south-west. The green lines indicate the boundaries of Gonarezhou NP and Zinave NP. The mauve lines indicates the international borders.



Map 9. Distribution of elephant bulls in Gonarezhou NP and surrounds during 2009



Map 10. Distribution of elephant cows in Gonarezhou NP and surrounds during 2009

Table 5. Population estimates and statistics for Elephant in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	2543	531	247047	39.6	1535	3550	2.18
Chilojo A	1210	247	146294	67.0	399	2021	2.63
Chilojo B	1790	378	143733	43.2	1017	2563	2.97
Naivasha	950	193	70204	57.4	405	1495	1.07
Chefu	1495	183	248291	72.0	418	2571	1.47
Mabalauta NP	1136	231	62255	44.9	625	1646	1.39
Subtotals	9123	1763	917825	20.8	7221	11025	1.84
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	8	1	67	232.6	0	27	0.03
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	15	2	189	209.9	0	46	0.02
Subtotals	23	3	256	149.6	0	57	0.01
National Subtotals	**9146**	**1766**	**918081**	**20.8**	**7244**	**11048**	**1.29**
MOZAMBIQUE							
International border							
North Border	103	13	8332	185.4	0	295	0.16
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	32	4	1136	256.9	0	115	0.05
Subtotals	136	17	9468	148.9	0	337	0.06
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	0	0	0	0.0	0	0	0.00
Zinave NP west	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**136**	**17**	**9468**	**148.9**	**0**	**337**	**0.015**
Totals	**9281**	**1783**	**927549**	**20.6**	**7370**	**11193**	**0.57**

Table 6. Population estimates and statistics for Elephant Bulls in Gonarezhou NP, Zinave NP and surrounds

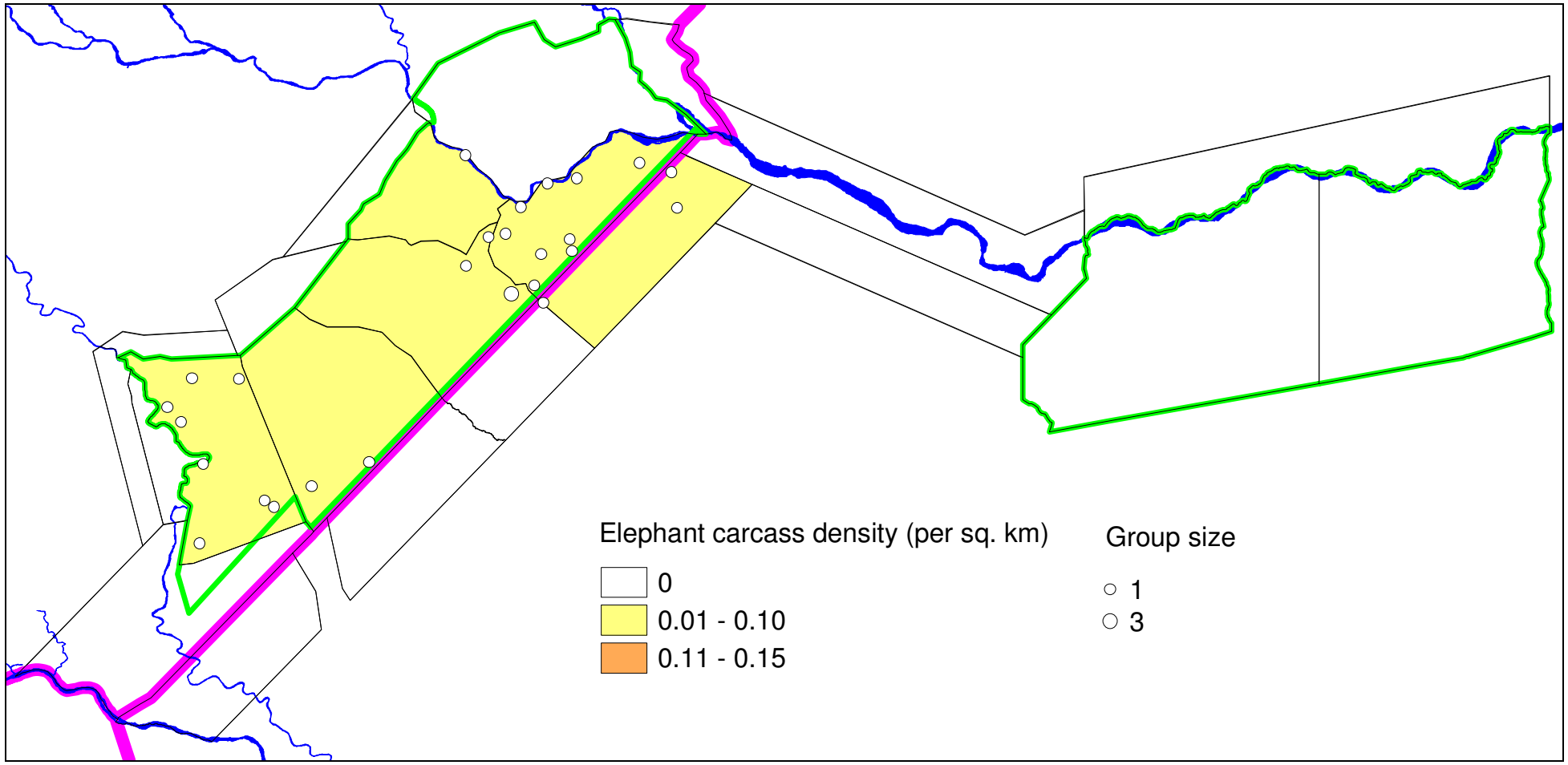
Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	215	45	2249	44.6	119	312	0.19
Chilojo A	98	20	1657	88.1	12	184	0.21
Chilojo B	95	20	653	55.0	43	147	0.16
Naivasha	49	10	423	86.0	7	92	0.06
Chefu	172	21	3746	77.1	39	304	0.17
Mabalauta NP	128	26	839	46.3	69	187	0.16
Subtotals	757	142	9567	25.8	561	952	0.15
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	8	1	67	232.6	0	27	0.03
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	15	2	189	209.9	0	46	0.02
Subtotals	23	3	256	149.6	0	57	0.01
National Subtotals	**780**	**145**	**9823**	**25.4**	**582**	**977**	**0.11**
MOZAMBIQUE							
International border							
North Border	8	1	57	200.0	0	24	0.01
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	32	4	1136	256.9	0	115	0.05
Subtotals	40	5	1193	211.0	0	125	0.02
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	0	0	0	0.0	0	0	0.00
Zinave NP west	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**40**	**5**	**1193**	**211.0**	**0**	**125**	**0.004**
Totals	**820**	**150**	**11016**	**25.5**	**611**	**1029**	**0.05**

Table 7. Population estimates and statistics for Elephant Cows in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	2327	486	244799	43.1	1325	3330	1.99
Chilojo A	1112	227	144637	72.5	306	1919	2.42
Chilojo B	1695	358	143081	45.5	924	2467	2.82
Naivasha	901	183	69780	60.3	358	1444	1.02
Chefu	1323	162	244545	80.7	255	2391	1.30
Mabalauta NP	1008	205	61416	50.3	501	1515	1.23
Subtotals	8366	1621	908258	22.6	6474	10258	1.69
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
National Subtotals	**8366**	**1621**	**908258**	**22.6**	**6474**	**10258**	**1.18**
MOZAMBIQUE							
International border							
North Border	95	12	8275	200.2	0	287	0.14
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	95	12	8275	200.2	0	287	0.04
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	0	0	0	0.0	0	0	0.00
Zinave NP west	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**95**	**12**	**8275**	**200.2**	**0**	**287**	**0.01**
Totals	**8462**	**1633**	**916533**	**22.5**	**6562**	**10361**	**0.52**

Table 8. Population estimates and statistics for Elephant Carcasses 3 in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	0	0	0	0.0	0	0	0.00
Chilojo A	5	1	18	182.6	0	14	0.011
Chilojo B	43	9	132	55.0	19	66	0.071
Naivasha	5	1	21	189.4	0	14	0.006
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	20	4	105	106.6	0	41	0.024
Subtotals	72	15	275	45.8	39	105	0.015
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
National Subtotals	**72**	**15**	**275**	**45.8**	**39**	**105**	**0.010**
MOZAMBIQUE							
International border							
North Border	24	3	151	108.3	0	50	0.036
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	24	3	151	108.3	0	50	0.010
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	0	0	0	0.0	0	0	0.00
Zinave NP west	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**24**	**3**	**151**	**108.3**	**0**	**50**	**0.003**
Totals	**96**	**18**	**427**	**42.8**	**55**	**137**	**0.006**



Map 11. Distribution of elephant carcasses categories 3 (old) and 4 (very old) in Gonarezhou NP and surrounds during 2009

Table 9. Population estimates and statistics for Elephant Carcasses 4 in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})	All Carcass Ratio (%)
ZIMBABWE								
Gonarezhou NP								
Chipinda Pools	0	0	0	0.0	0	0	0.00	0
Chilojo A	0	0	0	0.0	0	0	0.00	0.4
Chilojo B	0	0	0	0.0	0	0	0.00	2.3
Naivasha	20	4	192	144.9	0	48	0.022	2.6
Chefu	16	2	106	135.9	0	39	0.016	1.1
Mabalauta NP	20	4	67	85.3	3	36	0.024	3.4
Subtotals	56	10	365	68.8	17	94	0.011	1.4
Malapati SA								
Malapati	0	0	0	0.0	0	0	0.00	- [a]
Communal lands								
Mahenye	0	0	0	0.0	0	0	0.00	- [a]
Chingwesi	0	0	0	0.0	0	0	0.00	- [a]
Matibi	0	0	0	0.0	0	0	0.00	0
Gonakudzingwa	0	0	0	0.0	0	0	0.00	- [a]
Masukwe	0	0	0	0.0	0	0	0.00	- [a]
Sengwe	0	0	0	0.0	0	0	0.00	0
Subtotals	0	0	0	0.0	0	0	0.00	0
National Subtotals	**56**	**10**	**365**	**68.8**	**17**	**94**	**0.008**	**1.4**
MOZAMBIQUE								
International border								
North Border	0	0	0	0.0	0	0	0.00	18.9
Border Maunge	0	0	0	0.0	0	0	0.00	- [a]
Border Chefu	0	0	0	0.0	0	0	0.00	- [a]
Border Limpopo	0	0	0	0.0	0	0	0.00	0
Subtotals	0	0	0	0.0	0	0	0.00	15.0
Potential corridor								
Save Corridor	0	0	0	0.0	0	0	0.00	- [a]
Southern Corridor	0	0	0	0.0	0	0	0.00	- [a]
Subtotals	0	0	0	0.0	0	0	0.00	- [a]
Zinave NP								
Zinave NP east	0	0	0	0.0	0	0	0.00	- [a]
Zinave NP west	0	0	0	0.0	0	0	0.00	- [a]
Subtotals	0	0	0	0.0	0	0	0.00	- [a]
Coutada 4								
North Zinave	0	0	0	0.0	0	0	0.00	- [a]
National Subtotals	**0**	**0**	**0**	**0.0**	**0**	**0**	**0.00**	**15.0**
Totals	**56**	**10**	**365**	**68.8**	**17**	**94**	**0.003**	**1.6**

The all carcass ratio refers to elephant carcasses in categories 1, 2, 3 and 4 (although no category 1 or 2 carcasses were seen in the search strips during this survey)

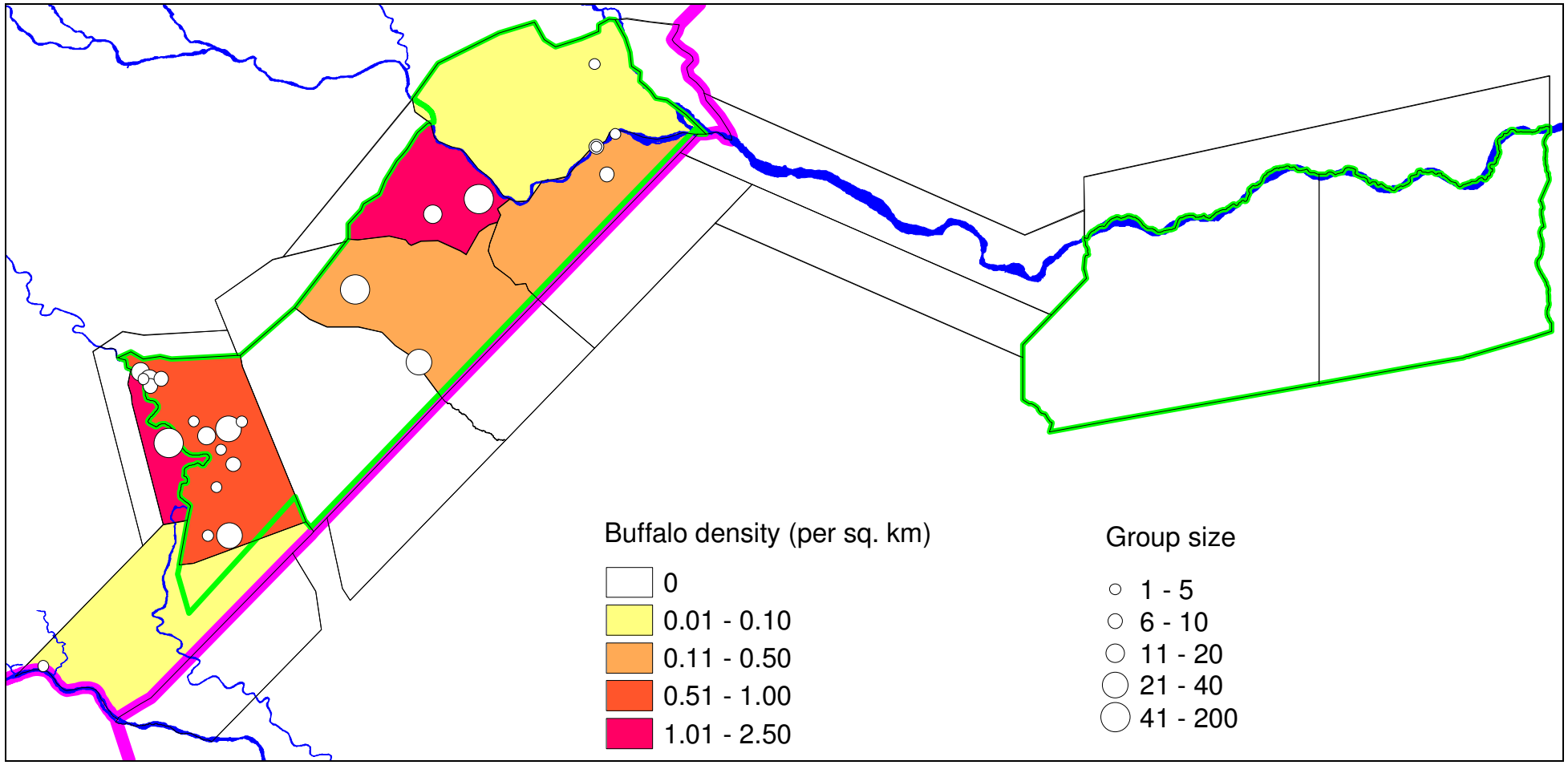
[a] No elephants, dead or alive, were seen in stratum

Table 10. Population estimates and statistics for Unidentified Carcasses in Gonarezhou NP, Zinave NP and surrounds

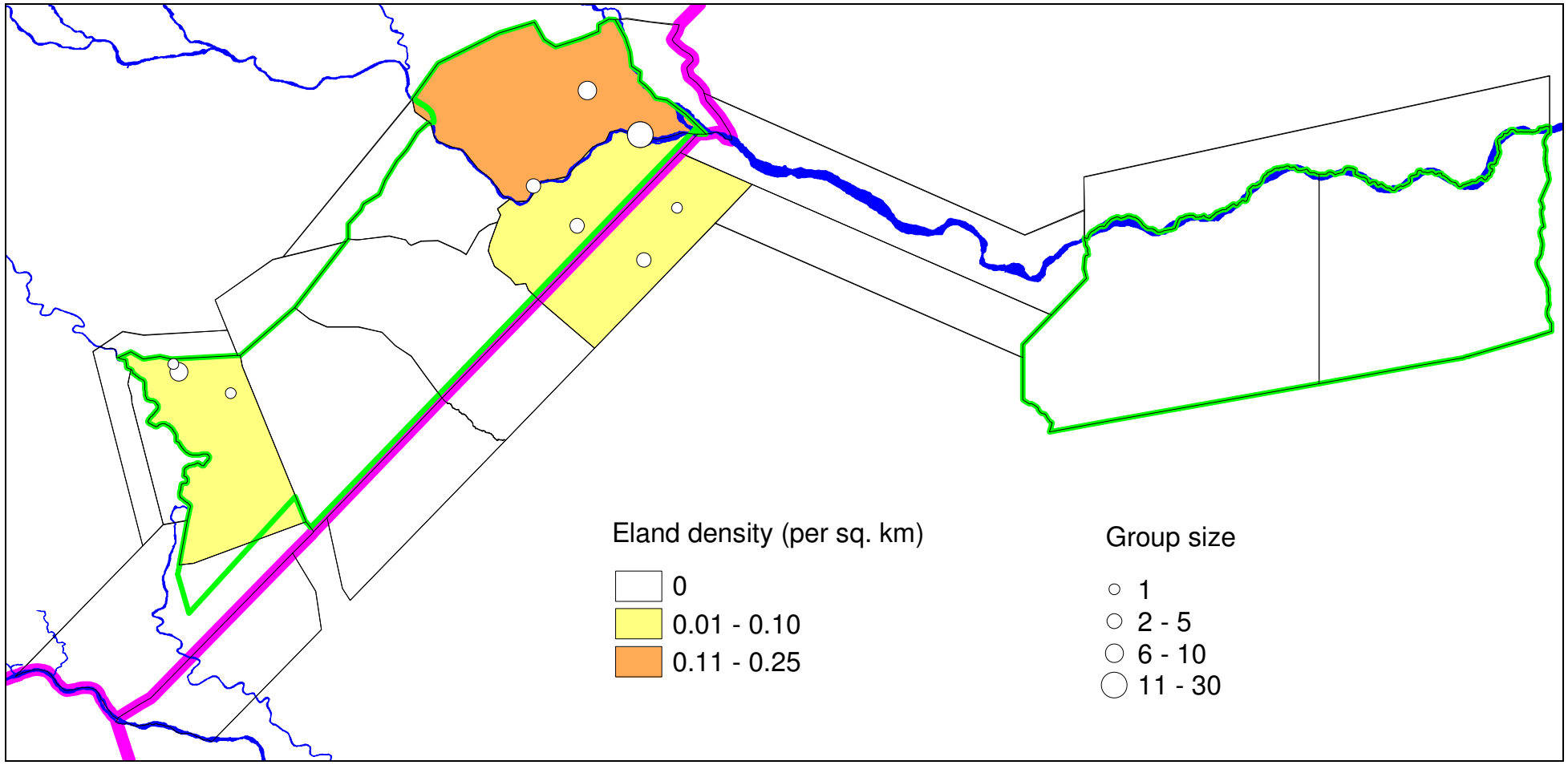
Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	0	0	0	0.0	0	0	0.000
Chilojo A	15	3	46	98.2	0	29	0.032
Chilojo B	19	4	96	105.3	0	39	0.031
Naivasha	34	7	219	88.2	4	65	0.039
Chefu	57	7	1002	119.6	0	126	0.056
Mabalauta NP	84	17	286	41.4	49	118	0.102
Subtotals	209	38	1649	39.6	126	291	0.042
Malapati SA							
Malapati	29	6	191	98.6	0	58	0.167
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.000
Chingwesi	8	1	63	213.1	0	25	0.037
Matibi	8	1	64	225.9	0	27	0.033
Gonakudzingwa	17	2	121	143.1	0	42	0.141
Masukwe	0	0	0	0.0	0	0	0.000
Sengwe	59	8	702	101.2	0	119	0.061
Subtotals	93	12	950	70.9	27	158	0.047
National Subtotals	**331**	**56**	**2789**	**32.0**	**225**	**437**	**0.046**
MOZAMBIQUE							
International border							
North Border	0	0	0	0.0	0	0	0.000
Border Maunge	0	0	0	0.0	0	0	0.000
Border Chefu	0	0	0	0.0	0	0	0.000
Border Limpopo	24	3	92	97.5	1	48	0.039
Subtotals	24	3	92	97.4	1	48	0.011
Potential corridor							
Save Corridor	8	1	52	189.8	0	22	0.007
Southern Corridor	0	0	0	0.0	0	0	0.000
Subtotals	8	1	52	189.8	0	22	0.004
Zinave NP							
Zinave NP east	6	1	36	191.0	0	19	0.004
Zinave NP west	7	1	37	190.6	0	19	0.003
Subtotals	13	2	73	131.6	0	30	0.003
Coutada 4							
North Zinave	6	1	35	188.2	0	18	0.005
National Subtotals	**51**	**7**	**252**	**62.8**	**19**	**83**	**0.006**
Totals	**382**	**63**	**3041**	**28.9**	**272**	**492**	**0.023**

Table 11. Population estimates and statistics for Buffalo in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	5	1	19	185.5	0	14	0.004
Chilojo A	1063	217	751065	172.8	0	2901	2.31
Chilojo B	95	20	3256	122.9	0	211	0.16
Naivasha	394	80	58634	126.4	0	892	0.45
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	718	146	54893	66.7	239	1197	0.88
Subtotals	2274	464	867866	85.2	337	4212	0.46
Malapati SA							
Malapati	438	90	160908	191.0	0	1275	2.50
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	30	4	778	213.1	0	93	0.03
Subtotals	30	4	778	213.2	0	93	0.015
National Subtotals	**2742**	**558**	**1029552**	**75.8**	**664**	**4820**	**0.39**
MOZAMBIQUE							
International border							
North Border	0	0	0	0.0	0	0	0.00
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	0	0	0	0.0	0	0	0.00
Zinave NP west	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**0**	**0**	**0**	**0.0**	**0**	**0**	**0.00**
Totals	**2742**	**558**	**1029552**	**75.8**	**664**	**4820**	**0.17**



Map 12. Distribution of buffalo in Gonarezhou NP and surrounds during 2009



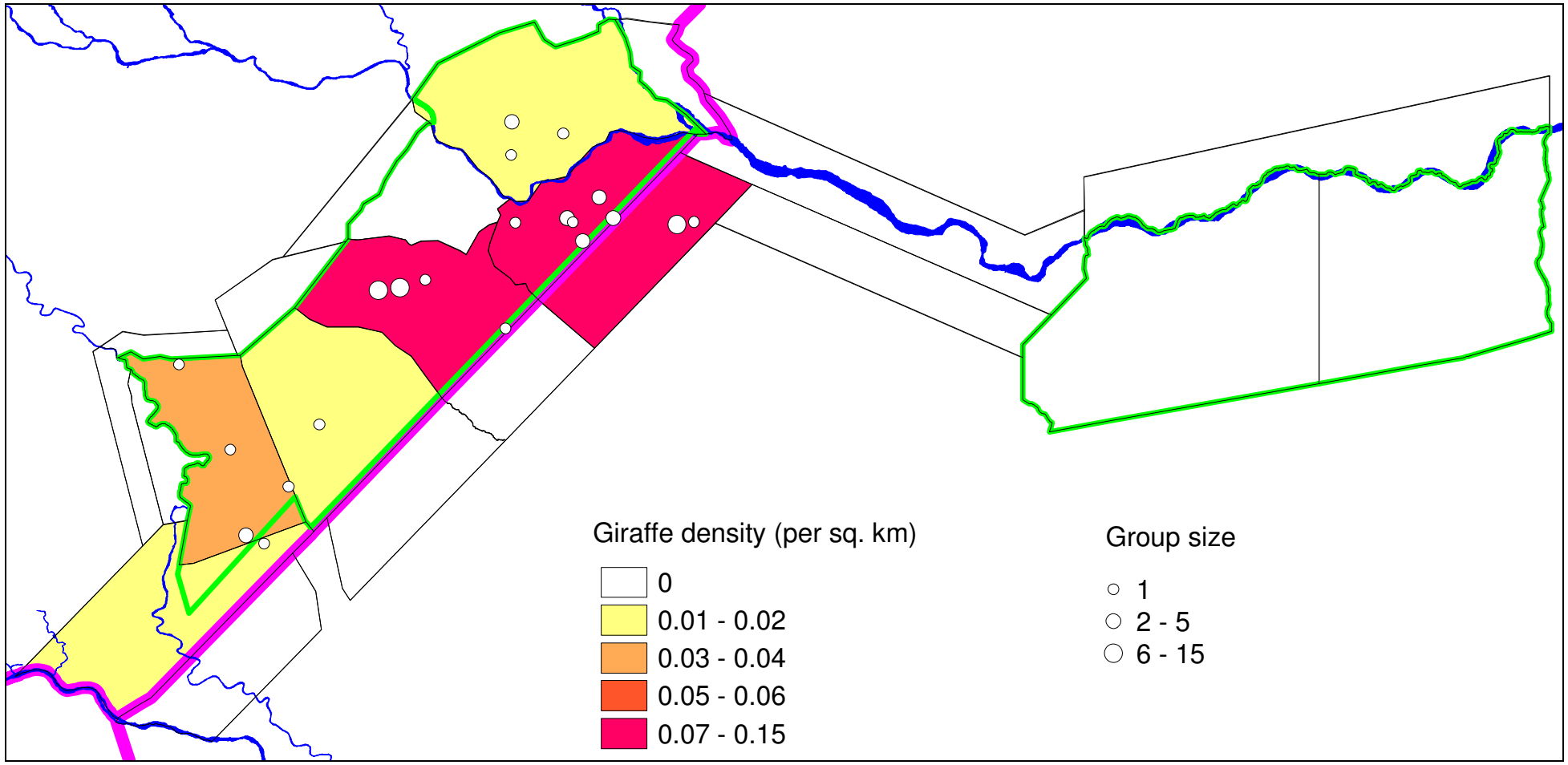
Map 13. Distribution of eland in Gonarezhou NP and surrounds during 2009

Table 12. Population estimates and statistics for Eland in Gonarezhou NP, Zinave NP and surrounds

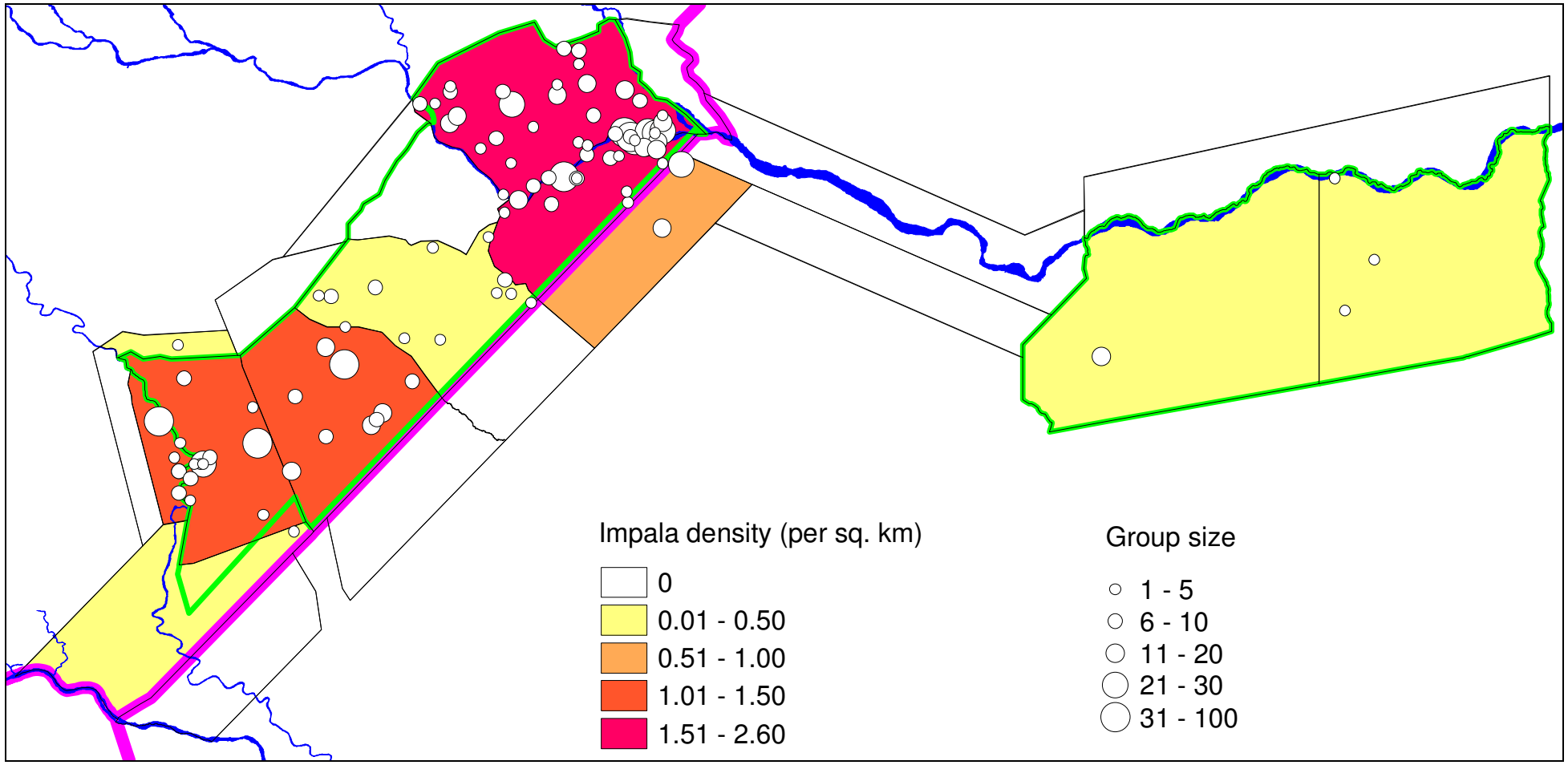
Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	259	54	34384	145.3	0	634	0.22
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	14	3	154	178.1	0	40	0.02
Naivasha	0	0	0	0.0	0	0	0.00
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	44	9	923	140.4	0	106	0.05
Subtotals	317	66	35461	120.2	0	698	0.06
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
National Subtotals	**317**	**66**	**35461**	**120.2**	**0**	**698**	**0.04**
MOZAMBIQUE							
International border							
North Border	24	3	274	145.7	0	59	0.04
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	24	3	274	145.7	0	59	0.01
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	0	0	0	0.0	0	0	0.00
Zinave NP west	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**24**	**3**	**274**	**145.7**	**0**	**59**	**0.003**
Totals	**341**	**69**	**35735**	**112.2**	**0**	**723**	**0.02**

Table 13. Population estimates and statistics for Giraffe in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	24	5	310	148.9	0	60	0.02
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	71	15	898	86.0	10	132	0.12
Naivasha	118	24	4394	115.4	0	254	0.13
Chefu	8	1	62	207.5	0	25	0.008
Mabalauta NP	30	6	216	102.0	0	60	0.04
Subtotals	251	51	5880	61.6	96	405	0.05
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	7	1	46	207.6	0	23	0.008
Subtotals	7	1	46	207.6	0	23	0.004
National Subtotals	**258**	**52**	**5927**	**60.1**	**103**	**413**	**0.04**
MOZAMBIQUE							
International border							
North Border	72	9	3681	178.0	0	199	0.11
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	72	9	3681	178.0	0	199	0.03
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	0	0	0	0.0	0	0	0.00
Zinave NP west	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**72**	**9**	**3681**	**178.0**	**0**	**199**	**0.008**
Totals	**330**	**61**	**9608**	**59.5**	**134**	**526**	**0.02**



