

Changes in number and distribution of hippopotamus (*Hippopotamus amphibius*) in the Sabie River, Kruger National Park, during the 1992 drought

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The 1991/92 drought in Southern Africa and the effect of the resultant reduced flow of the Sabie River on hippopotami was investigated. Hippopotami are counted annually in the Kruger National Park's (KNP) major rivers as part of the park's monitoring programme. Two additional aerial surveys were conducted to document changes in hippopotamus population densities in the Sabie River during the drought period. The hippopotamus population decreased during the drought by 12.6% to 672 animals between July 1991 and October 1992. The highest and lowest hippopotamus densities recorded were 11.6 and 2.2 animals/km river length respectively in different river sections. Only 12 hippopotamus mortalities were recorded at the end of the 1992 dry season (October).

Key words: aerial census, drought, hippopotamus, Kruger National Park, population density.

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Introduction

Hippopotami are counted annually by helicopter in the Kruger National Park (KNP) as part of an extensive monitoring programme (Joubert 1983). The six major rivers, the Crocodile, Sabie, Olifants, Letaba, Shingwedzi and Luvuvhu/Limpopo, are covered by this census.

The 1991 census recorded more than 700 hippopotami, the highest density (6.9 animals/km) in any KNP river, for the Sabie River (Viljoen 1992). The decrease in the Sabie River's flow during the severe 1991/92 drought was expected to cause significant changes in hippopotamus numbers and distribution, as hippopotamus mortalities were reported in several regions during previous droughts in southern Africa (Smuts & Whyte 1981; Walker *et al.* 1987; Whyte & Viljoen 1989).

Two additional hippopotamus censuses were therefore conducted to complement the annual census to document the expected numerical and spatial changes in the Sabie River hippopotamus population. This paper refers to the changes that occurred.

Methods

A standardised aerial census technique has been in use since 1984 for a mid-dry season (June-August) hippopotamus census in KNP rivers (Joubert 1983). The two additional Sabie River censuses, in 1992, were conducted at the beginning (13 May) and the end of the dry season (15 October) while the regular annual census was completed on 4 August 1992.

The census helicopter (Bell 206 Jetranger) had a crew consisting of the pilot (front right seat), two observers (front left seat and rear

