

May 1984

N 18/2/1/9

AERIAL CENSUS OF ELEPHANTS IN ETOSHA NATIONAL PARK,
MAY 1984.

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1. INTRODUCTION

The object of this census was to establish the number of elephants in Etosha, at the end of the rainy season - beginning of dry season period, as well as to determine elephant distribution and herd composition. Results have also been used to determine the need to reduce the population although the census was originally intended to be a research-monitoring action.

This census is the second in a series of fixed-wing aerial censuses of elephants aimed at obtaining absolute numbers and maximum information regarding movements, distribution, and population structure. This census is not particularly suitable for counting other animals but the relatively low operating costs (approximately R2 200 for the entire census) makes it an ideal research method if repeated regularly. Until adjoining areas and even distant areas in Kaokoland and Owambo are surveyed, it must be accepted that long term population trends will not be forthcoming from elephant censuses. Censusing Etosha alone will only reveal annual and seasonal trends in range utilization in Etosha by elephants, as well as provide an excellent opportunity to sample a large fraction of the population in terms of social structure and recruitment. It furthermore provides a near instantaneous picture of elephant distribution in relation to environmental variables. Information thus collected would have taken years of ground work.

2. METHODS

- 2.1 A fixed-wing (high wing) aircraft (Piper Super Cub) seating one observer, was used to fly systematic transects in blocks specified by Berry and de Villiers (1982). Transect width, altitude and cruising speed varied between 2 - 4km, 33 - 135m (100 - 400ft.) and 60 - 150km/h, respectively. Variations were allowed because of variation in elephant density, ground cover and topography.
- 2.2 Herd sizes of elephants were recorded separately for each census block, as well as the number of adult cows and calves less than one year of age. All adults within a herd were assumed to be female. In practice, it was found that other age classes or the sexes of all individuals could not be determined with any degree of accuracy. Only classifications done by myself were used in the analysis.
- 2.3 A photogrammetrical survey of all herds was done according to the method of Croze (1972) where vertical photographs of herds were taken for analysis of population structure. The results of this survey will be presented in a separate report as soon as the film has been processed.

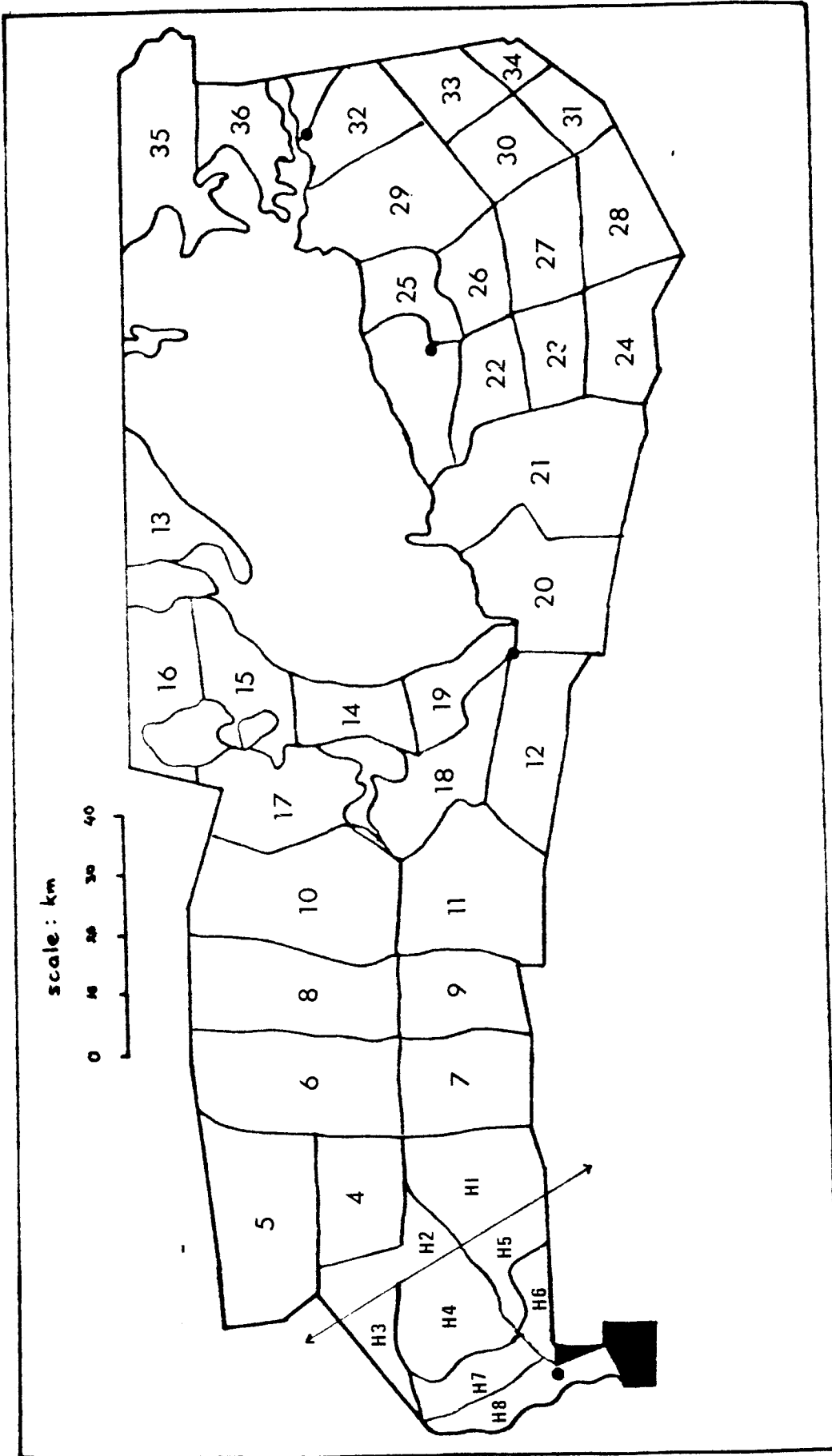


Figure 1: Census blocks in Etosha National Park. H indicates blocks counted by helicopter.

