The Elesmap census in Etosha National Park July/August 1995

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Introduction: Etosha National Park, hereafter referred to as Etosha, was counted as part of the first co-ordinated regional Elesmap census from 15 July to 3 August 1995. The aim of this report is to present the results of the elephant count, data for the other species will be presented separately.
Etosha is a 23 000 km² conservation area surrounding a large saline pan. The vegetation is mainly open Mopane and Acacia savanna and short grass plains. Topography is mainly very flat, with only a few hills in the west. For a detailed description see *inter alia* le Roux *et al*.(1988).
Aerial censuses have been undertaken in Etosha since 1968 at irregular intervals and different coverage. The first count to cover the entire national park was conducted in 1982, with further complete and sample counts since.

Methodology: Etosha was essentially systematic sample counted at two different intensities, namely 10 and 40%, using a Cessna 182 with a navigator/recorder next to the pilot and two observers in the backseats. The 40% intensity was chosen based on previous sample counts in Etosha as a good compromise between cost and accuracy, while 10% was chosen to be comparable with Elesmap counts done elsewhere in the region. . The area was stratified using the G.I.S. software Idrisi. The area within a 10 km radius of good permanent water was counted at 40%, the other areas except the main pan (4756 km²) was counted at 10%, while the pan itself was searched at high altitude for bigger groups of animals. The stratification used, based on a 500m grid, is depicted in Figure 1, with the permanent waterholes used in the planning shown as well as the actual transects. Transects were planned using a custom software developed by C.Craig, interval spacing between the transects was either 1.25 km or 5.0 km and all were aligned in a N-S direction. The block codes are shown in the map inset (Figure 1). Block sizes, sampling intensities, ground speeds and height deviations summaries are given in Tables 1. Blocks were used to break the two strata up into number of smaller units to simplify transect design and actual counting. Etosha was counted from west to east.
A Garmin GPS 150 and 100 Surveyor were used for navigation, waypoint location and flight path recording. Flight path data was recorded automatically at set 500 m intervals by the GPS independent of observation waypoint storing by the navigator/recorder. Data was downloaded from the GPS to a laptop PC and checked after each flight.
Ground speed data was recorded during the flights at roughly two minute intervals, based on the GPS reading, together with flying height deviation from a radar altimeter.
Two counting strips were demarcated on each side of the plane by streamers on the wingstrut, a 250m and 500m strip. Calibration of the observers was done at the start of the census, following standard procedure, whereby observed strip for the counters is compared to an calculated average strip as defined by the streamers. The 250m strip was calibrated with the aid of 30

