

N. 18/1/2/1

1984 RESEARCH & MANAGEMENT MEETING

2302

AT WINDHOEK

PROGRESS REPORT OF THE BIOLOGIST (OKAUKUEJO)

2nd TOTAL AERIAL CENSUS OF ETOSHA

NATIONAL PARK

N 18/1/2/1

SECOND TOTAL CENSUS OF ETOSHA USING A HELICOPTER AND FIXED-WING
AIRCRAFT

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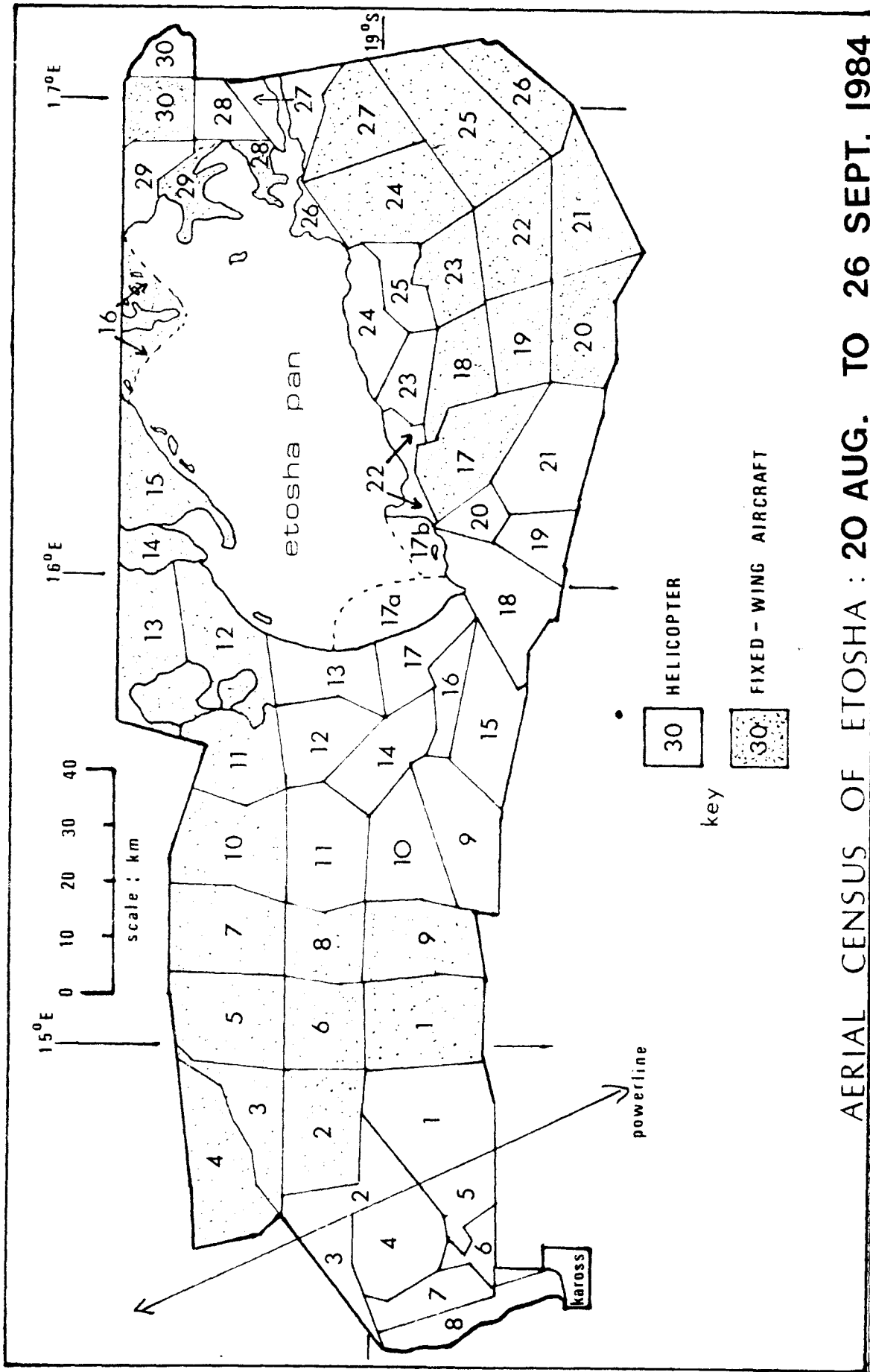
1. INTRODUCTION

The first total aerial census of Etosha took place from 26 April to 4 June 1982. It attempted to establish a baseline of the larger herbivore species' numbers and distribution. The report on this census (N 18/1/2/1) was presented at the Annual Meeting of Research and Management in 1982. It recommended that a total census of Etosha be repeated at regular intervals, but pointed out that the time of year of the first total census reflected a wet season situation, where temporary, rainwater pools were abundant. This has a profound influence on the numbers and distribution of animals in Etosha. Furthermore, vegetation cover shortly after the rainy season is at a maximum, reducing visibility for the observer.

Consequently, it was decided to do a total aerial census of Etosha during August and September 1984 : a period of minimum availability of drinking water as well as maximum visibility.

2. METHODS

- 2.1 We applied the same basic method followed in 1982 by dividing Etosha into 60 blocks (Figure 1) and counting these by fixed-wing aircraft, using a pilot, navigator/spotter and 4 observers, and a helicopter, using the pilot as navigator/spotter and 2 observers.
- 2.2 In 1984 it was decided to refine the counting method further by supplying the pilots with sets of 1 : 100 000 scale maps of each block, on which they could pre-plot the direction, length and number of transects to be flown during each day of the census. It was consequently possible to accurately forecast the time required for censussing.
- 2.3 We furthermore standardised the flying height of both aircraft at 75 to 90m and their airspeed at 180 km/h for the fixed-wing and 120 km/h for the helicopter. Flying 2 km-wide transects, this meant that the fixed-wing covered 3km² per minute and the helicopter 2km² per minute.
- 2.4 In both aircraft the following data were recorded during each flight:
 - total flying time
 - time spent counting in each block
 - direction of transects
 - direction of movement
 - temperature
 - windspeed and direction
 - cloudcover
 - visibility
 - vegetation type
- 2.5 These data plus the counts were written directly onto standardised forms by the fixed-wing observers, using one form for the left-hand side and one for the right hand side. In the case of the helicopter, all data were first recorded on cassettes and transcribed onto the standard form after each days' census.



AERIAL CENSUS OF ETOSHA : 20 AUG. TO 26 SEPT. 1984

FIG. 1: Division of Etosha into 60 blocks for the purpose of an aerial census of the total area

- 2.6 Censussing was done between 08h00 and 13h00, except in 5 blocks where the helicopter also flew during the afternoon and in 4 blocks where the fixed-wing flew during the afternoon. Censussing was restricted from Mondays to Fridays.
- 2.7 In addition, the fixed-wing aircraft undertook separate surveys of the Etosha Pan to locate animals which may have moved onto the pan.
- 2.8 During the census the fixed-wing aircraft was used to count the number of fence breaks occurring along the boundary.

3. RESULTS

- 3.1 The totals for each species counted are given in Table 1 and a comparison is made with the 1982 census.
- 3.2 Mean group size, range in group size and its standard deviation are shown for the major species in Table 2.
- 3.3 Predominant vegetation types occurring in each census block are shown in Figure 2.
- 3.4 Distribution maps for 12 major species are given in Figures 3 to 14.
- 3.5 Fence breaks recorded are shown in Figure 15.

4. DISCUSSION

4.1 Flying times

The helicopter's total flying time was 95h05 min, with a daily range of 1h 58 min (Block 16) to 5h 48 min (Block 1) (mean daily time flown : 3h 24 min). Actual census time totalled 75h 41 min (daily range : 1h 10 min (Block 27) to 5h 34 min (Block 4); (mean 3h 12 min). Ferry time comprised 19h 24 min or 20% of the time flown.

The fixed-wing's total flying time was 88h 25 min, with a daily range of 1h 50 min (Block 30) to 5h 11 min (Block 7) (mean daily time flown : 3h 04 min). Actual census time totalled 65h 43 min (daily range : 1h 11 min (Block 16) to 3h 10 min (Block 25); mean 2h 16 min). Ferry time comprised 23h 02 min or 26% of the time flown.

4.2 Number of transects flown

The helicopter flew a total of 663 transects with a minimum daily amount of 11 (Block 30) and a maximum of 35 (Block 8). The daily average was 22 transects.

The fixed-wing flew a total of 669 transects with a minimum daily amount of 12 (Block 30) and a maximum of 38 (Block 3). The daily average was 23 transects.

TABLE 1: Number of animals and birds counted during the total census of August - September 1984 (184 hours flown) and the census of April - June 1982 (198 hours flown).

SPECIES	DATE		1984 total as percentage increase/de- crease over 1982
	April - June 1982	August - Sept. 1984	
Hartmann's zebra	* 2 665 (777)	620	* -330% (20%)
Burchell's zebra	7 970	5 332	- 33%
Springbok	16 011	10 722	- 33%
Kemabok	5 081	3 248	- 36%
Wildebeest	2 195	2 253	+ 3%
Giraffe	1 184	1 376	+ 16%
Kudu	1 041	1 061	+ 2%
Eland	692	353	- 49%
Red Hartebeest	396	486	+ 23%
Steenbok	240	156	- 35%
Black-faced impala	93	164	+ 76%
Roan antelope	19	2	-
Grimm's Duiker	11	15	-
Damara Dik-Dik	0	0	-
Klipspringer	0	0	-
Warthog	328	142	- 57%
Hook-lipped rhino	121	150	+ 24%
Elephant	2 202	2 464	+ 12%
Elephant carcasses	54	15	-260%

* Refer Section 4.4.1 for explanation

TABLE 1: Continued.