- 2.4 The approximate localities of all elephant herds and seasonal water catchments (containing water at the time) were recorded on a 1 : 500 000 map.
- 2.5 A helicopter census of game in the far West of Etosha was done concurrently with the fixed-wing census, and the elephant numbers used in this report for blocks H1 - H8 represent the helicopter counts. Blocks H3 and H4 were counted with the fixed-wing aircraft one day after being counted by helicopter, to serve as a check on accuracy.
- 2.6 A 20km wide strip around the Western and Northern boundaries in Kaokoland and Ovambo was censused as requested.
- 2.7 The ideal situation of only one observer with a concomittant standard error on all observations could not be achieved, due to illness at the time, and two nature conservators counted the first few blocks.
- 2.8 Figure 1 illustrates the census blocks used in this census.

3. RESULTS

- 3.1 Figure 2 illustrates the total number of elephants counted in each census block in Etosha. Comparisons between elephant numbers and herds in the Western, Central and Eastern Districts of Etosha, are presented in table 1. Figure 3 and 4 illustrates the number of elephants in each block in May 1984 compared to the rainy season (December - January 1983 - 1984) and the previous dry season May 1983.
- 3.2 Figure 5a illustrates the number and distribution of elephant bull herds in May 1984 and December - January 1983 - 1984, while elephant bull numbers and distribution in relation to herd concentrations are shown in figure 5b. Adult elephant bulls as a percentage of the total number of elephants counted in each census block in May 1984, and the previous census, are presented in figure 6.
- 3.3 Figure 7 illustrates the approximate sizes and localities of elephant herds and the distribution of seasonal water pools and gravel pits containing water during the census period. The number of seasonal water sources in each block during the census is presented in figure 8.
- 3.4 Figure 9 illustrates the number and distribution of elephants found outside the boundaries of Etosha in May 1984 and May 1983.
- 3.5 No previously unknown elephant carcasses were recorded.

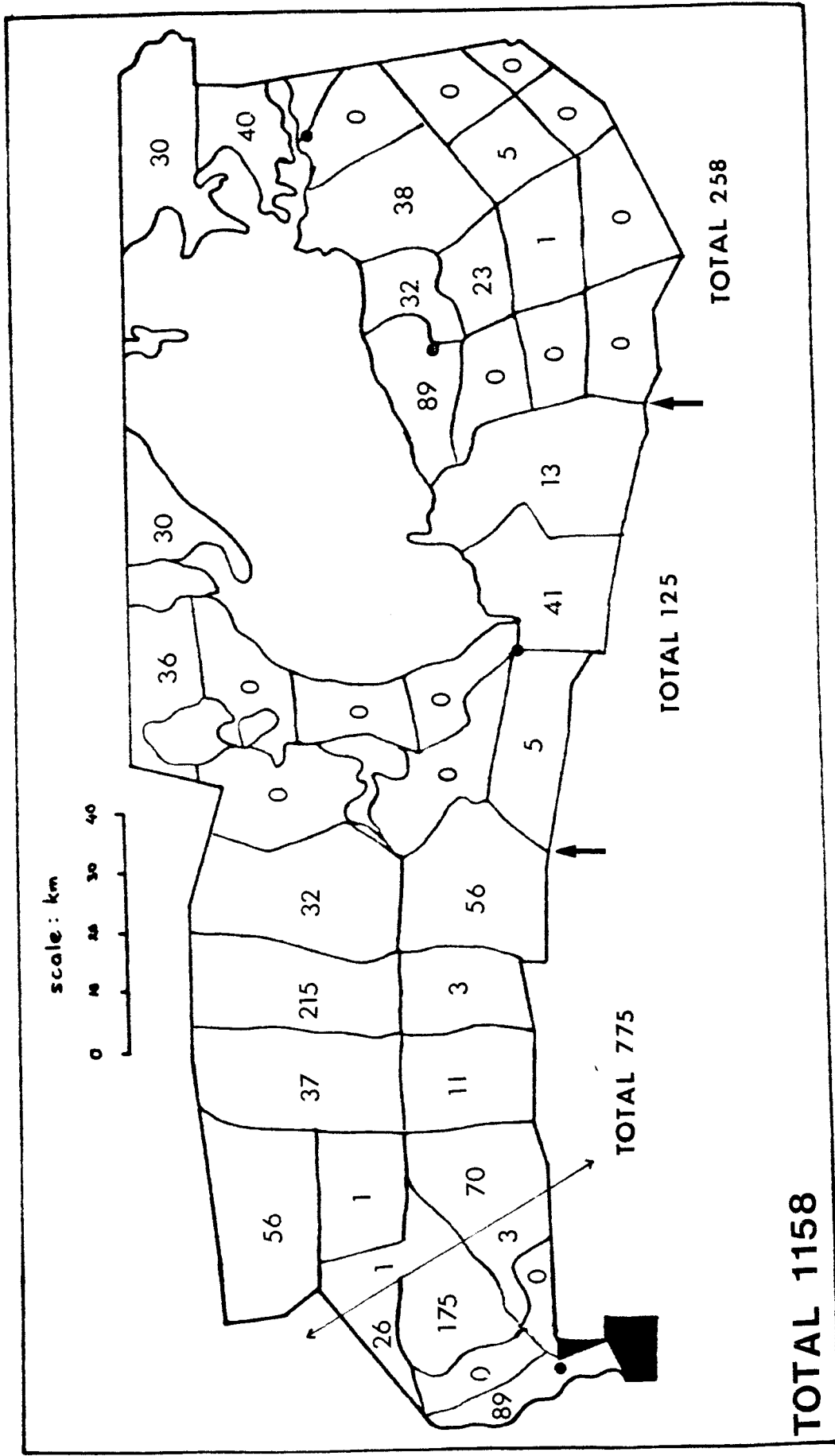


Figure 2: Total number of elephants counted in May 1984 in Etosha National Park.