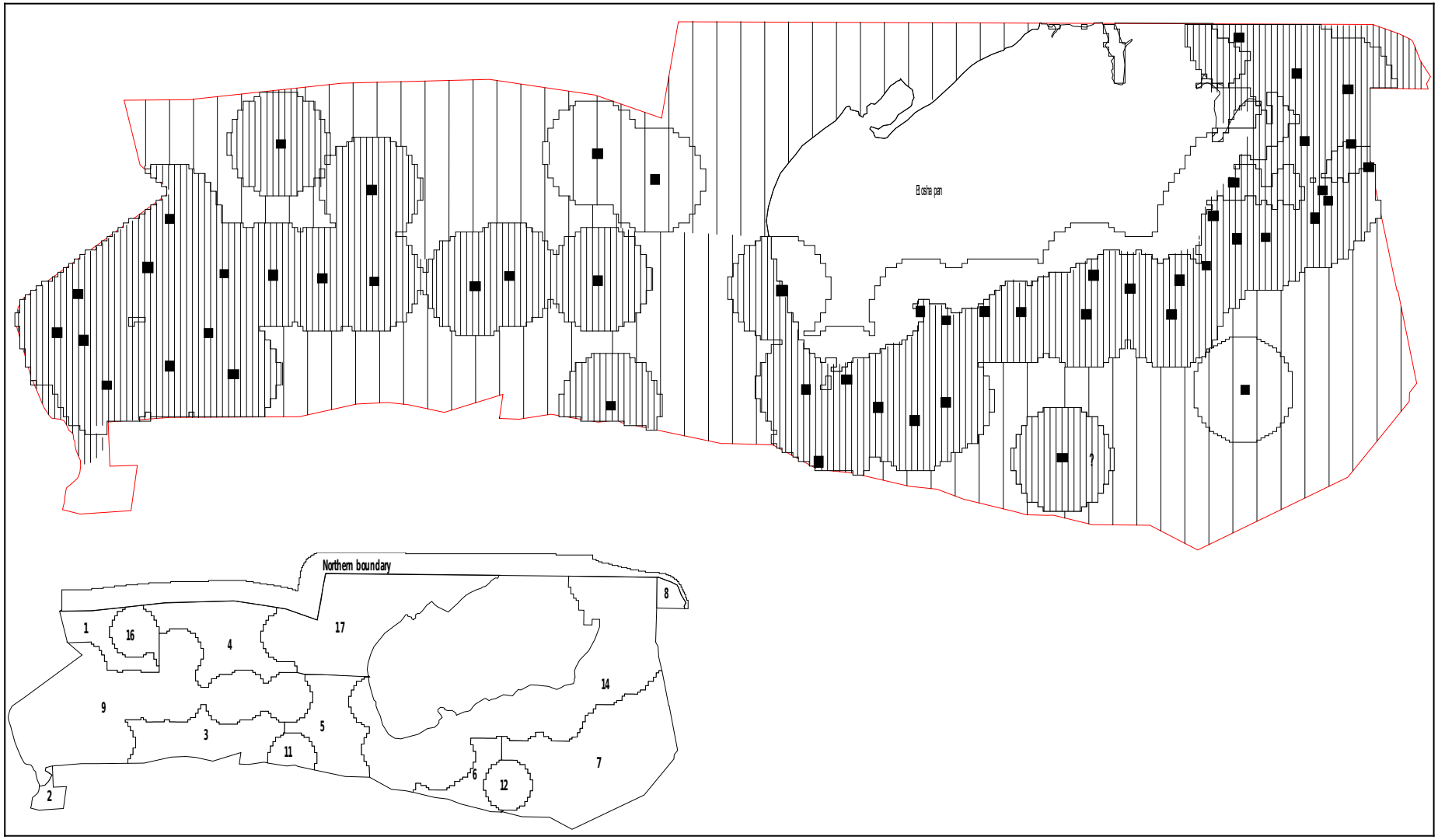
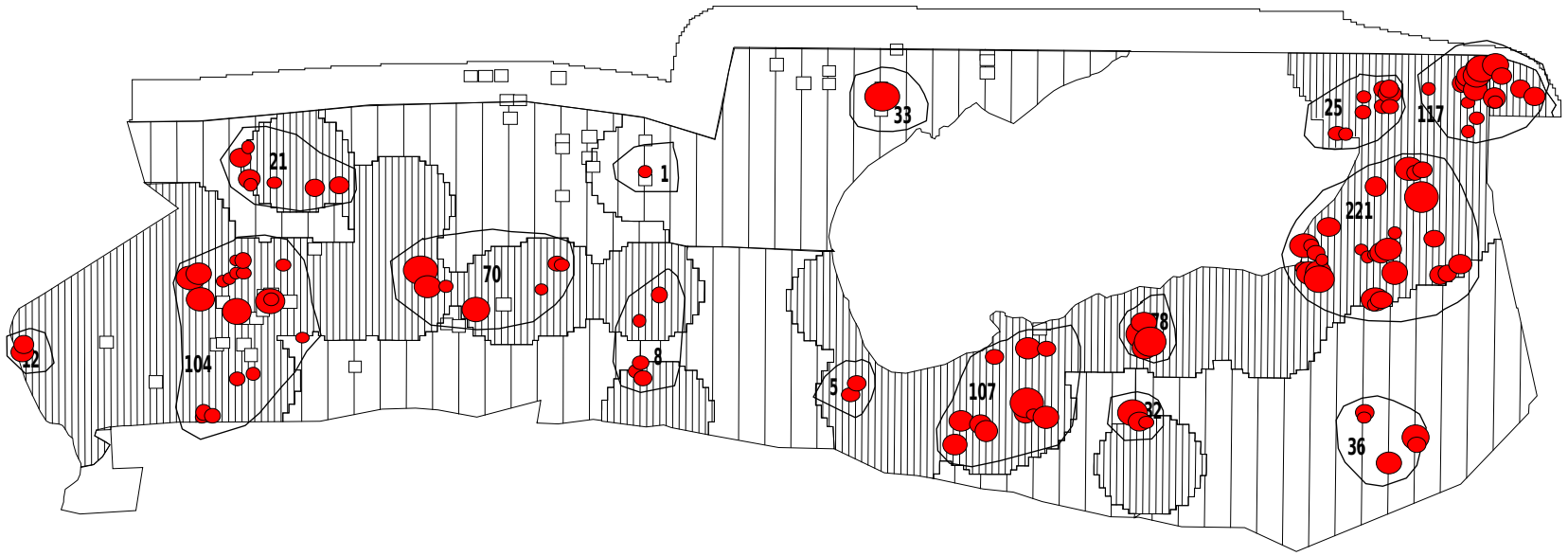