SPECIES	DATE		1984 total as percentage increase/de- crease over 1982
	April - June 1982	August - Sept. 1984	
Lion	38	29	-
Leopard	2	3	-
Cheetah	2	4	-
Black-backed jackal	99	62	-
Spotted Hyaena	6	12	-
Brown Hyaena	4	2	-
Bat-eared Fox	56	9	-
Aardvark	0	1	-
Honey Badger	4	35	-
Porcupine	2	4	-
Aardwolf	9	4	-
Baboon	20	11	-
Ostrich	1 835	1 311	-29%
Marabou Stork	130	4	-
Vultures	348	298	-14%
Eagles	68	71	+ 4%
Secretary Bird	37	35	+ 5%
Kori Bustard	45	142	+216%
Ludwig's Bustard	2	0	-
Crowned Crane	2	0	-
Blue Crane	49	18	-
Guineafowl	60	217	-
Pelicans	81	0	-
Flamingos	5 (flocks)	14	-
Temporary rain- water pans	1 010	5	-

TABLE 2: Mean group size, range and standard deviation of the major species counted at Etosha

Species	No. of observations (n)	Mean group size	Range	\pm SD
Hartmann's zebra	119	5	1- 23	4
Burchell's zebra	297	15	1- 280	26
Springbok	679	16	1- 450	42
Gemsbok	537	4	1- 53	6
Wildebeest	130	17	1- 120	22
Giraffe	391	3	1- 36	4
Kudu	157	5	1- 21	3
Eland	43	6	1- 27	6
Hartebeest	73	5	1- 30	6
Impala	12	13	1- 67	20
Warthog	31	2	1- 5	1
Rhino	78	1,4	1- 3	0,6
Elephant	156	9	1- 91	13
Ostrich	485	3	1- 40	17

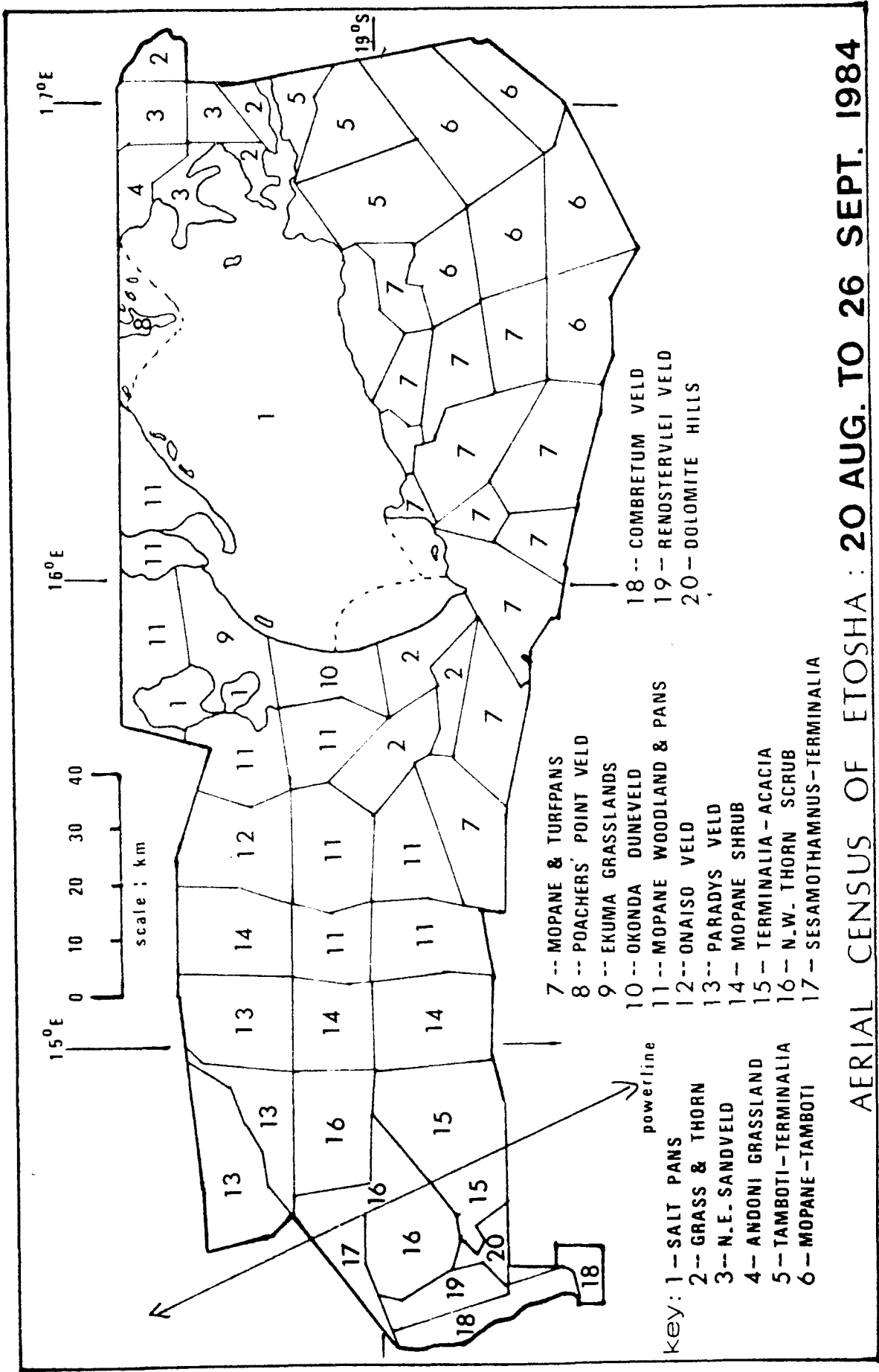
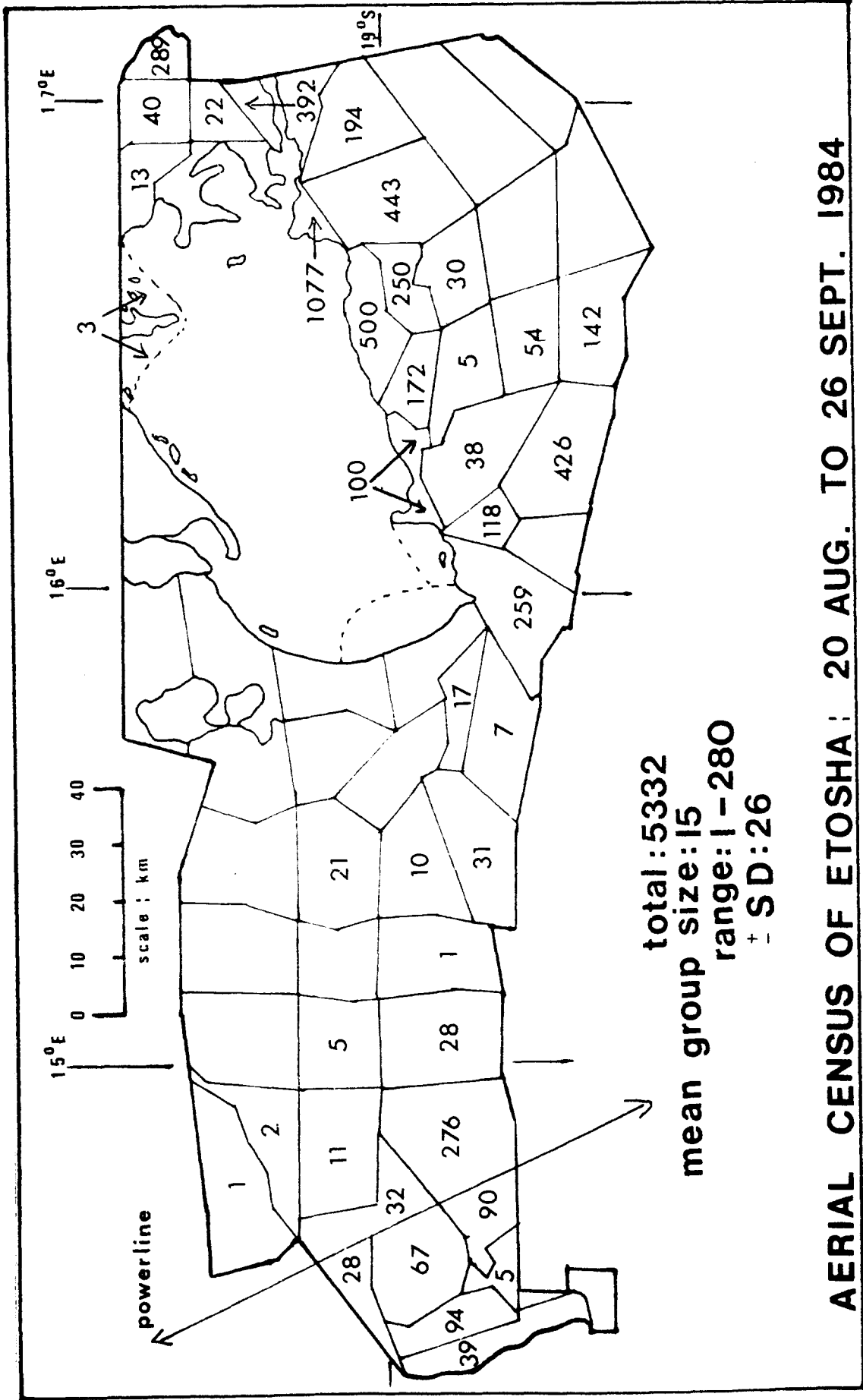


FIG. 2 : PREDOMINANT TYPES OF VEGETATION ENCOUNTERED IN THE CENSUS BLOCKS (ACCORDING TO LE ROUX, 1980)



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FIG. 3 : DISTRIBUTION AND NUMBERS OF RHINOCEROS GROUPS RECORDED PER CELL ON MAP.