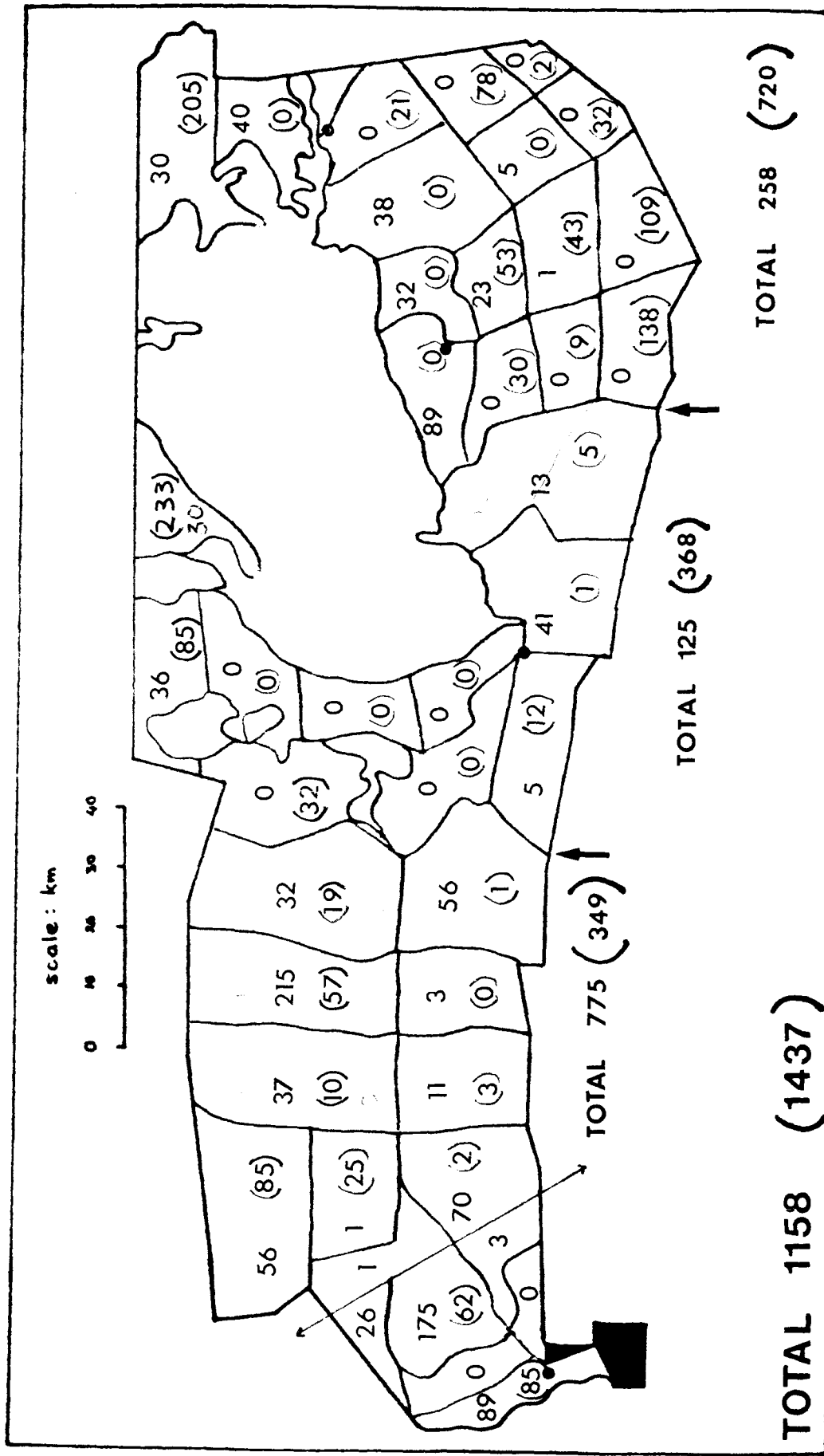


Figure 3. Number of elephants in each census block in May 1964 and December-
January 1963-1964 ().

TABLE 1

COMPARISONS BETWEEN ELEPHANT NUMBERS AND HERDS IN THE WESTERN, CENTRAL AND EASTERN DISTRICTS OF ETOSHA NATIONAL PARK

	West	Central	East	Total
Total number counted	775	125	258	1 158
N: breeding herds	44	8	13	65
N. elephants in breeding herds	738	103	204	1 045
N. bull herds	28	15	12	55
N. elephants in bull herds	37	22	54	113
Mean size (\pm SE) of breeding herds	16,8 \pm 1,7 (5 - 55)	12,9 \pm 3,7 (5 - 33)	15,7 \pm 1,8 (5 - 29)	
Mean size (\pm SE) of bull herds	1,4 \pm 0,2 (1 - 4)	1,5 \pm 0,2 (1 - 3)	4,5 \pm 1,1 (1 - 10)	
Mean ratio (\pm SE) of 1 year old calves to adults in breeding herds (N breeding herds)	0,43 \pm 0,08 (0,00-1,00) (N = 10)	0,29 \pm 0,09 (0,00-0,500) (N = 7)	0,42 \pm 0,14 (0,00-1,00) (N = 6)	
% 1 year old calves/ breeding herds	7,3	6,8	8,8	
% 1 year old calves/ total elephants	7,0	5,6	7,0	
% breeding herds without 1 year old calves	4,8%	28,6%	8,3%	
% bulls in bull herds/ total elephants counted	4,8	17,6	20,9	
N. 1-year old calves	54	7	18	79