Figure 1 The 10 km radii around the selected waterholes (solid squares) and the actual transects flown. The inset shows the different counting blocks.

Figure 2

Distribution of 870 elephant counted during the Elesmap census 1995



Individual elephant groups have been visually grouped together and the total for these groupings are indicated in the figure. The additional 27 elephant without waypoint data were observed in the grouping in the west with 104 elephant. Open squares indicate the distribution of seasonal water. Each circle represents an elephant/elephant group sighting, with circle diameter indicating group size.

large white numbered squares at 10m intervals. The 500m strip was calibrated using vehicles parked 50m apart around the 500m mark.

Results: The survey was completed in just over 67 counting hours and 18.5 hours ferry time inside Etosha, spread over 32 flights. Two pilots familiar with Etosha alternated in flying the Cessna 182. Summary information about block size, sampling intensity, search rate etc. is given in Table 1.

Observer calibration was done for only 3 observers actually used in Etosha, these however counted during 80% of the counting sessions.

Table 1

Observers used, the number of counting sessions and calibration data

Observer	sessions counted	actual 250m strip width	actual 500m strip width
Fritz	29	256	500
Alwyn	22	231	511
Peter	7	260	500
Johan	6		
Wynand	4		
Gerhard	2		
Johannes	2		
Total	72		

897 elephant were actually observed, 427 of these in the 250m strips alone. The elephant were observed in 155 groups ranging in size between 1 and 33, average group size was 5.8 ± 6.4 elephant. The population estimates for the 250m and 500m strips are given in Table 2. 72 elephant carcasses were actually observed in the 250 strip, 84 in the 500m strip. Only one carcass was a fresh one with vultures on it.

The distribution of 870 elephant could be plotted accurately (Figure 2), another 27 elephant, all seen on one transect in block 9 have no waypoint data.

The distribution of seasonal veld water, based on this census, is shown in Figure 2. 61% of the estimated elephant population was found within 10 km from permanent water and 84% within 15 km (Figure 3).

57% of the estimated elephant population was seen in the following vegetation types, the north-eastern sandveld, the Ekuma woodlands, *C.mopane/ C.apiculatum/ T.pruniodes* bushveld and the sweet grassveld on lime plains. No major vegetation type was avoided by elephant, those were no elephant where counted were all less than 5% the size of Etosha.