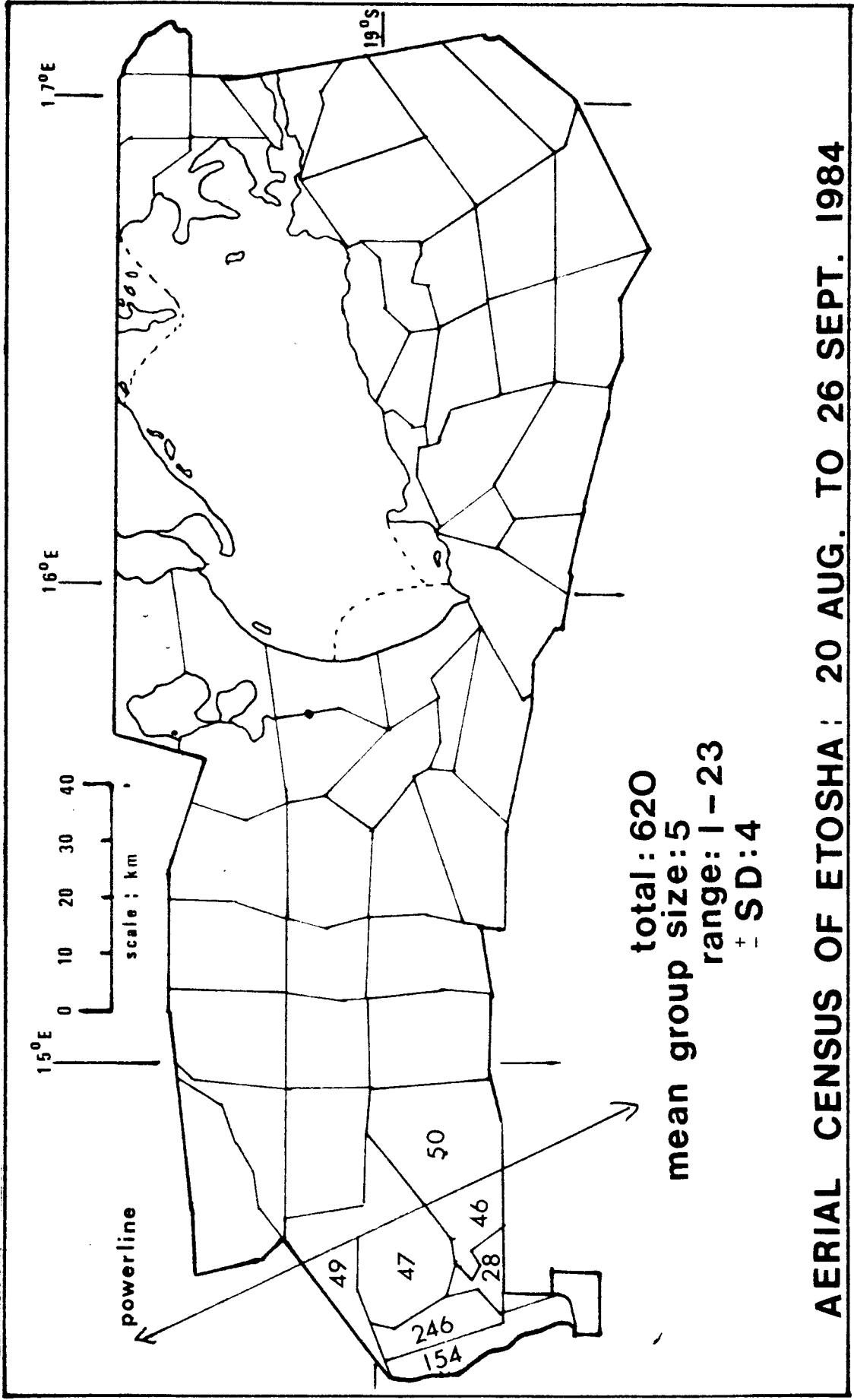


FIG. 4 : DISTRIBUTION AND NUMBERS OF HARTMANN'S ZEBRA RECORDED PER CENSUS BLOCK.

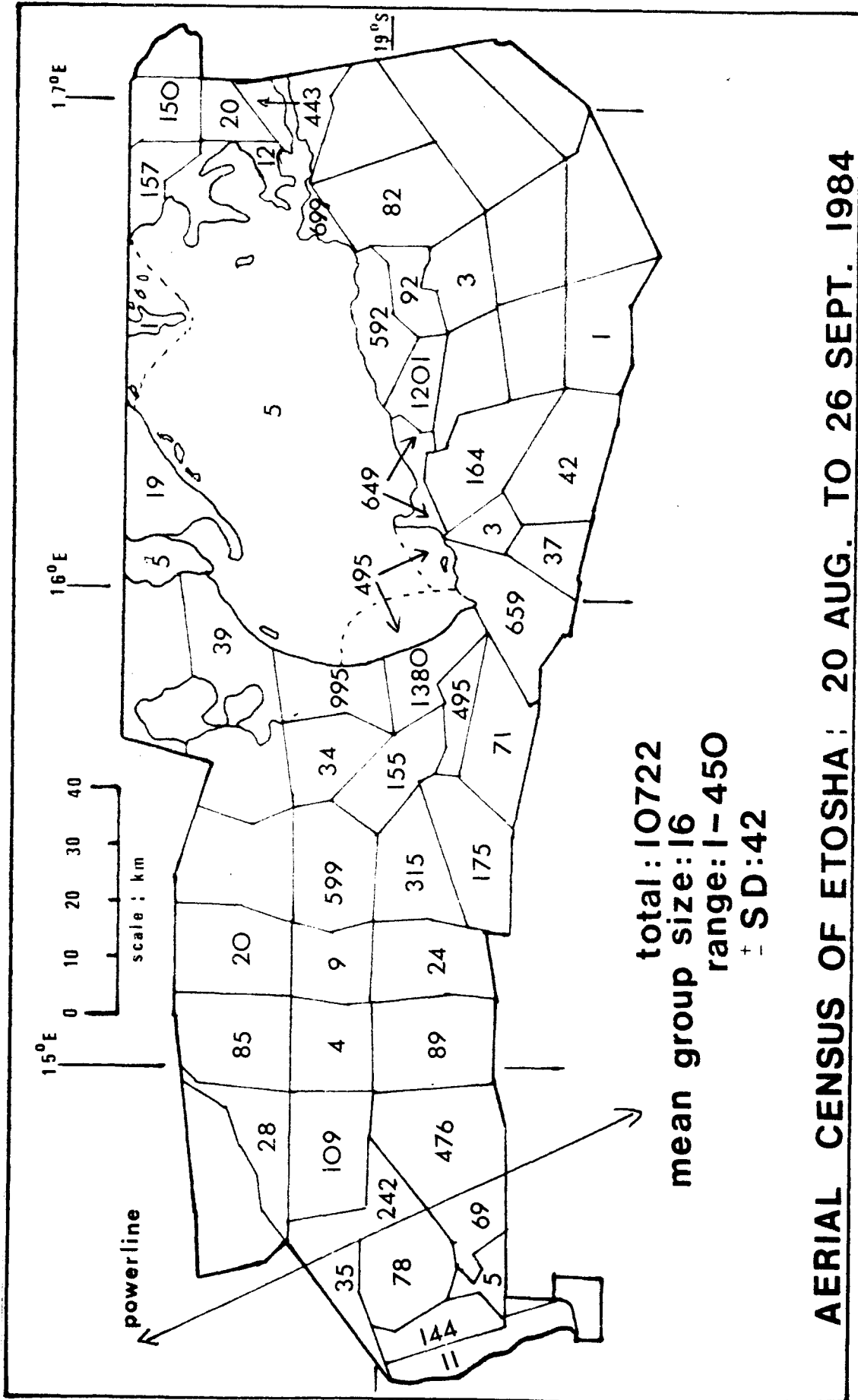


FIG. 5 : DISTRIBUTION AND ABUNDANCE OF STRIPED OSTRACODS IN ETOSHA PAN.