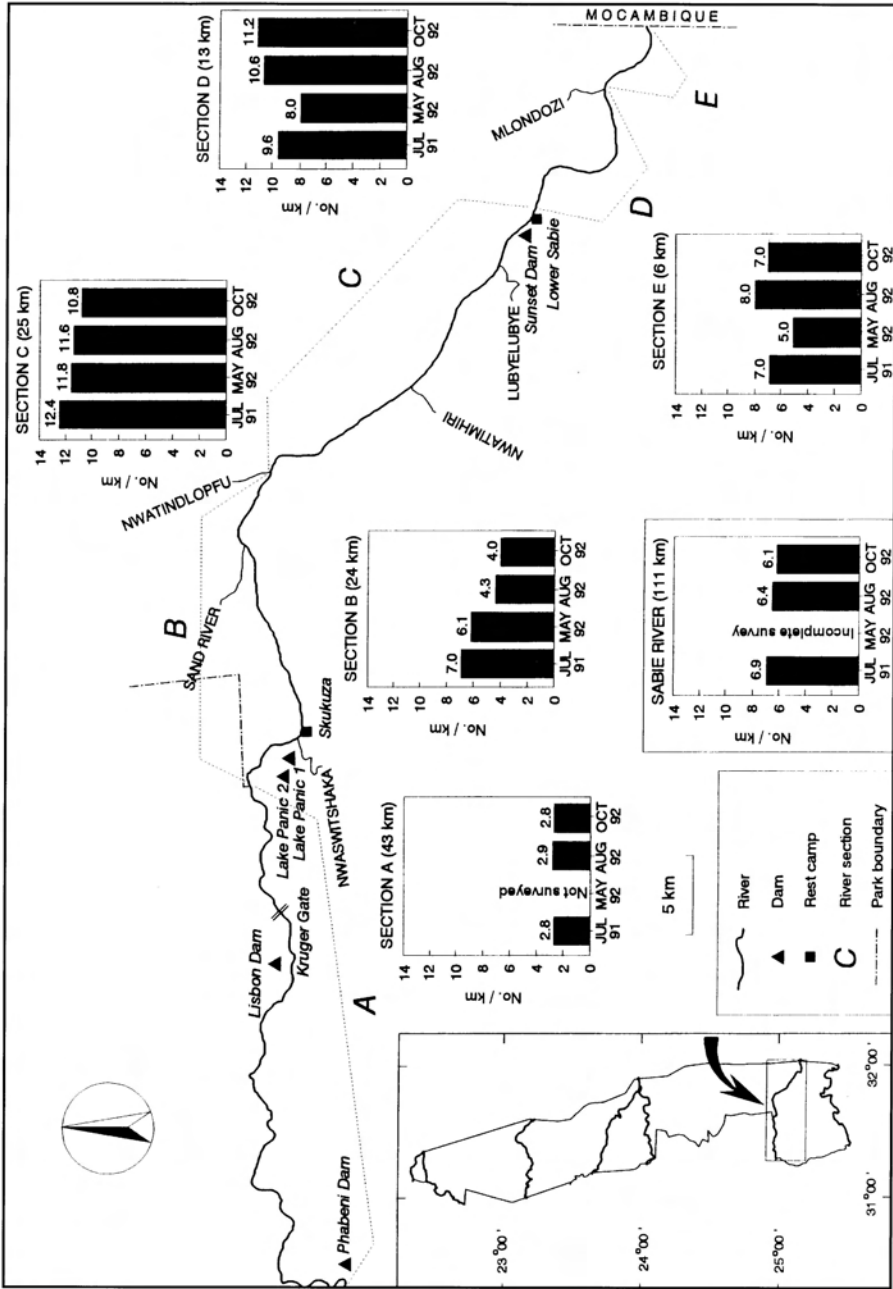


Fig. 1. Changes in the density of hippopotami (animals / km of river length) in five different river sections of the Sabie River (May, August and October 1992)

right seat) and a data recorder (left rear seat) who assisted as an additional observer. All hippopotamus sightings were plotted directly onto 1:10000 topographical maps, noting the locality, group size and number of calves (i.e. animals estimated to be younger than one year). Hippopotami counted in and out of the water were recorded separately. Warm, sunny days were selected for the censuses and flights were undertaken between late morning and early afternoon (10:00 - 14:00) when the majority of hippopotami are usually outside the water and therefore easier to count. The duration of the censuses were 01:37h, 01:51h and 01:44h in May, August and October respectively. The flight height was 20-55m above ground at an air speed of about 25-35 knots. A criss-cross flight path was followed in sections where the river is wide or braided. Although the full length of the Sabie River was censused during the August and October censuses, the May census included only the section downstream of Kruger Gate (Fig. 1). Hippopotami counted in dams in the near vicinity of the Sabie River were also included in the river total.

All recorded observations on the data maps were transferred to a computerised grid system with a digitiser tablet and computer.

Table 1
Census totals for hippopotami in the Sabie River as obtained during the 1991 annual census and three 1992 censuses (May, August and October)

Census Period	River	
	Sections B-E	Total ^a
July 1991	647	769
May 1992 ^a	574	574
August 1992	582	708
October 1992	553	672

^a River Section A was excluded in the May 1992 census (see Fig. 1).

The data were extracted and analysed using a commercial statistical software product (SAS Institute 1991). Hippopotamus densities were calculated according to five different river sections adapted from a classification proposed by Venter (1991).

Results and discussion

The August census, the first complete census of the Sabie River in 1992, provided

Table 2
Number of hippopotami in dams near the Sabie River during three 1992 hippopotamus censuses (May, August and October)

Dam	Distance from the river(km)	May		August		October	
		Total	Calves	Total	Calves	Total	Calves
Phabeni	1.0	a		26	6	30	
Lisbon	1.0	a		12	1	11	
Lake Panic 1	0.6	1		3			
Lake Panic 2	1.2	19	1	8		8	
Sunset	0.3			1		2	

^a River section A was excluded in the May 1992 census (see Fig. 1).