Figure 3

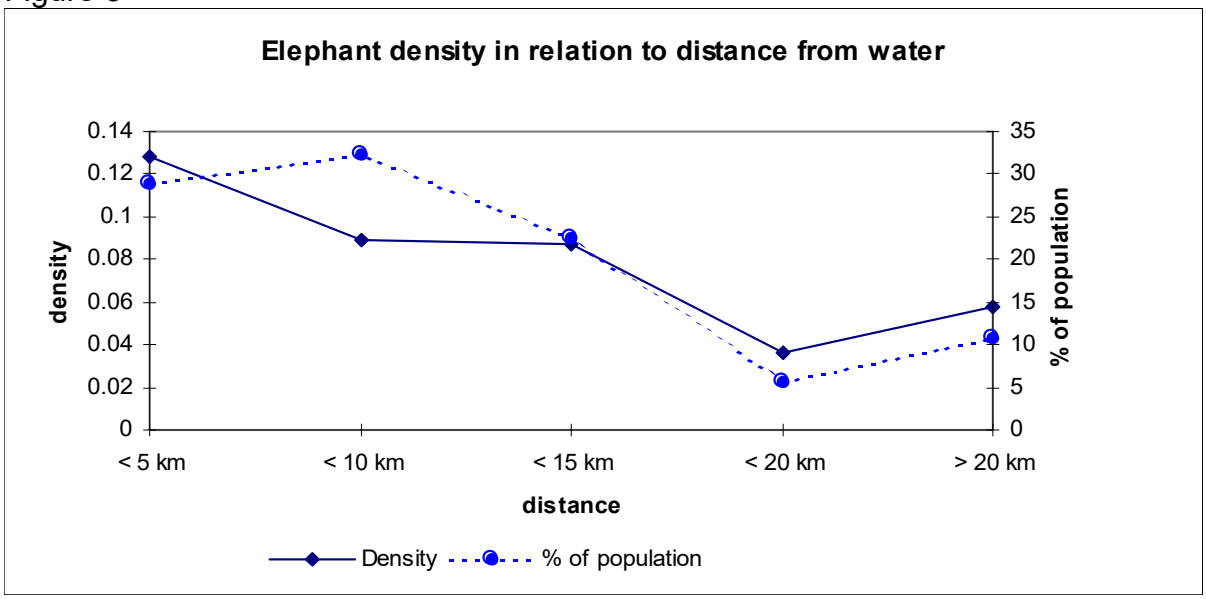


Figure 4:

Previous elephant census results (◊) and elephant culled (▬) as well as and exponential trendline fitted to the counts from 1950-1983.