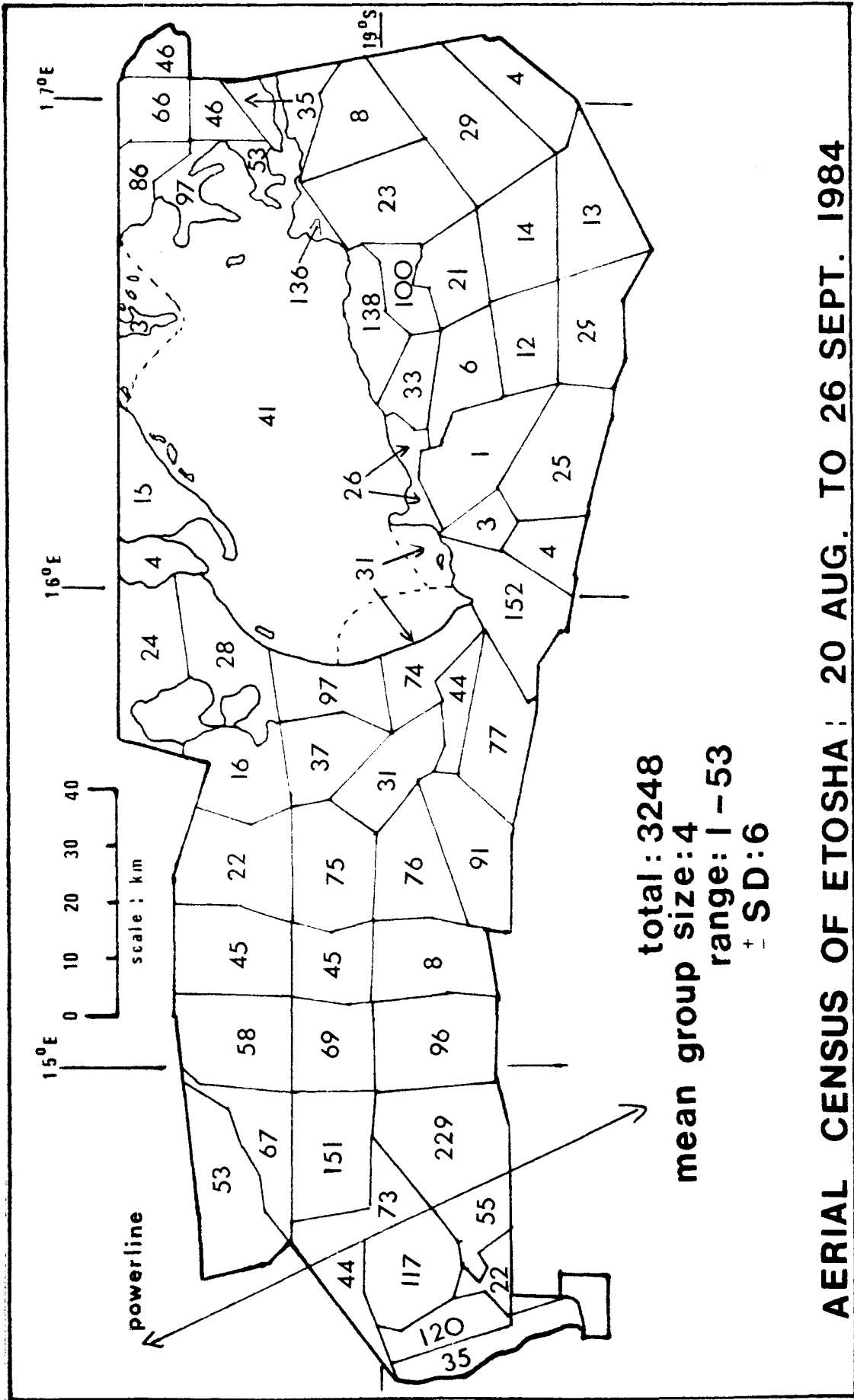
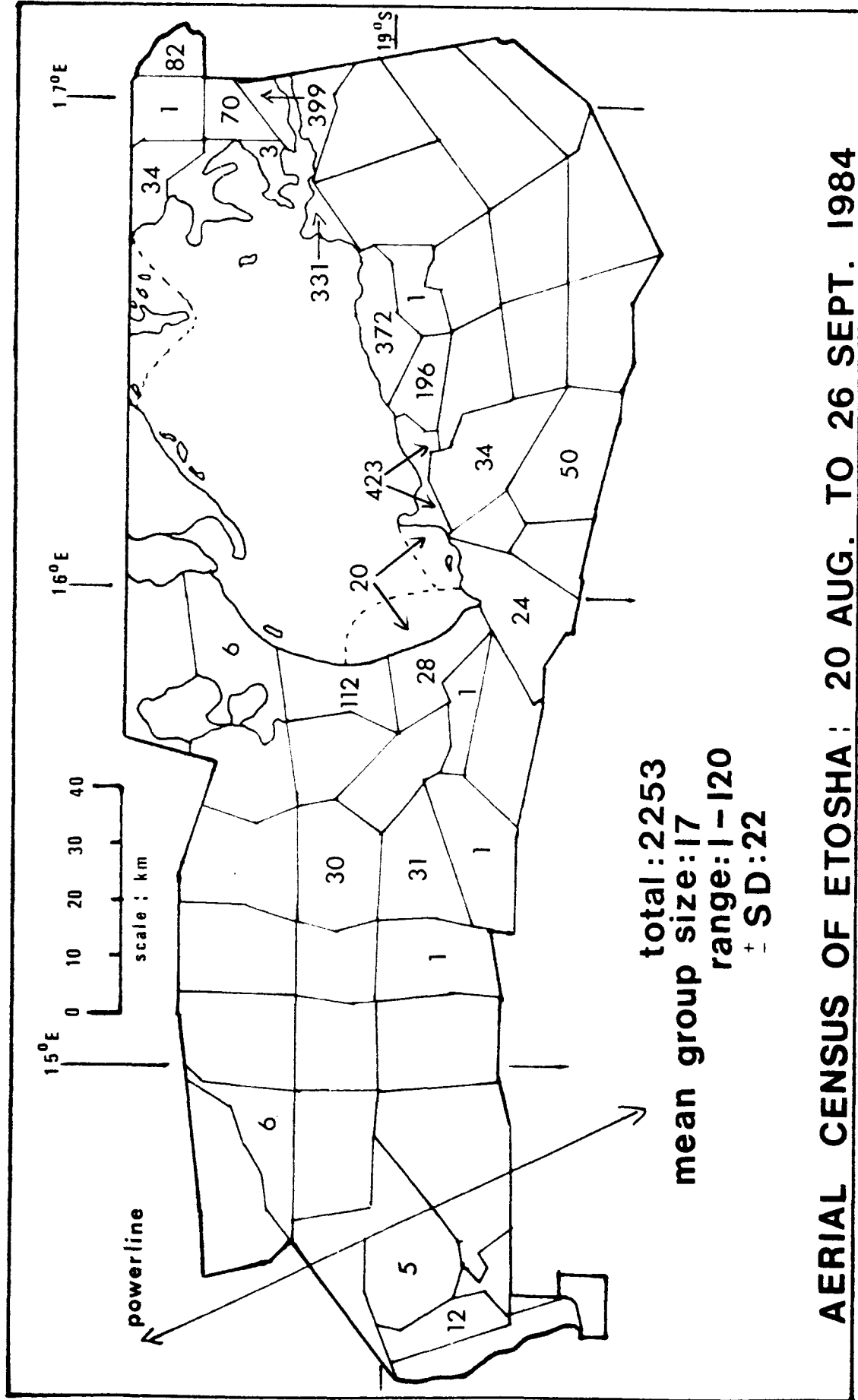


FIG. 6 : DISTRIBUTION AND NUMBERS OF GEMSBOKS REGISTERED DURING 20 AUG. TO 26 SEPT. 1984.



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FIG. 7 : DISTRIBUTION AND NUMBERS OF BLUE WILDEBEEST RECORDED DURING CENSUS IN 1984.