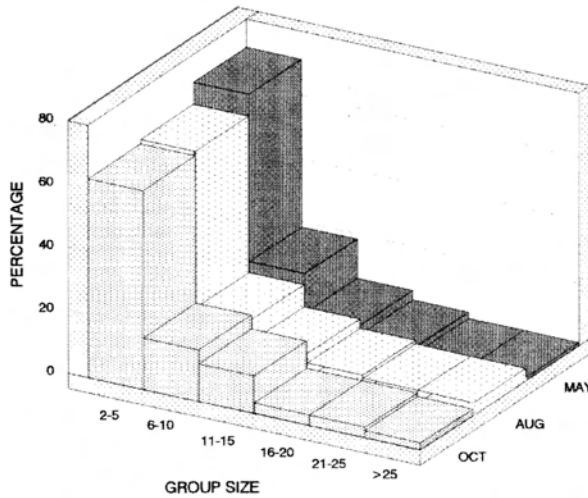


Fig. 2. Hippopotamus group sizes recorded during three censuses in the Sabie River (May, August and October 1992).

the best comparison with the previous annual census. A population decrease of 7.9% from July 1991 (Viljoen 1992) to 708 hippopotami in August 1992 was recorded (Table 1), including those in five dams near the Sabie River (Table 2). The overall population density was 6.4 animals/km. Population densities in the five river sections varied from 2.9 animals/km upstream from Skukuza to 11.6 animals between Nwatindlopfu and Lower Sabie (Fig. 1). A population decrease of 38.5% occurred from July 1991 to August 1992 between Skukuza and Nwatindlopfu (Section B). Hippopotami increased in the two sections downstream of Lower Sabie (12.8% and 14.3% respectively) while remaining relatively unchanged upstream of Skukuza (Section A).

The annual census in August and the two additional censuses in the Sabie River during 1992 indicated that changes in both hippopotamus numbers and distribution occurred (Fig. 1). The population density

remained relatively unchanged upstream of Skukuza (Section A) during the August and October censuses. With the exception of the section between Nwatindlopfu and Lower Sabie (Section C) where the density remained relatively stable, densities varied in the other sections. The most noticeable changes occurred between Skukuza and Nwatindlopfu (Section B) where the hippopotamus density decreased between August and October, and downstream of Lower Sabie where density increased. These changes in population density are not significant (Two-way analysis of variance; F -ratio=0.475; $P>0.05$). The only hippopotamus mortalities ($n = 12$) were recorded during the October census.

Several hippopotami were present in dams near the Sabie River during the censuses (Table 2), contributing 7.1% and 7.6% to the total during the August and October censuses respectively. Phabeni Dam near the western boundary of the KNP and Lisbon Dam north-west of Kruger Gate

Table 3

Hippopotami recorded on land and in the water during three 1992 censuses (May, August and October)

Period	Hippopotami						Total ^a
	On Land		In Water		Calves ^{aa} seen		
	Total	%	Total	%	Total	%	
May ^a	226	39.4	348	60.6	35	6.1	574
August	655	92.5	53	7.5	62	8.6	708
October	65	9.7	607	90.3	4	0.6	672

^a River section A was excluded in the May 1992 census (see Fig. 1).

^{aa} Animals aged younger than one year (both on land in the water).

Table 4

Group sizes of hippopotami recorded both on land and in the water during three 1992 censuses (May, August and October)

Period	On land		Avg group size ^a	In water		Avg group size ^a
	No. of individ. ^a	No. of groups ^{aa}		No. of individ. ^{aaa}	No. of groups ^{aa}	
May (%)	27 11.9	45	4.4	28 8.0	52	6.2
August (%)	45 6.9	78	7.8	17 32.1	11	3.3
October (%)	29 44.6	10	3.6	46 7.6	82	6.8
Mean	33.7	44.3	6.4	30.3	48.3	6.3

^a Average group size of groups consisting of ≥ 2 individuals.

^{aa} Number of groups consisting of ≥ 2 individuals.

^{aaa} Total number of single individuals.

River section A was excluded in the May 1992 census (see Fig. 1).