Map 14. Distribution of giraffe in Gonarezhou NP and surrounds during 2009



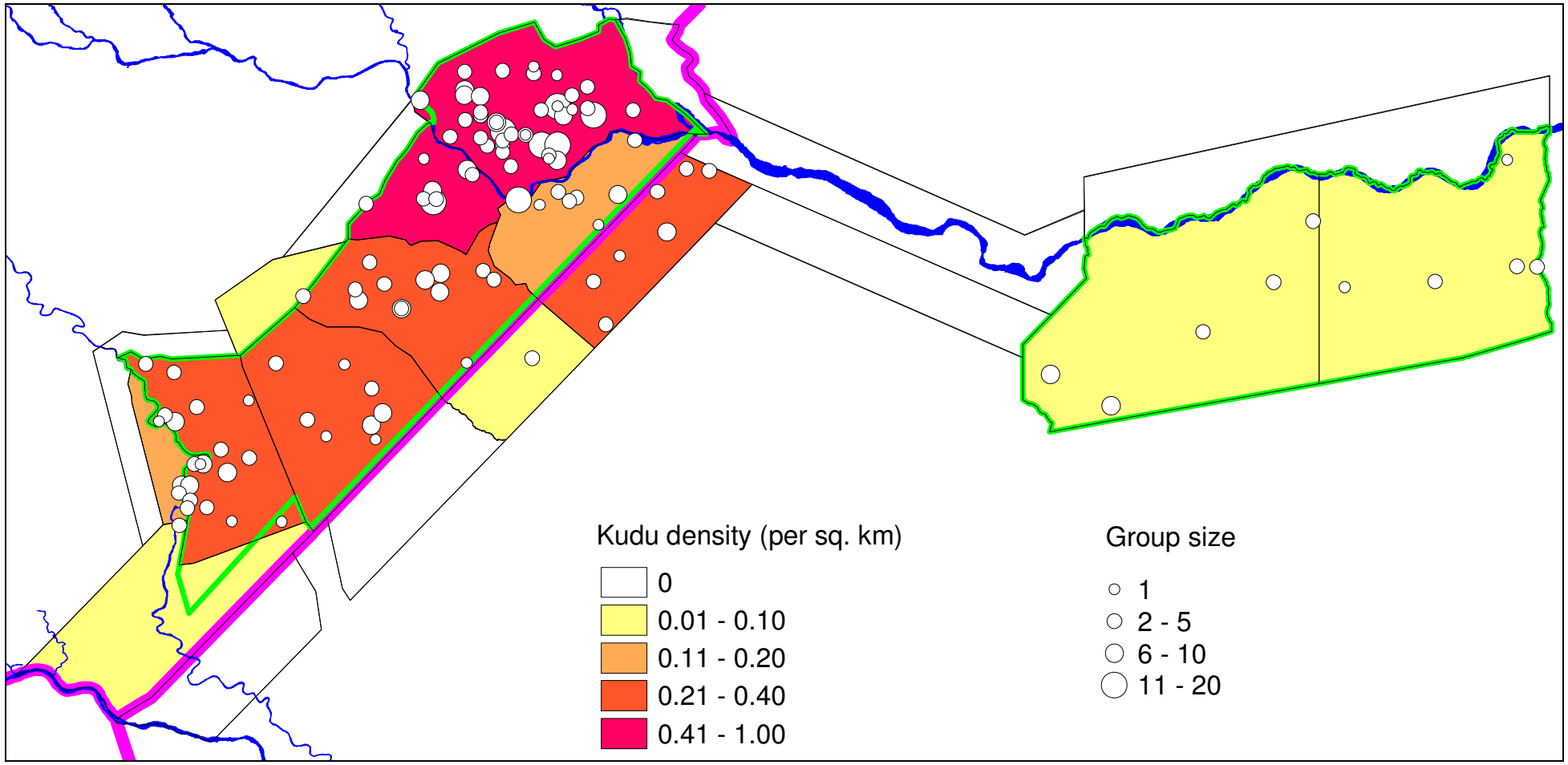
Map 15. Distribution of impala in Gonarezhou NP, Zinave NP and surrounds during 2009

Table 14. Population estimates and statistics for Impala in Gonarezhou NP, Zinave NP and surrounds

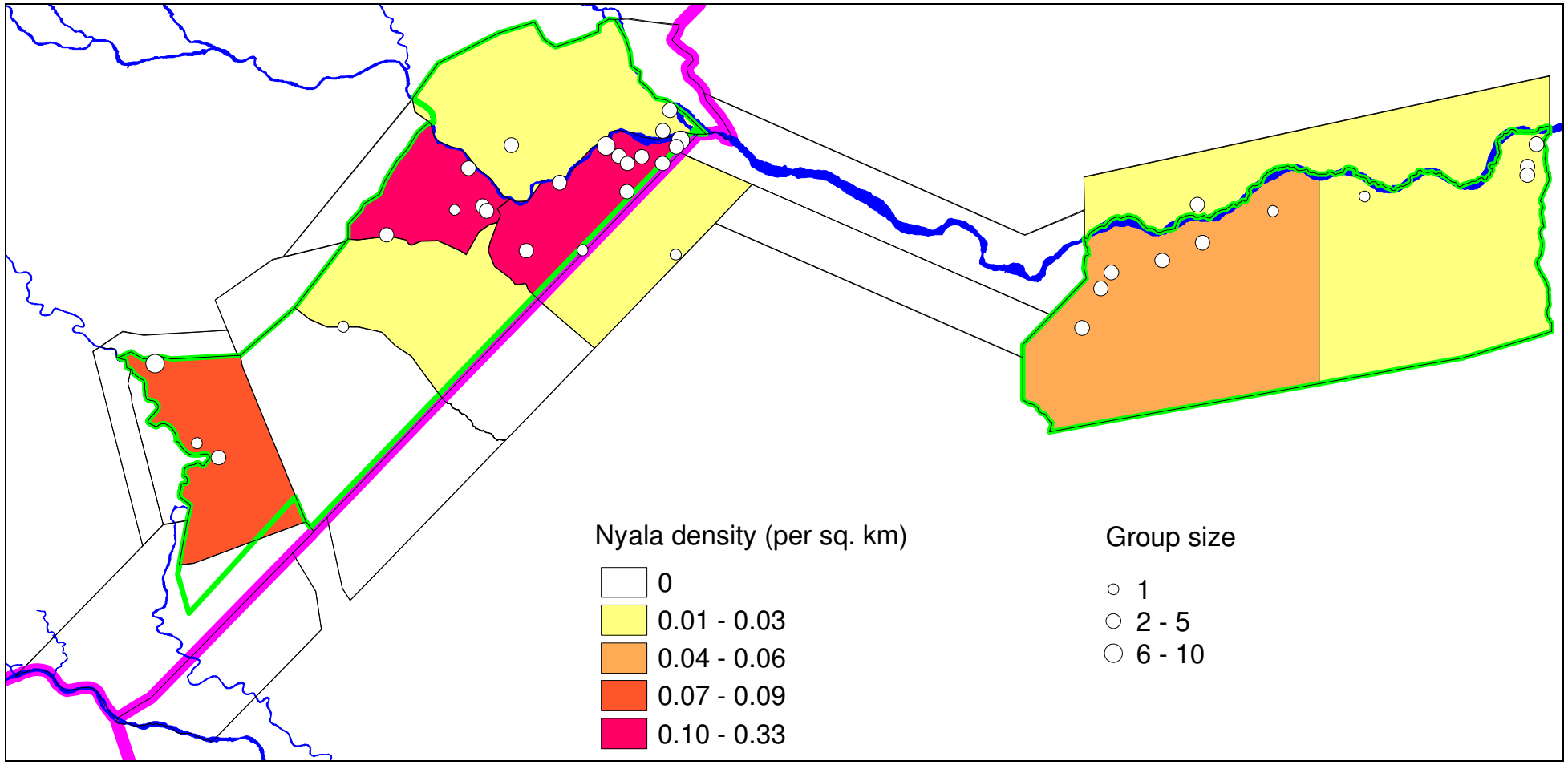
Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	2102	439	248914	48.1	1091	3113	1.80
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	1558	329	573086	99.1	14	3102	2.59
Naivasha	221	45	4348	61.2	86	357	0.25
Chefu	1086	133	205346	90.1	107	2065	1.07
Mabalauta NP	1037	211	250094	98.6	15	2060	1.27
Subtotals	6005	1157	1281788	37.4	3756	8254	1.21
Malapati SA							
Malapati	209	43	7817	88.1	25	394	1.20
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	26	3	560	204.8	0	78	0.21
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	22	3	398	203.3	0	67	0.02
Subtotals	48	6	958	135.6	0	113	0.02
National Subtotals	**6262**	**1206**	**1290563**	**36.0**	**4007**	**8518**	**0.88**
MOZAMBIQUE							
International border							
North Border	358	45	61797	145.9	0	880	0.54
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	358	45	61797	145.9	0	880	0.16
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	58	9	929	108.1	0	122	0.03
Zinave NP west	91	14	7237	190.6	0	266	0.04
Subtotals	150	23	8165	122.5	0	334	0.04
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**508**	**68**	**69962**	**108.0**	**0**	**1056**	**0.06**
Totals	**6770**	**1274**	**1360525**	**34.2**	**4457**	**9083**	**0.41**

Table 15. Population estimates and statistics for Kudu in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	1154	241	70421	46.6	616	1692	0.99
Chilojo A	196	40	12065	118.8	0	429	0.43
Chilojo B	95	20	1574	85.4	14	176	0.16
Naivasha	271	55	6553	61.5	104	437	0.31
Chefu	245	30	19125	121.9	0	544	0.24
Mabalauta NP	324	66	6167	49.5	164	485	0.40
Subtotals	2285	452	115905	29.7	1607	2963	0.46
Malapati SA							
Malapati	68	14	1766	128.6	0	156	0.39
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	16	2	247	222.8	0	53	0.07
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	30	4	778	213.1	0	93	0.03
Subtotals	46	6	1025	149.7	0	115	0.02
National Subtotals	**2399**	**472**	**118696**	**28.6**	**1713**	**3084**	**0.34**
MOZAMBIQUE							
International border							
North Border	183	23	3886	71.6	52	314	0.28
Border Maunge	16	2	223	239.7	0	54	0.04
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	199	25	4109	67.4	65	333	0.09
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	84	13	1292	88.3	10	159	0.05
Zinave NP west	150	23	4163	88.0	18	282	0.07
Subtotals	235	36	5455	63.5	86	384	0.06
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**434**	**61**	**9564**	**45.1**	**238**	**629**	**0.05**
Totals	**2832**	**533**	**128261**	**25.1**	**2121**	**3544**	**0.17**



Map 16. Distribution of kudu in Gonarezhou NP, Zinave NP and surrounds during 2009



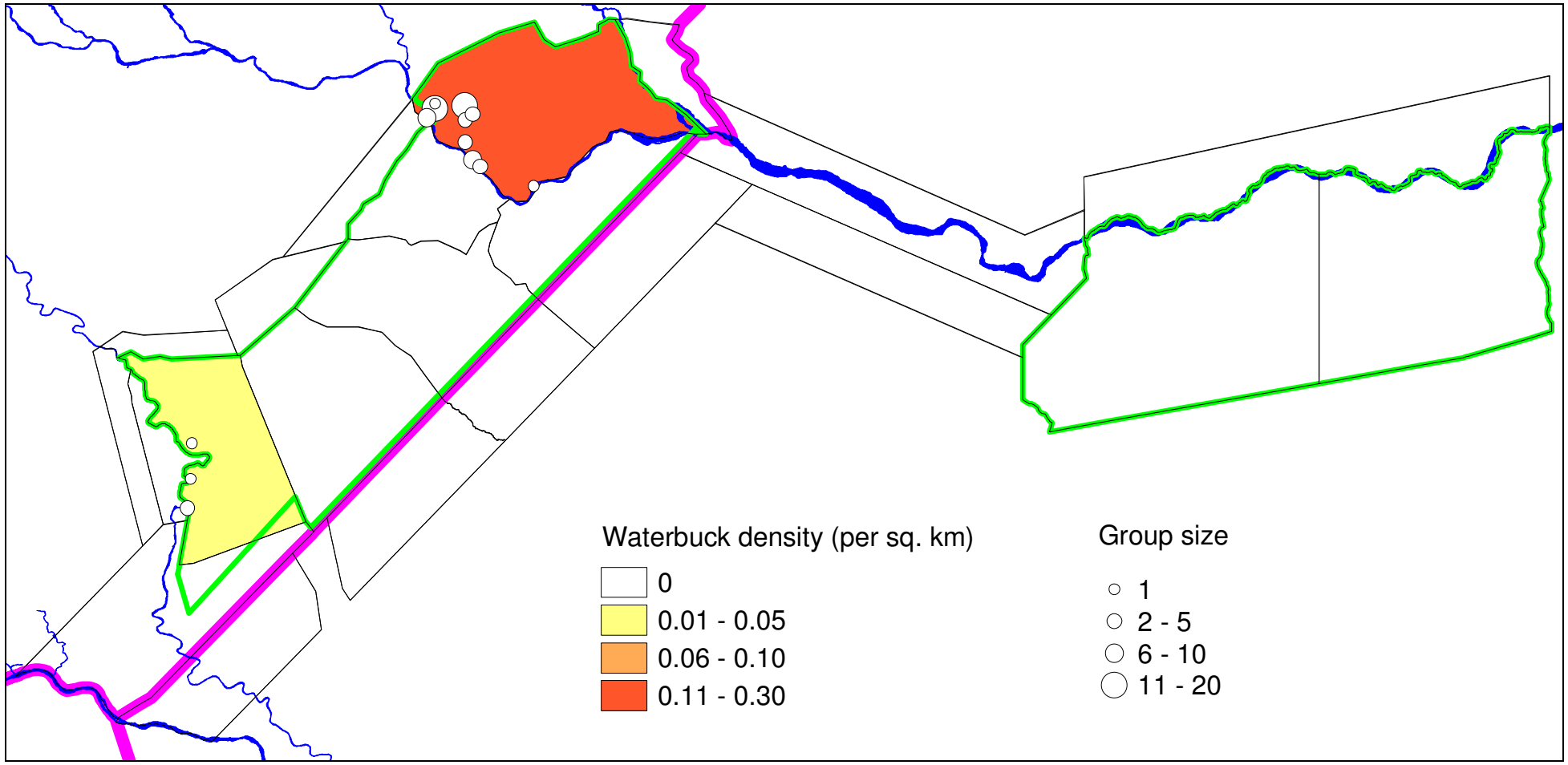
Map 17. Distribution of nyala in Gonarezhou NP, Zinave NP and surrounds during 2009

Table 16. Population estimates and statistics for Nyala in Gonarezhou NP, Zinave NP and surrounds

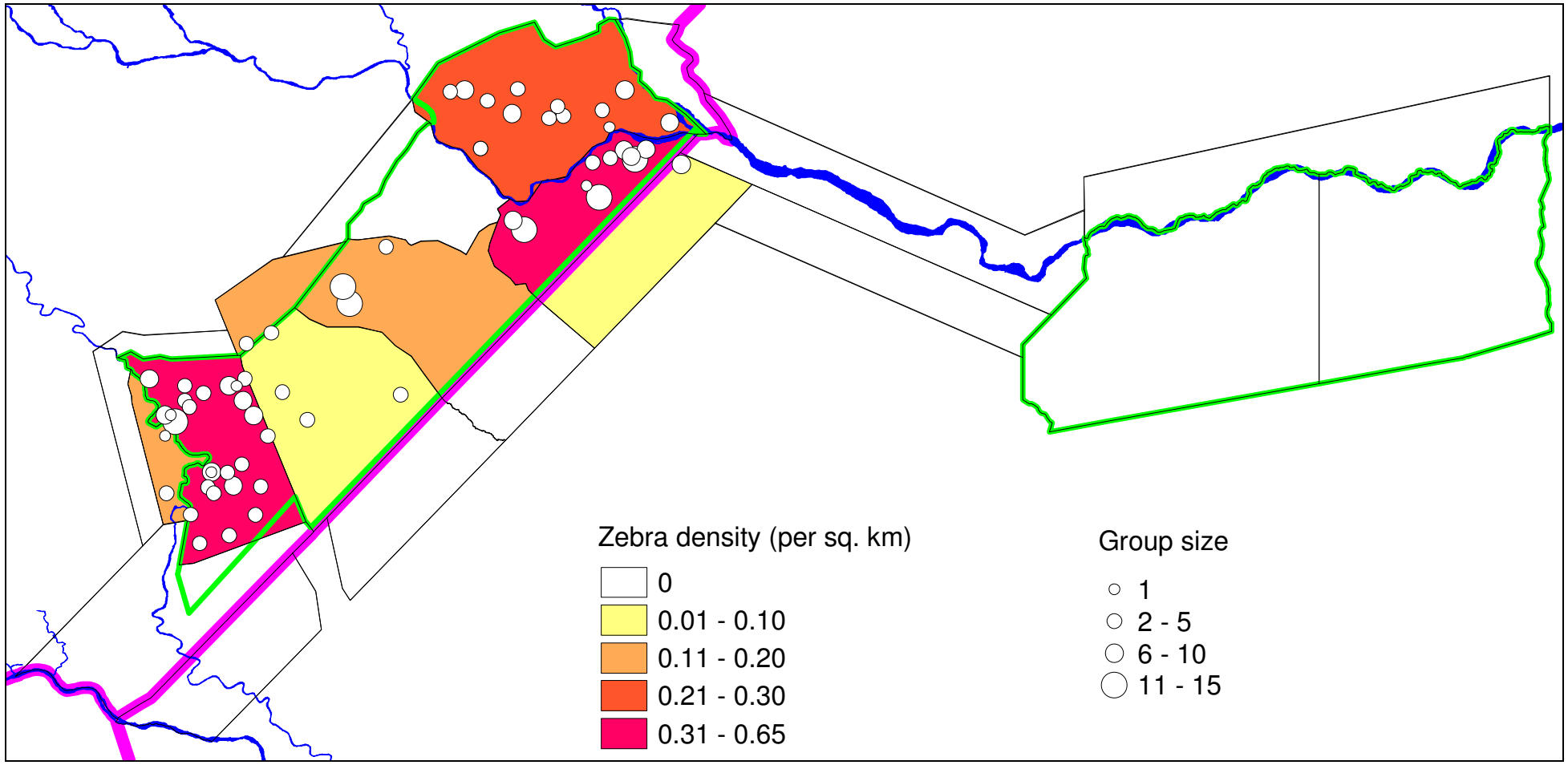
Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	38	8	419	108.3	0	80	0.03
Chilojo A	69	14	752	84.8	10	127	0.15
Chilojo B	199	42	6457	82.4	35	363	0.33
Naivasha	5	1	20	186.8	0	14	0.006
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	59	12	1122	116.1	0	128	0.07
Subtotals	370	77	8770	50.8	182	558	0.07
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
National Subtotals	**370**	**77**	**8770**	**50.8**	**182**	**558**	**0.05**
MOZAMBIQUE							
International border							
North Border	8	1	58	200.3	0	24	0.01
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	8	1	58	200.3	0	24	0.003
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	58	9	1138	119.7	0	128	0.03
Zinave NP west	85	13	965	74.9	21	148	0.04
Subtotals	143	22	2103	64.3	51	236	0.04
Coutada 4							
North Zinave	25	4	555	187.0	0	73	0.02
National Subtotals	**177**	**27**	**2715**	**58.8**	**73**	**281**	**0.02**
Totals	**546**	**104**	**11485**	**39.0**	**333**	**759**	**0.03**

Table 17. Population estimates and statistics for Waterbuck in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	326	68	22630	93.6	21	630	0.28
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	0	0	0	0.0	0	0	0.00
Naivasha	0	0	0	0.0	0	0	0.00
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	34	7	490	131.5	0	80	0.04
Subtotals	360	75	23120	85.5	52	668	0.07
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
National Subtotals	**360**	**75**	**23120**	**85.5**	**52**	**668**	**0.05**
MOZAMBIQUE							
International border							
North Border	0	0	0	0.0	0	0	0.00
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	0	0	0	0.0	0	0	0.00
Zinave NP west	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**0**	**0**	**0**	**0.0**	**0**	**0**	**0.00**
Totals	**360**	**75**	**23120**	**85.5**	**52**	**668**	**0.02**



Map 18. Distribution of waterbuck in Gonarezhou NP and surrounds during 2009



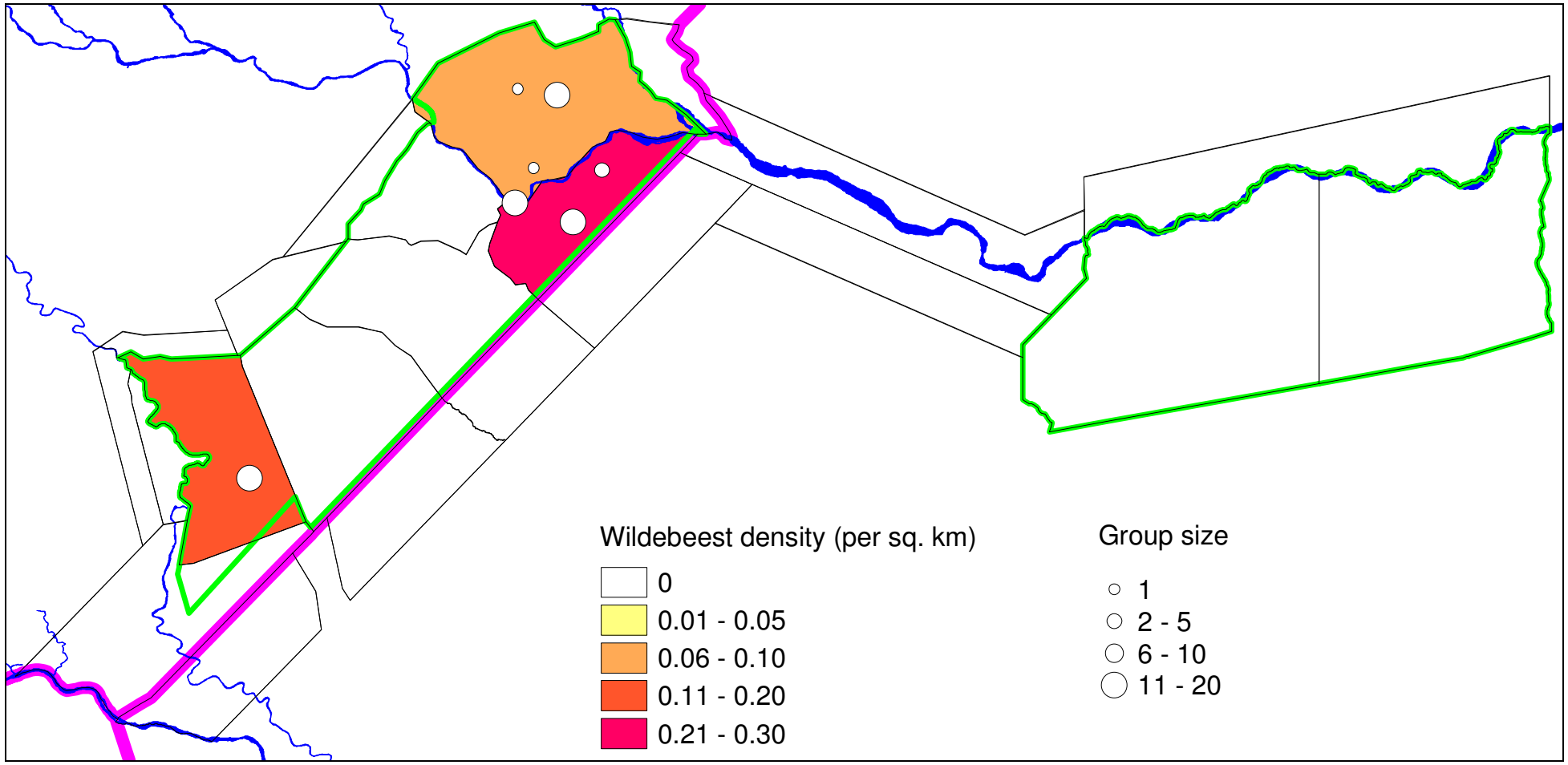
Map 19. Distribution of zebra in Gonarezhou NP and surrounds during 2009

Table 18. Population estimates and statistics for Zebra in Gonarezhou NP, Zinave NP and surrounds

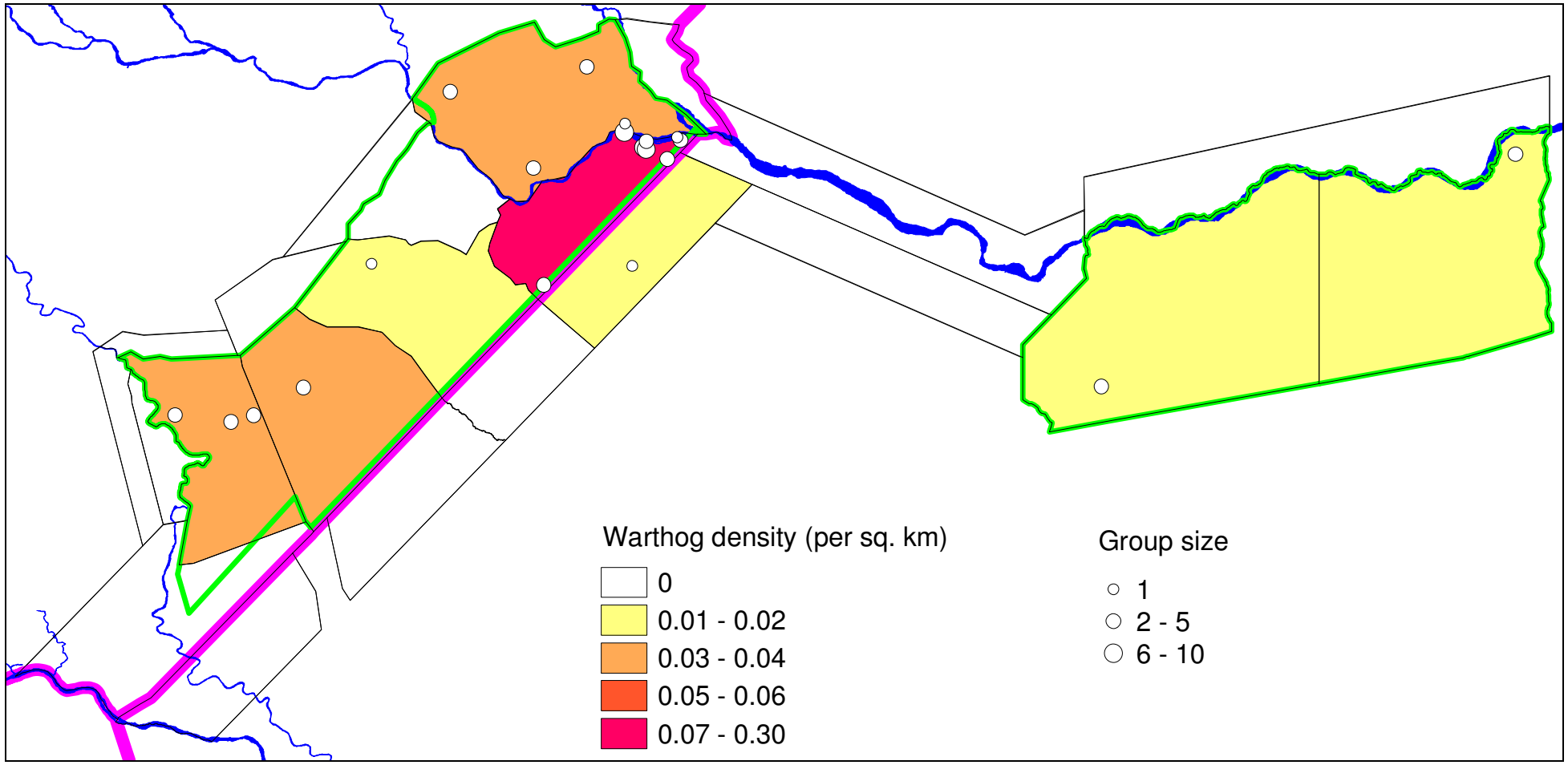
Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	297	62	5146	49.0	152	442	0.25
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	350	74	21240	84.8	53	648	0.58
Naivasha	143	29	5853	110.2	0	300	0.16
Chefu	98	12	2268	105.0	0	201	0.10
Mabalauta NP	497	101	10168	41.5	290	703	0.61
Subtotals	1385	278	44675	30.3	965	1804	0.28
Malapati SA							
Malapati	19	4	200	151.5	0	49	0.11
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	33	4	1295	255.1	0	116	0.13
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	0	0	0	0.0	0	0	0.00
Subtotals	33	4	1295	255.1	0	116	0.02
National Subtotals	**1437**	**286**	**46170**	**29.7**	**1010**	**1863**	**0.20**
MOZAMBIQUE							
International border							
North Border	64	8	3672	200.0	0	191	0.10
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	64	8	3672	200.0	0	191	0.03
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	0	0	0	0.0	0	0	0.00
Zinave NP west	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**64**	**8**	**3672**	**200.0**	**0**	**191**	**0.007**
Totals	**1500**	**294**	**49841**	**29.5**	**1058**	**1942**	**0.09**

Table 19. Population estimates and statistics for Wildebeest in Gonarezhou NP, Zinave NP and surrounds

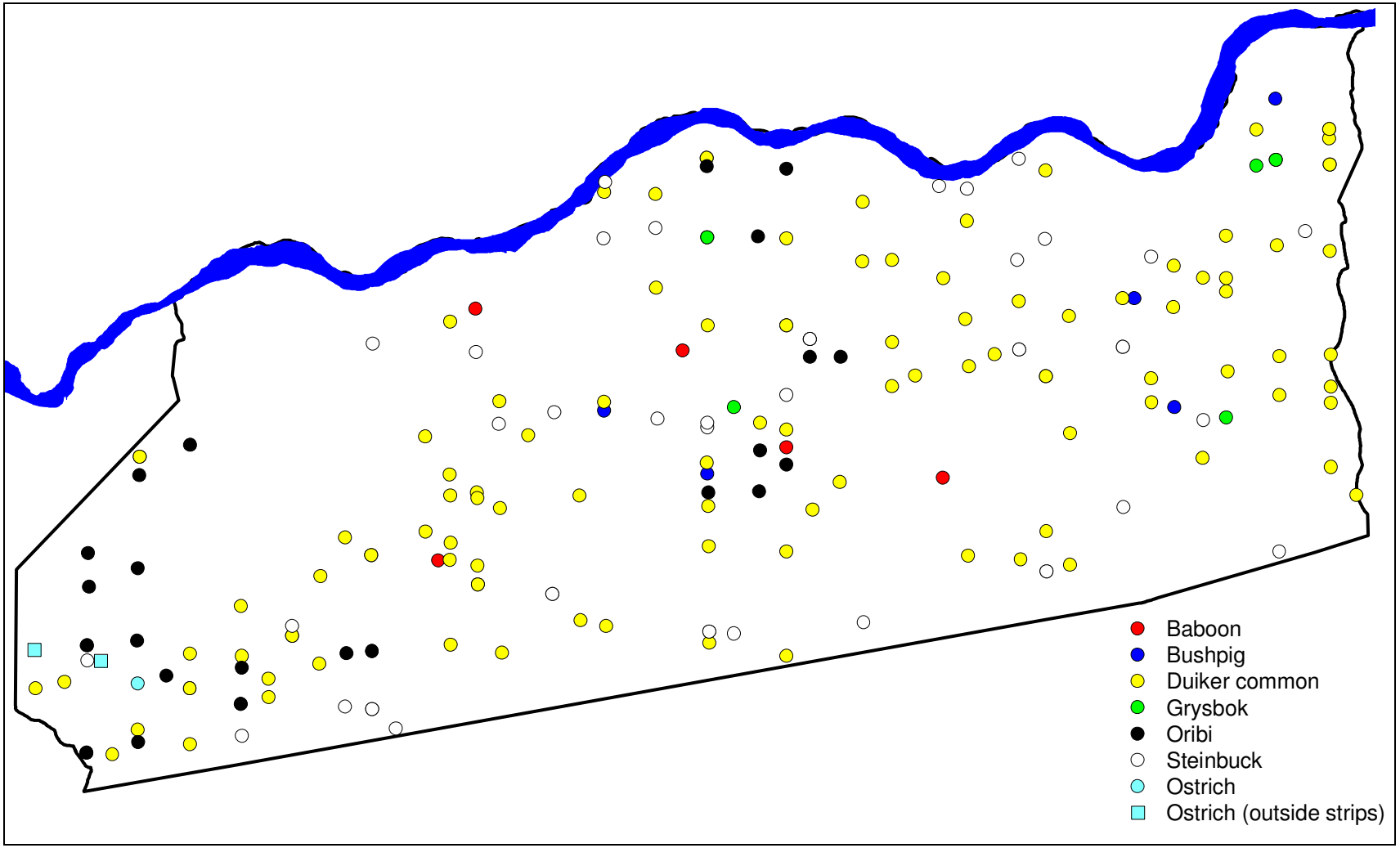
Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	86	18	4872	164.1	0	228	0.07
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	180	38	10120	114.0	0	385	0.30
Naivasha	0	0	0	0.0	0	0	0.00
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	98	20	7497	180.1	0	275	0.12
Subtotals	364	76	22489	81.8	66	663	0.07
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
National Subtotals	**364**	**76**	**22489**	**81.8**	**66**	**663**	**0.05**
MOZAMBIQUE							
International border							
North Border	0	0	0	0.0	0	0	0.00
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	0	0	0	0.0	0	0	0.00
Zinave NP west	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**0**	**0**	**0**	**0.0**	**0**	**0**	**0.00**
Totals	**364**	**76**	**22489**	**81.8**	**66**	**663**	**0.02**



Map 20. Distribution of wildebeest in Gonarezhou NP and surrounds during 2009



Map 21. Distribution of warthog in Gonarezhou NP, Zinave NP and surrounds during 2009



Map 22. Distribution of baboon, bushpig, common duiker, grysbok, oribi, steinbuck and ostrich in Zinave NP during 2009

Only sightings within the search strips are shown here, except in the case of ostrich, for which sightings outside the search strips are also shown.