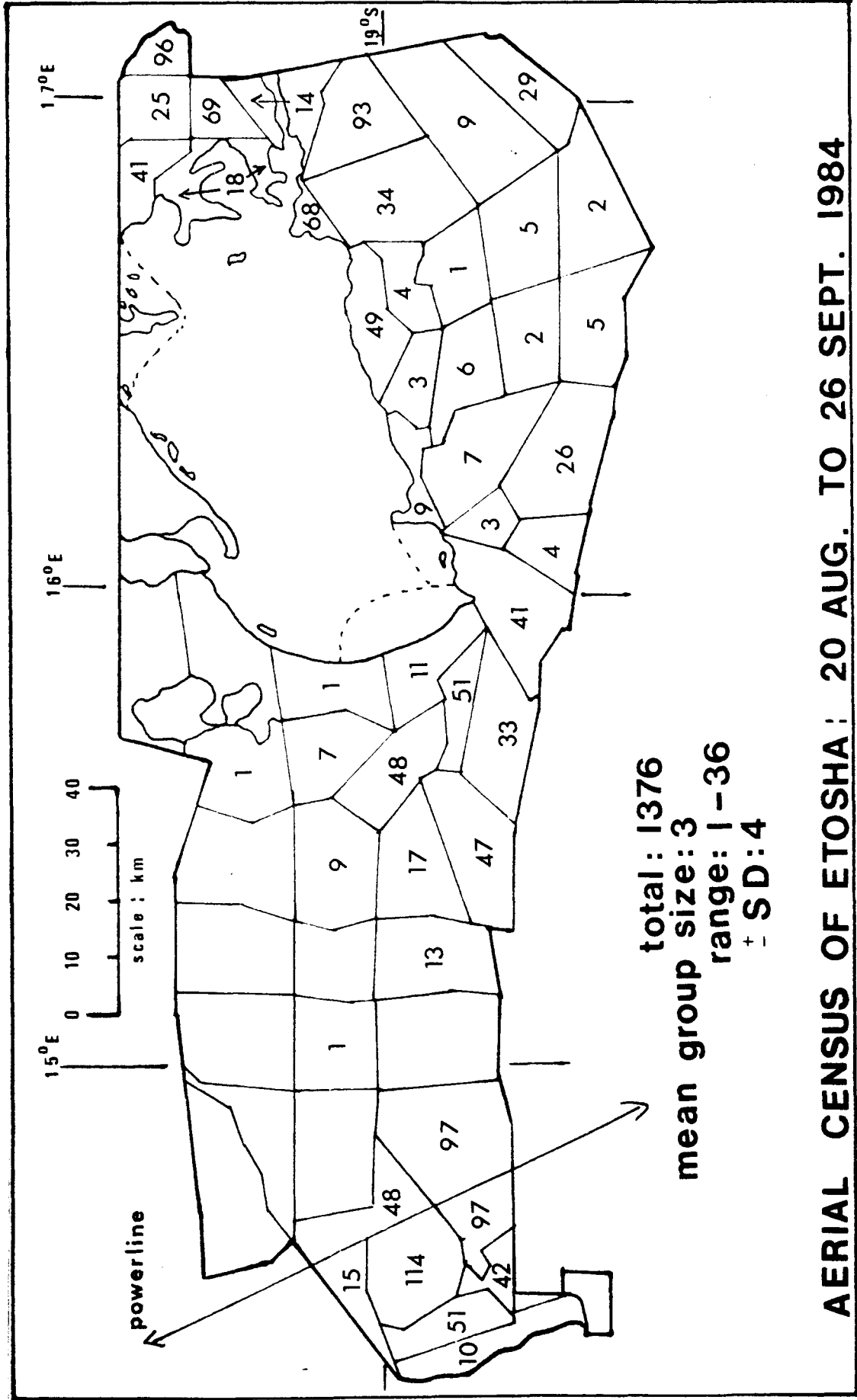
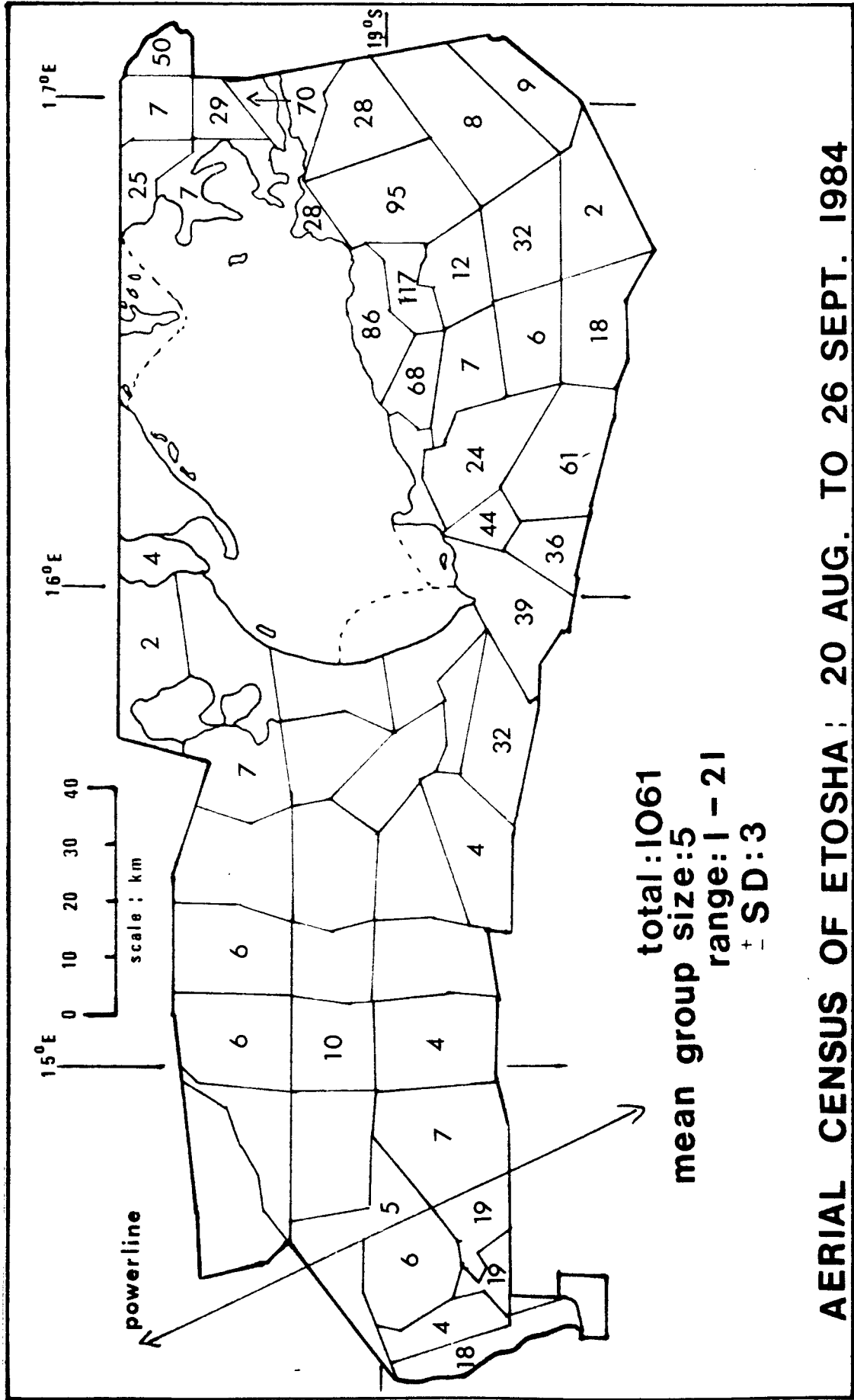


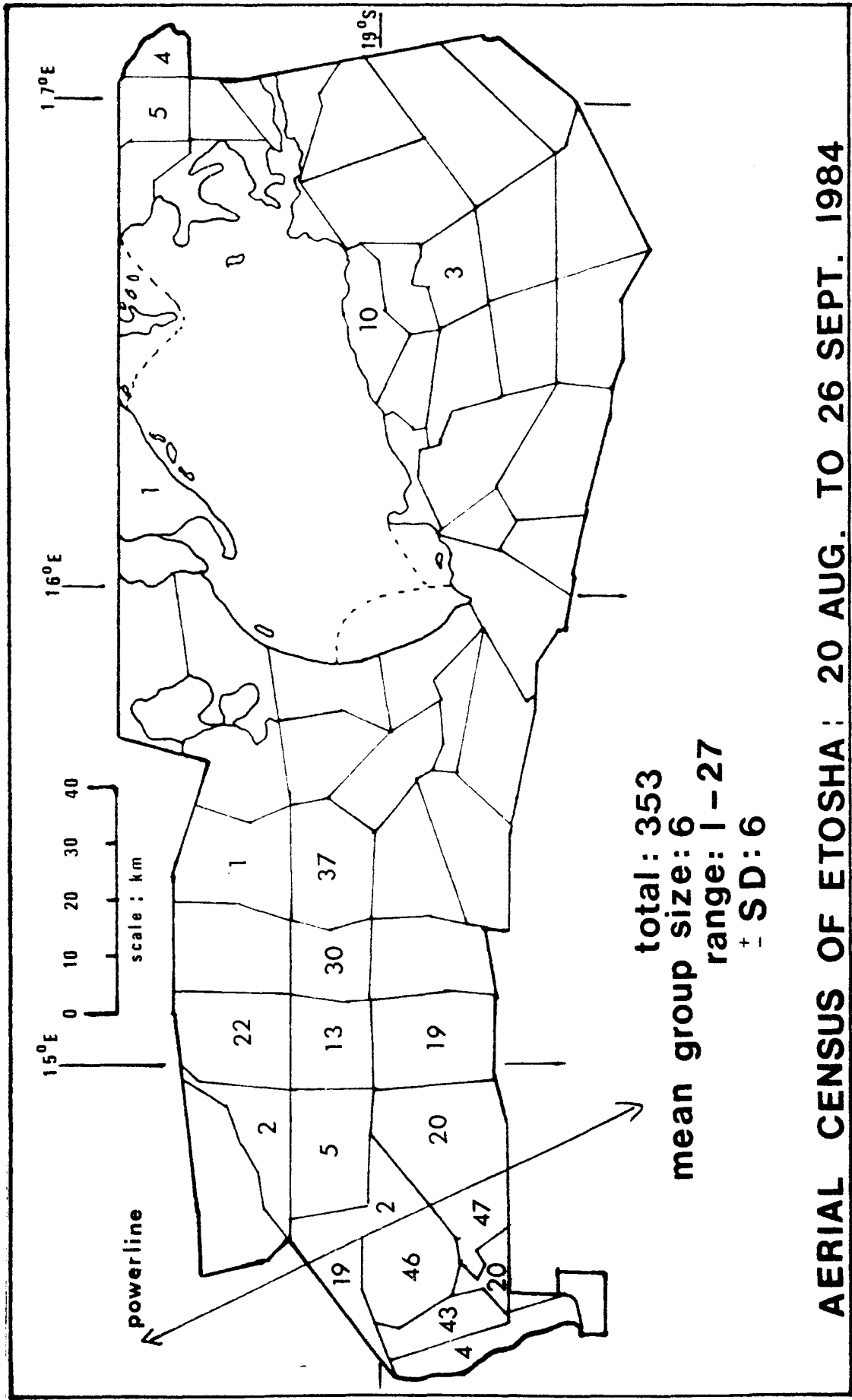
FIG. 8 : DISTRIBUTION AND NUMBERS OF GIRAFFE RECORDED PER COUNTING POINT.