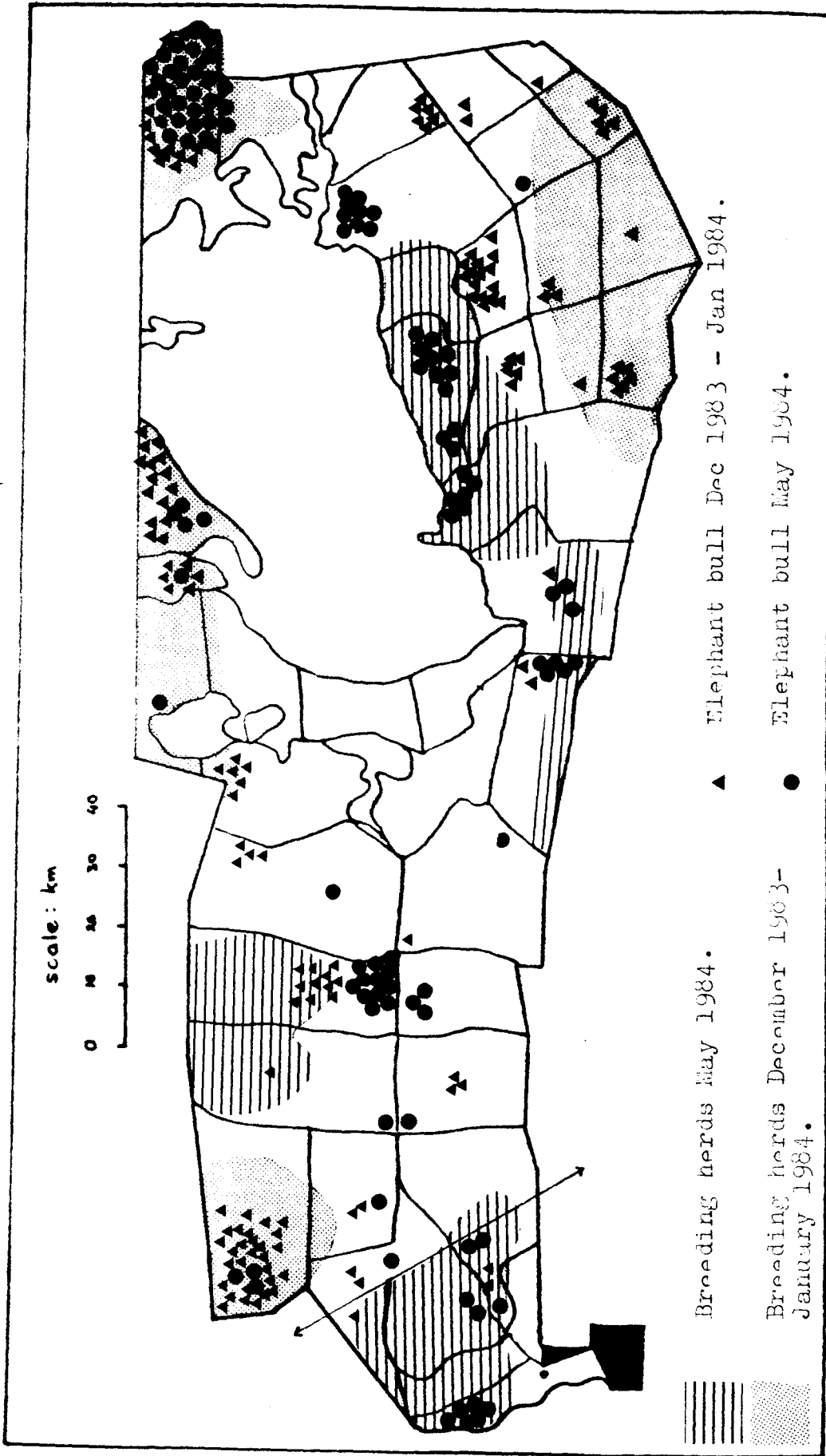


Figure b: Distribution and number of elephant bulls in May 1984 and December 1983-January 1984 relative to major areas of concentration of breeding herds.