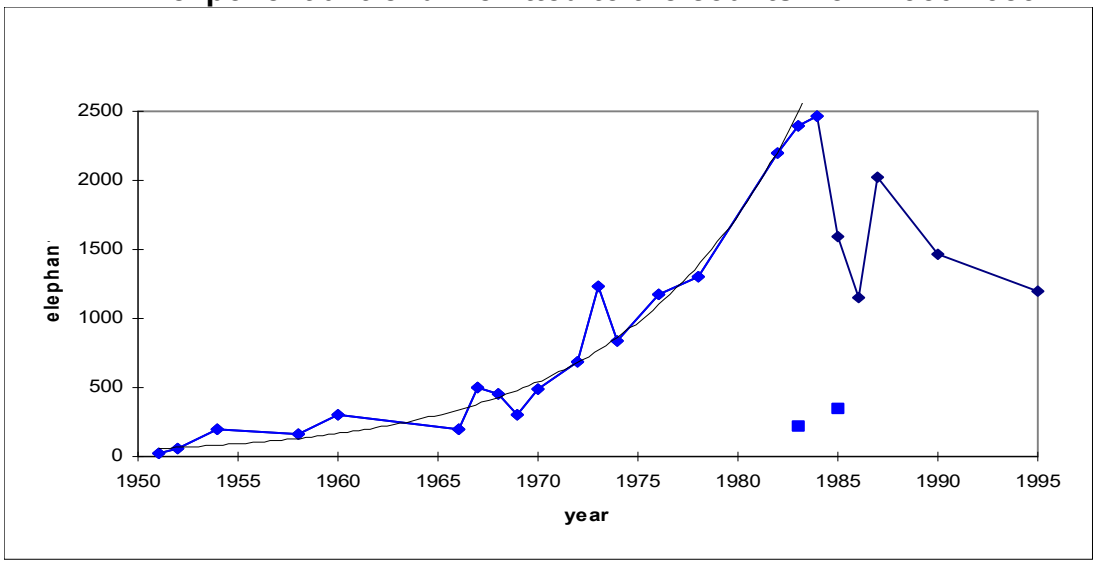


Table: 2

Data for the different counting blocks

Counting block	block size (km²)	sampled area (km²)	sampling intensity	average	ferry time (hh:mm)	counting time (hh:mm)	search rate (km²/h)	average	speed S.E.	n	average	height S.E.	n
1	503.8	51.1	10.1		1:13	1:00	51.1			0	7.0	1.5	7
(Kaross) 2													
3	1113.1	128.2	11.5		1:01	2:01	63.6	158	13.8	35	1.6	5.3	34
4	1277.5	125.6	9.8		0:58	2:14	56.2	161	10.4	31	0.2	3.8	31
5	983.5	97	9.9	10.1		1:37	60.0	158	16.2	17	3.2	12.3	19
6	425.8	39.5	9.3		0:34	0:44	53.9	174	7.5	12	-0.2	4.8	12
7	2768.0	283.9	10.3		1:18	3:57	71.9	173	10.1	42	0.3	4.9	42
17	2336.9	232.1	9.9		1:18	3:47	61.3	162	7.7	59	1.0	5.8	60
8	121.2	50.7	41.8		0:21	0:42	72.4	174	9.2	14	2.4	3.8	14
9	3939.1	1507.3	38.3		5:31	20:27	73.7	168	12.9	377	1.9	6.4	394
11	253.0	100	39.5	39.8		1:36	62.5	168	23.5	29	1.0	6.3	29
12	359.4	145.3	40.4		0:27	2:02	71.5	163	13.6	30	1.0	3.4	30
14	4105.6	1680.3	40.9		3:28	20:40	81.3	172	8.1	310	0.2	5.0	305
16	389.0	148.3	38.1		1:10	2:01	73.5	174	5.1	26	-0.5	2.5	27
northern boundary	(2591.5)	(275)	10.6		1:14	4:16	64.5						
total	18575.9	4589.3			18:33	67:04							
main pan not covered	4381.0					85:37							
Park	22956.9												

Table 3

The population estimate based on a 250m strip width

Block	Sum of y	intensity	Y	Var(y)	SE(y)	95%CL	as% of Y
1	0	10					
3	0	10					
4	0	10					
5	0	10					
6	0	10					
7	15	10	145.7	16748.0	129.4	273.06	
8	22	40	54.6	1024.3	32.0	73.80	
9	144	40	389.7	11655.9	108.0	214.85	
11	2	40	5.1	14.7	3.8	8.13	
12	1	40	2.5	3.6	1.9	4.05	
14	241	40	585.3	13324.2	115.4	228.55	
16	2	40	5.3	6.9	2.6	5.55	
17	0	10					
	427		1188.2	42777.6	206.8	405.4	34.1

The population estimate based on 500m strip width

Block	Sum of y	intensity	Y	Var(y)	SE(y)	95%CL	
1	1	20	5.2	103.8	10.2	24.10	
3	0	20					
4	0	20					
5	0	20					
6	0	20					
7	29	20	145.6	25365.0	159.3	336.05	
8	34	80	43.8	1408.1	37.5	86.53	
9	196	80	264.7	53452.8	231.2	460.09	
11	5	80	6.3	60.3	7.8	16.46	
12	32	80	40.8	2287.1	47.8	101.39	
14	477	80	596.8	39426.6	198.6	393.15	
16	6	80	7.7	65.6	8.1	17.17	
17	34	20	170.0	98861.5	314.4	666.58	
	814		1281.0	221030.8	470.1	921.5	71.9