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FIG. 9 : DISTRIBUTION AND NUMBERS OF BIRDS RECORDED PER CENSUS BLOCK.



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FIG. 10 : DISTRIBUTION AND NUMBERS OF ISLAND POPULATIONS IN ETOSHA, 1984.

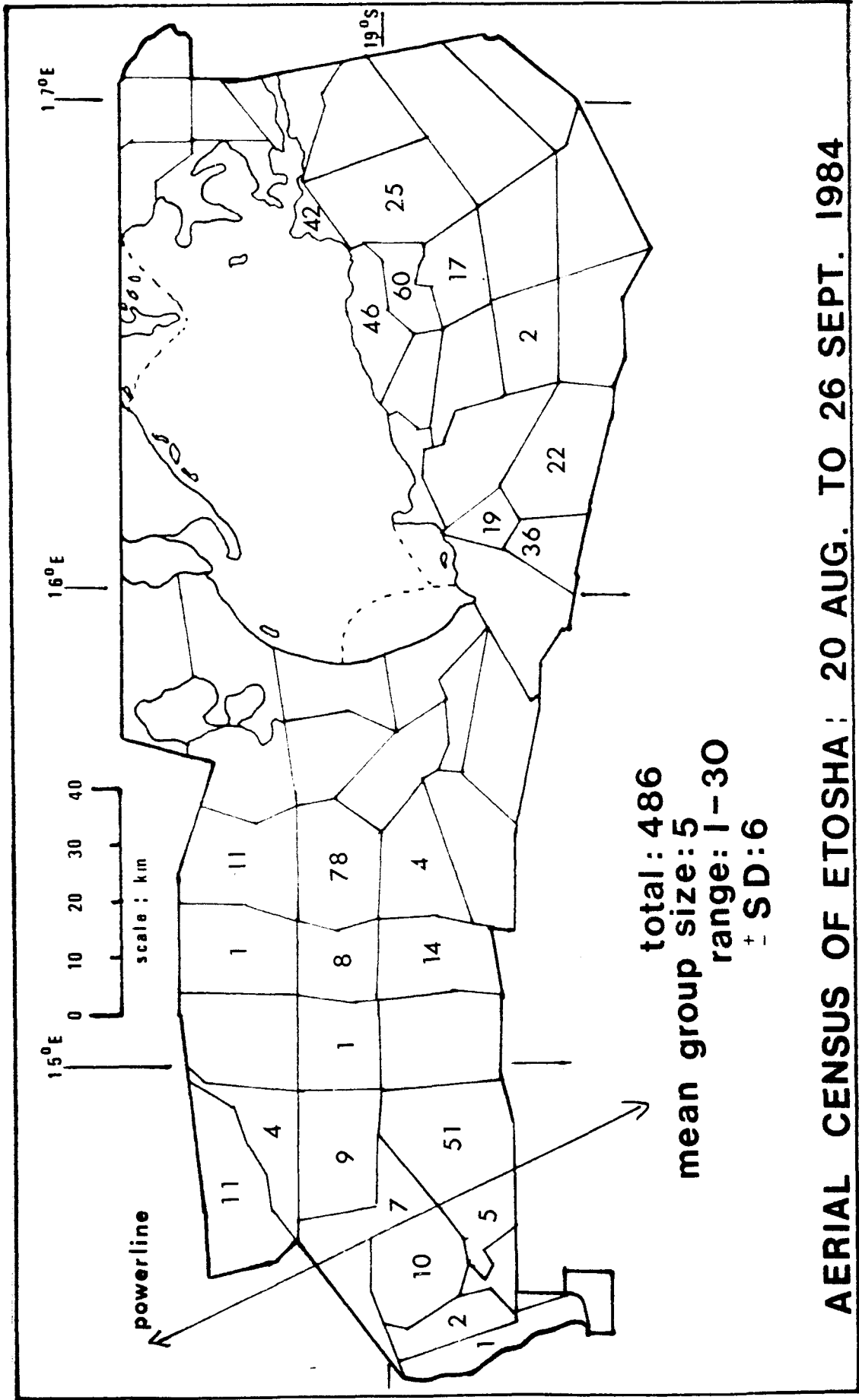
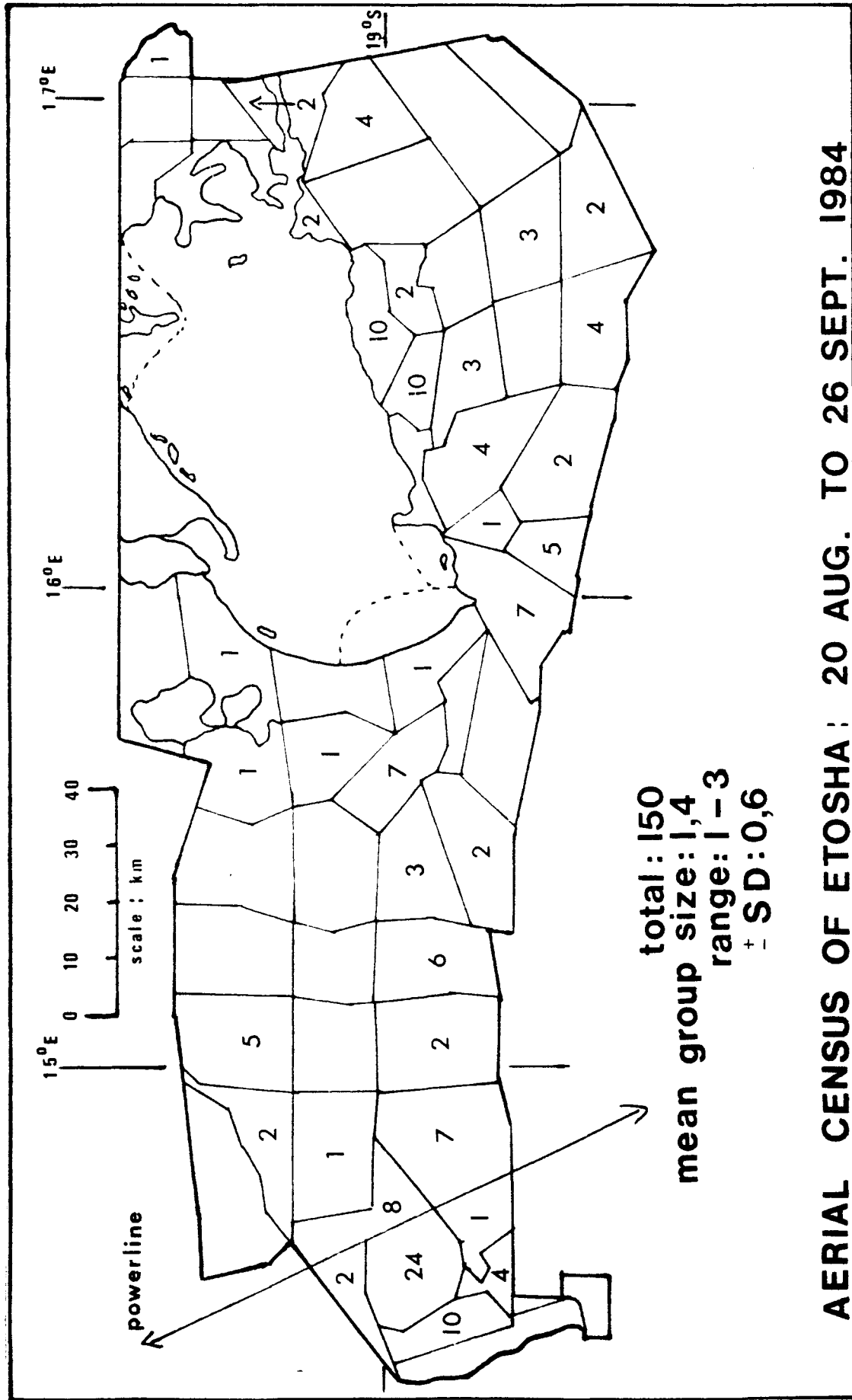


FIG. 11 : DISTRIBUTION AND NUMBERS OF GROUPS OF *OROTOCORPUS* IN ETOSHA, 20 AUG. TO 26 SEPT. 1984.



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FIG. 12 : DISTRIBUTION AND NUMBERS OF LOCUST-LITTERED MITHOCYTRUS RECORDED PER QUANTUS BLOCK.