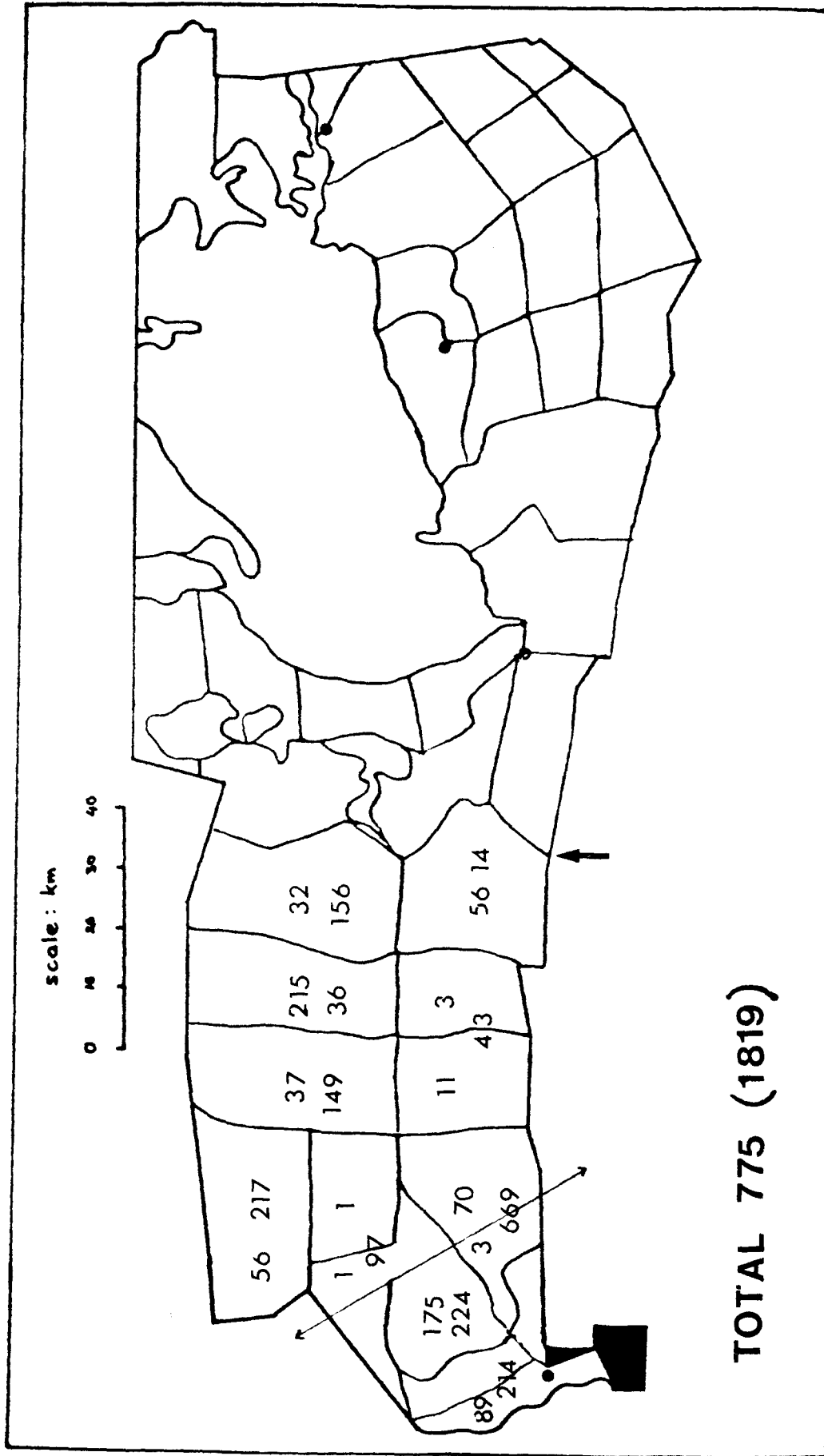


Figure 4: Number of elephants in the Western District of Ezo, census block in May 1904 and May 1903 ().

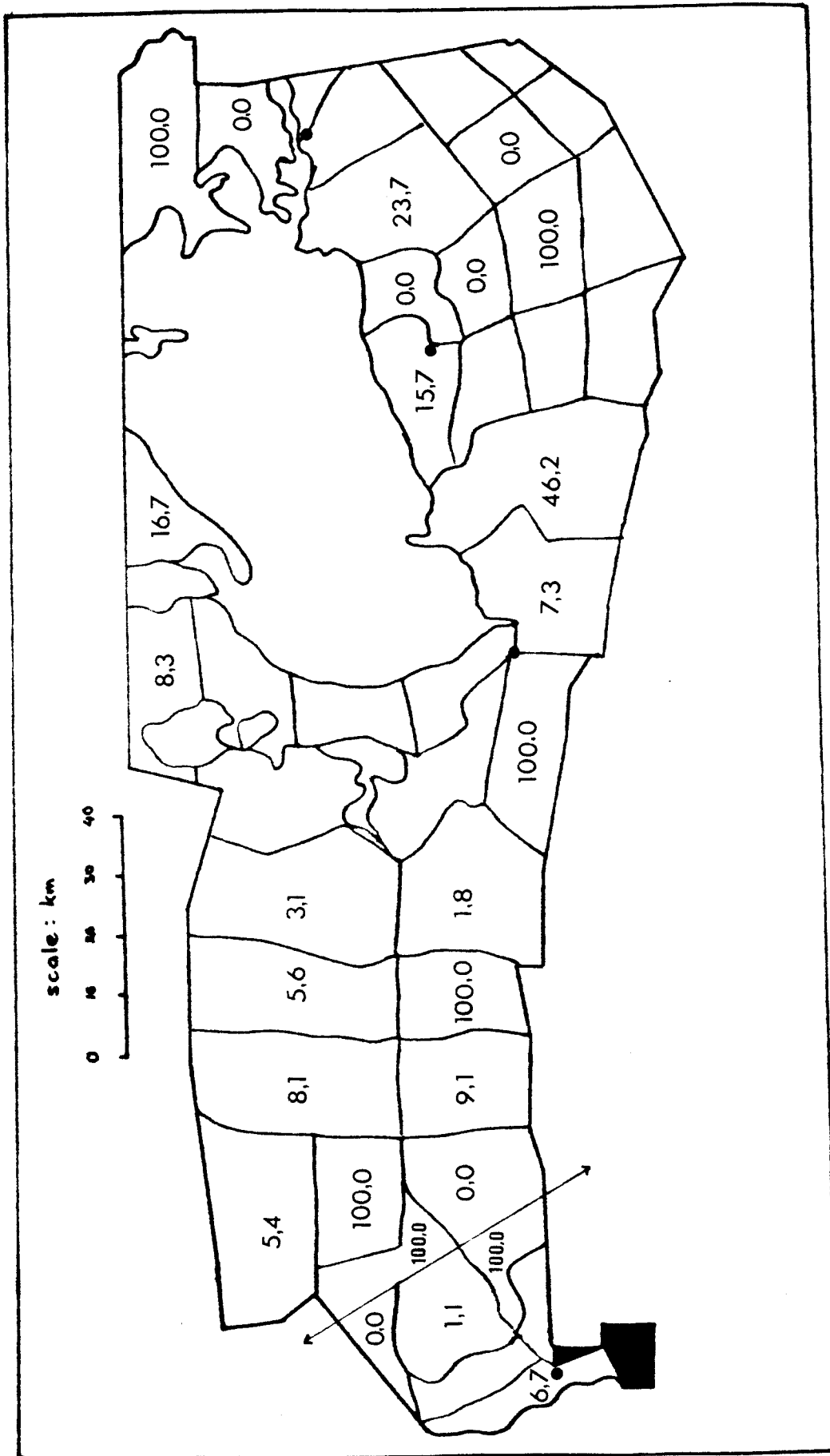


Figure 6: Adult elephant bulls as a percentage of the total number of elephants counted in each block in Etosha National Park in May 1984.