Table 20. Population estimates and statistics for Warthog in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	34	7	225	90.6	3	64	0.03
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	161	34	9292	122.1	0	358	0.27
Naivasha	5	1	18	179.3	0	14	0.01
Chefu	33	4	1014	210.5	0	101	0.03
Mabalauta NP	34	7	446	125.5	0	78	0.04
Subtotals	267	53	10994	79.4	55	478	0.05
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
National Subtotals	**267**	**53**	**10994**	**79.4**	**55**	**478**	**0.04**
MOZAMBIQUE							
International border							
North Border	8	1	57	199.5	0	24	0.012
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	8	1	57	199.5	0	24	0.003
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	19	3	317	189.7	0	56	0.011
Zinave NP west	26	4	591	190.6	0	76	0.012
Subtotals	46	7	908	132.9	0	106	0.011
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**54**	**8**	**965**	**116.3**	**0**	**116**	**0.006**
Totals	**320**	**61**	**11960**	**68.7**	**100**	**540**	**0.02**

Table 21. Population estimates and statistics for Common Duiker in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	0	0	0	0.0	0	0	0.00
Chilojo A	5	1	17	180.5	0	14	0.01
Chilojo B	33	7	131	70.4	10	56	0.06
Naivasha	39	8	174	68.8	12	66	0.05
Chefu	57	7	358	71.5	16	98	0.06
Mabalauta NP	25	5	154	103.4	0	50	0.03
Subtotals	159	28	835	36.4	101	217	0.03
Malapati SA							
Malapati	10	2	72	182.3	0	27	0.06
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	8	1	59	212.0	0	24	0.04
Sengwe	0	0	0	0.0	0	0	0.00
Subtotals	8	1	59	211.9	0	24	0.004
National Subtotals	**177**	**31**	**966**	**35.1**	**115**	**239**	**0.02**
MOZAMBIQUE							
International border							
North Border	199	25	1878	45.8	108	290	0.30
Border Maunge	32	4	223	119.8	0	70	0.08
Border Chefu	32	4	873	240.3	0	108	0.05
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	263	33	2974	42.9	150	375	0.11
Potential corridor							
Save Corridor	108	14	884	56.0	48	169	0.10
Southern Corridor	63	4	2088	156.5	0	162	0.09
Subtotals	171	18	2973	65.7	59	284	0.10
Zinave NP							
Zinave NP east	461	71	5599	33.7	306	616	0.26
Zinave NP west	438	67	6051	36.4	278	597	0.20
Subtotals	899	138	11650	24.1	682	1116	0.22
Coutada 4							
North Zinave	121	19	607	41.2	71	170	0.10
National Subtotals	**1453**	**208**	**18203**	**18.4**	**1185**	**1721**	**0.16**
Totals	**1629**	**239**	**19170**	**16.8**	**1355**	**1904**	**0.10**

Table 22. Population estimates and statistics for Grysbok in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	0	0	0	0.0	0	0	0.00
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	9	2	33	123.0	0	21	0.02
Naivasha	5	1	19	179.8	0	14	0.01
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	10	2	36	124.4	0	22	0.01
Subtotals	24	5	87	76.6	6	43	0.005
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
National Subtotals	**24**	**5**	**87**	**76.6**	**6**	**43**	**0.003**
MOZAMBIQUE							
International border							
North Border	8	1	58	200.5	0	24	0.01
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	8	1	58	200.5	0	24	0.003
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	26	4	193	110.9	0	55	0.014
Zinave NP west	13	2	69	130.7	0	30	0.006
Subtotals	39	6	262	84.1	6	72	0.010
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**47**	**7**	**320**	**76.5**	**11**	**83**	**0.01**
Totals	**71**	**12**	**407**	**56.4**	**31**	**111**	**0.004**

Table 23. Population estimates and statistics for Oribi in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	0	0	0	0.0	0	0	0.00
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	0	0	0	0.0	0	0	0.00
Naivasha	0	0	0	0.0	0	0	0.00
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
National Subtotals	**0**	**0**	**0**	**0.0**	**0**	**0**	**0.00**
MOZAMBIQUE							
International border							
North Border	0	0	0	0.0	0	0	0.00
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	52	8	845	116.0	0	112	0.03
Zinave NP west	202	31	4332	66.6	68	337	0.09
Subtotals	254	39	5176	57.3	109	400	0.06
Coutada 4							
North Zinave	13	2	68	130.5	0	29	0.01
National Subtotals	**267**	**41**	**5244**	**54.8**	**121**	**414**	**0.03**
Totals	**267**	**41**	**5244**	**54.8**	**121**	**414**	**0.02**

Table 24. Population estimates and statistics for Reedbuck in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	0	0	0	0.0	0	0	0.00
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	0	0	0	0.0	0	0	0.00
Naivasha	0	0	0	0.0	0	0	0.00
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
National Subtotals	**0**	**0**	**0**	**0.0**	**0**	**0**	**0.00**
MOZAMBIQUE							
International border							
North Border	0	0	0	0.0	0	0	0.00
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	32	5	431	132.6	0	76	0.02
Zinave NP west	0	0	0	0.0	0	0	0.00
Subtotals	32	5	431	132.6	0	76	0.01
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**32**	**5**	**431**	**132.6**	**0**	**76**	**0.004**
Totals	**32**	**5**	**431**	**132.6**	**0**	**76**	**0.002**

Table 25. Population estimates and statistics for Steinbuck in Gonarezhou NP, Zinave NP and surrounds

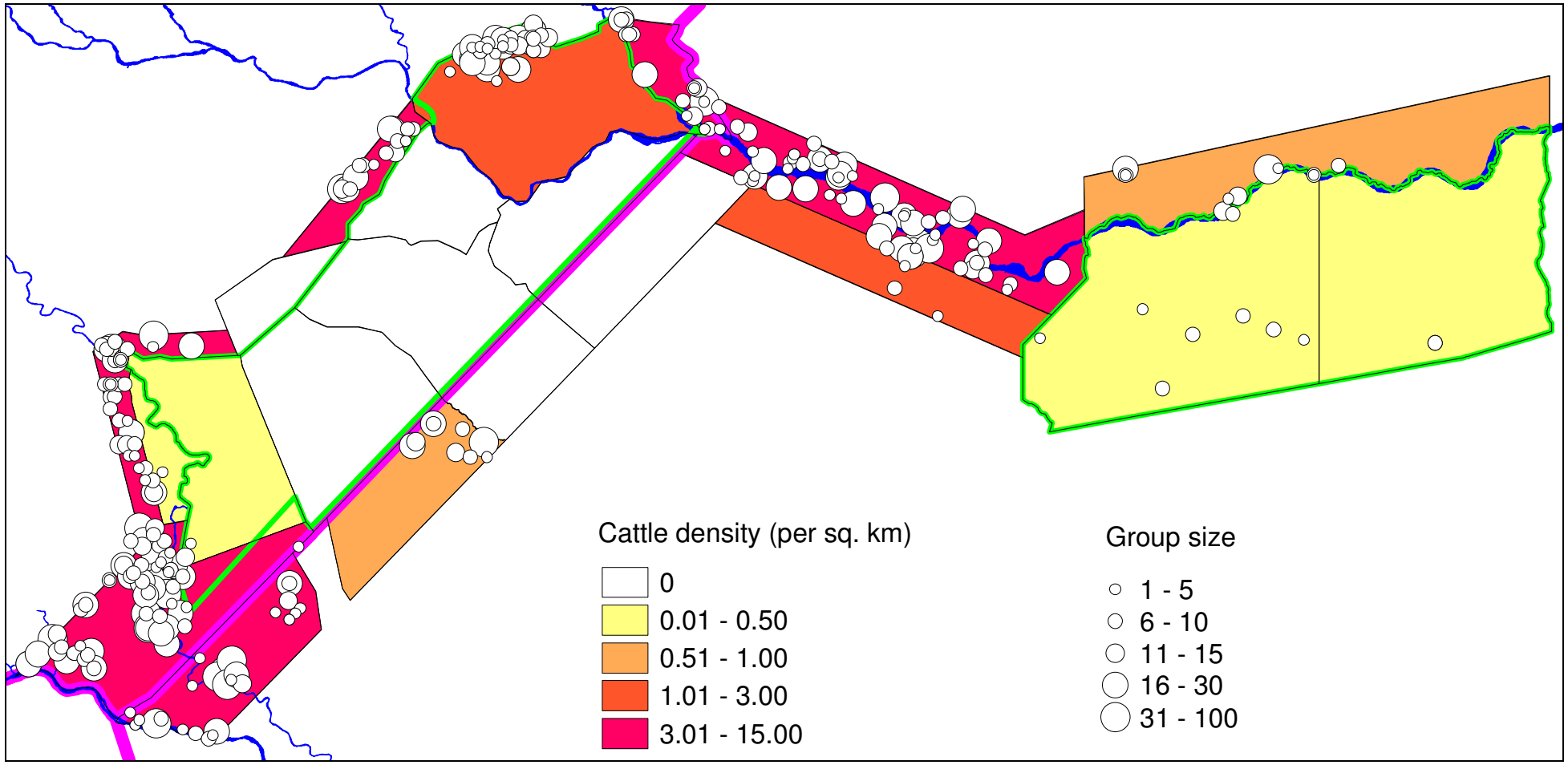
Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	10	2	37	129.6	0	22	0.01
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	14	3	48	99.3	0	28	0.02
Naivasha	20	4	194	145.4	0	48	0.02
Chefu	25	3	277	146.7	0	60	0.02
Mabalauta NP	29	6	128	78.4	6	53	0.04
Subtotals	97	18	684	53.7	45	150	0.02
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	7	1	46	207.2	0	23	0.01
Subtotals	7	1	46	207.2	0	23	0.004
National Subtotals	**105**	**19**	**730**	**51.5**	**51**	**159**	**0.01**
MOZAMBIQUE							
International border							
North Border	48	6	397	87.7	6	90	0.07
Border Maunge	8	1	57	242.1	0	27	0.02
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	8	1	51	217.6	0	25	0.01
Subtotals	64	8	505	72.6	17	110	0.03
Potential corridor							
Save Corridor	23	3	146	106.2	0	48	0.02
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	23	3	146	106.2	0	48	0.01
Zinave NP							
Zinave NP east	117	18	661	45.6	64	170	0.07
Zinave NP west	124	19	745	45.1	68	180	0.06
Subtotals	241	37	1405	31.3	166	316	0.06
Coutada 4							
North Zinave	19	3	98	105.0	0	39	0.02
National Subtotals	**347**	**51**	**2155**	**26.6**	**255**	**439**	**0.04**
Totals	**452**	**70**	**2885**	**23.5**	**346**	**558**	**0.03**

Table 26. Population estimates and statistics for Bushpig in Gonarezhou NP, Zinave NP and surrounds

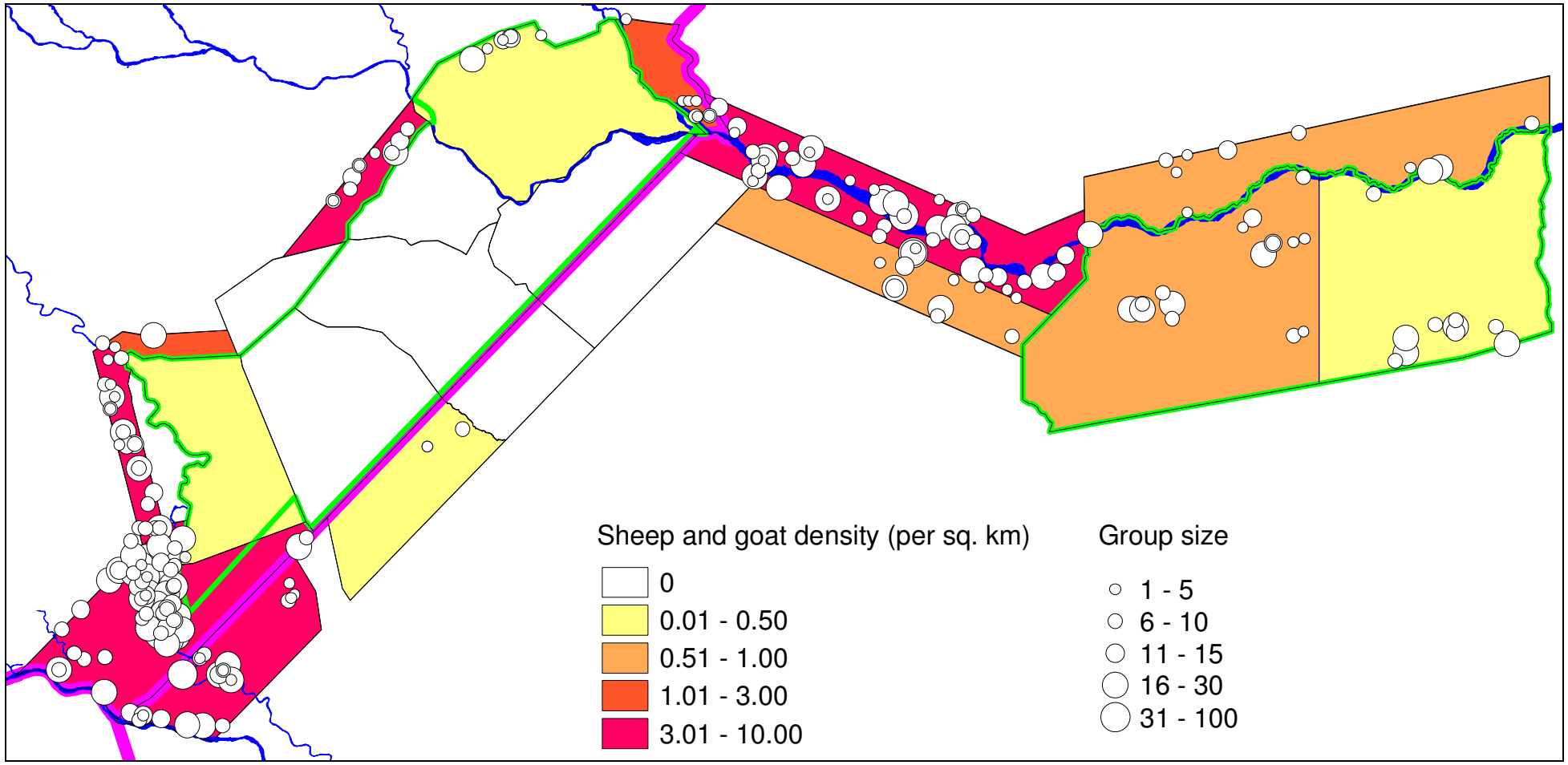
Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	0	0	0	0.0	0	0	0.00
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	0	0	0	0.0	0	0	0.00
Naivasha	0	0	0	0.0	0	0	0.00
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
National Subtotals	**0**	**0**	**0**	**0.0**	**0**	**0**	**0.00**
MOZAMBIQUE							
International border							
North Border	24	3	517	200.2	0	72	0.04
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	24	3	517	200.2	0	72	0.01
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	71	11	1768	122.1	0	159	0.04
Zinave NP west	72	11	2615	145.8	0	177	0.03
Subtotals	143	22	4384	92.9	10	276	0.04
Coutada 4							
North Zinave	13	2	66	128.6	0	29	0.01
National Subtotals	**180**	**27**	**4967**	**78.4**	**39**	**321**	**0.02**
Totals	**180**	**27**	**4967**	**85.4**	**26**	**333**	**0.01**

Table 27. Population estimates and statistics for Cattle in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	2859	597	567087	53.4	1333	4384	2.45
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	0	0	0	0.0	0	0	0.00
Naivasha	0	0	0	0.0	0	0	0.00
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	133	27	5970	119.0	0	291	0.16
Subtotals	2991	624	573057	51.3	1457	4525	0.60
Malapati SA							
Malapati	24	5	498	191.2	0	71	0.14
Communal lands							
Mahenye	1946	210	454051	79.9	392	3500	8.81
Chingwesi	1779	219	552406	91.0	160	3399	8.05
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	858	100	127378	92.7	63	1653	7.03
Masukwe	3039	394	409212	44.6	1683	4395	14.90
Sengwe	7089	958	3197163	57.1	3045	11134	7.29
Subtotals	14711	1881	4740210	31.1	10137	19286	7.40
National Subtotals	**17727**	**2510**	**5313765**	**26.9**	**12958**	**22496**	**2.49**
MOZAMBIQUE							
International border							
North Border	0	0	0	0.0	0	0	0.00
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	1201	152	436342	141.4	0	2900	2.02
Border Limpopo	2697	336	430775	59.6	1091	4303	4.39
Subtotals	3898	488	867117	53.2	1823	5973	1.71
Potential corridor							
Save Corridor	8446	1094	3290815	43.7	4756	12137	7.60
Southern Corridor	946	60	478675	158.0	0	2440	1.39
Subtotals	9392	1154	3769490	41.7	5471	13313	5.24
Zinave NP							
Zinave NP east	130	20	14188	190.2	0	377	0.07
Zinave NP west	490	75	17936	56.0	215	764	0.22
Subtotals	620	95	32124	58.1	259	980	0.16
Coutada 4							
North Zinave	603	95	79876	94.4	34	1172	0.52
National Subtotals	**14513**	**1832**	**4748607**	**30.1**	**10144**	**18882**	**1.57**
Totals	**32240**	**4342**	**10062372**	**19.7**	**25899**	**38581**	**1.97**



Map 23. Distribution of cattle in Gonarezhou NP, Zinave NP and surrounds during 2009



Map 24. Distribution of sheep and goats in Gonarezhou NP, Zinave NP and surrounds during 2009

Table 28. Population estimates and statistics for Sheep and Goats in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	378	79	28439	90.3	37	720	0.32
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	0	0	0	0.0	0	0	0.00
Naivasha	0	0	0	0.0	0	0	0.00
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	74	15	2408	136.1	0	174	0.09
Subtotals	452	94	30847	78.4	98	806	0.09
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	380	41	53117	139.9	0	911	1.72
Chingwesi	853	105	80066	72.3	236	1470	3.86
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	300	35	33617	136.1	0	709	2.46
Masukwe	1890	245	307506	62.2	714	3065	9.26
Sengwe	8458	1143	2945554	45.9	4576	12341	8.70
Subtotals	11881	1569	3419860	33.9	7852	15911	5.98
National Subtotals	**12333**	**1663**	**3450707**	**32.8**	**8286**	**16381**	**1.73**
MOZAMBIQUE							
International border							
North Border	0	0	0	0.0	0	0	0.00
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	119	15	6046	168.6	0	318	0.20
Border Limpopo	2368	295	395151	65.0	829	3906	3.86
Subtotals	2486	310	401198	62.3	936	4036	1.09
Potential corridor							
Save Corridor	5597	725	908307	34.6	3659	7536	5.04
Southern Corridor	1419	90	606333	118.5	0	3101	2.08
Subtotals	7016	815	1514641	35.4	4534	9498	3.92
Zinave NP							
Zinave NP east	903	139	135794	84.7	138	1667	0.50
Zinave NP west	1136	174	83696	52.1	544	1729	0.52
Subtotals	2039	313	219490	46.3	1095	2983	0.51
Coutada 4							
North Zinave	609	96	41551	67.4	199	1020	0.53
National Subtotals	**12151**	**1534**	**2176879**	**24.3**	**9197**	**15104**	**1.32**
Totals	**24484**	**3197**	**5627586**	**19.8**	**19639**	**29329**	**1.50**

Table 29. Population estimates and statistics for Donkey in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	53	11	2306	184.7	0	150	0.05
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	0	0	0	0.0	0	0	0.00
Naivasha	0	0	0	0.0	0	0	0.00
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	0	0	0	0.0	0	0	0.00
Subtotals	53	11	2306	184.7	0	150	0.01
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	28	3	374	160.5	0	72	0.13
Chingwesi	24	3	653	228.5	0	80	0.11
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	17	2	281	217.6	0	54	0.14
Masukwe	262	34	15012	99.0	3	522	1.29
Sengwe	577	78	32899	71.1	167	988	0.59
Subtotals	909	120	49220	51.3	443	1375	0.46
National Subtotals	**961**	**131**	**51525**	**49.4**	**486**	**1437**	**0.14**
MOZAMBIQUE							
International border							
North Border	0	0	0	0.0	0	0	0.00
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	47	6	968	168.7	0	127	0.08
Border Limpopo	361	45	11757	73.5	96	626	0.59
Subtotals	409	51	12725	67.6	133	685	0.18
Potential corridor							
Save Corridor	23	3	465	189.5	0	67	0.02
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	23	3	465	189.5	0	67	0.01
Zinave NP							
Zinave NP east	0	0	0	0.0	0	0	0.00
Zinave NP west	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**432**	**54**	**13191**	**62.9**	**160**	**703**	**0.05**
Totals	**1393**	**185**	**64716**	**37.5**	**870**	**1916**	**0.09**

Table 30. Population estimates and statistics for Ostrich in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	10	2	37	128.2	0	22	0.01
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	28	6	244	112.2	0	60	0.05
Naivasha	0	0	0	0.0	0	0	0.00
Chefu	8	1	61	205.8	0	25	0.01
Mabalauta NP	0	0	0	0.0	0	0	0.00
Subtotals	46	9	341	80.3	9	83	0.01
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
National Subtotals	**46**	**9**	**341**	**80.3**	**9**	**83**	**0.01**
MOZAMBIQUE							
International border							
North Border	8	1	57	200.2	0	24	0.01
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	8	1	57	200.2	0	24	0.003
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	0	0	0	0.0	0	0	0.00
Zinave NP west	7	1	38	193.5	0	19	0.003
Subtotals	7	1	38	193.5	0	19	0.002
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**14**	**2**	**96**	**136.6**	**0**	**34**	**0.002**
Totals	**61**	**11**	**437**	**68.6**	**19**	**102**	**0.004**

Table 31. Population estimates and statistics for Ground Hornbill in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	110	23	1373	68.2	35	185	0.09
Chilojo A	39	8	589	131.2	0	91	0.09
Chilojo B	24	5	227	129.9	0	54	0.04
Naivasha	64	13	1242	113.3	0	136	0.07
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	88	18	1882	100.3	0	177	0.11
Subtotals	325	67	5314	44.4	181	470	0.07
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	16	2	277	235.8	0	55	0.07
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	15	2	188	209.8	0	46	0.02
Subtotals	31	4	465	147.1	0	77	0.02
National Subtotals	**357**	**71**	**5779**	**42.2**	**206**	**507**	**0.05**
MOZAMBIQUE							
International border							
North Border	24	3	516	200.0	0	72	0.04
Border Maunge	24	3	511	242.1	0	82	0.06
Border Chefu	24	3	494	241.1	0	81	0.04
Border Limpopo	8	1	56	228.4	0	26	0.01
Subtotals	80	10	1578	103.8	0	162	0.03
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	156	24	3762	81.6	29	283	0.09
Zinave NP west	176	27	2795	61.4	68	285	0.08
Subtotals	332	51	6557	49.1	169	495	0.08
Coutada 4							
North Zinave	38	6	401	105.9	0	78	0.03
National Subtotals	**450**	**67**	**8536**	**41.0**	**266**	**634**	**0.05**
Totals	**806**	**138**	**14315**	**29.3**	**570**	**1043**	**0.05**

Table 32. Population estimates and statistics for Crocodile in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	187	39	14359	130.0	0	430	0.16
Chilojo A	15	3	87	134.8	0	35	0.03
Chilojo B	57	12	530	82.6	10	104	0.09
Naivasha	0	0	0	0.0	0	0	0.00
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	34	7	490	131.5	0	80	0.04
Subtotals	293	61	15466	85.8	42	544	0.06
Malapati SA							
Malapati	5	1	20	191.0	0	14	0.03
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	74	10	4824	212.3	0	231	0.08
Subtotals	74	10	4824	212.3	0	231	0.04
National Subtotals	**372**	**72**	**20310**	**77.0**	**85**	**658**	**0.05**
MOZAMBIQUE							
International border							
North Border	0	0	0	0.0	0	0	0.00
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Potential corridor							
Save Corridor	8	1	52	189.3	0	22	0.01
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	8	1	52	189.3	0	22	0.004
Zinave NP							
Zinave NP east	13	2	68	131.5	0	30	0.01
Zinave NP west	0	0	0	0.0	0	0	0.00
Subtotals	13 [a]	2	68	131.5	0	30	0.003
Coutada 4							
North Zinave	25 [a]	4	270	130.4	0	58	0.02
National Subtotals	**46**	**7**	**389**	**85.2**	**7**	**85**	**0.005**
Totals	**418**	**79**	**20699**	**69.1**	**129**	**706**	**0.03**

[a] During a total count along the river, 38 crocodiles were seen in the stretch of the Save River that separates Zinave NP and the North Zinave stratum (see Appendix 6)

Table 33. Population estimates and statistics for Hippopotamus in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	220	46	17329	121.1	0	487	0.19
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	57	12	2495	179.3	0	159	0.09
Naivasha	0	0	0	0.0	0	0	0.00
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	0	0	0	0.0	0	0	0.00
Subtotals	277	58	19824	102.2	0	560	0.06
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
National Subtotals	**277**	**58**	**19824**	**102.2**	**0**	**560**	**0.04**
MOZAMBIQUE							
International border							
North Border	0	0	0	0.0	0	0	0.00
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	0	0	0	0.0	0	0	0.00
Zinave NP west	0	0	0	0.0	0	0	0.00
Subtotals	0 [a]	0	0	0.0	0	0	0.00
Coutada 4							
North Zinave	0 [a]	0	0	0.0	0	0	0.00
National Subtotals	**0**	**0**	**0**	**0.0**	**0**	**0**	**0.00**
Totals	**277**	**58**	**19824**	**102.2**	**0**	**560**	**0.02**

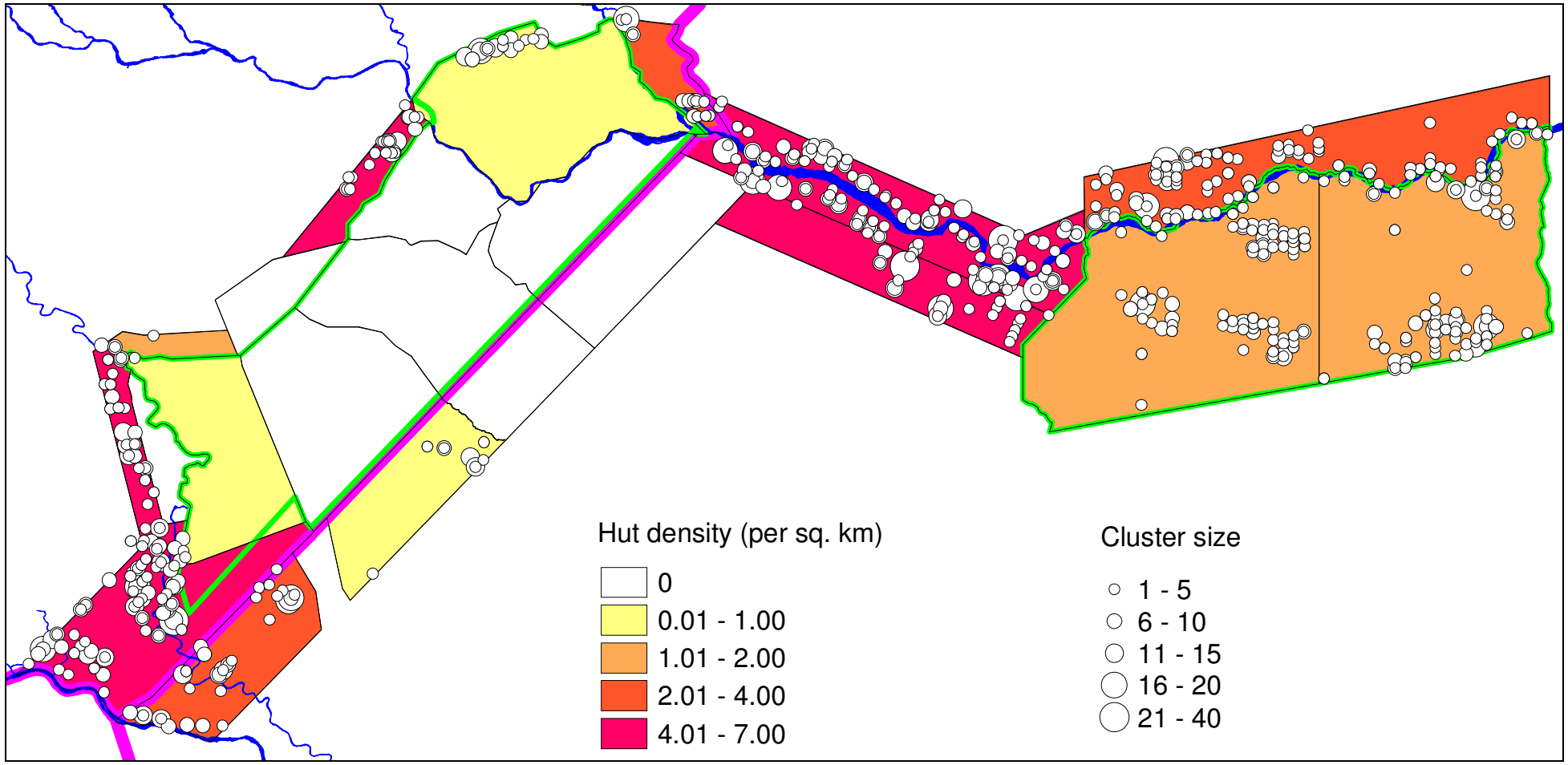
[a] During a total count along the river, 88 hippos were seen in the stretch of the Save River that separates Zinave NP and the North Zinave stratum (see Appendix 6)

Table 34. Population estimates and statistics for Poachers' Camps in Gonarezhou NP, Zinave NP and surrounds