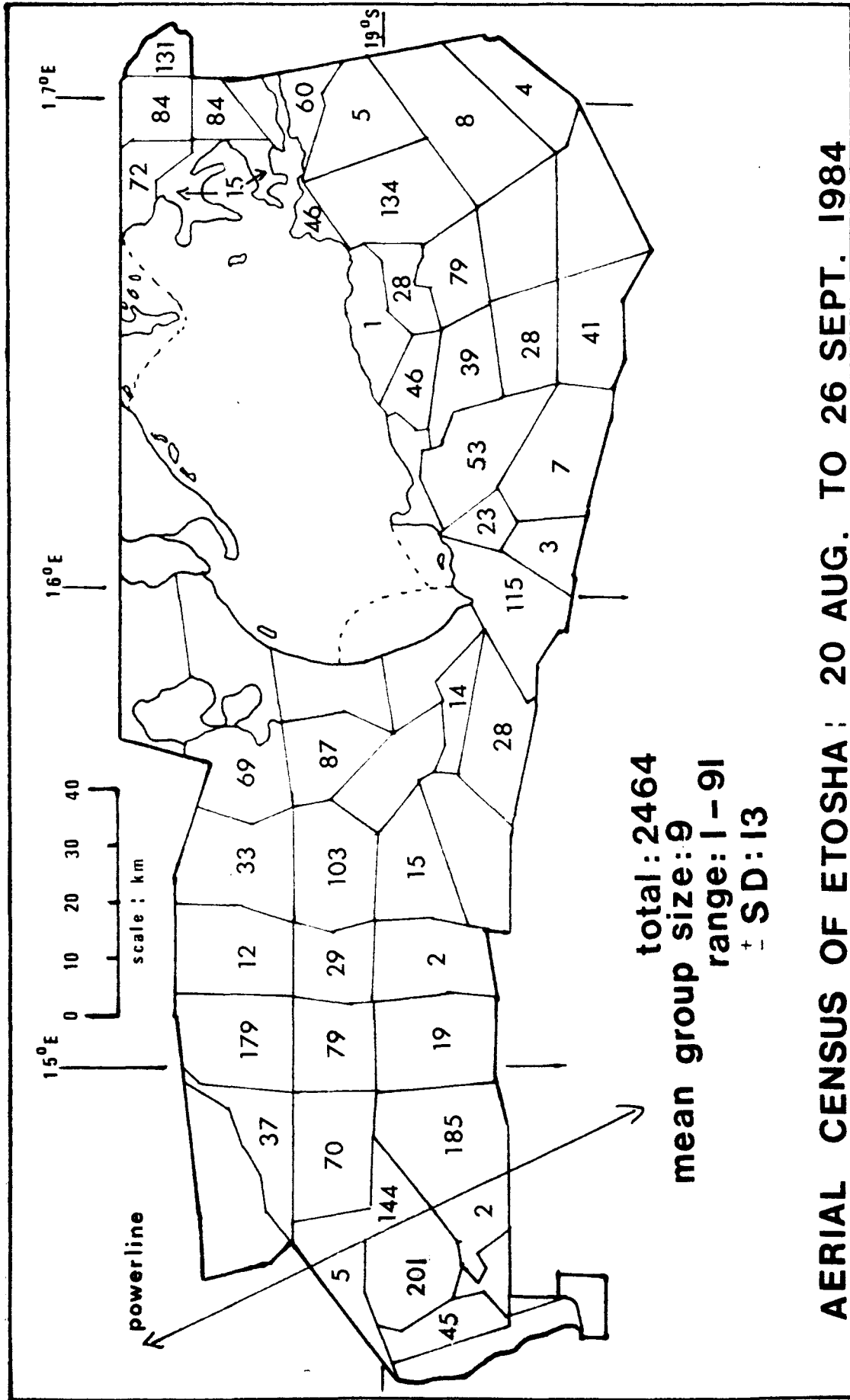


FIG. 13 : DISTRIBUTION AND NUMBERS OF ELEPHANT RECORDED PER CENSUS FLIGHT.

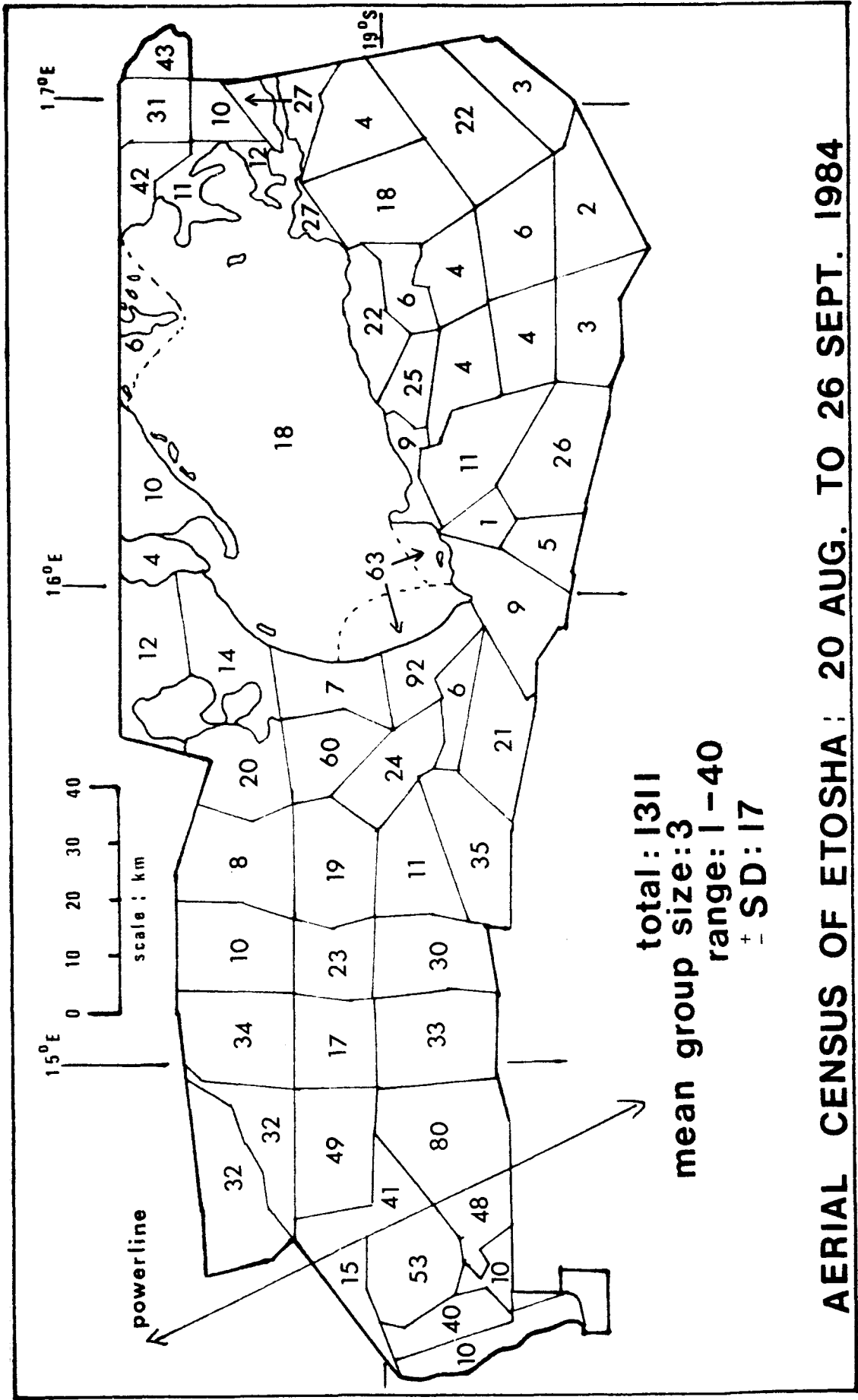


FIG. 14 : DISTRIBUTION AND NUMBER OF OVERLAP DECODED PER CENSUS BLOCK.