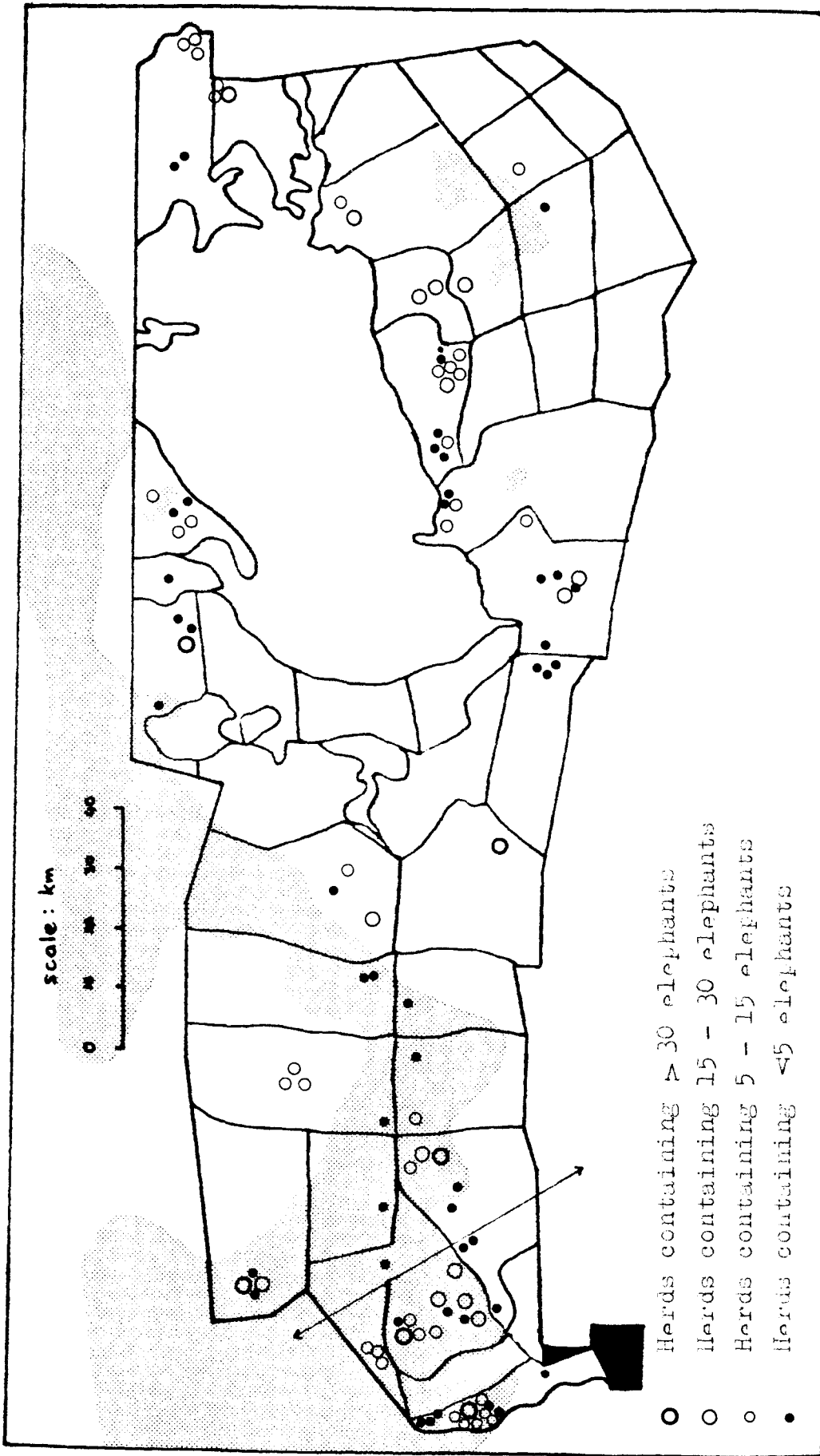


Figure 7: Distribution of rain water pools and seasonal pans in Etosha National Park during May 1984, and approximate localities of all elephant herds.