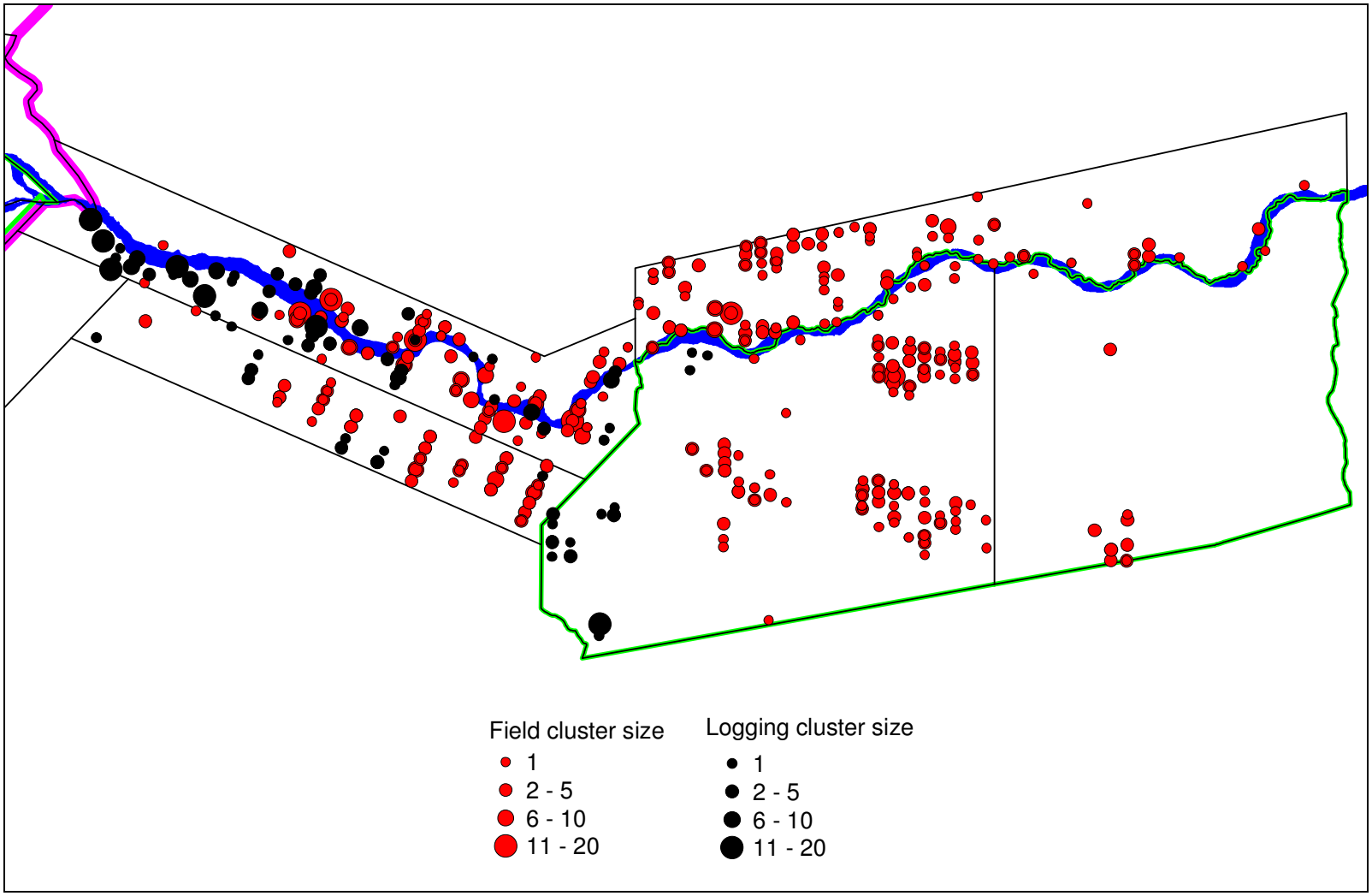
Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	48	10	261	68.3	15	81	0.04
Chilojo A	5	1	19	190.4	0	14	0.01
Chilojo B	0	0	0	0.0	0	0	0.00
Naivasha	0	0	0	0.0	0	0	0.00
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	0	0	0	0.0	0	0	0.00
Subtotals	53	11	280	64.0	19	87	0.01
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	0	0	0	0.0	0	0	0.00
Chingwesi	0	0	0	0.0	0	0	0.00
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	0	0	0	0.0	0	0	0.00
Masukwe	0	0	0	0.0	0	0	0.00
Sengwe	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
National Subtotals	**53**	**11**	**280**	**64.0**	**19**	**87**	**0.007**
MOZAMBIQUE							
International border							
North Border	8	1	58	200.5	0	24	0.01
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	0	0	0	0.0	0	0	0.00
Border Limpopo	0	0	0	0.0	0	0	0.00
Subtotals	8	1	58	200.5	0	24	0.003
Potential corridor							
Save Corridor	0	0	0	0.0	0	0	0.00
Southern Corridor	0	0	0	0.0	0	0	0.00
Subtotals	0	0	0	0.0	0	0	0.00
Zinave NP							
Zinave NP east	0	0	0	0.0	0	0	0.00
Zinave NP west	13	2	70	131.6	0	30	0.01
Subtotals	13	2	70	131.6	0	30	0.003
Coutada 4							
North Zinave	0	0	0	0.0	0	0	0.00
National Subtotals	**21**	**3**	**128**	**108.4**	**0**	**44**	**0.002**
Totals	**74**	**14**	**408**	**54.5**	**34**	**114**	**0.01**

Table 35. Population estimates and statistics for Huts in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	603	126	27092	55.3	270	937	0.52
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	0	0	0	0.0	0	0	0.00
Naivasha	0	0	0	0.0	0	0	0.00
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	103	21	3895	123.6	0	231	0.13
Subtotals	707	147	30987	50.1	352	1061	0.14
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	871	94	166086	107.9	0	1811	3.94
Chingwesi	1129	139	196416	85.5	163	2095	5.11
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	146	17	8818	143.5	0	355	1.20
Masukwe	1381	179	76234	42.4	795	1966	6.77
Sengwe	3922	530	876374	54.0	1805	6040	4.04
Subtotals	7449	959	1323928	32.5	5032	9866	3.75
National Subtotals	**8155**	**1106**	**1354915**	**29.9**	**5719**	**10592**	**1.15**
MOZAMBIQUE							
International border							
North Border	0	0	0	0.0	0	0	0.00
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	419	53	22096	91.2	37	801	0.71
Border Limpopo	1613	201	453638	102.2	0	3261	2.63
Subtotals	2032	254	475734	83.1	344	3720	0.89
Potential corridor							
Save Corridor	6740	873	714435	25.5	5021	8460	6.07
Southern Corridor	3437	218	2291615	95.1	167	6707	5.05
Subtotals	10177	1091	3006050	35.4	6571	13783	5.68
Zinave NP							
Zinave NP east	2598	400	272577	41.7	1515	3681	1.44
Zinave NP west	2436	373	265354	43.3	1381	3491	1.11
Subtotals	5033	773	537931	29.3	3560	6507	1.26
Coutada 4							
North Zinave	2830	446	285384	38.0	1754	3906	2.44
National Subtotals	**20073**	**2564**	**4305100**	**20.9**	**15879**	**24266**	**2.17**
Totals	**28228**	**3670**	**5660015**	**16.9**	**23464**	**32992**	**1.73**



Map 25. Distribution of huts in Gonarezhou NP, Zinave NP and surrounds during 2009



Map 26. Distribution of fields and commercial logging in Zinave NP and other strata downstream of the Save-Runde confluence

Table 36. Population estimates and statistics for brick Buildings in Gonarezhou NP, Zinave NP and surrounds

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km^{-2})
ZIMBABWE							
Gonarezhou NP							
Chipinda Pools	24	5	248	133.2	0	56	0.02
Chilojo A	0	0	0	0.0	0	0	0.00
Chilojo B	0	0	0	0.0	0	0	0.00
Naivasha	0	0	0	0.0	0	0	0.00
Chefu	0	0	0	0.0	0	0	0.00
Mabalauta NP	44	9	636	116.6	0	96	0.05
Subtotals	68	14	884	87.6	8	128	0.01
Malapati SA							
Malapati	0	0	0	0.0	0	0	0.00
Communal lands							
Mahenye	83	9	2122	127.4	0	190	0.38
Chingwesi	171	21	16850	165.8	0	453	0.77
Matibi	0	0	0	0.0	0	0	0.00
Gonakudzingwa	112	13	2961	108.7	0	233	0.91
Masukwe	262	34	4678	55.3	117	407	1.29
Sengwe	903	122	60276	61.5	347	1458	0.93
Subtotals	1531	199	86888	40.6	909	2153	0.77
National Subtotals	**1599**	**213**	**87771**	**39.1**	**974**	**2224**	**0.22**
MOZAMBIQUE							
International border							
North Border	40	5	1425	199.4	0	119	0.06
Border Maunge	0	0	0	0.0	0	0	0.00
Border Chefu	40	5	323	116.9	0	86	0.07
Border Limpopo	249	31	19260	136.5	0	588	0.41
Subtotals	328	41	21008	104.5	0	671	0.14
Potential corridor							
Save Corridor	139	18	2171	68.2	44	234	0.13
Southern Corridor	284	18	70890	202.7	0	859	0.42
Subtotals	423	36	73062	138.1	0	1007	0.24
Zinave NP							
Zinave NP east	6	1	36	190.7	0	19	0.004
Zinave NP west	46	7	492	99.4	0	91	0.02
Subtotals	52	8	528	89.7	5	99	0.01
Coutada 4							
North Zinave	25	4	129	90.2	2	48	0.02
National Subtotals	**828**	**89**	**94726**	**77.8**	**184**	**1473**	**0.09**
Totals	**2427**	**302**	**182498**	**35.7**	**1562**	**3293**	**0.15**

Appendix 1. Calibration of strip width

For each run (i.e. flight over the calibration numbers):

- Strip width (in meters) for one observer = 10 x (1 + Difference between outer and inner);
- Combined strip width (in meters) at flying height = Left strip width + right strip width; and
- Combined strip width at 300 ft agl[1] = Actual combined strip width x 300 / (Flying height)

[1] agl: above ground level

Calibration flights were flown at Chipinda Pools on 2 September 2009 (runs 1-25) and on 4, 6, 7, 8 and 12 September 2009 (three runs on each date, runs 26-40).

Run no.	Left observer: Julius Shimbani			Right observer: Ezekiel Mungoni			Combined strip width (m) at flying height	Flying height agl (ft)	Combined strip width (m) when flying at 300 ft
	Outer marker	Inner marker	Strip width (m)	Outer marker	Inner marker	Strip width (m)			
1	18	7	120	16	5	120	240	200	360
2	23	8	160	23	12	120	280	300	280
3	29	11	190	23	9	150	340	320	319
4	18	6	130	26	12	150	280	290	290
5	28	12	170	18	6	130	300	290	310
6	25	11	150	22	10	130	280	290	290
7	28	14	150	18	6	130	280	290	290
8	22	9	140	24	11	140	280	300	280
9	28	15	140	18	6	130	270	310	261
10	18	4	150	25	15	110	260	320	244
11	24	12	130	18	6	130	260	250	312
12	17	3	150	20	10	110	260	250	312
13	25	11	150	15	3	130	280	220	382
14	13	3	110	24	12	130	240	240	300
15	35	18	180	20	6	150	330	360	275
16	30	10	210	35	20	160	370	370	300
17	29	14	160	27	10	180	340	330	309
18	21	5	170	35	19	170	340	370	276
19	23	11	130	18	6	130	260	260	300
20	16	4	130	26	12	150	280	260	323
21	34	18	170	18	6	130	300	280	321
22	14	3	120	27	14	140	260	290	269
23	-	15	-	16	2	150	-	320	-
24	24	7	180	24	12	130	310	310	300

Run no.	Left observer: Julius Shimbani			Right observer: Ezekiel Mungoni			Combined strip width (m) at flying height	Flying height agl (ft)	Combined strip width (m) when flying at 300 ft
	Outer marker	Inner marker	Strip width (m)	Outer marker	Inner marker	Strip width (m)			
25	34	13	220	25	9	170	390	330	355
26	23	9	150	20	8	130	280	260	323
27	24	11	140	19	7	130	270	280	289
28	26	9	180	28	13	160	340	330	309
29	21	11	110	17	6	120	230	240	288
30	28	11	180	24	9	160	340	310	329
31	34	12	230	20	8	130	360	290	372
32	25	10	160	20	9	120	280	260	323
33	22	8	150	20	10	110	260	290	269
34	21	8	140	23	8	160	300	270	333
35	27	11	170	23	9	150	320	290	331
36	25	13	130	19	6	140	270	300	270
37	29	13	170	23	9	150	320	310	310
38	27	10	180	20	8	130	310	290	321
39	21	8	140	24	12	130	270	300	270
40	26	11	160	21	10	120	280	320	263
Mean combined strip width (in meters) when flying at 300 feet agl =									**304.0**
Standard error of mean combined strip width as a percentage of the mean									**1.6**

Appendix 2. Survey flight summary

Date	Time take off	Time land	Flight time (hours)	Duty
02-Sep-09	11:12	11:28	0.27	Calibration
02-Sep-09	11:36	11:53	0.28	Calibration
02-Sep-09	14:59	15:33	0.57	Calibration
03-Sep-09	7:47	9:04	1.28	Stratum Chingwesi
03-Sep-09	14:36	15:53	1.28	Stratum Mahenye
04-Sep-09	7:46	11:17	3.52	Stratum Chipinda Pools, transects 1-18
04-Sep-09	15:03	17:33	2.50	Stratum Chipinda Pools, transects 19-30
05-Sep-09	7:36	11:25	3.82	Stratum Chipinda Pools, transects 31-38, & stratum Chilojo B
06-Sep-09	7:32	10:25	2.88	Stratum North Border
07-Sep-09	7:28	10:18	2.83	Stratum Chilojo A
07-Sep-09	14:43	16:25	1.70	Stratum Border Maunge
08-Sep-09	7:27	11:14	3.78	Stratum Naivasha, transects 1-20
08-Sep-09	14:36	17:16	2.67	Strata Naivasha (transects 21-27), stratum Matibi, and repositioning to Mabalauta
09-Sep-09	7:40	10:53	3.22	Stratum Chefu
09-Sep-09	14:25	16:38	2.22	Stratum Border Chefu
10-Sep-09	7:20	10:37	3.28	Stratum Sengwe
10-Sep-09	14:24	16:38	2.23	Stratum Border Limpopo
11-Sep-09	7:24	11:01	3.62	Stratum Mabalauta, transects 1-19
11-Sep-09	14:18	17:09	2.85	Stratum Mabalauta (transects 20-30) & stratum Masukwe
12-Sep-09	7:32	8:39	1.12	Stratum Gonakudzingwa & repositioning to Chipinda Pools
14-Sep-09	9:53	10:12	0.32	Chipinda Pools to Buffalo Range, en route to Zinave NP
14-Sep-09	10:42	13:00	2.30	Buffalo Range to Vilancolus, en route to Zinave NP
14-Sep-09	15:56	16:49	0.88	Vilancolus to Zinave NP
15-Sep-09	7:44	11:03	3.32	Stratum Zinave NP, transects 1-12
15-Sep-09	14:05	17:09	3.07	Stratum Zinave NP, transects 13-22
16-Sep-09	6:42	10:43	4.02	Stratum Zinave NP, transects 23-34
16-Sep-09	14:02	17:47	3.75	Stratum Zinave NP, transects 35-45
17-Sep-09	7:03	11:12	4.15	Stratum North Zinave (part of Coutada 4), transects 1-38
17-Sep-09	14:00	17:24	3.40	Stratum North Zinave (transects 39-46), stratum Zinave NP (transects 46-52) & Save River count
18-Sep-09	6:07	10:52	4.75	Stratum Save Corridor
18-Sep-09	14:22	15:30	1.13	Save River count continued

Date	Time take off	Time land	Flight time (hours)	Duty
19-Sep-09	6:15	8:30	2.25	Stratum Southern Corridor
19-Sep-09	9:14	10:11	0.95	Zinave NP to Vilancolus, en route to Chipinda Pools
19-Sep-09	11:46	12:39	0.88	Vilancolus to Zinave, en route to Chipinda Pools
19-Sep-09	13:47	15:06	1.32	Zinave to Buffalo Range, en route to Chipinda Pools
19-Sep-09	15:35	16:01	0.43	Buffalo Range to Chipinda Pools
		Total	**82.83**	

Appendix 3. Transect start and end points, and lengths

Degrees and decimal minutes; datum WGS84

Mahenye
Number of transects : 9
Transect Bearing : 90.00 Degrees
Transect Spacing : 2.90 km

Transect # : 1
Start Lat : S 21 : 18.383 Start Lon : E 32 : 25.347
Finish Lat : S 21 : 18.383 Finish Lon : E 32 : 28.367
Length : 5.22 km

Transect # : 2
Start Lat : S 21 : 16.817 Start Lon : E 32 : 27.336
Finish Lat : S 21 : 16.817 Finish Lon : E 32 : 23.707
Length : 6.27 km

Transect # : 3
Start Lat : S 21 : 15.251 Start Lon : E 32 : 21.625
Finish Lat : S 21 : 15.251 Finish Lon : E 32 : 26.045
Length : 7.64 km

Transect # : 4
Start Lat : S 21 : 13.685 Start Lon : E 32 : 25.354
Finish Lat : S 21 : 13.685 Finish Lon : E 32 : 19.209
Length : 10.62 km

Transect # : 5
Start Lat : S 21 : 12.118 Start Lon : E 32 : 18.375
Finish Lat : S 21 : 12.118 Finish Lon : E 32 : 23.876
Length : 9.51 km

Transect # : 6
Start Lat : S 21 : 10.552 Start Lon : E 32 : 24.386
Finish Lat : S 21 : 10.552 Finish Lon : E 32 : 17.315
Length : 12.22 km

Transect # : 7
Start Lat : S 21 : 8.986 Start Lon : E 32 : 16.991
Finish Lat : S 21 : 8.986 Finish Lon : E 32 : 22.724
Length : 9.91 km

Transect # : 8
Start Lat : S 21 : 7.420 Start Lon : E 32 : 22.466
Finish Lat : S 21 : 7.420 Finish Lon : E 32 : 16.331
Length : 10.60 km

Transect # : 9
Start Lat : S 21 : 5.854 Start Lon : E 32 : 16.127
Finish Lat : S 21 : 5.854 Finish Lon : E 32 : 17.398
Length : 2.20 km

Chipinda Pools
Number of transects : 38
Transect Bearing : 0.00 Degrees
Transect Spacing : 1.50 km

Transect # : 1
Start Lat : S 21 : 13.856 Start Lon : E 31 : 53.180
Finish Lat : S 21 : 16.704 Finish Lon : E 31 : 53.180
Length : 5.27 km

Transect # : 2
Start Lat : S 21 : 17.339 Start Lon : E 31 : 54.048
Finish Lat : S 21 : 12.643 Finish Lon : E 31 : 54.048
Length : 8.70 km

Transect # : 3
Start Lat : S 21 : 11.396 Start Lon : E 31 : 54.915
Finish Lat : S 21 : 19.296 Finish Lon : E 31 : 54.915
Length : 14.63 km

Transect # : 4
Start Lat : S 21 : 19.891 Start Lon : E 31 : 55.782
Finish Lat : S 21 : 10.626 Finish Lon : E 31 : 55.782
Length : 17.16 km

Transect # : 5
Start Lat : S 21 : 10.199 Start Lon : E 31 : 56.650
Finish Lat : S 21 : 20.256 Finish Lon : E 31 : 56.650
Length : 18.62 km

Transect # : 6
Start Lat : S 21 : 20.496 Start Lon : E 31 : 57.517
Finish Lat : S 21 : 9.772 Finish Lon : E 31 : 57.517
Length : 19.86 km

Transect # : 7
Start Lat : S 21 : 9.344 Start Lon : E 31 : 58.384
Finish Lat : S 21 : 21.049 Finish Lon : E 31 : 58.384
Length : 21.68 km

Transect # : 8
Start Lat : S 21 : 22.085 Start Lon : E 31 : 59.252
Finish Lat : S 21 : 8.917 Finish Lon : E 31 : 59.252
Length : 24.39 km

Transect # : 9
Start Lat : S 21 : 8.489 Start Lon : E 32 : 0.119
Finish Lat : S 21 : 23.035 Finish Lon : E 32 : 0.119
Length : 26.94 km

Transect # : 10
Start Lat : S 21 : 23.721 Start Lon : E 32 : 0.986
Finish Lat : S 21 : 8.062 Finish Lon : E 32 : 0.986
Length : 29.00 km

Transect # : 11
Start Lat : S 21 : 7.634 Start Lon : E 32 : 1.853
Finish Lat : S 21 : 24.738 Finish Lon : E 32 : 1.853
Length : 31.67 km

Transect # : 12
Start Lat : S 21 : 25.898 Start Lon : E 32 : 2.721
Finish Lat : S 21 : 7.294 Finish Lon : E 32 : 2.721
Length : 34.45 km

Transect # : 13
Start Lat : S 21 : 7.037 Start Lon : E 32 : 3.588
Finish Lat : S 21 : 26.310 Finish Lon : E 32 : 3.588
Length : 35.69 km

Transect # : 14
Start Lat : S 21 : 26.536 Start Lon : E 32 : 4.455
Finish Lat : S 21 : 6.781 Finish Lon : E 32 : 4.455
Length : 36.58 km

Transect # : 15
Start Lat : S 21 : 6.524 Start Lon : E 32 : 5.323
Finish Lat : S 21 : 26.511 Finish Lon : E 32 : 5.323
Length : 37.01 km

Transect # : 16
Start Lat : S 21 : 25.666 Start Lon : E 32 : 6.190
Finish Lat : S 21 : 6.267 Finish Lon : E 32 : 6.190
Length : 35.92 km

Transect # : 17
Start Lat : S 21 : 7.562 Start Lon : E 32 : 7.057
Finish Lat : S 21 : 24.375 Finish Lon : E 32 : 7.057
Length : 31.13 km

Transect # : 18
Start Lat : S 21 : 24.143 Start Lon : E 32 : 7.925
Finish Lat : S 21 : 8.507 Finish Lon : E 32 : 7.925
Length : 28.96 km

Transect # : 19
Start Lat : S 21 : 8.978 Start Lon : E 32 : 8.792
Finish Lat : S 21 : 24.005 Finish Lon : E 32 : 8.792
Length : 27.83 km

Transect # : 20
Start Lat : S 21 : 23.799 Start Lon : E 32 : 9.659
Finish Lat : S 21 : 8.708 Finish Lon : E 32 : 9.659
Length : 27.95 km

Transect # : 21
Start Lat : S 21 : 8.438 Start Lon : E 32 : 10.527
Finish Lat : S 21 : 23.117 Finish Lon : E 32 : 10.527
Length : 27.18 km

Transect # : 22
Start Lat : S 21 : 22.045 Start Lon : E 32 : 11.394
Finish Lat : S 21 : 8.168 Finish Lon : E 32 : 11.394
Length : 25.70 km

Transect # : 23
Start Lat : S 21 : 7.832 Start Lon : E 32 : 12.261
Finish Lat : S 21 : 21.136 Finish Lon : E 32 : 12.261
Length : 24.64 km

Transect # : 24
Start Lat : S 21 : 20.331 Start Lon : E 32 : 13.128
Finish Lat : S 21 : 7.474 Finish Lon : E 32 : 13.128
Length : 23.81 km

Transect # : 25
Start Lat : S 21 : 6.285 Start Lon : E 32 : 13.996
Finish Lat : S 21 : 19.915 Finish Lon : E 32 : 13.996
Length : 25.24 km

Transect # : 26
Start Lat : S 21 : 18.731 Start Lon : E 32 : 14.863
Finish Lat : S 21 : 5.859 Finish Lon : E 32 : 14.863
Length : 23.84 km

Transect # : 27
Start Lat : S 21 : 6.339 Start Lon : E 32 : 15.730
Finish Lat : S 21 : 18.481 Finish Lon : E 32 : 15.730
Length : 22.48 km

Transect # : 28
Start Lat : S 21 : 18.624 Start Lon : E 32 : 16.598
Finish Lat : S 21 : 7.901 Finish Lon : E 32 : 16.598
Length : 19.86 km

Transect # : 29
Start Lat : S 21 : 11.295 Start Lon : E 32 : 17.465
Finish Lat : S 21 : 18.792 Finish Lon : E 32 : 17.465
Length : 13.88 km

Transect # : 30
Start Lat : S 21 : 19.149 Start Lon : E 32 : 18.332
Finish Lat : S 21 : 11.816 Finish Lon : E 32 : 18.332
Length : 13.58 km

Transect # : 31
Start Lat : S 21 : 13.675 Start Lon : E 32 : 19.200
Finish Lat : S 21 : 19.371 Finish Lon : E 32 : 19.200
Length : 10.55 km

Transect # : 32
Start Lat : S 21 : 19.499 Start Lon : E 32 : 20.067
Finish Lat : S 21 : 14.784 Finish Lon : E 32 : 20.067
Length : 8.73 km

Transect # : 33
Start Lat : S 21 : 14.995 Start Lon : E 32 : 20.934
Finish Lat : S 21 : 19.383 Finish Lon : E 32 : 20.934
Length : 8.13 km

Transect # : 34
Start Lat : S 21 : 19.203 Start Lon : E 32 : 21.801
Finish Lat : S 21 : 15.381 Finish Lon : E 32 : 21.801
Length : 7.08 km

Transect # : 35
Start Lat : S 21 : 16.025 Start Lon : E 32 : 22.669
Finish Lat : S 21 : 18.927 Finish Lon : E 32 : 22.669
Length : 5.37 km

Transect # : 36
Start Lat : S 21 : 18.806 Start Lon : E 32 : 23.536
Finish Lat : S 21 : 16.669 Finish Lon : E 32 : 23.536
Length : 3.96 km

Transect # : 37
Start Lat : S 21 : 17.482 Start Lon : E 32 : 24.403
Finish Lat : S 21 : 18.877 Finish Lon : E 32 : 24.403
Length : 2.58 km

Transect # : 38
Start Lat : S 21 : 18.900 Start Lon : E 32 : 25.271
Finish Lat : S 21 : 18.310 Finish Lon : E 32 : 25.271
Length : 1.09 km

Chilojo A
Number of transects : 17
Transect Bearing : 45.00 Degrees
Transect Spacing : 1.50 km

Transect # : 1
Start Lat : S 21 : 17.700 Start Lon : E 31 : 54.405
Finish Lat : S 21 : 19.491 Finish Lon : E 31 : 52.484
Length : 4.69 km

Transect # : 2
Start Lat : S 21 : 22.952 Start Lon : E 31 : 49.999
Finish Lat : S 21 : 18.559 Finish Lon : E 31 : 54.712
Length : 11.50 km

Transect # : 3A
Start Lat : S 21 : 19.399 Start Lon : E 31 : 55.040
Finish Lat : S 21 : 25.183 Finish Lon : E 31 : 48.834
Length : 15.15 km

Transect # : 3B
Start Lat : S 21 : 26.418 Start Lon : E 31 : 47.509
Finish Lat : S 21 : 27.255 Finish Lon : E 31 : 46.611
Length : 2.19 km

Transect # : 4
Start Lat : S 21 : 29.874 Start Lon : E 31 : 45.031
Finish Lat : S 21 : 19.879 Finish Lon : E 31 : 55.754
Length : 26.17 km

Transect # : 5
Start Lat : S 21 : 20.236 Start Lon : E 31 : 56.600
Finish Lat : S 21 : 30.839 Finish Lon : E 31 : 45.224
Length : 27.77 km

Transect # : 6
Start Lat : S 21 : 30.868 Start Lon : E 31 : 46.423
Finish Lat : S 21 : 20.502 Finish Lon : E 31 : 57.544
Length : 27.15 km

Transect # : 7
Start Lat : S 21 : 20.962 Start Lon : E 31 : 58.279
Finish Lat : S 21 : 30.688 Finish Lon : E 31 : 47.845
Length : 25.47 km

Transect # : 8
Start Lat : S 21 : 30.508 Start Lon : E 31 : 49.267
Finish Lat : S 21 : 21.584 Finish Lon : E 31 : 58.840
Length : 23.37 km

Transect # : 9
Start Lat : S 21 : 22.233 Start Lon : E 31 : 59.373
Finish Lat : S 21 : 30.608 Finish Lon : E 31 : 50.388
Length : 21.93 km

Transect # : 10
Start Lat : S 21 : 30.842 Start Lon : E 31 : 51.366
Finish Lat : S 21 : 22.873 Finish Lon : E 31 : 59.915
Length : 20.87 km

Transect # : 11
Start Lat : S 21 : 23.399 Start Lon : E 32 : 0.580
Finish Lat : S 21 : 31.386 Finish Lon : E 31 : 52.011
Length : 20.92 km

Transect # : 12
Start Lat : S 21 : 31.041 Start Lon : E 31 : 53.610
Finish Lat : S 21 : 23.925 Finish Lon : E 32 : 1.245
Length : 18.64 km

Transect # : 13
Start Lat : S 21 : 24.600 Start Lon : E 32 : 1.750
Finish Lat : S 21 : 30.990 Finish Lon : E 31 : 54.894
Length : 16.74 km

Transect # : 14
Start Lat : S 21 : 31.240 Start Lon : E 31 : 55.855
Finish Lat : S 21 : 25.275 Finish Lon : E 32 : 2.255
Length : 15.62 km

Transect # : 15
Start Lat : S 21 : 25.950 Start Lon : E 32 : 2.760
Finish Lat : S 21 : 31.618 Finish Lon : E 31 : 56.678
Length : 14.85 km

Transect # : 16
Start Lat : S 21 : 31.997 Start Lon : E 31 : 57.501
Finish Lat : S 21 : 27.597 Finish Lon : E 32 : 2.221
Length : 11.52 km

Transect # : 17A
Start Lat : S 21 : 28.827 Start Lon : E 32 : 2.131
Finish Lat : S 21 : 28.890 Finish Lon : E 32 : 2.063
Length : 0.17 km

Transect # : 17B
Start Lat : S 21 : 31.800 Start Lon : E 31 : 58.941
Finish Lat : S 21 : 32.416 Finish Lon : E 31 : 58.281
Length : 1.61 km

Chilojo B
Number of transects : 32
Transect Bearing : -48.00 Degrees (= 132.00 degrees)
Transect Spacing : 1.50 km

Transect # : 1
Start Lat : S 21 : 18.900 Start Lon : E 32 : 24.665
Finish Lat : S 21 : 19.004 Finish Lon : E 32 : 24.789
Length : 0.29 km

Transect # : 2
Start Lat : S 21 : 19.606 Start Lon : E 32 : 24.207
Finish Lat : S 21 : 18.753 Finish Lon : E 32 : 23.191
Length : 2.36 km

Transect # : 3
Start Lat : S 21 : 19.066 Start Lon : E 32 : 22.265
Finish Lat : S 21 : 20.207 Finish Lon : E 32 : 23.625
Length : 3.16 km

Transect # : 4
Start Lat : S 21 : 20.809 Start Lon : E 32 : 23.043
Finish Lat : S 21 : 19.334 Finish Lon : E 32 : 21.286
Length : 4.08 km

Transect # : 5
Start Lat : S 21 : 19.494 Start Lon : E 32 : 20.177
Finish Lat : S 21 : 21.411 Finish Lon : E 32 : 22.461
Length : 5.31 km

Transect # : 6
Start Lat : S 21 : 22.012 Start Lon : E 32 : 21.880
Finish Lat : S 21 : 19.236 Finish Lon : E 32 : 18.571
Length : 7.68 km

Transect # : 7
Start Lat : S 21 : 18.597 Start Lon : E 32 : 16.512
Finish Lat : S 21 : 22.614 Finish Lon : E 32 : 21.298
Length : 11.12 km

Transect # : 8
Start Lat : S 21 : 23.215 Start Lon : E 32 : 20.716
Finish Lat : S 21 : 18.585 Finish Lon : E 32 : 15.199
Length : 12.81 km

Transect # : 9
Start Lat : S 21 : 19.204 Start Lon : E 32 : 14.637
Finish Lat : S 21 : 23.817 Finish Lon : E 32 : 20.134
Length : 12.77 km

Transect # : 10
Start Lat : S 21 : 24.419 Start Lon : E 32 : 19.552
Finish Lat : S 21 : 19.854 Finish Lon : E 32 : 14.113
Length : 12.63 km

Transect # : 11
Start Lat : S 21 : 20.244 Start Lon : E 32 : 13.279
Finish Lat : S 21 : 25.020 Finish Lon : E 32 : 18.970
Length : 13.22 km

Transect # : 12
Start Lat : S 21 : 25.622 Start Lon : E 32 : 18.388
Finish Lat : S 21 : 20.763 Finish Lon : E 32 : 12.599
Length : 13.45 km

Transect # : 13
Start Lat : S 21 : 21.369 Start Lon : E 32 : 12.022
Finish Lat : S 21 : 26.224 Finish Lon : E 32 : 17.807
Length : 13.44 km

Transect # : 14
Start Lat : S 21 : 26.825 Start Lon : E 32 : 17.225
Finish Lat : S 21 : 21.974 Finish Lon : E 32 : 11.445
Length : 13.42 km

Transect # : 15
Start Lat : S 21 : 22.625 Start Lon : E 32 : 10.921
Finish Lat : S 21 : 27.427 Finish Lon : E 32 : 16.643
Length : 13.29 km

Transect # : 16
Start Lat : S 21 : 28.029 Start Lon : E 32 : 16.061
Finish Lat : S 21 : 23.275 Finish Lon : E 32 : 10.397
Length : 13.15 km

Transect # : 17
Start Lat : S 21 : 23.784 Start Lon : E 32 : 9.705
Finish Lat : S 21 : 28.630 Finish Lon : E 32 : 15.479
Length : 13.41 km

Transect # : 18
Start Lat : S 21 : 29.232 Start Lon : E 32 : 14.897
Finish Lat : S 21 : 24.028 Finish Lon : E 32 : 8.696
Length : 14.40 km

Transect # : 19
Start Lat : S 21 : 24.179 Start Lon : E 32 : 7.578
Finish Lat : S 21 : 29.833 Finish Lon : E 32 : 14.315
Length : 15.65 km

Transect # : 20
Start Lat : S 21 : 30.435 Start Lon : E 32 : 13.734
Finish Lat : S 21 : 24.667 Finish Lon : E 32 : 6.861
Length : 15.96 km

Transect # : 21
Start Lat : S 21 : 25.357 Start Lon : E 32 : 6.384
Finish Lat : S 21 : 31.037 Finish Lon : E 32 : 13.152
Length : 15.72 km

Transect # : 22
Start Lat : S 21 : 31.638 Start Lon : E 32 : 12.570
Finish Lat : S 21 : 26.047 Finish Lon : E 32 : 5.907
Length : 15.47 km