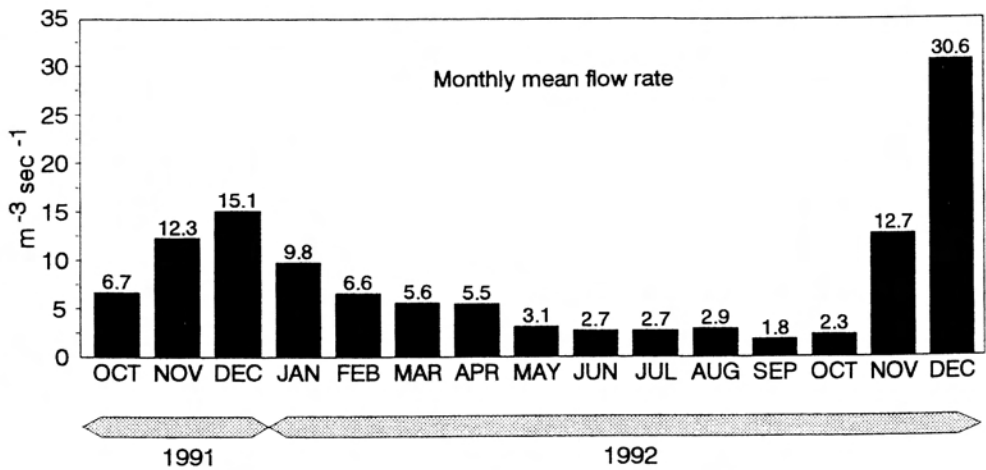


Fig. 3. Monthly mean flow rate of the Sabie River measured at Kruger Gate between October 1991 and December 1992 (data source: Directorate Hydrology, SA Department of Water Affairs).

contained an average of 5.7% of the Sabie River hippopotami in August and October.

The number of calves observed varied between four in October (0.6% of the population) and 62 in August (8.6% of the population). The majority of hippopotami (92.5%) were on land during the August census but only 39.4% and 9.7% were outside the water during the May and October censuses respectively (Table 3). Hippopotamus calves are very difficult to count in the water and the high percentages of hippopotami in the water during the May and October censuses possibly resulted in an undercount of calves. An earlier experimental count in the Olifants River revealed that significantly fewer hippopotamus calves are counted when the majority of hippopotami are in the water, although the total number of animals does not differ significantly (Viljoen, unpublished data). Only seven calves were counted in dams during the August census and none during the October census (Table 2).

Hippopotamus births have been reported to be positively correlated with rainfall (Laws & Clough 1966; Smuts & Whyte 1981). Smuts & Whyte (1981) found that hippopotamus conception rates in the KNP differed significantly between drought years and those with above average rainfall. The percentage calves recorded during the August census differs by only 3.3% (below) from the nine-year average for the Sabie River (Viljoen 1993).

The majority of hippopotamus herds (66.3%; $n=278$) consisted of 2-5 individuals during all three censuses (Fig. 2). Only 5.1% numbered more than 20 individuals. Although overall group sizes remained largely unchanged during the three surveys (Fig. 2), the percentage of single individuals (Table 4) varied significantly between the three surveys ($\chi^2=41.89$; $P<0.01$; $df=2$). The highest percentage of single animals occurred in October (44.6% and 7.6% on land in the water respectively) and the lowest in May 1992 (11.9% and 8.0% on land in the water respectively). Mean group

sizes did not differ significantly between hippopotami on land and in the water during the three censuses ($\chi^2=3.11$; $P>0.05$; $df=2$).

Hippopotamus groups are variable in size and composition, and changes may even occur during one day (Klingel 1991). Group size is not a sociological parameter but depends on density and habitat conditions such as the availability of suitable pools and sandy banks (Klingel 1991). The relatively unchanged group sizes in the Sabie River are probably the result of pool sizes and sandy banks which remained suitable in spite of the reduced flow conditions.

Conclusions

Although the Sabie River hippopotamus population total decreased during the drought, densities in the different river sections remained largely unchanged, even when the Sabie River's flow decreased to a monthly mean of only $1.8 \text{ m}^{-3} \text{ sec}^{-1}$ during September 1992 (Fig. 3). The drought resulted in only a few mortalities towards the end of the dry season, unlike the Letaba and Luvuvhu rivers where large numbers of hippopotami died during the 1992 dry season (Viljoen 1993). During drought conditions the availability of pools often becomes a severe limiting factor (Smuts & Whyte 1981). Hippopotamus group sizes did not change significantly, nor was the percentage calves recorded significantly lower than during previous years, indicating that pool conditions in the Sabie River remained adequate to sustain the present hippopotamus population during the study period.

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