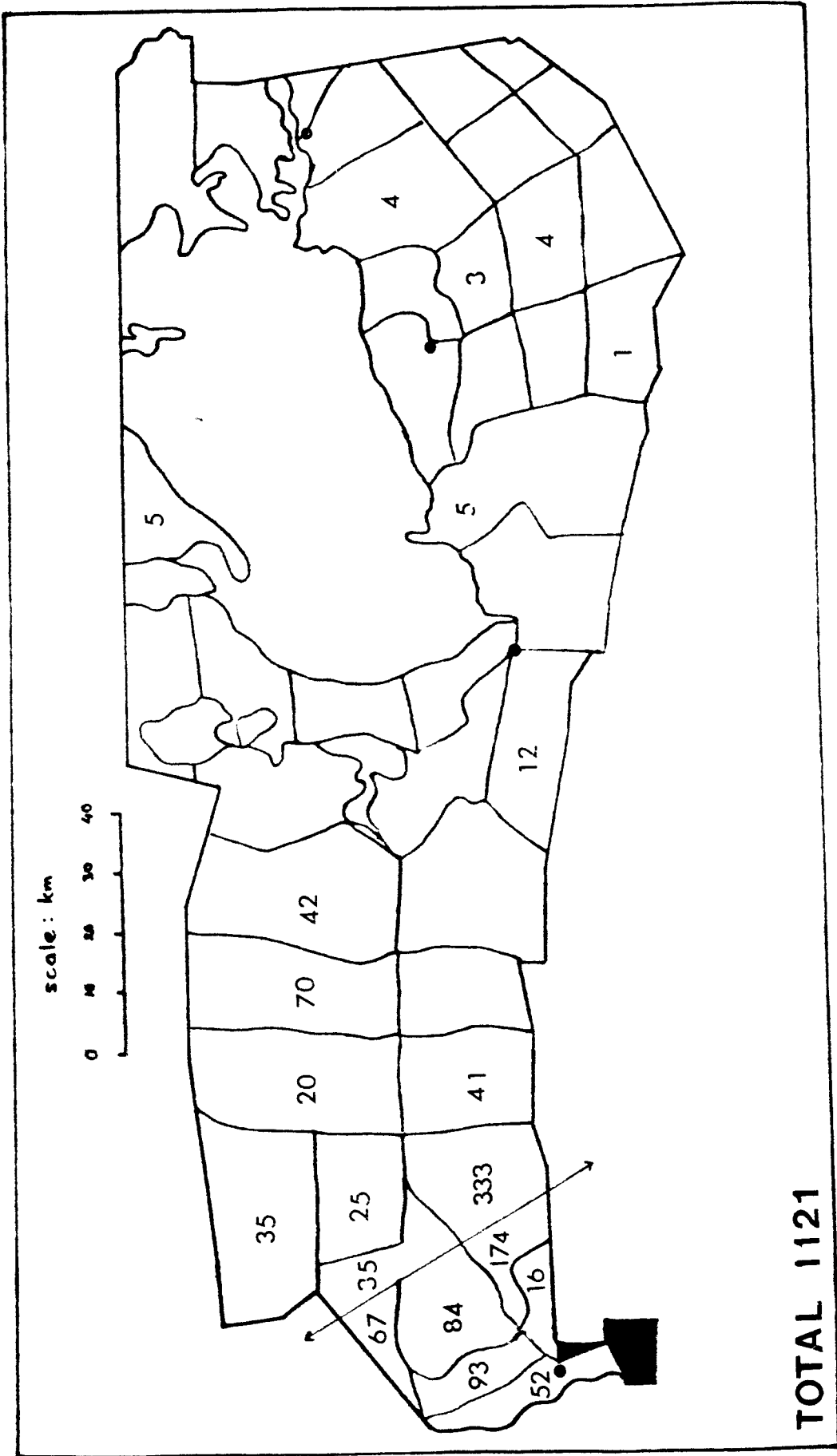


Figure 8: Number of seasonal water catchments in May 1984 in Etosha National Park.

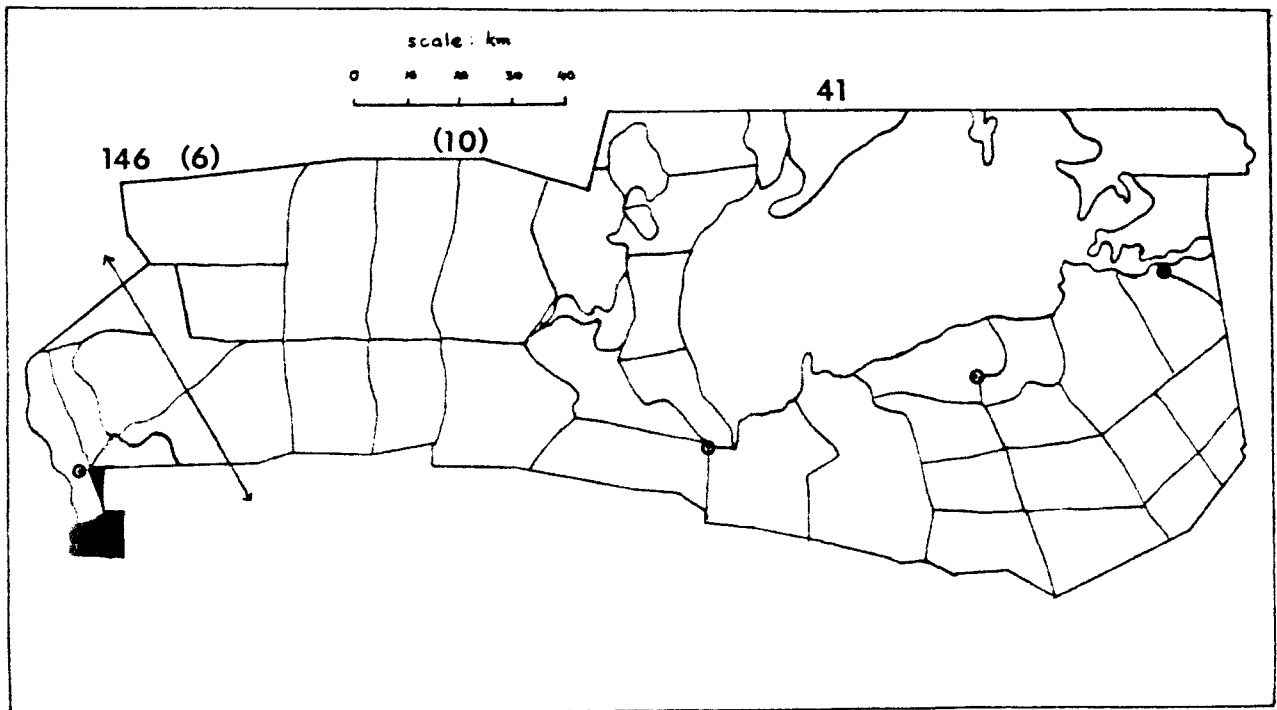


Figure 9: Number of elephants counted in a 20km strip outside Etosha National Park in Ovambo and Maokoland. Figures in brackets indicate elephants outside Etosha boundaries in May 1983.

- 3.6 The investigation into accuracy produced ambiguous results, since blocks could not be counted simultaneously by helicopter and fixed-wing aircraft. Because of the limited time available for this census and the expenses involved, an experimental simultaneous count of one block by the two aircraft could not be arranged.