Transect # : 23
Start Lat : S 21 : 26.499 Start Lon : E 32 : 5.147
Finish Lat : S 21 : 32.240 Finish Lon : E 32 : 11.988
Length : 15.89 km

Transect # : 24
Start Lat : S 21 : 32.842 Start Lon : E 32 : 11.406
Finish Lat : S 21 : 26.338 Finish Lon : E 32 : 3.657
Length : 18.00 km

Transect # : 25
Start Lat : S 21 : 26.751 Start Lon : E 32 : 2.850
Finish Lat : S 21 : 33.443 Finish Lon : E 32 : 10.824
Length : 18.52 km

Transect # : 26
Start Lat : S 21 : 34.045 Start Lon : E 32 : 10.242
Finish Lat : S 21 : 27.298 Finish Lon : E 32 : 2.203
Length : 18.67 km

Transect # : 27
Start Lat : S 21 : 28.454 Start Lon : E 32 : 2.281
Finish Lat : S 21 : 34.647 Finish Lon : E 32 : 9.660
Length : 17.14 km

Transect # : 28
Start Lat : S 21 : 35.248 Start Lon : E 32 : 9.079
Finish Lat : S 21 : 29.276 Finish Lon : E 32 : 1.963
Length : 16.53 km

Transect # : 29
Start Lat : S 21 : 30.108 Start Lon : E 32 : 1.655
Finish Lat : S 21 : 35.850 Finish Lon : E 32 : 8.497
Length : 15.89 km

Transect # : 30
Start Lat : S 21 : 36.451 Start Lon : E 32 : 7.915
Finish Lat : S 21 : 30.939 Finish Lon : E 32 : 1.347
Length : 15.26 km

Transect # : 31
Start Lat : S 21 : 31.837 Start Lon : E 32 : 1.118
Finish Lat : S 21 : 37.053 Finish Lon : E 32 : 7.333
Length : 14.44 km

Transect # : 32A
Start Lat : S 21 : 37.655 Start Lon : E 32 : 6.751
Finish Lat : S 21 : 36.926 Finish Lon : E 32 : 5.882
Length : 2.02 km

Transect # : 32B
Start Lat : S 21 : 35.926 Start Lon : E 32 : 4.691
Finish Lat : S 21 : 33.253 Finish Lon : E 32 : 1.507
Length : 7.39 km

Naivasha
Number of transects : 27
Transect Bearing : -48.00 Degrees (= 132 degrees)
Transect Spacing : 1.50 km

Transect # : 1
Start Lat : S 21 : 28.991 Start Lon : E 32 : 1.746
Finish Lat : S 21 : 29.197 Finish Lon : E 32 : 1.992
Length : 0.57 km

Transect # : 2
Start Lat : S 21 : 30.029 Start Lon : E 32 : 1.684
Finish Lat : S 21 : 29.367 Finish Lon : E 32 : 0.895
Length : 1.83 km

Transect # : 3
Start Lat : S 21 : 29.866 Start Lon : E 32 : 0.190
Finish Lat : S 21 : 30.860 Finish Lon : E 32 : 1.376
Length : 2.75 km

Transect # : 4
Start Lat : S 21 : 31.748 Start Lon : E 32 : 1.135
Finish Lat : S 21 : 30.534 Finish Lon : E 31 : 59.686
Length : 3.36 km

Transect # : 5A
Start Lat : S 21 : 31.264 Start Lon : E 31 : 59.257
Finish Lat : S 21 : 33.084 Finish Lon : E 32 : 1.427
Length : 5.04 km

Transect # : 5B
Start Lat : S 21 : 35.911 Start Lon : E 32 : 4.800
Finish Lat : S 21 : 36.587 Finish Lon : E 32 : 5.605
Length : 1.87 km

Transect # : 6
Start Lat : S 21 : 38.196 Start Lon : E 32 : 6.224
Finish Lat : S 21 : 31.994 Finish Lon : E 31 : 58.827
Length : 17.16 km

Transect # : 7
Start Lat : S 21 : 31.979 Start Lon : E 31 : 57.510
Finish Lat : S 21 : 38.795 Finish Lon : E 32 : 5.639
Length : 18.86 km

Transect # : 8
Start Lat : S 21 : 39.395 Start Lon : E 32 : 5.054
Finish Lat : S 21 : 30.998 Finish Lon : E 31 : 55.040
Length : 23.24 km

Transect # : 9
Start Lat : S 21 : 31.038 Start Lon : E 31 : 53.787
Finish Lat : S 21 : 39.994 Finish Lon : E 32 : 4.469
Length : 24.79 km

Transect # : 10
Start Lat : S 21 : 40.594 Start Lon : E 32 : 3.884
Finish Lat : S 21 : 31.284 Finish Lon : E 31 : 52.782
Length : 25.76 km

Transect # : 11
Start Lat : S 21 : 30.704 Start Lon : E 31 : 50.790
Finish Lat : S 21 : 41.193 Finish Lon : E 32 : 3.299
Length : 29.03 km

Transect # : 12
Start Lat : S 21 : 41.792 Start Lon : E 32 : 2.714
Finish Lat : S 21 : 30.509 Finish Lon : E 31 : 49.257
Length : 31.23 km

Transect # : 13
Start Lat : S 21 : 30.652 Start Lon : E 31 : 48.127
Finish Lat : S 21 : 42.392 Finish Lon : E 32 : 2.129
Length : 32.49 km

Transect # : 14
Start Lat : S 21 : 42.991 Start Lon : E 32 : 1.544
Finish Lat : S 21 : 30.795 Finish Lon : E 31 : 46.998
Length : 33.75 km

Transect # : 15
Start Lat : S 21 : 30.876 Start Lon : E 31 : 45.795
Finish Lat : S 21 : 43.591 Finish Lon : E 32 : 0.959
Length : 35.19 km

Transect # : 16
Start Lat : S 21 : 44.190 Start Lon : E 32 : 0.374
Finish Lat : S 21 : 31.113 Finish Lon : E 31 : 44.777
Length : 36.19 km

Transect # : 17
Start Lat : S 21 : 31.773 Start Lon : E 31 : 44.264
Finish Lat : S 21 : 44.790 Finish Lon : E 31 : 59.789
Length : 36.02 km

Transect # : 18
Start Lat : S 21 : 45.389 Start Lon : E 31 : 59.204
Finish Lat : S 21 : 32.433 Finish Lon : E 31 : 43.752
Length : 35.86 km

Transect # : 19
Start Lat : S 21 : 33.094 Start Lon : E 31 : 43.240
Finish Lat : S 21 : 45.989 Finish Lon : E 31 : 58.619
Length : 35.69 km

Transect # : 20
Start Lat : S 21 : 46.588 Start Lon : E 31 : 58.034
Finish Lat : S 21 : 33.754 Finish Lon : E 31 : 42.727
Length : 35.52 km

Transect # : 21
Start Lat : S 21 : 34.414 Start Lon : E 31 : 42.215
Finish Lat : S 21 : 47.188 Finish Lon : E 31 : 57.449
Length : 35.35 km

Transect # : 22
Start Lat : S 21 : 47.787 Start Lon : E 31 : 56.864
Finish Lat : S 21 : 35.075 Finish Lon : E 31 : 41.702
Length : 35.18 km

Transect # : 23A
Start Lat : S 21 : 35.735 Start Lon : E 31 : 41.190
Finish Lat : S 21 : 41.110 Finish Lon : E 31 : 47.601
Length : 14.88 km

Transect # : 23B
Start Lat : S 21 : 46.436 Start Lon : E 31 : 53.952
Finish Lat : S 21 : 48.386 Finish Lon : E 31 : 56.279
Length : 5.40 km

Transect # : 24
Start Lat : S 21 : 40.800 Start Lon : E 31 : 45.931
Finish Lat : S 21 : 36.395 Finish Lon : E 31 : 40.678
Length : 12.19 km

Transect # : 25
Start Lat : S 21 : 37.056 Start Lon : E 31 : 40.165
Finish Lat : S 21 : 40.800 Finish Lon : E 31 : 44.631
Length : 10.36 km

Transect # : 26
Start Lat : S 21 : 40.800 Start Lon : E 31 : 43.331
Finish Lat : S 21 : 37.716 Finish Lon : E 31 : 39.653
Length : 8.54 km

Transect # : 27
Start Lat : S 21 : 38.376 Start Lon : E 31 : 39.140
Finish Lat : S 21 : 40.183 Finish Lon : E 31 : 41.295
Length : 5.00 km

Chefu
Number of transects : 14
Transect Bearing : 42.00 Degrees
Transect Spacing : 2.50 km

Transect # : 1
Start Lat : S 21 : 48.131 Start Lon : E 31 : 55.208
Finish Lat : S 22 : 3.299 Finish Lon : E 31 : 40.518
Length : 37.80 km

Transect # : 2
Start Lat : S 22 : 1.986 Start Lon : E 31 : 39.836
Finish Lat : S 21 : 46.987 Finish Lon : E 31 : 54.361
Length : 37.37 km

Transect # : 3
Start Lat : S 21 : 45.844 Start Lon : E 31 : 53.514
Finish Lat : S 22 : 0.570 Finish Lon : E 31 : 39.253
Length : 36.70 km

Transect # : 4
Start Lat : S 21 : 59.154 Start Lon : E 31 : 38.670
Finish Lat : S 21 : 44.701 Finish Lon : E 31 : 52.668
Length : 36.02 km

Transect # : 5
Start Lat : S 21 : 43.722 Start Lon : E 31 : 51.662
Finish Lat : S 21 : 57.739 Finish Lon : E 31 : 38.087
Length : 34.93 km

Transect # : 6
Start Lat : S 21 : 56.323 Start Lon : E 31 : 37.504
Finish Lat : S 21 : 42.924 Finish Lon : E 31 : 50.480
Length : 33.39 km

Transect # : 7
Start Lat : S 21 : 41.955 Start Lon : E 31 : 49.465
Finish Lat : S 21 : 54.907 Finish Lon : E 31 : 36.921
Length : 32.27 km

Transect # : 8
Start Lat : S 21 : 53.491 Start Lon : E 31 : 36.339
Finish Lat : S 21 : 41.245 Finish Lon : E 31 : 48.199
Length : 30.52 km

Transect # : 9
Start Lat : S 21 : 40.884 Start Lon : E 31 : 46.595
Finish Lat : S 21 : 52.076 Finish Lon : E 31 : 35.756
Length : 27.89 km

Transect # : 10
Start Lat : S 21 : 50.660 Start Lon : E 31 : 35.173
Finish Lat : S 21 : 40.800 Finish Lon : E 31 : 44.722
Length : 24.57 km

Transect # : 11
Start Lat : S 21 : 40.800 Start Lon : E 31 : 42.768
Finish Lat : S 21 : 49.244 Finish Lon : E 31 : 34.590
Length : 21.04 km

Transect # : 12
Start Lat : S 21 : 47.828 Start Lon : E 31 : 34.007
Finish Lat : S 21 : 40.219 Finish Lon : E 31 : 41.376
Length : 18.96 km

Transect # : 13
Start Lat : S 21 : 39.518 Start Lon : E 31 : 40.101
Finish Lat : S 21 : 46.413 Finish Lon : E 31 : 33.425
Length : 17.18 km

Transect # : 14
Start Lat : S 21 : 44.940 Start Lon : E 31 : 32.897
Finish Lat : S 21 : 38.721 Finish Lon : E 31 : 38.920
Length : 15.50 km

Mabalauta
Number of transects : 30
Transect Bearing : 90.00 Degrees
Transect Spacing : 1.50 km

Transect # : 1A
Start Lat : S 21 : 44.277 Start Lon : E 31 : 32.770
Finish Lat : S 21 : 44.277 Finish Lon : E 31 : 28.335
Length : 7.63 km

Transect # : 1B
Start Lat : S 21 : 44.277 Start Lon : E 31 : 24.046
Finish Lat : S 21 : 44.277 Finish Lon : E 31 : 22.950
Length : 1.89 km

Transect # : 1C
Start Lat : S 21 : 44.277 Start Lon : E 31 : 21.333
Finish Lat : S 21 : 44.277 Finish Lon : E 31 : 18.909
Length : 4.17 km

Transect # : 2
Start Lat : S 21 : 45.087 Start Lon : E 31 : 19.733
Finish Lat : S 21 : 45.087 Finish Lon : E 31 : 32.925
Length : 22.70 km

Transect # : 3
Start Lat : S 21 : 45.897 Start Lon : E 31 : 33.213
Finish Lat : S 21 : 45.897 Finish Lon : E 31 : 20.208
Length : 22.38 km

Transect # : 4
Start Lat : S 21 : 46.707 Start Lon : E 31 : 20.017
Finish Lat : S 21 : 46.707 Finish Lon : E 31 : 33.547
Length : 23.28 km

Transect # : 5
Start Lat : S 21 : 47.517 Start Lon : E 31 : 33.881
Finish Lat : S 21 : 47.517 Finish Lon : E 31 : 19.977
Length : 23.92 km

Transect # : 6
Start Lat : S 21 : 48.327 Start Lon : E 31 : 20.243
Finish Lat : S 21 : 48.327 Finish Lon : E 31 : 34.215
Length : 24.04 km

Transect # : 7
Start Lat : S 21 : 49.137 Start Lon : E 31 : 34.549
Finish Lat : S 21 : 49.137 Finish Lon : E 31 : 20.373
Length : 24.39 km

Transect # : 8
Start Lat : S 21 : 49.947 Start Lon : E 31 : 20.550
Finish Lat : S 21 : 49.947 Finish Lon : E 31 : 34.883
Length : 24.66 km

Transect # : 9
Start Lat : S 21 : 50.757 Start Lon : E 31 : 35.217
Finish Lat : S 21 : 50.757 Finish Lon : E 31 : 20.769
Length : 24.86 km

Transect # : 10
Start Lat : S 21 : 51.567 Start Lon : E 31 : 20.987
Finish Lat : S 21 : 51.567 Finish Lon : E 31 : 35.550
Length : 25.06 km

Transect # : 11
Start Lat : S 21 : 52.377 Start Lon : E 31 : 35.885
Finish Lat : S 21 : 52.377 Finish Lon : E 31 : 21.206
Length : 25.26 km

Transect # : 12
Start Lat : S 21 : 53.187 Start Lon : E 31 : 21.424
Finish Lat : S 21 : 53.187 Finish Lon : E 31 : 36.218
Length : 25.46 km

Transect # : 13
Start Lat : S 21 : 53.997 Start Lon : E 31 : 36.552
Finish Lat : S 21 : 53.997 Finish Lon : E 31 : 21.642
Length : 25.66 km

Transect # : 14
Start Lat : S 21 : 54.807 Start Lon : E 31 : 21.861
Finish Lat : S 21 : 54.807 Finish Lon : E 31 : 36.886
Length : 25.85 km

Transect # : 15
Start Lat : S 21 : 55.617 Start Lon : E 31 : 37.220
Finish Lat : S 21 : 55.617 Finish Lon : E 31 : 22.079
Length : 26.05 km

Transect # : 16
Start Lat : S 21 : 56.427 Start Lon : E 31 : 22.298
Finish Lat : S 21 : 56.427 Finish Lon : E 31 : 37.554
Length : 26.25 km

Transect # : 17
Start Lat : S 21 : 57.237 Start Lon : E 31 : 37.888
Finish Lat : S 21 : 57.237 Finish Lon : E 31 : 22.516
Length : 26.45 km

Transect # : 18
Start Lat : S 21 : 58.047 Start Lon : E 31 : 22.735
Finish Lat : S 21 : 58.047 Finish Lon : E 31 : 38.222
Length : 26.65 km

Transect # : 19
Start Lat : S 21 : 58.857 Start Lon : E 31 : 38.556
Finish Lat : S 21 : 58.857 Finish Lon : E 31 : 22.953
Length : 26.85 km

Transect # : 20
Start Lat : S 21 : 59.667 Start Lon : E 31 : 23.172
Finish Lat : S 21 : 59.667 Finish Lon : E 31 : 38.890
Length : 27.05 km

Transect # : 21
Start Lat : S 22 : 0.477 Start Lon : E 31 : 39.224
Finish Lat : S 22 : 0.477 Finish Lon : E 31 : 23.390
Length : 27.25 km

Transect # : 22
Start Lat : S 22 : 1.287 Start Lon : E 31 : 23.609
Finish Lat : S 22 : 1.287 Finish Lon : E 31 : 39.558
Length : 27.44 km

Transect # : 23
Start Lat : S 22 : 2.097 Start Lon : E 31 : 39.892
Finish Lat : S 22 : 2.097 Finish Lon : E 31 : 23.827
Length : 27.64 km

Transect # : 24A
Start Lat : S 22 : 2.907 Start Lon : E 31 : 24.045
Finish Lat : S 22 : 2.907 Finish Lon : E 31 : 25.803
Length : 3.02 km

Transect # : 24B
Start Lat : S 22 : 2.907 Start Lon : E 31 : 26.697
Finish Lat : S 22 : 2.907 Finish Lon : E 31 : 40.226
Length : 23.28 km

Transect # : 25
Start Lat : S 22 : 3.717 Start Lon : E 31 : 38.055
Finish Lat : S 22 : 3.717 Finish Lon : E 31 : 26.545
Length : 19.81 km

Transect # : 26
Start Lat : S 22 : 4.527 Start Lon : E 31 : 26.393
Finish Lat : S 22 : 4.527 Finish Lon : E 31 : 35.857
Length : 16.28 km

Transect # : 27
Start Lat : S 22 : 5.337 Start Lon : E 31 : 33.658
Finish Lat : S 22 : 5.337 Finish Lon : E 31 : 26.241
Length : 12.76 km

Transect # : 28
Start Lat : S 22 : 6.147 Start Lon : E 31 : 26.088
Finish Lat : S 22 : 6.147 Finish Lon : E 31 : 31.459
Length : 9.24 km

Transect # : 29
Start Lat : S 22 : 6.957 Start Lon : E 31 : 29.260
Finish Lat : S 22 : 6.957 Finish Lon : E 31 : 25.936
Length : 5.72 km

Transect # : 30
Start Lat : S 22 : 7.767 Start Lon : E 31 : 25.784
Finish Lat : S 22 : 7.767 Finish Lon : E 31 : 26.093
Length : 0.53 km

Chingwesi
Number of transects : 13
Transect Bearing : 90.00 Degrees
Transect Spacing : 2.50 km

Transect # : 1
Start Lat : S 21 : 15.679 Start Lon : E 31 : 52.545
Finish Lat : S 21 : 15.679 Finish Lon : E 31 : 51.766
Length : 1.34 km

Transect # : 2
Start Lat : S 21 : 17.029 Start Lon : E 31 : 50.651
Finish Lat : S 21 : 17.029 Finish Lon : E 31 : 53.624
Length : 5.13 km

Transect # : 3
Start Lat : S 21 : 18.379 Start Lon : E 31 : 53.357
Finish Lat : S 21 : 18.379 Finish Lon : E 31 : 49.535
Length : 6.60 km

Transect # : 4
Start Lat : S 21 : 19.729 Start Lon : E 31 : 48.420
Finish Lat : S 21 : 19.729 Finish Lon : E 31 : 52.335
Length : 6.76 km

Transect # : 5
Start Lat : S 21 : 21.079 Start Lon : E 31 : 51.367
Finish Lat : S 21 : 21.079 Finish Lon : E 31 : 47.304
Length : 7.01 km

Transect # : 6
Start Lat : S 21 : 22.429 Start Lon : E 31 : 46.189
Finish Lat : S 21 : 22.429 Finish Lon : E 31 : 50.327
Length : 7.14 km

Transect # : 7
Start Lat : S 21 : 23.779 Start Lon : E 31 : 49.501
Finish Lat : S 21 : 23.779 Finish Lon : E 31 : 45.074
Length : 7.64 km

Transect # : 8
Start Lat : S 21 : 25.129 Start Lon : E 31 : 43.958
Finish Lat : S 21 : 25.129 Finish Lon : E 31 : 48.857
Length : 8.46 km

Transect # : 9
Start Lat : S 21 : 26.479 Start Lon : E 31 : 47.406
Finish Lat : S 21 : 26.479 Finish Lon : E 31 : 42.843
Length : 7.88 km

Transect # : 10
Start Lat : S 21 : 27.829 Start Lon : E 31 : 41.727
Finish Lat : S 21 : 27.829 Finish Lon : E 31 : 46.221
Length : 7.76 km

Transect # : 11
Start Lat : S 21 : 29.179 Start Lon : E 31 : 45.054
Finish Lat : S 21 : 29.179 Finish Lon : E 31 : 40.612
Length : 7.67 km

Transect # : 12
Start Lat : S 21 : 30.529 Start Lon : E 31 : 39.497
Finish Lat : S 21 : 30.529 Finish Lon : E 31 : 45.023
Length : 9.54 km

Transect # : 13
Start Lat : S 21 : 31.879 Start Lon : E 31 : 41.620
Finish Lat : S 21 : 31.879 Finish Lon : E 31 : 38.381
Length : 5.59 km

Matibi
Number of transects : 9
Transect Bearing : 90.00 Degrees
Transect Spacing : 2.50 km

Transect # : 1
Start Lat : S 21 : 31.909 Start Lon : E 31 : 44.173
Finish Lat : S 21 : 31.909 Finish Lon : E 31 : 41.493
Length : 4.62 km

Transect # : 2
Start Lat : S 21 : 33.259 Start Lon : E 31 : 36.258
Finish Lat : S 21 : 33.259 Finish Lon : E 31 : 43.122
Length : 11.83 km

Transect # : 3
Start Lat : S 21 : 34.609 Start Lon : E 31 : 42.072
Finish Lat : S 21 : 34.609 Finish Lon : E 31 : 34.316
Length : 13.36 km

Transect # : 4
Start Lat : S 21 : 35.959 Start Lon : E 31 : 32.374
Finish Lat : S 21 : 35.959 Finish Lon : E 31 : 41.021
Length : 14.90 km

Transect # : 5
Start Lat : S 21 : 37.309 Start Lon : E 31 : 39.971
Finish Lat : S 21 : 37.309 Finish Lon : E 31 : 30.432
Length : 16.44 km

Transect # : 6
Start Lat : S 21 : 38.659 Start Lon : E 31 : 30.236
Finish Lat : S 21 : 38.659 Finish Lon : E 31 : 38.896
Length : 14.92 km

Transect # : 7
Start Lat : S 21 : 40.009 Start Lon : E 31 : 37.342
Finish Lat : S 21 : 40.009 Finish Lon : E 31 : 30.786
Length : 11.30 km

Transect # : 8
Start Lat : S 21 : 41.359 Start Lon : E 31 : 31.337
Finish Lat : S 21 : 41.359 Finish Lon : E 31 : 35.789
Length : 7.67 km

Transect # : 9
Start Lat : S 21 : 42.709 Start Lon : E 31 : 34.235
Finish Lat : S 21 : 42.709 Finish Lon : E 31 : 31.888
Length : 4.04 km

Gonakudzingwa
Number of transects : 11
Transect Bearing : 0.00 Degrees
Transect Spacing : 2.50 km

Transect # : 1
Start Lat : S 21 : 44.094 Start Lon : E 31 : 31.521
Finish Lat : S 21 : 41.811 Finish Lon : E 31 : 31.521
Length : 4.23 km

Transect # : 2
Start Lat : S 21 : 41.230 Start Lon : E 31 : 30.070
Finish Lat : S 21 : 44.178 Finish Lon : E 31 : 30.070
Length : 5.46 km

Transect # : 3
Start Lat : S 21 : 44.261 Start Lon : E 31 : 28.618
Finish Lat : S 21 : 41.316 Finish Lon : E 31 : 28.618
Length : 5.45 km

Transect # : 4
Start Lat : S 21 : 41.402 Start Lon : E 31 : 27.167
Finish Lat : S 21 : 44.344 Finish Lon : E 31 : 27.167
Length : 5.45 km

Transect # : 5
Start Lat : S 21 : 44.428 Start Lon : E 31 : 25.715
Finish Lat : S 21 : 41.487 Finish Lon : E 31 : 25.715
Length : 5.44 km

Transect # : 6
Start Lat : S 21 : 41.573 Start Lon : E 31 : 24.264
Finish Lat : S 21 : 44.328 Finish Lon : E 31 : 24.264
Length : 5.10 km

Transect # : 7
Start Lat : S 21 : 44.298 Start Lon : E 31 : 22.812
Finish Lat : S 21 : 41.659 Finish Lon : E 31 : 22.812
Length : 4.89 km

Transect # : 8
Start Lat : S 21 : 41.663 Start Lon : E 31 : 21.360
Finish Lat : S 21 : 44.293 Finish Lon : E 31 : 21.360
Length : 4.87 km

Transect # : 9
Start Lat : S 21 : 43.809 Start Lon : E 31 : 19.909
Finish Lat : S 21 : 41.417 Finish Lon : E 31 : 19.909
Length : 4.43 km

Transect # : 10
Start Lat : S 21 : 41.896 Start Lon : E 31 : 18.457
Finish Lat : S 21 : 43.382 Finish Lon : E 31 : 18.457
Length : 2.75 km

Transect # : 11
Start Lat : S 21 : 43.104 Start Lon : E 31 : 17.006
Finish Lat : S 21 : 42.862 Finish Lon : E 31 : 17.006
Length : 0.45 km

Masukwe
Number of transects : 17
Transect Bearing : 90.00 Degrees
Transect Spacing : 2.50 km

Transect # : 1
Start Lat : S 21 : 43.292 Start Lon : E 31 : 18.309
Finish Lat : S 21 : 43.261 Finish Lon : E 31 : 15.410
Length : 5.00 km

Transect # : 2
Start Lat : S 21 : 44.630 Start Lon : E 31 : 16.774
Finish Lat : S 21 : 44.660 Finish Lon : E 31 : 19.674
Length : 5.00 km

Transect # : 3
Start Lat : S 21 : 46.020 Start Lon : E 31 : 20.196
Finish Lat : S 21 : 45.991 Finish Lon : E 31 : 17.296
Length : 5.00 km

Transect # : 4
Start Lat : S 21 : 47.342 Start Lon : E 31 : 17.005
Finish Lat : S 21 : 47.372 Finish Lon : E 31 : 19.906
Length : 5.00 km

Transect # : 5
Start Lat : S 21 : 48.731 Start Lon : E 31 : 20.341
Finish Lat : S 21 : 48.691 Finish Lon : E 31 : 17.390
Length : 5.09 km

Transect # : 6
Start Lat : S 21 : 50.082 Start Lon : E 31 : 17.756
Finish Lat : S 21 : 50.089 Finish Lon : E 31 : 20.660
Length : 5.00 km

Transect # : 7
Start Lat : S 21 : 51.447 Start Lon : E 31 : 20.979
Finish Lat : S 21 : 51.456 Finish Lon : E 31 : 18.052
Length : 5.04 km

Transect # : 8
Start Lat : S 21 : 52.799 Start Lon : E 31 : 18.366
Finish Lat : S 21 : 52.805 Finish Lon : E 31 : 21.272
Length : 5.00 km

Transect # : 9
Start Lat : S 21 : 54.163 Start Lon : E 31 : 21.620
Finish Lat : S 21 : 54.157 Finish Lon : E 31 : 18.645
Length : 5.12 km

Transect # : 10
Start Lat : S 21 : 55.499 Start Lon : E 31 : 19.028
Finish Lat : S 21 : 55.522 Finish Lon : E 31 : 21.995
Length : 5.11 km

Transect # : 11
Start Lat : S 21 : 56.880 Start Lon : E 31 : 22.372
Finish Lat : S 21 : 56.857 Finish Lon : E 31 : 19.394
Length : 5.13 km

Transect # : 12
Start Lat : S 21 : 58.215 Start Lon : E 31 : 19.673
Finish Lat : S 21 : 58.238 Finish Lon : E 31 : 22.663
Length : 5.15 km

Transect # : 13
Start Lat : S 21 : 59.599 Start Lon : E 31 : 23.317
Finish Lat : S 21 : 59.566 Finish Lon : E 31 : 19.967
Length : 5.77 km

Transect # : 14
Start Lat : S 22 : 0.972 Start Lon : E 31 : 20.263
Finish Lat : S 22 : 0.959 Finish Lon : E 31 : 23.826
Length : 6.13 km

Transect # : 15
Start Lat : S 22 : 2.318 Start Lon : E 31 : 24.290
Finish Lat : S 22 : 2.298 Finish Lon : E 31 : 20.682
Length : 6.21 km

Transect # : 16
Start Lat : S 22 : 3.656 Start Lon : E 31 : 21.031
Finish Lat : S 22 : 3.670 Finish Lon : E 31 : 23.912
Length : 4.96 km

Transect # : 17
Start Lat : S 22 : 5.039 Start Lon : E 31 : 22.632
Finish Lat : S 22 : 5.136 Finish Lon : E 31 : 19.789
Length : 4.89 km

Sengwe
Number of transects : 10
Transect Bearing : 42.00 Degrees
Transect Spacing : 2.50 km

Transect # : 1
Start Lat : S 22 : 3.963 Start Lon : E 31 : 23.249
Finish Lat : S 22 : 20.408 Finish Lon : E 31 : 7.290
Length : 40.98 km

Transect # : 2
Start Lat : S 22 : 19.719 Start Lon : E 31 : 9.916
Finish Lat : S 22 : 2.844 Finish Lon : E 31 : 26.293
Length : 42.05 km

Transect # : 3
Start Lat : S 22 : 4.815 Start Lon : E 31 : 26.338
Finish Lat : S 22 : 20.385 Finish Lon : E 31 : 11.228
Length : 38.80 km

Transect # : 4
Start Lat : S 22 : 21.511 Start Lon : E 31 : 12.094
Finish Lat : S 22 : 7.316 Finish Lon : E 31 : 25.869
Length : 35.37 km

Transect # : 5
Start Lat : S 22 : 7.579 Start Lon : E 31 : 27.572
Finish Lat : S 22 : 22.019 Finish Lon : E 31 : 13.558
Length : 35.98 km

Transect # : 6
Start Lat : S 22 : 21.802 Start Lon : E 31 : 15.726
Finish Lat : S 22 : 6.448 Finish Lon : E 31 : 30.627
Length : 38.26 km

Transect # : 7
Start Lat : S 22 : 5.318 Start Lon : E 31 : 33.682
Finish Lat : S 22 : 22.772 Finish Lon : E 31 : 16.744
Length : 43.49 km

Transect # : 8
Start Lat : S 22 : 24.003 Start Lon : E 31 : 17.507
Finish Lat : S 22 : 4.188 Finish Lon : E 31 : 36.736
Length : 49.38 km

Transect # : 9
Start Lat : S 22 : 3.058 Start Lon : E 31 : 39.791
Finish Lat : S 22 : 25.104 Finish Lon : E 31 : 18.396
Length : 54.94 km

Transect # : 10
Start Lat : S 22 : 23.013 Start Lon : E 31 : 22.384
Finish Lat : S 22 : 3.864 Finish Lon : E 31 : 40.966
Length : 47.72 km

Zinave NP
Number of transects : 52
Transect Bearing : 0.00 Degrees
Transect Spacing : 2.00 km

Transect # : 1A
Start Lat : S 21 : 18.029 Start Lon : E 34 : 1.833
Finish Lat : S 21 : 19.007 Finish Lon : E 34 : 1.833
Length : 1.81 km

Transect # : 1B
Start Lat : S 21 : 23.136 Start Lon : E 34 : 1.833
Finish Lat : S 21 : 24.649 Finish Lon : E 34 : 1.833
Length : 2.80 km

Transect # : 1C
Start Lat : S 21 : 36.124 Start Lon : E 34 : 1.833
Finish Lat : S 21 : 38.954 Finish Lon : E 34 : 1.833
Length : 5.24 km

Transect # : 1D
Start Lat : S 21 : 39.466 Start Lon : E 34 : 1.833
Finish Lat : S 21 : 41.476 Finish Lon : E 34 : 1.833
Length : 3.72 km

Transect # : 2A
Start Lat : S 21 : 41.841 Start Lon : E 34 : 0.676
Finish Lat : S 21 : 33.674 Finish Lon : E 34 : 0.676
Length : 15.12 km

Transect # : 2B
Start Lat : S 21 : 33.377 Start Lon : E 34 : 0.676
Finish Lat : S 21 : 18.566 Finish Lon : E 34 : 0.676
Length : 27.43 km

Transect # : 3
Start Lat : S 21 : 18.689 Start Lon : E 33 : 59.519
Finish Lat : S 21 : 42.194 Finish Lon : E 33 : 59.519
Length : 43.53 km

Transect # : 4
Start Lat : S 21 : 42.530 Start Lon : E 33 : 58.362
Finish Lat : S 21 : 18.692 Finish Lon : E 33 : 58.362
Length : 44.14 km