The elephant carcass estimate based on the 250m strip width

Block	Sum of y	intensity	Y	Var(y)	SE(y)	95%CL	as% of Y
1	1	10	9.8	108.4	10.4		
3	0	10	0.0	0.0	0.0		
4	6	10	60.8	664.0	25.8		
5	2	10	20.3	329.2	18.1		
6	0	10	0.0	0.0	0.0		
7	4	10	38.8	519.3	22.8		
8	0	40	0.0	0.0	0.0		
9	26	40	70.4	145.7	12.1		
11	0	40	0.0	0.0	0.0		
12	1	40	2.5	3.6	1.9		
14	22	40	53.4	157.0	12.5		
16	5	40	13.2	12.5	3.5		
17	5	10	50.8	330.1	18.2		
	72		320.0	2269.9	47.6	93.4	29.2

Discussion: The Etosha elephant population only established itself inside Etosha in the early 1950's, grew by an average 12% per annum until 1984 and has since decreased somewhat. In 1983 and 1985, 220 and 350 elephant respectively, were culled in western Etosha. A further 200 elephant died in western Etosha in November 1981 to January 1982 and 101 elephant October to December 1989 in north-western Etosha from anthrax. These outbreaks can affect around 3% of the elephant population (Lindeque and Turnbull 1994). The 1995 elephant count seems to fit the general population trend in Etosha (Figure 4). In the 5½ years prior to the census 166 elephant mortalities had been recorded of which 76 had been anthrax positive.

This was the first count in Etosha based on GPS navigation and thus independent of physical block demarcations on the ground. At the same time we were able to collect a large body of accurate distribution data. This enabled us to move away from the previous block counting system based on man-made physical visible boundaries, which are not necessarily meaningful for stratification purposes. At the same time we could relate present elephant distribution data to that collected on a much coarser scale in the past (Figure 5).

The distribution of the elephant in Etosha varies considerably between the different counts. In the 1995 census 276 elephant were observed west of Okaukuejo and 621 east of it, where as in the September 1978 census 1032 elephant were observed in the west compared to 266 in the east. Part of this variation can be attributed to different counting intensities in the various areas, however it is clear that the elephant are very mobile and large scale shifts do occur inside Etosha dependent on rainfall, linked to surface water and food availability. Especially elephant north-east of Panpoint (upper half of Block 17) seem to be dependent on rainwater pools.