The helicopter totals of blocks H3 and H4 were 26 and 175 compared to 81 and 70 with the fixed-wing. It is clear that even 24h is a great enough interval for extensive elephant movement to occur and this type of comparison is meaningless.

Ground counts at waterholes in the Okavango region provided some proof of accuracy and results corresponded closely. In some cases large numbers of elephants were not found from the air at the exact same locality as reported from the ground, but regional totals corresponded well.

4. ELEPHANT NUMBERS AND DISTRIBUTION

- 4.1 It should be accepted that aerial censuses of elephants in Etosha reveal little about the status of elephants in S.W.A. Elephants are not restricted to Etosha and spend varying periods outside the park. It is furthermore not known whether elephants that do stay in the park throughout the year represent a discrete subgroup with its own breeding characteristics, or a loose agglomeration of family units. It might therefore not be valid to treat that fraction of the North Western population of elephants as either a stable, resident or sedentary group, and it may be more appropriate to regard elephants in Etosha as temporary residents, occasionally vacating the territory only to be replaced by others. Results from this and previous aerial censuses should therefore not be regarded as indicative of population trends other than the fluctuating degree of utilization of Etosha by elephants from this sub-region.

Differences in census block totals in May 1984 and the previous census furthermore do not seem to reflect the seasonal movements and preferred seasonal ranges of a semi-permanent resident population, but in gross terms, only the seasonal occupation of different areas by elephants. A few cases have been reported where known individuals have returned to the same winter grazing area, but these seem to be mostly adult bull elephants.

The total number of elephants counted in Etosha during the census period was 20% lower than during December 1983 - January 1984 (Lindeque, 1984), and although the total in the Western District has more than doubled since the previous census, it is still less than half of the total counted in May 1983 (Berry and Nott, 1983).

The closer similarity between present numbers (dry season) and 1983 - 1984 wet season numbers do not support earlier indications of drastic changes in population size from dry to wet and wet to dry seasons. Further investigation is however still needed urgently.

Seasonal variation in distribution is evident from figure 3 and the wet season concentration areas in the Ekuma - Oshigambo area and Nau-Obes - Tkai-Tkab area were far less densely populated during the dry season. The latter area especially contained only six elephants compared to 331, while the former contained 56 elephants compared to 318. It is evident that the availability of water in these two areas plays a major role in elephant occupancy, and in fact, the only reason why 56 elephants could subsist in the Ekuma - Oshigambo area is the presence of numerous seasonal pans in neighbouring Ovambo after late rains in the area. The absence of tracks on the shores of the Ekuma and Oshigambo indicated that the water is already too saline to drink.

The other wet season concentration area in the North-Eastern Sandveld experienced a similar reduction in elephants during the dry season (70 versus 205), although three artificial water sources remained operational throughout the year.

At present, elephant concentration areas were evident in the South Western corner of Etosha, South of Klein Kowares and West of Duineveld; Bitterwater - Sonderkop - Paradys; Eindpaal - Ombika - Aus - Homob, and Rietfontein - Nemeseb - Kalkheuvel. Only the first area was characterized by numerous seasonal water points, the remainder only containing natural fountains and artificial water points.

Perhaps the most interesting aspect of elephant distribution shown by this census was the distribution of bulls (Figure 5). As it would appear, bulls seem to concentrate in areas where breeding herds concentrate, with a few exceptions. In the North Eastern Sandveld 30 bulls were counted compared to 40 breeding herd numbers while in the South Western corner of Etosha, 12 bulls were counted compared to 363 breeding herd members. It could however indicate that a substantial number of bulls are closely associated with breeding herds in the Western District (all adults in breeding herds are counted as females), but not in the East. This might indicate longitudinal differences in social behaviour and breeding caused by longitudinal climatic differences.

It is clear that substantial movement of elephants still occurred at the time of the census, and large scale movement still has not ceased at the time of writing. Large numbers of elephants (200 - 300) occupy the Okaukuejo area at present and even more movement can take place prior to settling down for the winter, if

one or more of the crucial water sources dry up, such as Ombika, Eindpaal or Olifantsbad.

- 4.2 In view of the fact that elephants exhibit seasonal emmigration - immigration movements as well as seasonal differences in range inside Etosha, the identification of sub-populations among the residents at any time of the year proves to be extremely difficult. It is suspected that the characteristics used to typify a sub-population, such as recruitment rate and sex and age compositions, may be under greater environmental influences elsewhere than at the time and place these characteristics were measured. Such characteristics are not necessarily typical of a region and features such as retarded birth rates may occur in prime seasonal habitat inside Etosha, with the limiting factors operating elsewhere. Until it can be determined that each subgroup with its own winter and summer grazing area remain reasonably stable, the effect of amalgamation with elephants from other areas and possibly different individuals occupying the same area each year can not be ignored.

General trends are apparent however, such as an increase in average breeding herd size in the West since the previous census, and a decrease in the number of one-year old calves relative to the number of individuals per breeding herd in the West. (Lindeque, 83, Table 1).

It is not known whether these parameters are sufficiently accurate to depict real trends. It is also possible that several other differences between the Western, Central and Eastern districts are purely climatic, where the rainfall pattern, peaking earlier in the East, and later in the West, is the major controlling mechanism for movements, aggregation and breeding activities, which may result in different regional herd compositions as observed.

5. ACKNOWLEDGEMENTS

The enthusiasm and expertise of the pilot, N.C. Noli is again greatly appreciated. It must be emphasized that this type of census, where navigation is critical due to interrupted transects, and flying hazardous, could not have been executed without his superlative navigational piloting skills.

Nature Conservators Crous and Millard are thanked for enthusiastic assistance at short notice and all members of the helicopter censusing team are thanked for information collected and assistance rendered.

5. REFERENCES

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