Transect # : 5
Start Lat : S 21 : 18.848 Start Lon : E 33 : 57.205
Finish Lat : S 21 : 42.865 Finish Lon : E 33 : 57.205
Length : 44.48 km

Transect # : 6
Start Lat : S 21 : 43.200 Start Lon : E 33 : 56.048
Finish Lat : S 21 : 21.791 Finish Lon : E 33 : 56.048
Length : 39.65 km

Transect # : 7
Start Lat : S 21 : 24.041 Start Lon : E 33 : 54.891
Finish Lat : S 21 : 43.535 Finish Lon : E 33 : 54.891
Length : 36.10 km

Transect # : 8
Start Lat : S 21 : 43.870 Start Lon : E 33 : 53.735
Finish Lat : S 21 : 24.253 Finish Lon : E 33 : 53.735
Length : 36.33 km

Transect # : 9
Start Lat : S 21 : 24.560 Start Lon : E 33 : 52.578
Finish Lat : S 21 : 44.213 Finish Lon : E 33 : 52.578
Length : 36.39 km

Transect # : 10
Start Lat : S 21 : 44.443 Start Lon : E 33 : 51.421
Finish Lat : S 21 : 24.452 Finish Lon : E 33 : 51.421
Length : 37.02 km

Transect # : 11
Start Lat : S 21 : 23.784 Start Lon : E 33 : 50.264
Finish Lat : S 21 : 44.652 Finish Lon : E 33 : 50.264
Length : 38.64 km

Transect # : 12
Start Lat : S 21 : 44.861 Start Lon : E 33 : 49.107
Finish Lat : S 21 : 23.459 Finish Lon : E 33 : 49.107
Length : 39.63 km

Transect # : 13
Start Lat : S 21 : 23.240 Start Lon : E 33 : 47.950
Finish Lat : S 21 : 45.069 Finish Lon : E 33 : 47.950
Length : 40.42 km

Transect # : 14
Start Lat : S 21 : 45.276 Start Lon : E 33 : 46.793
Finish Lat : S 21 : 23.550 Finish Lon : E 33 : 46.793
Length : 40.23 km

Transect # : 15
Start Lat : S 21 : 24.745 Start Lon : E 33 : 45.637
Finish Lat : S 21 : 45.482 Finish Lon : E 33 : 45.637
Length : 38.40 km

Transect # : 16
Start Lat : S 21 : 45.688 Start Lon : E 33 : 44.480
Finish Lat : S 21 : 25.260 Finish Lon : E 33 : 44.480
Length : 37.83 km

Transect # : 17
Start Lat : S 21 : 24.906 Start Lon : E 33 : 43.323
Finish Lat : S 21 : 45.894 Finish Lon : E 33 : 43.323
Length : 38.87 km

Transect # : 18
Start Lat : S 21 : 46.100 Start Lon : E 33 : 42.166
Finish Lat : S 21 : 24.333 Finish Lon : E 33 : 42.166
Length : 40.31 km

Transect # : 19
Start Lat : S 21 : 23.848 Start Lon : E 33 : 41.009
Finish Lat : S 21 : 46.306 Finish Lon : E 33 : 41.009
Length : 41.59 km

Transect # : 20
Start Lat : S 21 : 46.513 Start Lon : E 33 : 39.852
Finish Lat : S 21 : 22.894 Finish Lon : E 33 : 39.852
Length : 43.74 km

Transect # : 21
Start Lat : S 21 : 22.940 Start Lon : E 33 : 38.695
Finish Lat : S 21 : 46.719 Finish Lon : E 33 : 38.695
Length : 44.03 km

Transect # : 22
Start Lat : S 21 : 46.925 Start Lon : E 33 : 37.538
Finish Lat : S 21 : 23.476 Finish Lon : E 33 : 37.538
Length : 43.42 km

Transect # : 23
Start Lat : S 21 : 23.480 Start Lon : E 33 : 36.382
Finish Lat : S 21 : 47.131 Finish Lon : E 33 : 36.382
Length : 43.80 km

Transect # : 24
Start Lat : S 21 : 47.337 Start Lon : E 33 : 35.225
Finish Lat : S 21 : 23.323 Finish Lon : E 33 : 35.225
Length : 44.47 km

Transect # : 25
Start Lat : S 21 : 22.983 Start Lon : E 33 : 34.068
Finish Lat : S 21 : 47.543 Finish Lon : E 33 : 34.068
Length : 45.48 km

Transect # : 26
Start Lat : S 21 : 47.749 Start Lon : E 33 : 32.911
Finish Lat : S 21 : 22.645 Finish Lon : E 33 : 32.911
Length : 46.49 km

Transect # : 27
Start Lat : S 21 : 22.669 Start Lon : E 33 : 31.754
Finish Lat : S 21 : 47.955 Finish Lon : E 33 : 31.754
Length : 46.83 km

Transect # : 28
Start Lat : S 21 : 48.162 Start Lon : E 33 : 30.597
Finish Lat : S 21 : 22.922 Finish Lon : E 33 : 30.597
Length : 46.74 km

Transect # : 29
Start Lat : S 21 : 23.809 Start Lon : E 33 : 29.441
Finish Lat : S 21 : 48.368 Finish Lon : E 33 : 29.441
Length : 45.48 km

Transect # : 30
Start Lat : S 21 : 48.574 Start Lon : E 33 : 28.284
Finish Lat : S 21 : 24.771 Finish Lon : E 33 : 28.284
Length : 44.08 km

Transect # : 31
Start Lat : S 21 : 26.427 Start Lon : E 33 : 27.127
Finish Lat : S 21 : 48.780 Finish Lon : E 33 : 27.127
Length : 41.39 km

Transect # : 32
Start Lat : S 21 : 48.986 Start Lon : E 33 : 25.970
Finish Lat : S 21 : 26.864 Finish Lon : E 33 : 25.970
Length : 40.97 km

Transect # : 33
Start Lat : S 21 : 27.494 Start Lon : E 33 : 24.813
Finish Lat : S 21 : 49.192 Finish Lon : E 33 : 24.813
Length : 40.18 km

Transect # : 34
Start Lat : S 21 : 49.398 Start Lon : E 33 : 23.656
Finish Lat : S 21 : 28.164 Finish Lon : E 33 : 23.656
Length : 39.32 km

Transect # : 35
Start Lat : S 21 : 28.204 Start Lon : E 33 : 22.499
Finish Lat : S 21 : 49.604 Finish Lon : E 33 : 22.499
Length : 39.63 km

Transect # : 36
Start Lat : S 21 : 49.810 Start Lon : E 33 : 21.343
Finish Lat : S 21 : 28.140 Finish Lon : E 33 : 21.343
Length : 40.13 km

Transect # : 37
Start Lat : S 21 : 28.386 Start Lon : E 33 : 20.186
Finish Lat : S 21 : 50.017 Finish Lon : E 33 : 20.186
Length : 40.06 km

Transect # : 38
Start Lat : S 21 : 50.223 Start Lon : E 33 : 19.029
Finish Lat : S 21 : 29.719 Finish Lon : E 33 : 19.029
Length : 37.97 km

Transect # : 39
Start Lat : S 21 : 29.999 Start Lon : E 33 : 17.872
Finish Lat : S 21 : 50.429 Finish Lon : E 33 : 17.872
Length : 37.83 km

Transect # : 40
Start Lat : S 21 : 50.635 Start Lon : E 33 : 16.715
Finish Lat : S 21 : 29.626 Finish Lon : E 33 : 16.715
Length : 38.90 km

Transect # : 41
Start Lat : S 21 : 29.025 Start Lon : E 33 : 15.558
Finish Lat : S 21 : 50.841 Finish Lon : E 33 : 15.558
Length : 40.40 km

Transect # : 42
Start Lat : S 21 : 51.047 Start Lon : E 33 : 14.401
Finish Lat : S 21 : 28.269 Finish Lon : E 33 : 14.401
Length : 42.18 km

Transect # : 43
Start Lat : S 21 : 28.461 Start Lon : E 33 : 13.244
Finish Lat : S 21 : 51.253 Finish Lon : E 33 : 13.244
Length : 42.21 km

Transect # : 44
Start Lat : S 21 : 51.459 Start Lon : E 33 : 12.088
Finish Lat : S 21 : 28.571 Finish Lon : E 33 : 12.088
Length : 42.39 km

Transect # : 45
Start Lat : S 21 : 29.396 Start Lon : E 33 : 10.931
Finish Lat : S 21 : 51.664 Finish Lon : E 33 : 10.931
Length : 41.24 km

Transect # : 46
Start Lat : S 21 : 51.867 Start Lon : E 33 : 9.774
Finish Lat : S 21 : 30.086 Finish Lon : E 33 : 9.774
Length : 40.34 km

Transect # : 47
Start Lat : S 21 : 35.999 Start Lon : E 33 : 8.617
Finish Lat : S 21 : 52.070 Finish Lon : E 33 : 8.617
Length : 29.76 km

Transect # : 48
Start Lat : S 21 : 52.274 Start Lon : E 33 : 7.460
Finish Lat : S 21 : 37.200 Finish Lon : E 33 : 7.460
Length : 27.91 km

Transect # : 49
Start Lat : S 21 : 38.402 Start Lon : E 33 : 6.303
Finish Lat : S 21 : 52.477 Finish Lon : E 33 : 6.303
Length : 26.07 km

Transect # : 50A
Start Lat : S 21 : 52.681 Start Lon : E 33 : 5.147
Finish Lat : S 21 : 52.407 Finish Lon : E 33 : 5.147
Length : 0.51 km

Transect # : 5OB
Start Lat : S 21 : 51.573 Start Lon : E 33 : 5.147
Finish Lat : S 21 : 39.603 Finish Lon : E 33 : 5.147
Length : 22.17 km

Transect # : 51
Start Lat : S 21 : 40.805 Start Lon : E 33 : 3.990
Finish Lat : S 21 : 50.491 Finish Lon : E 33 : 3.990
Length : 17.94 km

Transect # : 52
Start Lat : S 21 : 49.528 Start Lon : E 33 : 2.833
Finish Lat : S 21 : 42.006 Finish Lon : E 33 : 2.833
Length : 13.93 km

North Zinave
Number of transects : 46
Transect Bearing : 0.00 Degrees
Transect Spacing : 2.00 km

Transect # : 1
Start Lat : S 21 : 18.217 Start Lon : E 34 : 1.215
Finish Lat : S 21 : 12.440 Finish Lon : E 34 : 1.215
Length : 10.70 km

Transect # : 2
Start Lat : S 21 : 12.691 Start Lon : E 34 : 0.060
Finish Lat : S 21 : 18.709 Finish Lon : E 34 : 0.060
Length : 11.15 km

Transect # : 3
Start Lat : S 21 : 18.657 Start Lon : E 33 : 58.904
Finish Lat : S 21 : 12.942 Finish Lon : E 33 : 58.904
Length : 10.58 km

Transect # : 4
Start Lat : S 21 : 13.193 Start Lon : E 33 : 57.748
Finish Lat : S 21 : 18.398 Finish Lon : E 33 : 57.748
Length : 9.64 km

Transect # : 5
Start Lat : S 21 : 19.270 Start Lon : E 33 : 56.593
Finish Lat : S 21 : 13.443 Finish Lon : E 33 : 56.593
Length : 10.79 km

Transect # : 6A
Start Lat : S 21 : 13.694 Start Lon : E 33 : 55.437
Finish Lat : S 21 : 22.374 Finish Lon : E 33 : 55.437
Length : 16.07 km

Transect # : 6B
Start Lat : S 21 : 22.849 Start Lon : E 33 : 55.437
Finish Lat : S 21 : 23.220 Finish Lon : E 33 : 55.437
Length : 0.69 km

Transect # : 7
Start Lat : S 21 : 23.878 Start Lon : E 33 : 54.281
Finish Lat : S 21 : 13.945 Finish Lon : E 33 : 54.281
Length : 18.39 km

Transect # : 8
Start Lat : S 21 : 14.196 Start Lon : E 33 : 53.126
Finish Lat : S 21 : 24.365 Finish Lon : E 33 : 53.126
Length : 18.83 km

Transect # : 9
Start Lat : S 21 : 24.852 Start Lon : E 33 : 51.970
Finish Lat : S 21 : 14.446 Finish Lon : E 33 : 51.970
Length : 19.27 km

Transect # : 10
Start Lat : S 21 : 14.697 Start Lon : E 33 : 50.815
Finish Lat : S 21 : 24.258 Finish Lon : E 33 : 50.815
Length : 17.70 km

Transect # : 11
Start Lat : S 21 : 23.342 Start Lon : E 33 : 49.659
Finish Lat : S 21 : 14.948 Finish Lon : E 33 : 49.659
Length : 15.55 km

Transect # : 12
Start Lat : S 21 : 15.199 Start Lon : E 33 : 48.503
Finish Lat : S 21 : 23.208 Finish Lon : E 33 : 48.503
Length : 14.83 km

Transect # : 13
Start Lat : S 21 : 23.015 Start Lon : E 33 : 47.348
Finish Lat : S 21 : 15.449 Finish Lon : E 33 : 47.348
Length : 14.01 km

Transect # : 14A
Start Lat : S 21 : 15.700 Start Lon : E 33 : 46.192
Finish Lat : S 21 : 23.791 Finish Lon : E 33 : 46.192
Length : 14.98 km

Transect # : 14B
Start Lat : S 21 : 23.978 Start Lon : E 33 : 46.192
Finish Lat : S 21 : 24.383 Finish Lon : E 33 : 46.192
Length : 0.75 km

Transect # : 15
Start Lat : S 21 : 24.800 Start Lon : E 33 : 45.037
Finish Lat : S 21 : 15.951 Finish Lon : E 33 : 45.037
Length : 16.39 km

Transect # : 16
Start Lat : S 21 : 16.202 Start Lon : E 33 : 43.881
Finish Lat : S 21 : 25.094 Finish Lon : E 33 : 43.881
Length : 16.47 km

Transect # : 17
Start Lat : S 21 : 24.651 Start Lon : E 33 : 42.725
Finish Lat : S 21 : 16.452 Finish Lon : E 33 : 42.725
Length : 15.18 km

Transect # : 18
Start Lat : S 21 : 16.703 Start Lon : E 33 : 41.570
Finish Lat : S 21 : 24.494 Finish Lon : E 33 : 41.570
Length : 14.43 km

Transect # : 19
Start Lat : S 21 : 23.700 Start Lon : E 33 : 40.414
Finish Lat : S 21 : 16.954 Finish Lon : E 33 : 40.414
Length : 12.49 km

Transect # : 20
Start Lat : S 21 : 17.204 Start Lon : E 33 : 39.258
Finish Lat : S 21 : 22.738 Finish Lon : E 33 : 39.258
Length : 10.25 km

Transect # : 21
Start Lat : S 21 : 23.356 Start Lon : E 33 : 38.103
Finish Lat : S 21 : 17.455 Finish Lon : E 33 : 38.103
Length : 10.93 km

Transect # : 22
Start Lat : S 21 : 17.706 Start Lon : E 33 : 36.947
Finish Lat : S 21 : 23.241 Finish Lon : E 33 : 36.947
Length : 10.25 km

Transect # : 23
Start Lat : S 21 : 23.482 Start Lon : E 33 : 35.792
Finish Lat : S 21 : 17.957 Finish Lon : E 33 : 35.792
Length : 10.23 km

Transect # : 24
Start Lat : S 21 : 18.207 Start Lon : E 33 : 34.636
Finish Lat : S 21 : 23.179 Finish Lon : E 33 : 34.636
Length : 9.21 km

Transect # : 25
Start Lat : S 21 : 23.042 Start Lon : E 33 : 33.480
Finish Lat : S 21 : 18.458 Finish Lon : E 33 : 33.480
Length : 8.49 km

Transect # : 26
Start Lat : S 21 : 18.709 Start Lon : E 33 : 32.325
Finish Lat : S 21 : 22.541 Finish Lon : E 33 : 32.325
Length : 7.10 km

Transect # : 27
Start Lat : S 21 : 22.817 Start Lon : E 33 : 31.169
Finish Lat : S 21 : 18.960 Finish Lon : E 33 : 31.169
Length : 7.14 km

Transect # : 28
Start Lat : S 21 : 19.210 Start Lon : E 33 : 30.014
Finish Lat : S 21 : 23.243 Finish Lon : E 33 : 30.014
Length : 7.47 km

Transect # : 29
Start Lat : S 21 : 24.685 Start Lon : E 33 : 28.858
Finish Lat : S 21 : 19.461 Finish Lon : E 33 : 28.858
Length : 9.67 km

Transect # : 30
Start Lat : S 21 : 19.712 Start Lon : E 33 : 27.702
Finish Lat : S 21 : 26.000 Finish Lon : E 33 : 27.702
Length : 11.65 km

Transect # : 31
Start Lat : S 21 : 26.903 Start Lon : E 33 : 26.547
Finish Lat : S 21 : 19.963 Finish Lon : E 33 : 26.547
Length : 12.85 km

Transect # : 32
Start Lat : S 21 : 20.213 Start Lon : E 33 : 25.391
Finish Lat : S 21 : 27.295 Finish Lon : E 33 : 25.391
Length : 13.11 km

Transect # : 33
Start Lat : S 21 : 27.735 Start Lon : E 33 : 24.235
Finish Lat : S 21 : 20.464 Finish Lon : E 33 : 24.235
Length : 13.46 km

Transect # : 34
Start Lat : S 21 : 20.715 Start Lon : E 33 : 23.080
Finish Lat : S 21 : 28.428 Finish Lon : E 33 : 23.080
Length : 14.28 km

Transect # : 35
Start Lat : S 21 : 28.363 Start Lon : E 33 : 21.924
Finish Lat : S 21 : 20.966 Finish Lon : E 33 : 21.924
Length : 13.70 km

Transect # : 36
Start Lat : S 21 : 21.216 Start Lon : E 33 : 20.769
Finish Lat : S 21 : 28.172 Finish Lon : E 33 : 20.769
Length : 12.88 km

Transect # : 37
Start Lat : S 21 : 29.013 Start Lon : E 33 : 19.613
Finish Lat : S 21 : 21.467 Finish Lon : E 33 : 19.613
Length : 13.97 km

Transect # : 38
Start Lat : S 21 : 21.718 Start Lon : E 33 : 18.457
Finish Lat : S 21 : 29.829 Finish Lon : E 33 : 18.457
Length : 15.02 km

Transect # : 39
Start Lat : S 21 : 29.998 Start Lon : E 33 : 17.302
Finish Lat : S 21 : 21.969 Finish Lon : E 33 : 17.302
Length : 14.87 km

Transect # : 40
Start Lat : S 21 : 22.219 Start Lon : E 33 : 16.146
Finish Lat : S 21 : 29.589 Finish Lon : E 33 : 16.146
Length : 13.65 km

Transect # : 41
Start Lat : S 21 : 28.465 Start Lon : E 33 : 14.990
Finish Lat : S 21 : 22.470 Finish Lon : E 33 : 14.990
Length : 11.10 km

Transect # : 42
Start Lat : S 21 : 22.721 Start Lon : E 33 : 13.835
Finish Lat : S 21 : 28.244 Finish Lon : E 33 : 13.835
Length : 10.23 km

Transect # : 43
Start Lat : S 21 : 28.330 Start Lon : E 33 : 12.679
Finish Lat : S 21 : 22.972 Finish Lon : E 33 : 12.679
Length : 9.92 km

Transect # : 44
Start Lat : S 21 : 23.222 Start Lon : E 33 : 11.524
Finish Lat : S 21 : 29.153 Finish Lon : E 33 : 11.524
Length : 10.98 km

Transect # : 45
Start Lat : S 21 : 29.672 Start Lon : E 33 : 10.368
Finish Lat : S 21 : 23.473 Finish Lon : E 33 : 10.368
Length : 11.48 km

Transect # : 46
Start Lat : S 21 : 23.724 Start Lon : E 33 : 9.212
Finish Lat : S 21 : 30.731 Finish Lon : E 33 : 9.212
Length : 12.98 km

Save Corridor
Number of transects : 34
Transect Bearing : 25.00 Degrees
Transect Spacing : 2.50 km

Transect # : 1A
Start Lat : S 21 : 14.599 Start Lon : E 32 : 26.429
Finish Lat : S 21 : 15.293 Finish Lon : E 32 : 26.083
Length : 1.42 km

Transect # : 1B
Start Lat : S 21 : 20.339 Start Lon : E 32 : 23.563
Finish Lat : S 21 : 21.108 Finish Lon : E 32 : 23.178
Length : 1.57 km

Transect # : 2A
Start Lat : S 21 : 21.681 Start Lon : E 32 : 24.487
Finish Lat : S 21 : 18.896 Finish Lon : E 32 : 25.879
Length : 5.69 km

Transect # : 2B
Start Lat : S 21 : 16.498 Start Lon : E 32 : 27.076
Finish Lat : S 21 : 15.174 Finish Lon : E 32 : 27.738
Length : 2.71 km

Transect # : 3A
Start Lat : S 21 : 15.749 Start Lon : E 32 : 29.046
Finish Lat : S 21 : 17.826 Finish Lon : E 32 : 28.009
Length : 4.24 km

Transect # : 3B
Start Lat : S 21 : 18.868 Start Lon : E 32 : 27.488
Finish Lat : S 21 : 22.255 Finish Lon : E 32 : 25.797
Length : 6.92 km

Transect # : 4A
Start Lat : S 21 : 22.828 Start Lon : E 32 : 27.106
Finish Lat : S 21 : 19.626 Finish Lon : E 32 : 28.705
Length : 6.54 km

Transect # : 4B
Start Lat : S 21 : 19.480 Start Lon : E 32 : 28.778
Finish Lat : S 21 : 16.324 Finish Lon : E 32 : 30.354
Length : 6.45 km

Transect # : 5
Start Lat : S 21 : 16.898 Start Lon : E 32 : 31.663
Finish Lat : S 21 : 23.402 Finish Lon : E 32 : 28.415
Length : 13.29 km

Transect # : 6
Start Lat : S 21 : 23.975 Start Lon : E 32 : 29.724
Finish Lat : S 21 : 17.473 Finish Lon : E 32 : 32.971
Length : 13.29 km

Transect # : 7
Start Lat : S 21 : 18.048 Start Lon : E 32 : 34.280
Finish Lat : S 21 : 24.549 Finish Lon : E 32 : 31.032
Length : 13.28 km

Transect # : 8
Start Lat : S 21 : 25.120 Start Lon : E 32 : 32.343
Finish Lat : S 21 : 18.623 Finish Lon : E 32 : 35.588
Length : 13.28 km

Transect # : 9
Start Lat : S 21 : 19.197 Start Lon : E 32 : 36.896
Finish Lat : S 21 : 25.690 Finish Lon : E 32 : 33.654
Length : 13.27 km

Transect # : 10
Start Lat : S 21 : 26.260 Start Lon : E 32 : 34.964
Finish Lat : S 21 : 19.772 Finish Lon : E 32 : 38.205
Length : 13.26 km

Transect # : 11
Start Lat : S 21 : 20.347 Start Lon : E 32 : 39.513
Finish Lat : S 21 : 26.831 Finish Lon : E 32 : 36.275
Length : 13.25 km

Transect # : 12
Start Lat : S 21 : 27.401 Start Lon : E 32 : 37.585
Finish Lat : S 21 : 20.922 Finish Lon : E 32 : 40.822
Length : 13.24 km

Transect # : 13
Start Lat : S 21 : 21.497 Start Lon : E 32 : 42.130
Finish Lat : S 21 : 27.971 Finish Lon : E 32 : 38.896
Length : 13.23 km

Transect # : 14
Start Lat : S 21 : 28.541 Start Lon : E 32 : 40.207
Finish Lat : S 21 : 22.071 Finish Lon : E 32 : 43.438
Length : 13.22 km

Transect # : 15
Start Lat : S 21 : 22.646 Start Lon : E 32 : 44.747
Finish Lat : S 21 : 29.112 Finish Lon : E 32 : 41.517
Length : 13.21 km

Transect # : 16
Start Lat : S 21 : 29.682 Start Lon : E 32 : 42.828
Finish Lat : S 21 : 23.221 Finish Lon : E 32 : 46.055
Length : 13.20 km

Transect # : 17
Start Lat : S 21 : 23.796 Start Lon : E 32 : 47.363
Finish Lat : S 21 : 30.252 Finish Lon : E 32 : 44.138
Length : 13.19 km

Transect # : 18
Start Lat : S 21 : 30.823 Start Lon : E 32 : 45.449
Finish Lat : S 21 : 24.370 Finish Lon : E 32 : 48.672
Length : 13.18 km

Transect # : 19
Start Lat : S 21 : 24.945 Start Lon : E 32 : 49.980
Finish Lat : S 21 : 31.393 Finish Lon : E 32 : 46.760
Length : 13.17 km

Transect # : 20
Start Lat : S 21 : 31.963 Start Lon : E 32 : 48.070
Finish Lat : S 21 : 25.520 Finish Lon : E 32 : 51.289
Length : 13.17 km

Transect # : 21
Start Lat : S 21 : 26.095 Start Lon : E 32 : 52.597
Finish Lat : S 21 : 32.534 Finish Lon : E 32 : 49.381
Length : 13.16 km

Transect # : 22
Start Lat : S 21 : 33.104 Start Lon : E 32 : 50.692
Finish Lat : S 21 : 26.670 Finish Lon : E 32 : 53.906
Length : 13.15 km

Transect # : 23
Start Lat : S 21 : 27.244 Start Lon : E 32 : 55.214
Finish Lat : S 21 : 33.674 Finish Lon : E 32 : 52.002
Length : 13.14 km

Transect # : 24
Start Lat : S 21 : 34.245 Start Lon : E 32 : 53.313
Finish Lat : S 21 : 27.819 Finish Lon : E 32 : 56.522
Length : 13.13 km

Transect # : 25
Start Lat : S 21 : 28.394 Start Lon : E 32 : 57.831
Finish Lat : S 21 : 34.815 Finish Lon : E 32 : 54.624
Length : 13.12 km

Transect # : 26
Start Lat : S 21 : 35.385 Start Lon : E 32 : 55.934
Finish Lat : S 21 : 28.969 Finish Lon : E 32 : 59.139
Length : 13.11 km

Transect # : 27
Start Lat : S 21 : 29.543 Start Lon : E 33 : 0.447
Finish Lat : S 21 : 35.956 Finish Lon : E 32 : 57.245
Length : 13.10 km

Transect # : 28
Start Lat : S 21 : 36.526 Start Lon : E 32 : 58.556
Finish Lat : S 21 : 30.118 Finish Lon : E 33 : 1.756
Length : 13.09 km

Transect # : 29
Start Lat : S 21 : 29.805 Start Lon : E 33 : 3.508
Finish Lat : S 21 : 37.096 Finish Lon : E 32 : 59.866
Length : 14.90 km

Transect # : 30
Start Lat : S 21 : 37.667 Start Lon : E 33 : 1.177
Finish Lat : S 21 : 28.968 Finish Lon : E 33 : 5.521
Length : 17.77 km

Transect # : 31
Start Lat : S 21 : 28.131 Start Lon : E 33 : 7.535
Finish Lat : S 21 : 38.237 Finish Lon : E 33 : 2.487
Length : 20.65 km

Transect # : 32
Start Lat : S 21 : 38.807 Start Lon : E 33 : 3.798
Finish Lat : S 21 : 29.359 Finish Lon : E 33 : 8.597
Length : 19.3 km

Transect # : 33
Start Lat : S 21 : 31.297 Start Lon : E 33 : 9.145
Finish Lat : S 21 : 39.378 Finish Lon : E 33 : 5.109
Length : 16.51 km

Transect # : 34
Start Lat : S 21 : 36.486 Start Lon : E 33 : 8.148
Finish Lat : S 21 : 34.590 Finish Lon : E 33 : 9.096
Length : 3.88 km

Southern Corridor
Number of transects : 14
Transect Bearing : 25.00 Degrees
Transect Spacing : 5.00 km

Transect # : 1
Start Lat : S 21 : 25.151 Start Lon : E 32 : 30.625
Finish Lat : S 21 : 29.629 Finish Lon : E 32 : 28.385
Length : 9.15 km

Transect # : 2
Start Lat : S 21 : 30.773 Start Lon : E 32 : 31.009
Finish Lat : S 21 : 25.653 Finish Lon : E 32 : 33.569
Length : 10.46 km

Transect # : 3
Start Lat : S 21 : 26.795 Start Lon : E 32 : 36.194
Finish Lat : S 21 : 31.917 Finish Lon : E 32 : 33.632
Length : 10.46 km

Transect # : 4
Start Lat : S 21 : 33.060 Start Lon : E 32 : 36.255
Finish Lat : S 21 : 27.937 Finish Lon : E 32 : 38.818
Length : 10.47 km

Transect # : 5
Start Lat : S 21 : 29.079 Start Lon : E 32 : 41.442
Finish Lat : S 21 : 34.204 Finish Lon : E 32 : 38.879
Length : 10.47 km

Transect # : 6
Start Lat : S 21 : 35.348 Start Lon : E 32 : 41.502
Finish Lat : S 21 : 30.221 Finish Lon : E 32 : 44.066
Length : 10.48 km

Transect # : 7
Start Lat : S 21 : 31.363 Start Lon : E 32 : 46.691
Finish Lat : S 21 : 36.492 Finish Lon : E 32 : 44.125
Length : 10.48 km

Transect # : 8
Start Lat : S 21 : 37.635 Start Lon : E 32 : 46.748
Finish Lat : S 21 : 32.505 Finish Lon : E 32 : 49.315
Length : 10.48 km

Transect # : 9
Start Lat : S 21 : 33.647 Start Lon : E 32 : 51.939
Finish Lat : S 21 : 38.779 Finish Lon : E 32 : 49.372
Length : 10.49 km

Transect # : 10
Start Lat : S 21 : 39.923 Start Lon : E 32 : 51.995
Finish Lat : S 21 : 34.789 Finish Lon : E 32 : 54.563
Length : 10.49 km

Transect # : 11
Start Lat : S 21 : 35.931 Start Lon : E 32 : 57.187
Finish Lat : S 21 : 41.067 Finish Lon : E 32 : 54.619
Length : 10.49 km

Transect # : 12
Start Lat : S 21 : 42.211 Start Lon : E 32 : 57.242
Finish Lat : S 21 : 37.073 Finish Lon : E 32 : 59.812
Length : 10.50 km

Transect # : 13
Start Lat : S 21 : 38.215 Start Lon : E 33 : 2.436
Finish Lat : S 21 : 42.623 Finish Lon : E 33 : 0.474
Length : 8.9 km

Transect # : 14
Start Lat : S 21 : 40.061 Start Lon : E 33 : 4.708
Finish Lat : S 21 : 39.356 Finish Lon : E 33 : 5.060
Length : 1.44 km

North Border
Number of transects : 19
Transect Bearing : -48.00 Degrees (= 132.00 degrees)
Transect Spacing : 2.50 km

Transect # : 1
Start Lat : S 21 : 23.698 Start Lon : E 32 : 29.090
Finish Lat : S 21 : 25.060 Finish Lon : E 32 : 30.713
Length : 3.77 km

Transect # : 2
Start Lat : S 21 : 26.064 Start Lon : E 32 : 29.745
Finish Lat : S 21 : 21.712 Finish Lon : E 32 : 24.557
Length : 12.04 km

Transect # : 3
Start Lat : S 21 : 21.637 Start Lon : E 32 : 22.303
Finish Lat : S 21 : 27.068 Finish Lon : E 32 : 28.777
Length : 15.03 km

Transect # : 4
Start Lat : S 21 : 28.072 Start Lon : E 32 : 27.808
Finish Lat : S 21 : 22.639 Finish Lon : E 32 : 21.331
Length : 15.04 km

Transect # : 5
Start Lat : S 21 : 23.640 Start Lon : E 32 : 20.359
Finish Lat : S 21 : 29.077 Finish Lon : E 32 : 26.840
Length : 15.05 km

Transect # : 6
Start Lat : S 21 : 30.080 Start Lon : E 32 : 25.870
Finish Lat : S 21 : 24.641 Finish Lon : E 32 : 19.387
Length : 15.05 km

Transect # : 7
Start Lat : S 21 : 25.642 Start Lon : E 32 : 18.415
Finish Lat : S 21 : 31.083 Finish Lon : E 32 : 24.900
Length : 15.06 km

Transect # : 8
Start Lat : S 21 : 32.085 Start Lon : E 32 : 23.931
Finish Lat : S 21 : 26.643 Finish Lon : E 32 : 17.443
Length : 15.06 km