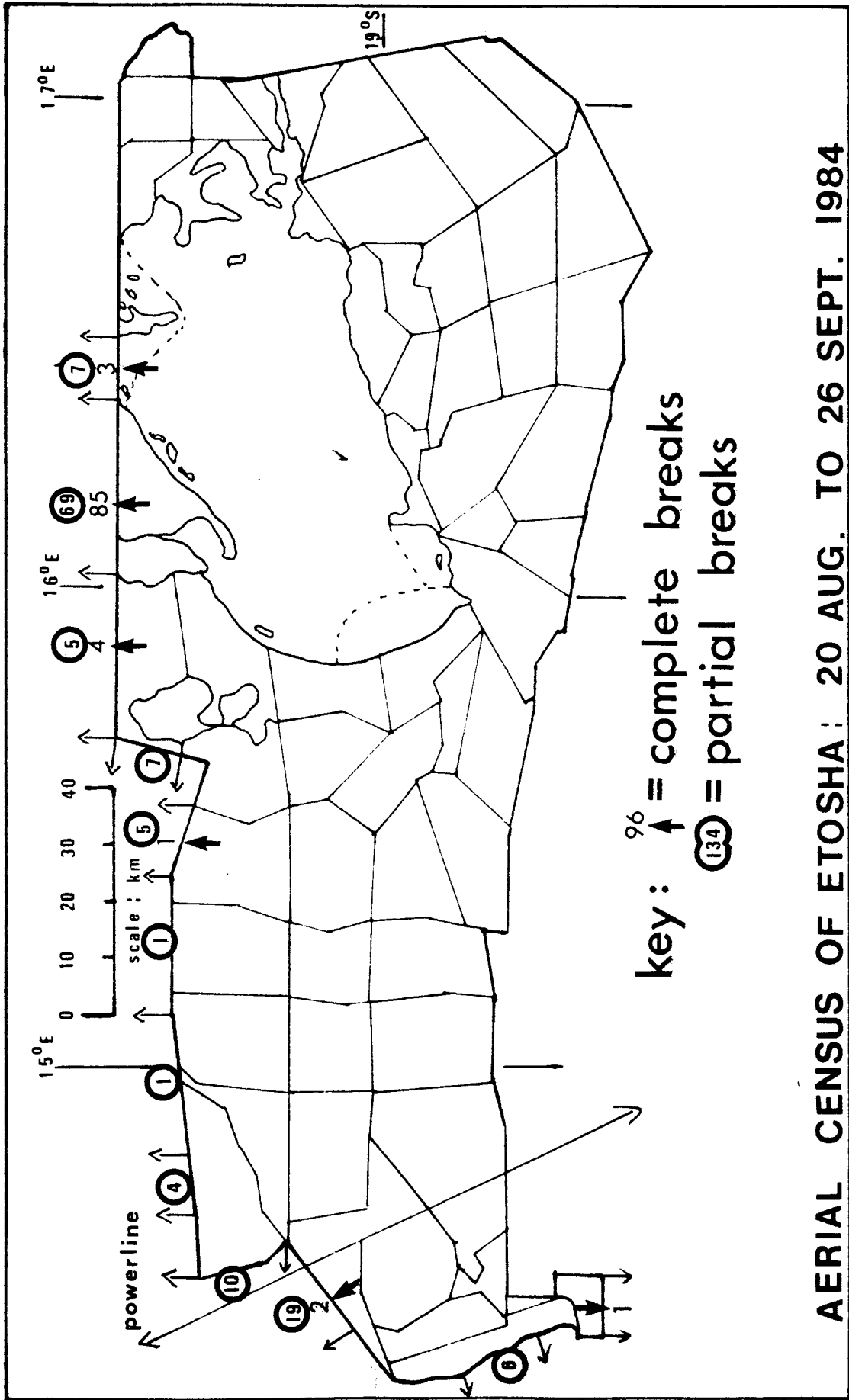


FIG. 15 : DISTRIBUTION OF COMPLETE AND PARTIAL BREAKS ON THE BOUNDARY OF ETOSHA (24 AUGUST).

4.3 Environmental conditions

Ambient temperature varied from 9 - 30°C during the counts, whilst wind speed was mostly light to gentle (< 20km/h) and moderate on only one day (< 30km/h). Cloud cover was zero for 26 of the 28 census days and on the remaining 2 days it was 1 octa high cloud. Consequently visibility was good, with only a few days where it could be regarded as average.

4.4 Numbers and Distribution of 12 Major Species

4.4.1 Hartmann's zebra (Figure 4)

Of the 2 665 zebra counted in 1982, 2 235 have subsequently been removed by capture and culling, which would theoretically leave a total of 430. However, it is more practical to take the May 1984 census when 1 027 zebra were present and deduct 250 which were captured subsequently. This leaves a theoretical total of 777. Consequently, the decline in zebra numbers due to natural factors appears to be 20% between May and August (from 777 to 620).

92% of the population occurred west of the powerline.

4.4.2 Burchell's zebra (Figure 3)

Similarly, 1 044 zebra were counted in the Otjovasandu area in May 1984, and 450 were subsequently captured, leaving a figure of 594. The August count was 512 which indicates a decline due to natural factors of 14% within that period.

In the eastern part of Etosha (surrounding the Pan) there were 6 038 zebra in 1982 and 4 591 in 1984. This represents a decline of 24%.

86% of the population occurred in the "tourist area", namely east of m'Bari windmill.

4.4.3 Springbok (Figure 5)

622 were culled in the west in 1983, but this figure does not account for the sharp reduction in numbers which was apparent in the eastern part of Etosha.

Allowing for springbok culled, the springbok population shows a decline of 29% between 1982 and 1984. 81% of the population occurred in the tourist area.

4.4.4 Gemsbok (Figure 6)

1 328 were counted in May 1984 and thereafter 265 were culled west of the powerline, leaving 1 063. In August the same area had 695, but gemsbok are highly mobile and so reasons for this decrease are speculative. Nevertheless, taking the cull figures of 1983 (200) plus those of 1984 (265) into account, there appears to be a natural decline of 30% in the population.

Gemsbok are probably the most evenly distributed large herbivore in Etosha, with 53% occurring in the tourist area.

4.4.5 Wildebeest (Figure 7)

The difference between the 1982 and 1984 censuses is 58 animals which represents no significant change in population. Nevertheless the present count of 2 253 is still cause for concern and wildebeest remain one of the most vulnerable species in Etosha. Only 24 wildebeest (1% of the population) remain west of the tourist area.

4.4.6 Giraffe (Figure 8)

Population strong and expanding, judging from the number of calves.

Two areas of concentration are apparent in Etosha, namely the Otjovasandu zone (474) and the Namutoni zone (424). Together they account for 65% of the population.

4.4.7 Kudu (Figure 9)

Surprisingly stable since 1982, if the subsequent rabies epidemic is taken into consideration. Casual ground observations show a high percentage of calves.

However, the Otjovasandu zone, an ideal habitat for kudu, shows that numbers are still low with only 78 (7%) of the population occurring there. Namutoni and Halali are the areas where kudu numbers are highest.

4.4.8 Eland (Figure 10)

Even with the addition of 36 eland from Kaross to Tsumcor, the population appears to have declined at the alarming rate of 49% in 2 years. For a herd animal, this makes the eland a threatened species in Etosha.

Only 24 eland (7% of the population) were sighted in the tourist area.

4.4.9 Hartebeest (Figure 11)

The species is well distributed and apparently on the increase, with 269 (55% of the population) occurring in the tourist area.

4.4.10 Hook-lipped rhinoceros (Figure 12)

Although subjected to disease (anthrax) and poaching pressures, the numbers indicate an increase in population. This is borne out by the good calving rate, namely 23 of the 37 cows which could be sexed with certainty had calves. Otjovasandu remains the Etosha rhino stronghold with 56 (37% of the population) counted there. The other area of noticeable rhino occurrence is Halali where 25 rhino were recorded.

4.4.11 Elephant (Figure 13)

This is the highest total count of elephant yet obtained in Etosha. The details and implications of the present census are discussed by Lindeque (1984).

4.4.12 Ostrich (Figure 14)

The decrease in numbers 524, (29% less than the 1982 population) was evident throughout Etosha. Nevertheless ostrich, along with gemsbok and springbok, are the most ubiquitous of the large species at Etosha. They were recorded in each of the 60 census blocks.

4.5 Fence breaks (Figure 15)

An aerial survey of the boundary fence on 24 August, using the fixed-wing aircraft, showed that a total of 230 sections were partially or completely broken. Of these only 1 occurred in the area adjoining the traditional white farms, whilst the rest adjoined the traditional black states of Damaraland, Kaokoland and Owambo. Not all the fence breaks were caused by elephant, since long sections of the wire have also been reported stolen.

4.6 Availability of Drinking Water

From Table 1 it is evident that the 1984 census can be regarded as a dry season count (5 temporary rainwater pans present), whereas the 1982 census was a wet season count (1 010 temporary rainwater pans present). Consequently, the distribution of many species varied considerably between the censuses.

5. COST

An operation as extensive as a total census of Etosha includes direct expenses, such as fuel and hire of aircraft, plus indirect expenses, such as transport of personnel by road to reach points where aircraft are based. Inevitably, last-minute changes in the program led to replacement of personnel and this incurred additional expenses.

The cost analysis can be approximated as follows:

ITEM	RAND
Aviation fuel (100 drums at R199,71 each)	19 971
Helicopter hire (105 hours at R270/hr)	28 350
Fixed-wing hire (98 hours at R115/hr)	11 270
Pilot hire (98 hours at R 35/hr)	3 430
Pilot S & T (39 days at R 41/day)	1 599
Fuel and staff transport (11 850 km at 39,6c/km)	4 693

S & T claims (40 days x 3 persons at R18,50/day)	2 250
(40 days x 3 persons at R14,75/day)	1 770
(40 days x 2 persons at R11,75/day)	940
	<hr/>
TOTAL:	74 273
	<hr/>

6. CONCLUSION AND RECOMMENDATIONS

Our censuses of 1982 and 1984 took place in a dry cycle and so it is predictable that large herbivore numbers may decline. Consequently, it is not surprising that grass feeders such as both zebra species and gemsbok have decreased in numbers. Mixed feeders such as springbok have also declined, whilst mixed-feeders such as elephant have increased.

Browsers such as giraffe and rhino have increased, while other browsers like eland have declined.

The reasons for the decreases of Burchell's zebra, springbok and gemsbok are probably the environmental pressures of non-ecological boundaries and abnormal levels of disease (especially anthrax) which, in turn, favours the predators. Added to these pressures, the more subtle influences of malnutrition which are coupled to a drought, such as reduced fecundity and increased pre- and post natal mortality, may also have played a role.

In the case of eland, the possibility exists that a number may have emigrated from Etosha.

Species which increased in numbers during this period may have had their numbers supplemented by immigrants to Etosha and/or the ability to compete successfully for food and water, thereby maintaining or expanding their birthrate.

It is recommended that another total aerial census of Etosha, based on our present methods, be done in 2 years, namely, 1986. August - September appears to be the most suitable period.

7. ACKNOWLEDGEMENTS

We gratefully acknowledge the help of all Research Staff, Nature Conservators and Tourist Officers who took part in the census. Dr T. van Wyk is specifically thanked for his help in arranging the program for the helicopter, whilst the Directorate's assistance in providing logistical support is appreciated. We record our thanks to the pilots for their interest and enthusiasm. The personnel of Okaukuejo, Halali and Namutoni were always willing to accommodate the census teams when changes in the program had to be made at short notice.

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OKAUKUEJO
1984-11-19