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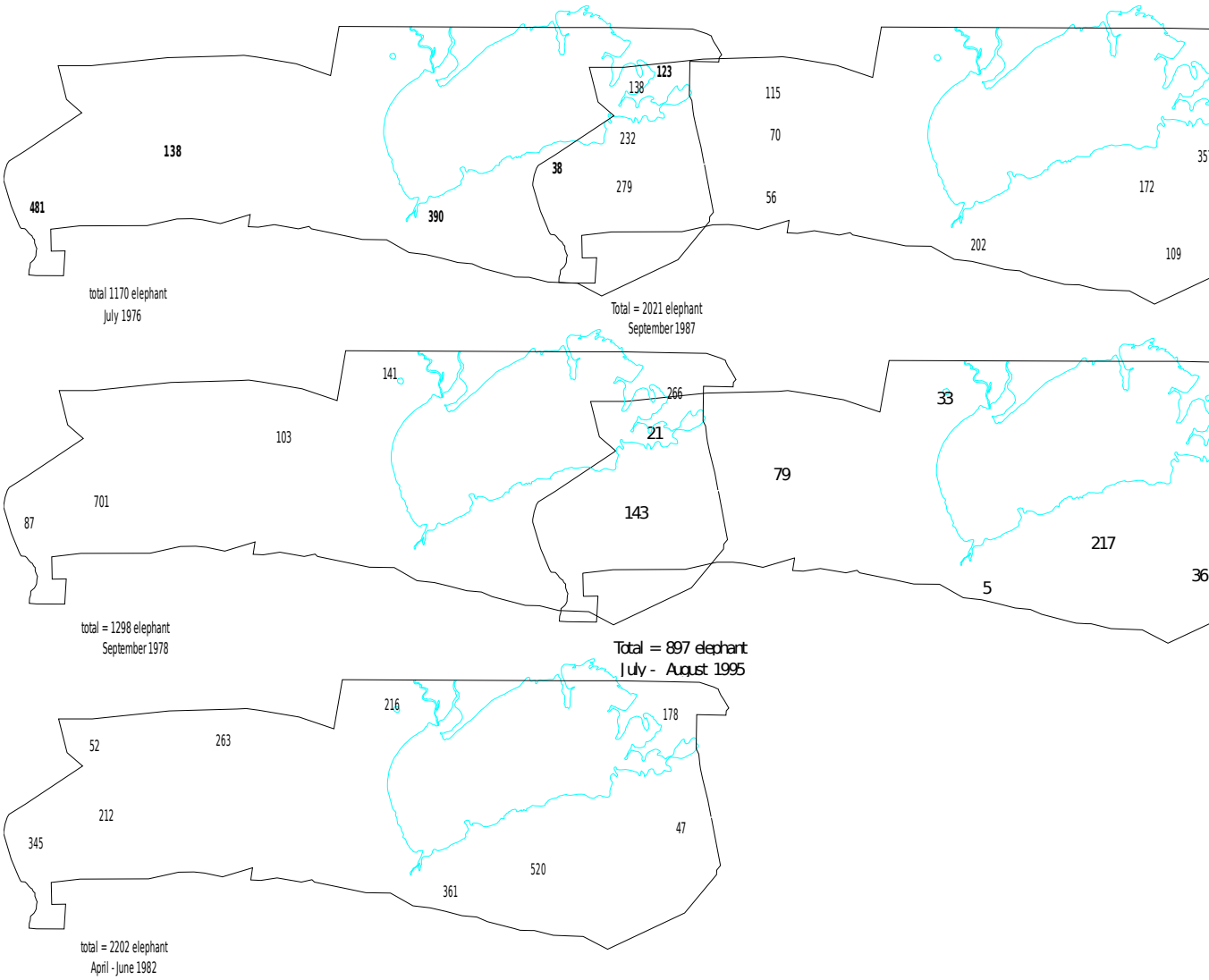
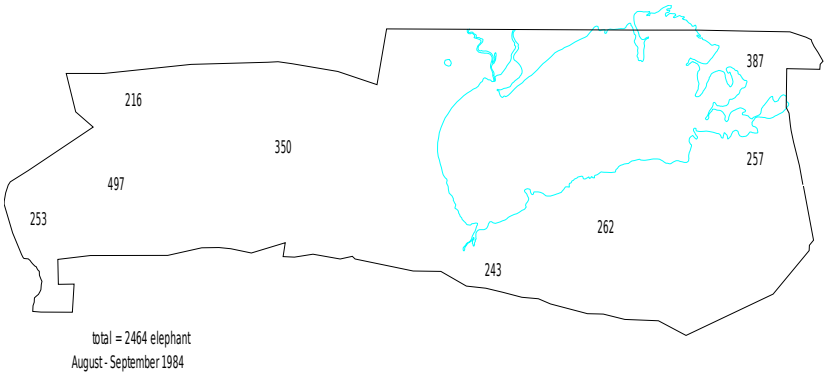


Figure 5
Elephant distribution during censusses in Etosha 1976 - 1995
"total" represents all elephant observed



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