Transect # : 9
Start Lat : S 21 : 27.644 Start Lon : E 32 : 16.471
Finish Lat : S 21 : 33.088 Finish Lon : E 32 : 22.961
Length : 15.07 km

Transect # : 10
Start Lat : S 21 : 34.091 Start Lon : E 32 : 21.991
Finish Lat : S 21 : 28.645 Finish Lon : E 32 : 15.499
Length : 15.07 km

Transect # : 11
Start Lat : S 21 : 29.647 Start Lon : E 32 : 14.527
Finish Lat : S 21 : 35.094 Finish Lon : E 32 : 21.021
Length : 15.08 km

Transect # : 12
Start Lat : S 21 : 36.097 Start Lon : E 32 : 20.051
Finish Lat : S 21 : 30.648 Finish Lon : E 32 : 13.555
Length : 15.08 km

Transect # : 13
Start Lat : S 21 : 31.649 Start Lon : E 32 : 12.583
Finish Lat : S 21 : 37.100 Finish Lon : E 32 : 19.081
Length : 15.09 km

Transect # : 14
Start Lat : S 21 : 38.103 Start Lon : E 32 : 18.111
Finish Lat : S 21 : 32.650 Finish Lon : E 32 : 11.611
Length : 15.09 km

Transect # : 15
Start Lat : S 21 : 33.651 Start Lon : E 32 : 10.639
Finish Lat : S 21 : 39.106 Finish Lon : E 32 : 17.141
Length : 15.10 km

Transect # : 16
Start Lat : S 21 : 40.109 Start Lon : E 32 : 16.171
Finish Lat : S 21 : 34.652 Finish Lon : E 32 : 9.667
Length : 15.10 km

Transect # : 17
Start Lat : S 21 : 35.653 Start Lon : E 32 : 8.695
Finish Lat : S 21 : 41.112 Finish Lon : E 32 : 15.201
Length : 15.11 km

Transect # : 18
Start Lat : S 21 : 42.115 Start Lon : E 32 : 14.231
Finish Lat : S 21 : 36.655 Finish Lon : E 32 : 7.722
Length : 15.11 km

Transect # : 19
Start Lat : S 21 : 37.656 Start Lon : E 32 : 6.750
Finish Lat : S 21 : 43.118 Finish Lon : E 32 : 13.261
Length : 15.12 km

Border Maunge
Number of transects : 6
Transect Bearing : 42.00 Degrees
Transect Spacing : 2.50 km

Transect # : 1
Start Lat : S 21 : 38.486 Start Lon : E 32 : 7.619
Finish Lat : S 21 : 49.650 Finish Lon : E 31 : 56.809
Length : 27.82 km

Transect # : 2
Start Lat : S 21 : 50.529 Start Lon : E 31 : 57.912
Finish Lat : S 21 : 39.398 Finish Lon : E 32 : 8.691
Length : 27.74 km

Transect # : 3
Start Lat : S 21 : 40.309 Start Lon : E 32 : 9.762
Finish Lat : S 21 : 51.414 Finish Lon : E 31 : 59.008
Length : 27.67 km

Transect # : 4
Start Lat : S 21 : 52.435 Start Lon : E 31 : 59.974
Finish Lat : S 21 : 41.220 Finish Lon : E 32 : 10.833
Length : 27.94 km

Transect # : 5
Start Lat : S 21 : 42.132 Start Lon : E 32 : 11.904
Finish Lat : S 21 : 52.969 Finish Lon : E 32 : 1.410
Length : 27.01 km

Transect # : 6
Start Lat : S 21 : 53.669 Start Lon : E 32 : 2.686
Finish Lat : S 21 : 43.043 Finish Lon : E 32 : 12.976
Length : 26.48 km

Border Chefu
Number of transects : 6
Transect Bearing : 42.00 Degrees
Transect Spacing : 2.50 km

Transect # : 1
Start Lat : S 21 : 49.640 Start Lon : E 31 : 56.804
Finish Lat : S 22 : 3.892 Finish Lon : E 31 : 42.814
Length : 35.46 km

Transect # : 2
Start Lat : S 22 : 5.414 Start Lon : E 31 : 43.398
Finish Lat : S 21 : 50.523 Finish Lon : E 31 : 57.904
Length : 37.35 km

Transect # : 3
Start Lat : S 21 : 51.409 Start Lon : E 31 : 59.002
Finish Lat : S 22 : 7.230 Finish Lon : E 31 : 43.687
Length : 39.24 km

Transect # : 4
Start Lat : S 22 : 08.665 Start Lon : E 31 : 44.262
Finish Lat : S 21 : 52.433 Finish Lon : E 31 : 59.965
Length : 40.78 km

Transect # : 5
Start Lat : S 21 : 52.963 Start Lon : E 32 : 1.407
Finish Lat : S 22 : 10.475 Finish Lon : E 31 : 44.433
Length : 43.55 km

Transect # : 6
Start Lat : S 22 : 11.724 Start Lon : E 31 : 45.242
Finish Lat : S 21 : 53.668 Finish Lon : E 32 : 2.680
Length : 44.80 km

Border Limpopo
Number of transects : 7
Transect Bearing : 42.00 Degrees
Transect Spacing : 2.50 km

Transect # : 1
Start Lat : S 22 : 23.977 Start Lon : E 31 : 20.779
Finish Lat : S 22 : 25.824 Finish Lon : E 31 : 18.986
Length : 4.60 km

Transect # : 2
Start Lat : S 22 : 26.121 Start Lon : E 31 : 20.656
Finish Lat : S 22 : 7.143 Finish Lon : E 31 : 38.957
Length : 47.31 km

Transect # : 3
Start Lat : S 22 : 8.114 Start Lon : E 31 : 39.968
Finish Lat : S 22 : 25.957 Finish Lon : E 31 : 22.775
Length : 43.81 km

Transect # : 4
Start Lat : S 22 : 26.154 Start Lon : E 31 : 24.543
Finish Lat : S 22 : 9.585 Finish Lon : E 31 : 40.688
Length : 41.21 km

Transect # : 5
Start Lat : S 22 : 10.817 Start Lon : E 31 : 41.403
Finish Lat : S 22 : 26.910 Finish Lon : E 31 : 25.768
Length : 39.98 km

Transect # : 6
Start Lat : S 22 : 27.138 Start Lon : E 31 : 27.507
Finish Lat : S 22 : 12.827 Finish Lon : E 31 : 41.387
Length : 36.19 km

Transect # : 7
Start Lat : S 22 : 13.933 Start Lon : E 31 : 42.126
Finish Lat : S 22 : 27.696 Finish Lon : E 31 : 28.925
Length : 33.21 km

Appendix 4. Transect summaries of sightings

Species codes:

Code	Species
Bab	Baboon
BbJ	Black-backed jackal
Bbk	Bushbuck
BCar	Carcass buffalo
Bld	Brick building
Bpig	Bushpig
Buff	Buffalo
Camp	Poachers' camp
Cart	Scotch cart
Catt	Cattle
Croc	Crocodile
Dkr	Common or Bush Duiker
Dog	Domestic dog
Donk	Donkey
ElC3	Elephant carcass, age category 3
ElC4	Elephant carcass, age category 4
Eld	Eland
EleF	Elephant cow
EleM	Elephant bull
FCmp	Fishing camp
Fire	Fireplace
Fld	Field
Gbk	Grysbok
Ghb	Ground hornbill
Grf	Giraffe
Hipo	Hippopotamus
Hut	Hut
Hya	Hyaena
Imp	Impala
Irrig	Irrigated plot(s)
KCar	Carcass kudu
Kiln	Charcoal kiln
Klip	Klipspringer
Kudu	Kudu
Lion	Lion
Log	Commercial logging
Nyl	Nyala
Orib	Oribi
Ost	Ostrich
Rbk	Reedbuck
Roan	Roan antelope
Sbk	Steinbuck
Shoa	Sheep and/or goats
TCut	Tree cutting
Trap	Fish trap
Verv	Vervet monkey

Code	Species
Water	Pan or other source of water for wildlife
Wbck	Waterbuck
Wbst	Wildebeest
Whog	Warthog
Zeb	Zebra

Other abbreviations

Abbreviation	Meaning
n	number of transects sampled
N	possible number of transects in stratum
t	Student's *t* value, $P = 0.05$
T #	transect number
-	no animals were seen in search strips

The following tables list, for each stratum, the number of individuals of each species that were seen inside the search strips on each transect.

Date of Survey : 04/09/09 | **Stratum Name : Chipinda Pools**
Stratum Locality : Gonarezhou | **Base Line Length : 58 km**
Stratum Area : 1167 km^2 | **Calibrated Strip Width at 300ft : 304 m**
N : 187 n : 38 | **t : 2.0262**
Pilot : Van der Westhuizen | **Observer : Shimbani, Mungoni**
Map overlay file : None

Transect summary table :

T #	EleM	EleF	Buff	Zeb	Wbck	Imp	Kudu	Hipo	Camp	Catt	Shoa	Donk	Sbk	Whog	Hut	Ghb	Nyl	KCar
1	-	-	-	-	-	8	6	-	-	-	-	-	-	-	-	-	-	-
2	1	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-
3	6	-	-	-	16	3	-	13	-	-	-	-	1	-	-	-	-	-
4	2	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	8	-	2	-	27	1	1	-	2	-	-	-	2	-	-	-	-
6	-	-	-	-	-	15	-	-	-	-	-	-	-	-	-	-	-	-
7	2	9	-	6	28	-	19	1	1	20	-	-	-	-	11	-	-	-
8	-	-	-	-	10	-	-	-	-	62	30	-	-	-	14	-	-	-
9	-	-	-	6	5	1	18	-	-	20	-	-	-	-	27	-	-	-
10	2	-	-	5	-	-	5	-	-	74	5	11	-	-	13	3	-	-
11	-	1	-	-	-	10	13	-	-	42	-	-	1	-	12	4	-	-
12	2	10	-	-	-	13	33	-	-	47	18	-	-	-	8	4	-	1
13	-	31	-	8	-	35	6	-	2	58	21	-	-	-	18	-	3	-
14	1	65	-	4	-	18	15	-	-	63	-	-	-	-	1	4	-	-
15	5	49	-	-	-	-	3	-	-	13	-	-	-	-	3	-	-	-
16	6	81	-	-	1	10	4	-	-	153	-	-	-	2	2	-	-	-
17	1	20	-	-	-	-	24	-	-	32	5	-	-	-	17	-	-	-
18	3	46	-	5	-	6	4	-	-	11	-	-	-	-	-	-	-	-
19	1	-	-	2	-	12	49	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	3	-	57	6	-	1	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-
22	2	-	-	-	-	12	-	-	1	-	-	-	-	-	-	-	-	-
23	-	28	-	-	-	26	8	-	1	-	-	-	-	2	-	-	-	-
24	-	11	1	-	-	6	20	-	-	-	-	-	-	-	-	-	-	-
25	1	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	2	-	1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
27	6	7	-	-	-	-	-	5	-	-	-	-	-	-	-	5	-	-
28	-	11	-	6	-	20	-	-	2	-	-	-	-	1	-	-	-	-
29	-	-	-	-	-	-	4	-	2	-	-	-	-	-	-	-	-	-
30	-	27	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-
31	-	47	-	-	-	70	-	-	-	-	-	-	-	-	-	-	-	-
32	-	-	-	-	-	34	-	-	-	-	-	-	-	-	-	-	-	-
33	-	4	-	-	-	50	-	26	-	-	-	-	-	-	-	-	2	-
34	3	14	-	10	-	-	-	-	-	-	-	-	-	-	-	-	3	-
35	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sighting Totals

	EleM	EleF	Buff	Zeb	Wbck	Imp	Kudu	Hipo	Camp	Catt	Shoa	Donk	Sbk	Whog	Hut	Ghb	Nyl	KCar
	45	486	1	62	68	439	241	46	10	597	79	11	2	7	126	23	8	1

Date of Survey : 04/09/09 | **Stratum Name : Chipinda Pools**
Stratum Locality : Gonarezhou | **Base Line Length : 58 km**
Stratum Area : 1167 km^2 | **Calibrated Strip Width at 300ft : 304 m**
N : 187 **n : 38** | **t : 2.0262**
Pilot : Van der Westhuizen | **Observer : Shimbani, Mungoni**
Map overlay file : None

Transect summary table :

T #	Grf	Wbst	Bld	Ost	Croc	Eld	Klip	Cart	Bbk
1	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	1	-
6	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	1	-
12	-	-	-	-	-	-	-	-	-
13	4	-	-	-	-	-	-	-	-
14	-	1	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-
16	-	1	-	-	-	5	-	-	-
17	-	-	3	-	-	-	-	-	-
18	-	-	-	1	-	-	-	-	-
19	-	16	-	1	-	-	-	-	-
20	1	-	-	-	-	-	-	-	-
21	-	-	-	-	1	-	-	-	-
22	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	8	3	-	-
24	-	-	-	-	-	-	-	-	-
25	-	-	-	-	5	-	-	-	-
26	-	-	-	-	-	-	-	-	-
27	-	-	-	-	1	-	-	-	-
28	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-
30	-	-	-	-	-	41	-	-	-
31	-	-	-	-	-	-	-	-	-
32	-	-	-	-	1	-	-	-	-
33	-	-	-	-	26	-	-	-	3
34	-	-	2	-	3	-	-	-	-
35	-	-	-	-	-	-	-	-	1
36	-	-	-	-	2	-	-	-	-
37	-	-	-	-	-	-	-	-	-
38	-	-	-	-	-	-	-	-	-

Sighting Totals

	Grf	Wbst	Bld	Ost	Croc	Eld	Klip	Cart	Bbk
	5	18	5	2	39	54	3	2	4

Date of Survey : 07/09/09
Stratum Locality : Gonarezhou
Stratum Area : 460 km^2
N : 82 n : 17
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : Chilojo A
Base Line Length : 25.2 km
Calibrated Strip Width at 300ft : 304 m
t : 2.12
Observer : Shimbani, Mungoni

Transect summary table :

T #	EleM	EleF	Buff	Kudu	ElC3	UnCa	Camp	Ghb	Croc	Dkr	Nyl	Klip	Bbk
1	-	-	-	-	-	-	-	-	-	-	-	-	-
2	1	-	-	-	-	-	-	4	-	-	-	-	-
3	-	-	-	3	-	-	-	-	-	-	-	-	-
4	-	-	-	1	-	1	-	-	1	-	-	-	-
5	-	-	-	-	-	-	-	-	-	1	-	-	-
6	5	22	-	-	-	-	-	-	-	-	-	-	-
7	9	9	-	-	1	-	-	-	-	-	-	-	-
8	3	63	-	12	-	-	-	-	-	-	3	-	-
9	-	-	-	24	-	1	-	-	-	-	2	4	-
10	2	40	17	-	-	-	-	-	-	-	-	-	1
11	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	32	-	-	-	-	-	4	-	-	1	-	-
13	-	61	200	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	2	-	5	-	-
15	-	-	-	-	-	1	-	-	-	-	3	-	-
16	-	-	-	-	-	-	1	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-

Sighting Totals

	EleM	EleF	Buff	Kudu	ElC3	UnCa	Camp	Ghb	Croc	Dkr	Nyl	Klip	Bbk
	20	227	217	40	1	3	1	8	3	1	14	4	1

Date of Survey : 03/09/09
Stratum Locality : Gonarezhou
Stratum Area : 221 km^2
N : 80 n : 9
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : Mahenye
Base Line Length : 25.5 km
Calibrated Strip Width at 300ft : 304 m
t : 2.306
Observer : Shimbani, Mungoni

Transect summary table :

T #	Catt	Shoa	Donk	Hut	Bld
1	17	-	2	-	1
2	17	24	-	23	2
3	40	12	1	40	5
4	27	-	-	-	-
5	17	-	-	-	-
6	-	-	-	-	-
7	-	-	-	-	-
8	27	-	-	13	-
9	65	5	-	18	1

Sighting Totals

	Catt	Shoa	Donk	Hut	Bld
	210	41	3	94	9

Date of Survey : 05/09/09
Stratum Locality : Gonarezhou
Stratum Area : 602 km^2
N : 150 n : 32
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : Chilojo B
Base Line Length : 47.4 km
Calibrated Strip Width at 300ft : 304 m
t : 2.0395
Observer : Shimbani, Mungoni

Transect summary table :

T #	EleM	EleF	Buff	Zeb	Imp	Kudu	Hipo	EIC3	Croc	Whog	Nyl	Bbk	Ost	Dkr	Ghb	Sbk	UnCa	Gbk
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	3	9	2	-	-	-	-	-	-
4	-	6	-	-	-	-	-	-	-	-	2	-	3	1	-	-	-	-
5	1	25	-	-	20	-	-	-	1	-	-	-	-	-	3	-	-	-
6	-	20	-	-	115	-	-	-	-	6	-	-	-	-	-	-	-	-
7	3	-	-	8	140	5	-	-	-	22	5	-	-	-	-	1	-	-
8	2	58	1	-	8	-	-	-	-	-	2	1	-	-	-	-	-	-
9	2	32	-	27	-	-	12	1	2	-	-	-	-	-	-	1	-	-
10	-	-	-	-	2	-	-	-	-	-	16	-	-	-	-	-	-	-
11	2	-	12	3	8	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	7	2	4	-	-	-	-	-	3	-	-	-	-	-	-	1
14	-	-	-	-	5	6	-	-	1	-	-	-	2	-	-	-	-	-
15	-	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	1	-	-	16	14	-	-	1	4	-	-	-	-	-	-	-	-	-
17	-	27	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
18	-	8	-	-	-	2	-	-	-	-	2	-	-	-	-	-	-	-
19	-	19	-	-	-	6	-	1	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	1	-	-	-	8	-	-	-	-	-	-	-	1	-	2	-	-	-
22	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	-
23	3	-	-	-	-	-	-	1	1	-	1	-	-	-	-	-	-	-
24	-	47	-	-	-	-	-	2	-	-	-	-	-	1	-	1	-	-
25	-	13	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
26	-	-	-	18	5	-	-	-	-	-	-	-	-	-	-	-	-	1
27	4	17	-	-	-	-	-	1	-	-	-	-	-	-	-	-	2	-
28	-	-	-	-	-	-	-	1	-	-	2	-	-	1	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	-	29	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
31	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-	-	1	-
32	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sighting Totals

	EleM	EleF	Buff	Zeb	Imp	Kudu	Hipo	EIC3	Croc	Whog	Nyl	Bbk	Ost	Dkr	Ghb	Sbk	UnCa	Gbk
	20	358	20	74	329	20	12	9	12	34	42	3	6	7	5	3	4	2

Date of Survey : 05/09/09
Stratum Locality : Gonarezhou
Stratum Area : 602 km^2
N : 150 n : 32
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : Chilojo B
Base Line Length : 47.4 km
Calibrated Strip Width at 300ft : 304 m
t : 2.039
Observer : Shimbani, Mungoni

Transect summary table :

T #	Wbst	Grf	BbJ	Roan	Eld
1	-	-	-	-	-
2	-	-	-	-	-
3	-	-	-	-	-
4	-	-	-	-	-
5	-	-	-	-	-
6	-	-	-	-	-
7	-	-	-	-	-
8	-	-	-	-	-
9	-	-	-	-	-
10	-	-	-	-	-
11	-	-	-	-	-
12	-	-	-	-	-
13	3	-	-	-	-
14	-	-	-	-	-
15	-	-	-	-	-
16	-	3	-	-	-
17	-	3	-	-	-
18	-	-	1	-	-
19	-	-	-	-	-
20	-	-	-	-	-
21	20	6	-	1	3
22	-	2	-	-	-
23	-	-	-	-	-
24	15	-	-	-	-
25	-	-	-	-	-
26	-	1	-	-	-
27	-	-	-	-	-
28	-	-	-	-	-
29	-	-	-	-	-
30	-	-	-	-	-
31	-	-	-	-	-
32	-	-	-	-	-

Sighting Totals

	Wbst	Grf	BbJ	Roan	Eld
	38	15	1	1	3

Date of Survey : 08/09/09 | **Stratum Name : Naivasha**
Stratum Locality : Gonarezhou | **Base Line Length : 39.5 km**
Stratum Area : 884 km^2 | **Calibrated Strip Width at 300ft : 304 m**
N : 132 n : 27 | **t : 2.056**
Pilot : Van der Westhuizen | **Observer : Shimbani, Mungoni**
Map overlay file : None

Transect summary table :

T #	EleM	EleF	Buff	Zeb	Imp	Kudu	EIC3	EIC4	UnCa	Sbk	Dkr	Ghb	Grf	Gbk	Whog	Nyl
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	3	-	1	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
6	1	-	-	-	9	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	4	6	-	3	1	-	-	-	-	-	-	-
8	-	-	-	-	4	-	-	1	1	3	-	-	-	-	-	-
9	-	-	-	-	3	-	-	-	3	-	2	1	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
11	1	15	-	-	-	7	-	-	-	-	1	-	1	-	-	-
12	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
13	-	26	-	3	-	14	-	-	-	-	2	-	1	1	-	-
14	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	24	-	-	-	3	-	-	-	-	-	-	8	-	1	-
17	-	-	-	-	-	2	-	-	1	-	-	7	-	-	-	-
18	-	3	-	-	9	12	-	-	-	-	-	5	14	-	-	-
19	-	7	-	-	-	-	-	-	-	-	1	-	-	-	-	-
20	3	-	50	-	-	3	-	-	-	-	-	-	-	-	-	-
21	-	46	-	11	5	8	-	-	-	-	-	-	-	-	-	-
22	-	-	30	15	-	-	-	-	1	-	-	-	-	-	-	-
23	3	11	-	-	6	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
25	-	35	-	-	-	-	-	-	-	-	-	-	-	-	-	1
26	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sighting Totals

	EleM	EleF	Buff	Zeb	Imp	Kudu	EIC3	EIC4	UnCa	Sbk	Dkr	Ghb	Grf	Gbk	Whog	Nyl
	10	183	80	29	45	55	1	4	7	4	8	13	24	1	1	1

Date of Survey : 09/09/09
Stratum Locality : Gonarezhou
Stratum Area : 1017 km^2
N : 118 n : 14
Pilot : Van der Westheizen
Map overlay file : None

Stratum Name : Chefu
Base Line Length : 36.2 km
Calibrated Strip Width at 300ft : 304 m
t : 2.16
Observer : Shimbani, Mungoni

Transect summary table :

T #	EleM	EleF	Zeb	Imp	Kudu	EIC4	UnCa	Dkr	Sbk	Ost	Grf	Whog
1	4	-	-	-	-	1	1	-	-	-	-	-
2	4	10	-	-	1	-	-	1	-	-	-	-
3	-	-	2	49	18	1	-	2	2	-	-	-
4	-	-	-	-	-	-	4	1	1	1	-	-
5	3	-	-	26	3	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	1	-
7	-	8	2	-	3	-	-	1	-	-	-	-
8	7	15	-	31	1	-	-	-	-	-	-	-
9	2	46	-	7	-	-	1	-	-	-	-	4
10	-	15	4	20	-	-	-	-	-	-	-	-
11	1	26	-	-	-	-	-	1	-	-	-	-
12	-	5	-	-	4	-	-	-	-	-	-	-
13	-	37	-	-	-	-	1	1	-	-	-	-
14	-	-	4	-	-	-	-	-	-	-	-	-

Sighting Totals

	EleM	EleF	Zeb	Imp	Kudu	EIC4	UnCa	Dkr	Sbk	Ost	Grf	Whog
	21	162	12	133	30	2	7	7	3	1	1	4

Date of Survey : 03/09/09
Stratum Locality : Gonarezhou
Stratum Area : 221 km^2
N : 110 n : 13
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : Chingwesi
Base Line Length : 33.3 km
Calibrated Strip Width at 300ft : 304 m
t : 2.179
Observer : Shimbani, Mungoni

Transect summary table :

T #	UnCa	Catt	Shoa	Donk	Hut	Bld
1	-	-	-	3	3	-
2	-	-	-	-	28	-
3	-	70	7	-	6	16
4	1	13	15	-	43	4
5	-	19	33	-	34	1
6	-	20	15	-	3	-
7	-	20	15	-	6	-
8	-	77	6	-	16	-
9	-	-	14	-	-	-
10	-	-	-	-	-	-
11	-	-	-	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-

Sighting Totals

	UnCa	Catt	Shoa	Donk	Hut	Bld
	1	219	105	3	139	21

Date of Survey : 11/09/09 | **Stratum Name : Mabalauta NP**
Stratum Locality : Gonarezhou | **Base Line Length : 44.4 km**
Stratum Area : 820 km^2 | **Calibrated Strip Width at 300ft : 304 m**
N : 146 n : 30 | **t : 2.045**
Pilot : Van der Westhuizen | **Observer : Shimbani, Mungoni**
Map overlay file : None

Transect summary table :

T #	EleM	EleF	Buff	Zeb	Wbck	Imp	Kudu	EIC3	EIC4	UnCa	Catt	Shoa	Hut	Bld	Eld	Nyl	Grf	Gbk
1	-	-	-	-	-	-	-	-	-	-	8	10	13	1	-	-	-	-
2	-	50	-	-	-	-	2	-	-	1	-	-	-	-	1	6	1	1
3	-	10	12	-	-	-	2	-	-	-	-	-	-	-	7	-	-	-
4	-	-	19	10	-	10	-	2	-	-	-	-	-	-	-	-	-	1
5	1	-	10	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	2	-	-	-	-	-	-	-	-	-	-	1	-	-	-
7	2	-	-	9	-	-	1	-	-	1	-	-	-	-	-	-	-	-
8	2	-	-	2	-	1	3	-	1	-	-	-	-	-	-	-	-	-
9	-	16	-	14	-	-	3	-	-	1	-	-	-	-	-	-	-	-
10	-	6	7	11	-	50	9	-	1	2	-	-	-	-	-	-	-	-
11	-	15	40	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
12	5	12	15	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	1	20	-	-	1	103	-	-	-	-	-	-	-	-	-	1	-	-
14	2	-	5	-	-	-	2	-	-	-	-	-	-	-	-	-	1	-
15	-	6	-	-	-	-	2	-	-	1	-	-	-	3	-	5	1	-
16	3	-	6	4	-	33	13	1	-	-	-	-	-	-	-	-	-	-
17	1	-	-	9	-	-	7	-	-	2	-	-	-	-	-	-	-	-
18	-	26	-	-	1	6	-	-	-	-	-	-	-	-	-	-	-	-
19	-	4	1	12	-	-	7	-	-	2	-	-	-	-	-	-	-	-
20	1	7	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	3	4	1	-	-	-	-	-	-	-	-	-	-
22	3	7	-	-	5	-	9	-	1	1	-	-	-	5	-	-	-	-
23	-	3	-	6	-	5	-	-	-	-	-	-	-	-	-	-	-	-
24	2	10	-	-	-	-	2	-	-	1	-	-	-	-	-	-	-	-
25	1	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
26	-	10	31	4	-	-	-	-	-	1	-	-	-	-	-	-	3	-
27	1	3	-	3	-	-	-	-	1	-	4	-	-	-	-	-	-	-
28	1	-	-	-	-	-	-	-	-	1	-	-	5	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	15	5	3	-	-	-	-	-
30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sighting Totals

	EleM	EleF	Buff	Zeb	Wbck	Imp	Kudu	EIC3	EIC4	UnCa	Catt	Shoa	Hut	Bld	Eld	Nyl	Grf	Gbk
	26	205	146	101	7	211	66	4	4	17	27	15	21	9	9	12	6	2

Date of Survey : 11/09/09 | **Stratum Name : Mabalauta NP**
Stratum Locality : Gonarezhou | **Base Line Length : 44.4 km**
Stratum Area : 820 km^2 | **Calibrated Strip Width at 300ft : 304 m**
N : 146 **n : 30** | **t : 2.045**
Pilot : Van der Westhuizen | **Observer : Shimbani, Mungoni**
Map overlay file : None

Transect summary table :

T #	Sbk	Croc	BCar	Ghb	Whog	Dkr	Wbst	KCar	Lion	Fire	Fld
1	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-
3	2	-	-	-	-	-	-	-	-	-	-
4	-	5	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-
6	1	-	-	-	-	-	-	-	-	-	-
7	-	-	1	-	-	-	-	-	-	-	-
8	-	-	-	1	-	-	-	-	-	-	-
9	-	-	-	-	4	1	-	-	-	-	-
10	-	-	-	-	3	2	-	-	-	-	-
11	-	1	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	20	-	-	-	-
19	-	-	-	6	-	-	-	-	-	-	-
20	-	1	-	3	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	1	-	-	-
22	1	-	-	8	-	2	-	-	3	-	-
23	1	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-
26	1	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	6	-
28	-	-	-	-	-	-	-	-	-	3	-
29	-	-	-	-	-	-	-	-	-	5	6
30	-	-	-	-	-	-	-	-	-	-	-

Sighting Totals

	Sbk	Croc	BCar	Ghb	Whog	Dkr	Wbst	KCar	Lion	Fire	Fld
	6	7	1	18	7	5	20	1	3	14	6

Date of Survey : 11/09/09
Stratum Locality : Gonarezhou
Stratum Area : 175 km^2
N : 105 n : 21
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : Malapati
Base Line Length : 32.4 km
Calibrated Strip Width at 300ft : 304 m
t : 2.086
Observer : Shimbani, Mungoni

Transect summary table :

T #	Buff	Zeb	Imp	Kudu	UnCa	Bbk	Croc	Dkr	Catt
1	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	1	-	-	-
5	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-
9	-	1	-	-	-	-	-	-	-
10	90	-	-	-	-	-	1	-	-
11	-	-	-	-	-	-	-	-	-
12	-	-	11	-	3	-	-	2	-
13	-	-	6	1	-	-	-	-	-
14	-	-	16	-	1	-	-	-	5
15	-	-	-	-	-	-	-	-	-
16	-	-	-	8	1	-	-	-	-
17	-	3	10	5	-	-	-	-	-
18	-	-	-	-	-	1	-	-	-
19	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-
21	-	-	-	-	1	-	-	-	-

Sighting Totals

	Buff	Zeb	Imp	Kudu	UnCa	Bbk	Croc	Dkr	Catt
	90	4	43	14	6	2	1	2	5

Date of Survey : 08/09/09
Stratum Locality : Gonarezhou
Stratum Area : 247 km^2
N : 79 n : 9
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : Matibi
Base Line Length : 24 km
Calibrated Strip Width at 300ft : 304 m
t : 2.306
Observer : Shimbani, Mungoni

Transect summary table :

T #	EleM	Zeb	Kudu	UnCa	Ghb
1	-	-	-	-	-
2	1	-	-	-	-
3	-	-	-	-	-
4	-	-	-	-	-
5	-	-	2	-	-
6	-	-	-	1	-
7	-	-	-	-	2
8	-	-	-	-	-
9	-	4	-	-	-

Sighting Totals

	EleM	Zeb	Kudu	UnCa	Ghb
	1	4	2	1	2

Date of Survey : 12/09/09
Stratum Locality : Gonarezhou
Stratum Area : 122 km^2
N : 94 n : 11
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : Gonakudzingwa
Base Line Length : 27 km
Calibrated Strip Width at 300ft : 304 m
t : 2.228
Observer : Shimbani, Mungoni

Transect summary table :

T #	Imp	UnCa	Catt	Shoa	Donk	Hut	Bld	KCar
1	-	1	-	-	-	-	-	-
2	-	-	-	-	-	-	-	1
3	-	-	-	-	-	-	-	-
4	-	-	25	-	-	-	-	-
5	3	-	-	-	-	-	-	-
6	-	-	-	-	-	-	1	-
7	-	-	32	20	-	2	6	-
8	-	-	-	-	-	-	-	-
9	-	1	7	-	-	-	4	-
10	-	-	26	5	2	9	1	-
11	-	-	10	10	-	6	1	-

Sighting Totals

	Imp	UnCa	Catt	Shoa	Donk	Hut	Bld	KCar
	3	2	100	35	2	17	13	1

Date of Survey : 11/09/09
Stratum Locality : Gonarezhou
Stratum Area : 204 km^2
N : 140 n : 17
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : Masukwe
Base Line Length : 41.7 km
Calibrated Strip Width at 300ft : 304 m
t : 2.12
Observer : Shimbani, Mungoni

Transect summary table :

T #	Dkr	Catt	Shoa	Donk	Hut	Bld
1	-	71	-	7	-	-
2	1	42	4	1	19	5
3	-	-	-	-	5	1
4	-	35	11	-	9	1
5	-	22	25	3	8	-
6	-	6	12	-	17	1
7	-	15	-	3	-	-
8	-	45	30	-	17	3
9	-	34	37	2	18	1
10	-	4	-	1	23	3
11	-	11	38	-	12	5
12	-	13	-	-	6	2
13	-	31	15	-	5	2
14	-	-	6	2	2	-
15	-	-	-	-	-	-
16	-	37	57	15	20	3
17	-	28	10	-	18	7

Sighting Totals

	Dkr	Catt	Shoa	Donk	Hut	Bld
	1	394	245	34	179	34

Date of Survey : 10/09/09
Stratum Locality : Gonarezhou
Stratum Area : 972 km^2
N : 74 n : 10
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : Sengwe
Base Line Length : 22.7 km
Calibrated Strip Width at 300ft : 304 m
t : 2.262
Observer : Shimbani, Mungoni

Transect summary table :

T #	EleM	Buff	Imp	Kudu	UnCa	Catt	Shoa	Donk	Hut	Bld	Klip	Dog	Croc	Hya	Grf	Sbk	Ghb
1	-	-	-	-	-	200	97	18	93	10	1	-	-	-	-	-	2
2	-	4	-	4	1	108	116	18	60	34	-	1	-	-	-	-	-
3	-	-	-	-	1	138	208	-	87	15	-	3	10	-	-	-	-
4	-	-	-	-	-	159	189	13	90	8	-	1	-	-	-	-	-
5	-	-	-	-	1	172	133	15	74	22	-	-	-	-	-	-	-
6	-	-	-	-	-	66	136	7	53	9	-	-	-	-	-	-	-
7	2	-	-	-	1	66	120	2	57	9	-	-	-	1	-	-	-
8	-	-	-	-	4	46	109	5	5	-	-	-	-	-	1	-	-
9	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	3	35	-	11	15	-	-	-	-	-	1	-

Sighting Totals

	EleM	Buff	Imp	Kudu	UnCa	Catt	Shoa	Donk	Hut	Bld	Klip	Dog	Croc	Hya	Grf	Sbk	Ghb
	2	4	3	4	8	958	1143	78	530	122	1	5	10	1	1	1	2

Date of Survey : 06/09/09
Stratum Locality : Gonarezhou / Zinave
Stratum Area : 661 km^2
N : 154 n : 19
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : North Border
Base Line Length : 46.9 km
Calibrated Strip Width at 300ft : 304 m
t : 2.101
Observer : Shimbani, Mungoni

Transect summary table :

T #	EleM	EleF	Zeb	Imp	Kudu	EIC3	Camp	Dkr	Sbk	Ghb	Gbk	Eld	Grf	Ost	Nyl	Bpig	Whog	Bld
1	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-
2	-	-	-	-	4	-	-	1	-	-	-	-	-	-	-	-	-	-
3	1	-	8	30	2	-	-	3	1	3	-	-	-	-	-	-	-	-
4	-	-	-	-	-	1	1	2	2	-	1	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	4	1	-	-	-	-	-	-	-	-	-
6	-	-	-	-	3	1	-	1	-	-	-	1	1	-	-	-	-	-
7	-	12	-	-	-	-	-	1	1	-	-	-	8	1	-	-	-	-
8	-	-	-	15	6	-	-	2	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	3	-	-	-	-	-	-	1	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	2	-	-	-	2	-	-	-	3	-	-
12	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	4	-	-	2	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-	5

Sighting Totals

	EleM	EleF	Zeb	Imp	Kudu	EIC3	Camp	Dkr	Sbk	Ghb	Gbk	Eld	Grf	Ost	Nyl	Bpig	Whog	Bld
	1	12	8	45	23	3	1	25	6	3	1	3	9	1	1	3	1	5

Date of Survey : 07/09/09
Stratum Locality : Gonarezhou / Zinave
Stratum Area : 417 km^2
N : 48 n : 6
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : Border Maunge
Base Line Length : 15.1 km
Calibrated Strip Width at 300ft : 304 m
t : 2.571
Observer : Shimbani, Mungoni

Transect summary table :

T #	Kudu	Dkr	Sbk	Ghb
1	-	-	-	-
2	-	-	-	-
3	2	1	-	-
4	-	2	-	-
5	-	-	-	-
6	-	1	1	3

Sighting Totals

	Kudu	Dkr	Sbk	Ghb
	2	4	1	3

Date of Survey : 09/09/09
Stratum Locality : Gonarezhou / Zinave
Stratum Area : 594 km^2
N : 48 n : 6
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : Border Chefu
Base Line Length : 15.1 km
Calibrated Strip Width at 300ft : 304 m
t : 2.571
Observer : Shimbani, Mungoni

Transect summary table :

T #	Catt	Shoa	Donk	Hut	Bld	Dkr	Ghb
1	92	-	2	-	2	-	-
2	-	5	-	6	-	-	-
3	7	10	4	11	-	-	-
4	12	-	-	-	1	-	-
5	38	-	-	15	-	-	3
6	3	-	-	21	2	4	-

Sighting Totals

	Catt	Shoa	Donk	Hut	Bld	Dkr	Ghb
	152	15	6	53	5	4	3

Date of Survey : 10/09/09
Stratum Locality : Gonarezhou / Zinave
Stratum Area : 614 km^2
N : 55 n : 7
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : Border Limpopo
Base Line Length : 16.8 km
Calibrated Strip Width at 300ft : 304 m
t : 2.447
Observer : Shimbani, Mungoni

Transect summary table :

T #	EleM	UnCa	Catt	Shoa	Donk	Hut	Bld	Sbk	Kiln	Ghb
1	4	-	1	15	-	6	-	-	-	-
2	-	1	12	98	10	51	5	1	-	-
3	-	-	85	20	16	23	3	-	28	-
4	-	1	111	88	13	104	21	-	7	-
5	-	-	69	42	6	9	2	-	1	-
6	-	1	25	25	-	6	-	-	-	-
7	-	-	33	7	-	2	-	-	-	1

Sighting Totals

	EleM	UnCa	Catt	Shoa	Donk	Hut	Bld	Sbk	Kiln	Ghb
	4	3	336	295	45	201	31	1	36	1

Date of Survey : 19/09/09
Stratum Locality : Gonarezhou / Zinave
Stratum Area : 681 km^2
N : 215 n : 14
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : Southern Corridor
Base Line Length : 68.5 km
Calibrated Strip Width at 300ft : 304 m
t : 2.16
Observer : Shimbani, Mungoni

Transect summary table :

T #	Catt	Shoa	Log	Dkr	Hut	Bld	Wat	Dog	Fld
1	-	-	2	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	2
3	-	-	-	3	2	-	-	-	1
4	-	-	-	-	-	-	-	-	-
5	-	-	8	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	11
7	8	5	-	1	21	-	-	-	10
8	47	47	3	-	95	18	1	-	16
9	-	-	6	-	-	-	-	-	2
10	5	30	-	-	56	-	-	1	30
11	-	2	-	-	9	-	-	-	14
12	-	-	-	-	16	-	-	-	28
13	-	6	1	-	16	-	-	-	41
14	-	-	-	-	3	-	-	-	-

Sighting Totals

	Catt	Shoa	Log	Dkr	Hut	Bld	Wat	Dog	Fld
	60	90	20	4	218	18	1	1	155

Date of Survey : 18/09/09
Stratum Locality : Gonarezhou / Zinave
Stratum Area : 1111 km^2
N : 262 n : 34
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : Save Corridor
Base Line Length : 84.7 km
Calibrated Strip Width at 300ft : 304 m
t : 2.0345
Observer : Shimbani, Mungoni

Transect summary table :

T #	UnCa	Catt	Shoa	Donk	Dkr	Hut	Log	Bld	Sbk	Croc	FCmp	Dog	Verv	Wat	Fld	Trap	Irig
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	10	15	-	2	9	-	-	-	-	-	-	-	-	-	3	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	12	20	-	-	46	30	-	-	-	-	2	-	-	-	-	-
5	-	15	-	-	1	4	20	-	-	-	-	-	-	-	-	-	-
6	-	9	10	-	2	37	27	-	-	-	-	1	-	-	7	-	-
7	-	67	88	-	-	63	18	5	-	-	-	-	-	-	-	-	-
8	-	-	3	-	-	24	2	-	-	-	-	-	-	-	2	3	-
9	-	45	26	-	-	32	19	-	-	-	-	-	-	-	-	-	-
10	-	19	61	-	1	31	10	-	-	-	-	-	-	-	-	-	-
11	-	50	-	3	-	45	28	2	-	-	-	1	-	-	-	-	-
12	-	6	-	-	-	15	4	-	-	-	-	-	1	-	-	2	-
13	-	90	27	-	-	28	1	-	-	-	-	3	-	1	-	-	-
14	-	5	5	-	2	33	17	-	-	-	-	-	-	-	5	-	-
15	-	20	-	-	-	17	8	-	1	-	-	-	-	-	1	-	-
16	-	-	13	-	-	25	17	-	-	-	-	-	-	-	34	-	-
17	-	34	40	-	-	25	28	1	-	-	-	1	-	-	35	-	-
18	-	37	36	-	-	22	4	-	-	-	-	-	-	-	16	-	-
19	-	107	60	-	1	6	6	-	-	-	-	-	-	-	8	-	-
20	-	40	-	-	2	8	-	-	-	-	-	-	-	-	8	-	-
21	-	133	65	-	-	57	7	1	-	-	-	5	-	-	7	1	-
22	-	46	35	-	-	1	18	-	-	-	-	-	-	-	59	-	-
23	-	100	60	-	1	17	-	-	-	-	-	-	-	-	8	2	-
24	-	-	35	-	-	6	-	-	1	-	-	-	-	1	7	1	-
25	-	15	10	-	-	13	1	-	-	-	-	-	-	-	18	1	-
26	-	180	30	-	-	6	1	2	1	1	2	-	-	-	25	-	1
27	-	8	10	-	-	87	2	2	-	-	-	-	-	-	12	-	-
28	1	-	12	-	-	60	-	-	-	-	-	-	-	-	18	-	-
29	-	11	3	-	-	29	9	3	-	-	-	-	-	-	28	-	-
30	-	-	11	-	-	27	3	-	-	-	-	-	-	2	5	-	-
31	-	-	20	-	-	47	-	2	-	-	2	-	-	1	43	3	-
32	-	35	30	-	1	52	12	-	-	-	1	-	-	-	25	3	-
33	-	-	-	-	1	1	2	-	-	-	-	-	-	-	1	-	-
34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sighting Totals

	UnCa	Catt	Shoa	Donk	Dkr	Hut	Log	Bld	Sbk	Croc	FCmp	Dog	Verv	Wat	Fld	Trap	Irig
	1	1094	725	3	14	873	294	18	3	1	5	13	1	5	372	19	1

Date of Survey : 17/09/09 | **Stratum Name : North Zinave**
Stratum Locality : Coutada 4 / Zinave | **Base Line Length : 91.8 km**
Stratum Area : 1159 km^2 | **Calibrated Strip Width at 300ft : 304 m**
N : 295 **n : 46** | **t : 2.0141**
Pilot : Van der Westhuizen | **Observer : Shimbani, Mungoni**
Map overlay file : None

Transect summary table :

T #	Catt	Shoa	Ghb	Hut	FCmp	Orib	Dkr	Bpig	Sbk	Croc	Wat	Nyl	Bld	UnCa	Dog	Fld	Trap
1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	10	-	3	1	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	1	-
4	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-
5	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	4	-	-	-	1	-	-	-	-	-	-	-	2	-
7	-	-	-	5	-	1	1	-	-	-	-	-	-	-	-	1	-
8	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-
10	-	-	-	2	-	-	1	-	-	-	-	-	-	-	-	-	-
11	-	20	2	11	-	-	-	-	-	-	-	-	-	-	-	1	-
12	-	20	-	7	1	-	1	-	1	-	-	-	-	-	-	-	-
13	-	-	-	6	-	-	2	-	-	-	-	-	-	-	-	4	-
14	-	2	-	6	1	-	1	-	-	2	-	-	-	-	-	6	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
17	-	-	-	1	-	-	1	-	1	-	-	-	-	-	-	1	-
18	-	-	-	12	1	-	-	-	-	-	-	-	-	-	-	2	-
19	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
21	10	-	-	8	-	-	2	-	-	-	-	-	-	-	-	3	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
23	-	-	-	14	-	-	-	-	-	-	-	-	-	-	-	5	-
24	-	-	-	5	-	-	1	-	-	-	-	-	-	-	-	3	-
25	-	10	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	14	-	-	-	-	-	-	-	-	-	-	-	7	2
27	2	-	-	11	-	-	-	-	-	-	-	-	-	-	-	4	-
28	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1
29	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-
30	-	-	-	20	-	-	-	-	-	-	-	-	-	-	-	6	-
31	15	-	-	2	-	-	-	-	-	-	1	-	-	-	-	9	-
32	5	15	-	12	-	-	-	-	-	-	1	-	-	-	-	1	-
33	-	-	-	9	-	-	-	-	-	-	-	-	-	-	-	7	-
34	-	-	-	17	-	-	-	-	-	-	1	-	-	-	-	10	-
35	-	-	-	5	-	-	-	-	-	-	-	4	-	-	-	2	-
36	-	8	-	34	-	-	1	-	-	-	-	-	1	-	-	13	-
37	-	1	-	22	-	-	-	-	-	-	-	-	-	-	1	14	-
38	-	10	-	76	-	-	-	-	-	-	-	-	1	-	-	21	-
39	-	-	-	29	-	-	-	-	-	-	2	-	1	-	-	26	-
40	-	-	-	23	-	-	-	-	-	-	-	-	-	-	-	14	-
41	-	-	-	15	-	-	2	-	-	-	1	-	-	-	-	20	-
42	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
43	-	-	-	15	-	-	-	-	-	-	-	-	1	-	-	8	-
44	-	-	-	21	-	-	-	-	-	-	-	-	-	-	-	17	-
45	-	-	-	27	-	-	1	-	-	2	-	-	-	-	-	10	-
46	-	-	2	-	1	-	-	-	-	-	1	-	-	-	-	2	-

Sighting Totals

	Catt	Shoa	Ghb	Hut	FCmp	Orib	Dkr	Bpig	Sbk	Croc	Wat	Nyl	Bld	UnCa	Dog	Fld	Trap
	95	96	6	446	6	2	19	2	3	4	7	4	4	1	1	225	3

Date of Survey : 15/09/09 | **Stratum Name : Zinave NP east**
Stratum Locality : Zinave | **Base Line Length : 45.7 km**
Stratum Area : 1800 km^2 | **Calibrated Strip Width at 300ft : 304 m**
N : 149 **n : 23** | **t : 2.074**
Pilot : Van der Westhuizen | **Observer : Shimbani, Mungoni**
Map overlay file : None

Transect summary table :

T #	Imp	Kudu	UnCa	Catt	Shoa	Dkr	Nyl	Hut	Sbk	Rbk	Gbk	Bpig	Whog	Ghb	Bld	Croc	Orib	Bab
1	-	-	-	-	-	1	-	4	-	-	-	-	-	-	-	-	-	-
2	-	4	-	-	-	11	3	10	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	5	4	2	-	-	-	-	-	-	-	-	-
4	-	3	-	-	-	5	-	15	1	2	2	6	3	-	-	-	-	-
5	-	1	-	-	20	1	-	12	-	3	1	-	-	-	-	-	-	-
6	-	-	-	-	10	6	-	40	-	-	1	-	-	2	-	-	-	-
7	-	-	1	-	-	2	-	49	1	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	3	-	43	-	-	-	1	-	-	1	-	-	-
9	-	-	-	-	-	2	-	18	1	-	-	-	-	-	-	-	-	-
10	-	-	-	-	42	2	-	59	2	-	-	4	-	-	-	1	-	-
11	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-	-
12	-	4	-	20	6	3	-	45	-	-	-	-	-	1	-	-	-	-
13	-	-	-	-	-	6	-	2	2	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	5	-	14	3	-	-	-	-	-	-	-	-	-
15	-	-	-	-	45	1	-	18	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	10	4	-	26	1	-	-	-	-	2	-	-	-	-
17	-	-	-	-	-	1	-	4	2	-	-	-	-	2	-	-	-	2
18	2	-	-	-	6	1	-	15	-	-	-	-	-	3	-	-	-	-
19	-	-	-	-	-	4	1	-	-	-	-	-	-	9	-	1	-	-
20	-	-	-	-	-	2	-	-	1	-	-	-	-	-	-	-	-	-
21	3	1	-	-	-	1	-	4	-	-	-	-	-	5	-	-	1	-
22	4	-	-	-	-	3	-	-	1	-	-	-	-	-	-	-	3	-
23	-	-	-	-	-	7	-	6	1	-	-	-	-	-	-	-	4	5

Sighting Totals

	Imp	Kudu	UnCa	Catt	Shoa	Dkr	Nyl	Hut	Sbk	Rbk	Gbk	Bpig	Whog	Ghb	Bld	Croc	Orib	Bab
	9	13	1	20	139	71	9	400	18	5	4	11	3	24	1	2	8	7

Date of Survey : 15/09/09
Stratum Locality : Zinave
Stratum Area : 1800 km^2
N : 149 **n : 23**
Pilot : Van der Westhuizen
Map overlay file : None

Stratum Name : Zinave NP east
Base Line Length : 45.7 km
Calibrated Strip Width at 300ft : 304 m
t : 2.074
Observer : Shimbani, Mungoni

Transect summary table :

T #	Bbk	Dog	Wat	Fld
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	1	-
5	-	-	-	-
6	-	-	-	1
7	-	-	-	-
8	-	-	-	-
9	-	-	-	-
10	-	1	-	-
11	-	-	-	-
12	1	-	-	-
13	-	-	1	-
14	-	-	-	-
15	-	-	3	9
16	-	-	-	11
17	-	-	-	2
18	-	-	4	-
19	-	-	1	-
20	-	-	-	-
21	-	-	1	1
22	-	-	1	-
23	-	-	1	-

Sighting Totals

	Bbk	Dog	Wat	Fld
	1	1	13	24

Date of Survey : 16/09/09 | **Stratum Name : Zinave NP west**
Stratum Locality : Zinave | **Base Line Length : 58.4 km**
Stratum Area : 2194 km^2 | **Calibrated Strip Width at 300ft : 304 m**
N : 192 **n : 29** | **t : 2.048**
Pilot : Van der Westhuizen | **Observer : Shimbani, Mungoni**
Map overlay file : None

Transect summary table :

T #	Imp	Kudu	UnCa	Camp	Catt	Shoa	Orib	Dkr	Gbk	Sbk	Bld	Bpig	Hut	Nyl	Ghb	Whog	Ost	Bbk
1	-	3	-	-	12	-	5	1	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	5	11	-	-	1	1	2	-	26	-	-	-	-	-
3	-	-	-	-	-	10	3	10	1	3	-	3	24	-	-	-	-	1
4	-	-	-	1	-	-	-	-	-	-	1	-	32	-	-	-	-	-
5	-	2	-	-	10	18	-	2	-	2	1	-	47	1	-	-	-	-
6	-	-	-	-	-	20	-	-	-	-	-	-	42	-	4	-	-	-
7	-	-	-	-	-	15	-	3	-	2	3	8	51	-	3	-	-	-
8	-	-	-	-	10	2	-	2	-	-	-	-	45	-	-	-	-	-
9	-	-	-	-	8	-	-	1	-	2	-	-	11	-	2	-	-	-
10	-	-	-	1	11	-	-	1	-	-	-	-	5	-	-	-	-	-
11	-	-	-	-	-	-	-	3	-	1	-	-	-	-	-	-	-	-
12	-	5	-	-	-	-	-	5	-	1	-	-	-	3	-	-	-	-
13	-	-	-	-	8	-	-	8	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	2	-	-	-	-	-	-	5	-	-	-
15	-	-	-	-	-	30	-	-	-	1	-	-	25	-	-	-	-	-
16	-	-	-	-	8	6	2	4	-	2	-	-	9	2	-	-	-	-
17	-	-	-	-	-	-	2	1	-	1	-	-	7	-	-	-	-	-
18	-	-	-	-	2	22	-	3	-	-	-	-	29	-	-	-	-	-
19	-	-	-	-	-	20	-	2	-	1	-	-	15	-	3	-	-	-
20	-	-	-	-	-	-	-	2	-	-	-	-	5	-	-	-	-	-
21	-	6	-	-	-	-	4	4	-	1	-	-	-	3	5	-	-	-
22	14	-	1	-	-	-	-	-	-	-	-	-	-	2	3	4	-	-
23	-	-	-	-	-	20	1	5	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	2	-	-	-	-	-	-	2	2	-	-	-
25	-	-	-	-	-	-	5	3	-	-	-	-	-	-	-	-	1	-
26	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
27	-	7	-	-	-	-	7	2	-	1	-	-	-	-	-	-	-	-
28	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-

Sighting Totals

	Imp	Kudu	UnCa	Camp	Catt	Shoa	Orib	Dkr	Gbk	Sbk	Bld	Bpig	Hut	Nyl	Ghb	Whog	Ost	Bbk
	14	23	1	2	75	174	31	67	2	19	7	11	373	13	27	4	1	1

Date of Survey : 16/09/09 | **Stratum Name : Zinave NP west**
Stratum Locality : Zinave | **Base Line Length : 58.4 km**
Stratum Area : 2194 km^2 | **Calibrated Strip Width at 300ft : 304 m**
N : 192 n : 29 | **t : 2.048**
Pilot : Van der Westhuizen | **Observer : Shimbani, Mungoni**
Map overlay file : None

Transect summary table :

T #	Wat	Dog	Bab	Log	FCmp	Irig	TCut	Fld
1	2	-	-	-	-	-	-	2
2	2	1	-	-	-	-	-	9
3	3	-	-	-	-	-	-	22
4	4	-	20	-	-	-	-	13
5	2	3	-	-	-	-	-	30
6	1	-	-	-	-	-	-	29
7	1	-	-	-	-	-	-	38
8	-	-	-	-	-	1	-	24
9	3	-	-	-	-	-	-	16
10	1	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-
12	-	-	6	-	-	-	-	-
13	-	1	15	-	-	-	-	1
14	-	-	-	-	-	-	-	2
15	2	-	-	-	-	-	-	4
16	-	-	-	-	-	-	-	6
17	2	-	-	-	-	-	-	6
18	-	-	-	-	-	-	-	19
19	-	-	-	1	-	-	-	3
20	-	-	-	2	-	-	-	3
21	1	-	-	-	-	-	-	-
22	-	-	-	-	-	-	7	-
23	-	-	-	-	2	-	-	-
24	-	-	-	-	-	-	-	-
25	-	-	-	5	-	-	-	-
26	-	-	-	16	-	-	-	-
27	-	-	-	-	-	-	-	-
28	-	-	-	6	-	-	-	-
29	-	-	-	11	-	-	-	-

Sighting Totals

	Wat	Dog	Bab	Log	FCmp	Irig	TCut	Fld
	24	5	41	41	2	1	7	227

Appendix 5. Comparison of observers

Introduction

The numbers of groups and animals counted by the two observers were compared to determine if the observers appeared to be similarly efficient.

Methods

For each of the commoner species, the total numbers of groups and of individual animals counted by each observer in all transects were determined. For each observer and each species, the numbers of groups and individual animals that the observer was expected to see (if the observers were equally efficient and the animals similarly distributed on the two sides of the aircraft) were calculated as follows.

$$\text{Expected Number} = \frac{\text{Total Number} \times \text{Observer's Strip Width}}{\text{Total Strip Width for both Observers}}$$

where:

Expected Number = the number of groups/animals of a given species that an observer was expected to count if the two observers saw similar numbers;

Total Number = the total number of groups/animals of a given species actually counted by both observers;

Observer's Strip Width = the width (in metres) of the search strip of one observer when the aircraft was flying at 300 feet above ground level; and

Total Strip Width for both Observers = the calibrated combined strip width (in metres) for both observers when the aircraft was flying at 300 feet above ground level (Appendix 1).

For each species, the observed and expected numbers of groups/animals were compared using a chi-square one-sample statistical test with 1 degree of freedom (Siegel 1956). No test was conducted for a species if either expected number was <5.

Results

The right observer saw more groups of elephant bulls, impala groups, steinbuck groups and 'groups' of elephant carcasses than the left observer (Table A5.1). For all other species, the two observers saw approximately similar numbers of groups. The right observer also saw more individual animals of nearly all species than the left observer.

Some species (e.g. buffalo, impala) often occur in relatively large groups. Furthermore, relatively few groups of these same species are seen during the survey. Hence, some of the differences, while statistically significant, are probably a consequence of chance. However, differences were found for most species and always in the same direction: the right observer saw more animals than expected if the observers were of similar efficiency.

Conclusion

The two observers appear to have been equally efficient at detecting groups of animals (except elephant carcasses). However, there does appear to have been a significant difference between the observers in their ability to count or estimate the number of animals in a group, once a group was detected. However, from the data collected during the survey,

there is no way of telling which observer provided the most accurate figures. The observer who saw most animals may have overestimated numbers, or the observer who saw least animals may have underestimated numbers.

Reference

Siegel, S. 1956. *Nonparametric Statistics for the Behavioral Sciences*. McGraw-Hill Kogakusha Ltd, Tokyo. 312 pp.

Table A5.1. Comparison of numbers of groups and numbers of individual animals seen by the left and right observers

The strip width when flying at 300 feet above ground level was 161.4 m for the left observer and 142.5 m for the right observer. No chi-square test was conducted if any expected number was <5. *P* indicates the probability of the observed numbers if there was no difference in the efficiency of the two observers. ns = not significant.

Species	Observed Number of Groups		Expected Number of Groups		Observed Number of individuals		Expected Number of individuals		Chi-square (groups)	*P*	Chi-square (individuals)	*P*
	Left	Right	Left	Right	Left	Right	Left	Right				
Buffalo	12	13	13	12	120	438	296	262	0.2	ns	222.9	0.000
Carcass elephant	4	22	14	12	4	24	15	13	15.5	0.000	17.4	0.000
Cattle	160	153	166	147	2130	2212	2306	2036	0.5	ns	28.6	0.000
Duiker	104	105	111	98	113	126	127	112	0.9	ns	3.3	ns
Eland	3	7	5	5	17	52	37	32	1.6	ns	23.3	0.000
Elephant bull	33	47	42	38	66	84	80	70	4.1	0.044	5.3	0.022
Elephant cow	66	61	67	60	741	892	867	766	0.0	ns	39.0	0.000
Giraffe	8	14	12	10	19	42	32	29	2.9	ns	11.1	0.001
Ground hornbill	19	29	25	23	54	84	73	65	3.0	ns	10.5	0.001
Hut	380	349	387	342	1862	1808	1949	1721	0.3	ns	8.3	0.004
Impala	42	59	54	47	362	912	677	597	5.7	0.017	312.8	0.000
Kudu	58	60	63	55	240	293	283	250	0.9	ns	13.9	0.000
Nyala	16	19	19	16	43	61	55	49	1.0	ns	5.6	0.018
Sheep/goat	118	124	129	113	1397	1800	1698	1499	2.0	ns	113.8	0.000
Steinbuck	26	40	35	31	29	41	37	33	4.9	0.026	3.7	ns
Warthog	11	10	11	10	24	37	32	29	0.0	ns	4.2	0.040
Waterbuck	9	7	8	8	14	61	40	35	0.3	ns	36.2	0.000
Wildebeest	5	3	4	4	37	39	40	36	-	-	0.5	ns
Zebra	29	32	32	29	125	169	156	138	0.6	ns	13.1	0.000

Appendix 6. Save River Count of Hippos and large Crocodiles

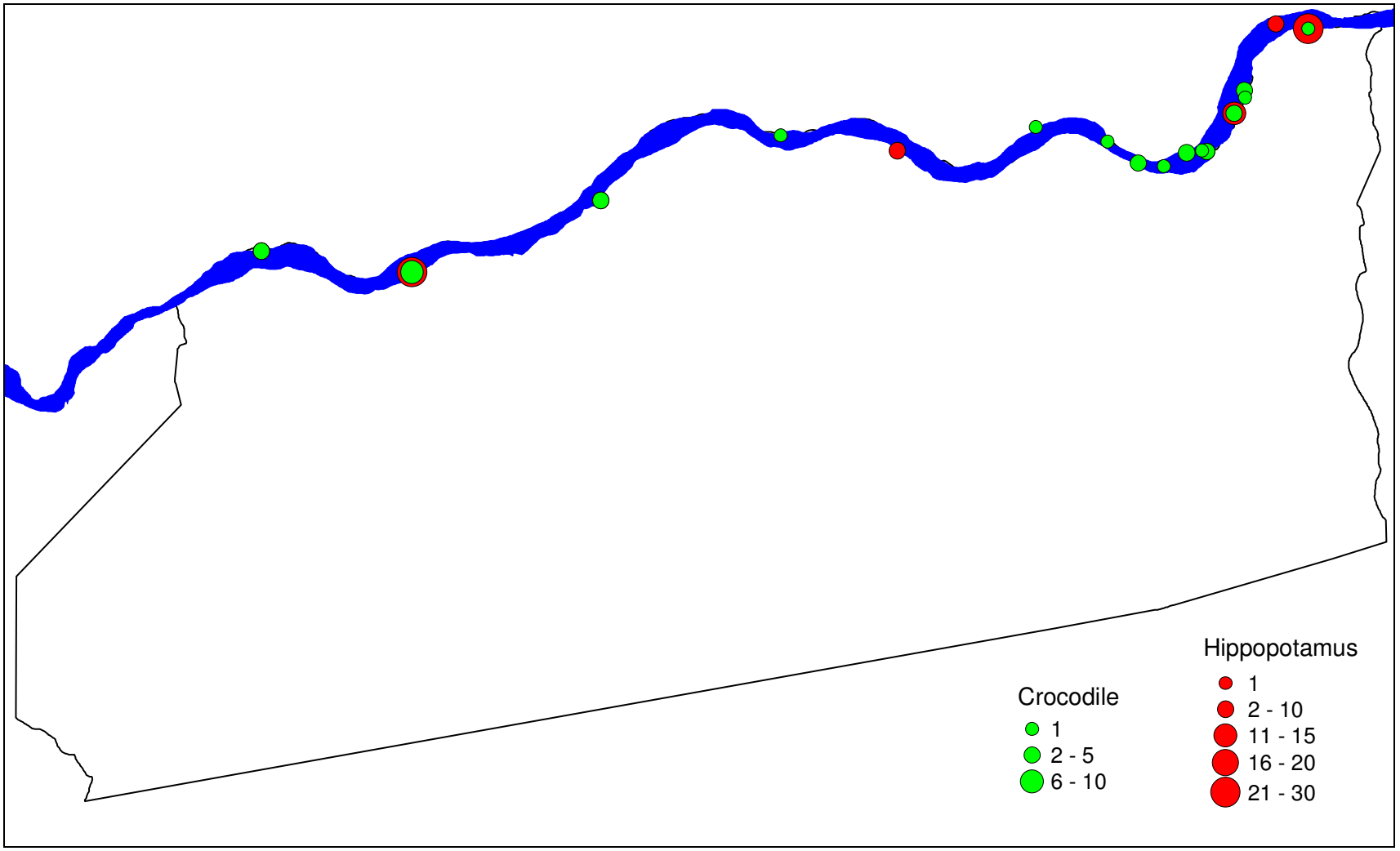
Introduction

The best method for counting hippos and large crocodiles living in a river is to fly at low level in a light aircraft along the river and to count all the individuals seen, circling large groups of hippos if necessary to count them accurately. The height of the aircraft above the ground is not important for the purposes of this survey technique and the plane can fly as low as safety permits.

This technique represents an attempt to conduct a total count, although it is likely that some animals (e.g. small crocodiles, small, juvenile hippos within large groups of hippos, submerged crocodiles and hippos). Hence the sum of the number of individuals of one species seen during a river count represents the minimum number of animals living in that stretch of river.

This method was used to count the hippos and large crocodiles in the stretch of the Save River that forms the northern boundary of Zinave NP. The river was surveyed during two sessions: the western section of approximately 60 km (measured along the Save River) for 35 minutes on the afternoon of 17 September 2009 and the eastern section of approximately 67 km for 46 minutes on the afternoon of 18 September 2009. The aircraft used was the same Cessna 185 as used for the transect surveys, with the same crew, namely a pilot, recorder and two observers. The recorder used a GPS receiver to record the location of each sighting of hippos or crocodiles and noted the number seen. The plane circled around large groups of hippos so that the observers could count the individuals in the groups.

During the total of 81 minutes spent surveying the 127 km long stretch of the Save River immediately to the north of Zinave NP, a total of 88 hippos (including three groups of 13, 25 and 30 hippos) and 38 crocodiles were seen. The location of the groups is shown in Map 27.



Map 27. Distribution of hippopotamus and crocodile in the Save River along the northern border of Zinave NP

Dot size indicates the approximate size of each group