

The Impacts of Environmental Change on Protected Areas: A Study of the Impact of Drought on Animal Utilization of the Makgadikgadi Pans Game Reserve

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INTRODUCTION

When we talk of environmental change in protected areas, we cannot separate wildlife, or indeed any living organism, from the environment it inhabits and from which it derives its sustenance. The drought which hit Botswana during the period 1981-1987 had an adverse effect on the Makgadikgadi Pans Game Reserve and on animal numbers and movements. Because rainfall was below average (100 mm), the Boteti River, which bounds the reserve on the west and flows only ephemerally even under normal conditions, was virtually dry. The condition of the vegetation was poor.

Makgadikgadi Pans Game Reserve has abundant wildlife, with animal species such as zebra, wildebeest, springbok, ostrich, gemsbok, hartebeest, kudu, giraffe, lion, impala, and other smaller species occurring in varying densities. The water-dependent species are numerous compared with less water-dependent ones. During the drought, there were a lot of die-offs, mostly

of zebra and wildebeest, due to lack of good grazing and water. The surviving species wandered outside the protected area in search of water. The less water-dependent species were not severely affected.

Water-dwelling species, such as hippopotamus and crocodile, crowded into discrete permanent pools along the Boteti. Artzen and Veenendaal (1986) stated that it appears that movement of animals in Botswana is, in general, influenced by rain and hence partly erratic. They concluded that wildebeest and zebra in Makgadi-kgadi Pans Game Reserve show seasonal movement from the grass plains along the Ntwetwe Pans in the wet season to the lower Boteti in the dry.

STUDY AREA

The reserve encompasses approximately 3,700 sq km and extends between 24 and 25 degrees east longitude and 20 and 21 degrees south latitude. It is part of the Makgadi-kgadi Pans complex, an old dry and flat lake bed (Mbano 1984). The Boteti River on the western boundary was dry during the drought except for a few pools. Around June 1989, floods finally reached the Boteti, which depends on overspill from the Okavango River to the north. On its southeastern side, the reserve is bounded by great salt pans which may accumulate rainwater during the wet season. However, due to low rainfall, high evaporation, and free-draining soil, surface water is scarce, with the pans generally drying up during the dry season.

The study area gets between 450 and 500 mm of rainfall per annum. The rain falls during the summer months (October to March). The rainfall in the reserve has a 40% variation and 200 mm deviation. Its intensity varies considerably (Mbano 1984).

METHODS

Two methods were used to monitor the numbers, movement, and distribution of the reserve's animal species.

Aerial survey Wet- and dry-season aerial surveys were conducted. The reserve was flown at 4% coverage by a fixed-wing single-engine light aircraft at an altitude of 300 ft. The plane was flown along transects with a fixed strip width of 200 m on both wings. Animal species seen on both sides were counted and recorded. Later, the results were put into a computer to calculate estimated numbers, confidence limits, density biomass, etc., for each species seen.

Road survey Road counts were done every month, starting in 1989, to intensify the monitoring. The method was adapted from that of Dasmann and Mossman (1962). The following parameters were recorded during the road counts: (1) perpendicular distance from the vehicle to the sighting, (2) distance traveled, and (3) number of species sighted. These parameters were used to calculate strip width, survey area, animal density index, and estimated population.

RESULTS AND DISCUSSION

The movement of wildebeest is similar in pattern to that of the zebra and the estimated numbers of species do not differ very much (see Table 1) but do vary between seasons. These species are found at the Boteti River during the dry season in herds of varying sizes. Counts along the river during the wet season indicate absence of these species. Although these species were the most affected by the drought because of their dependence on water, they seem to be more numerous in the reserve than other species that are less dependent. Following the drought, the animals seem to have been able to increase their popula-

Table 1. Population estimates of selected animal species in Makgadikgadi Pans Game Reserve, 1989-1991

Species	Season	Survey Method	1989	1990	1991
Zebra	wet	road	888	63,529	36,031
		aerial	—	667	33,775
	dry	road	35,455	53,662	518
		aerial	62	10,816	27,571
Wildebeest	wet	road	185	13,801	17,767
		aerial	—	128	2,379
	dry	road	23,921	33,386	76
		aerial	14,793	6,993	3,622
Springbok	wet	road	—	—	910
		aerial	—	—	7,026
	dry	road	33,948	37,876	642
		aerial	13,403	154	—
Ostrich	wet	road	—	3,796	1,406
		aerial	—	1,275	1,275
	dry	road	1,887	2,620	1,147
		aerial	1,392	1,050	1,087
Gemsbok	wet	road	2,812	3,585	1,976
		aerial	—	1,550	814
	dry	road	3,404	2,102	814
		aerial	416	450	764

Table 2. Population estimates of selected animal species in Makgadikgadi Pans Game Reserve, 1974-1987

Date	Wildebeest	Zebra	Springbok	Ostrich	Gemsbok
Nov. 1974	23,500	22,750	6,000	2,900	1,250
Mar. 1979	53,000	100,300	—	—	—
Feb. 1982	23,700	59,200	3,000	4,500	500
Feb. 1987	10,000	21,100	6,300	4,700	120
June 1987	—	300	10,800	1,400	360

tions. Yet there were years after the drought which had little rainfall; therefore, population estimates have fluctuated. Note the sharp drop in dry-season road counts for both zebra and wildebeest in 1991. Even within years there is considerable variation in zebra numbers between the wet and dry season. In 1989, the number of zebra increased greatly during the dry season, indicating the possibility that they came into the reserve from adjacent areas to utilize the river. But in 1991 the opposite happened, when both wildebeest and zebra appear to have left the reserve in large numbers during the dry season. This could have been caused by the fact that the Boteti did not flow at the expected time and hence was almost dry for most of the dry season that year.

The less water-dependent species (springbok, gemsbok, and ostrich) seem not to have been as affected by the drought since their numbers have not changed much from pre-drought levels (compare Tables 1 and 2). However, in 1987 the dry-season population of ostrich was reduced from 4,700 to 1,400, possibly due to hunting or poaching. In contrast, gemsbok and springbok increased during that dry season. But, as Table 1 shows, springbok were absent from the reserve during the wet seasons of 1989 and 1990, only to reappear in large numbers during the dry season. The springbok can

both graze and browse, but tends to favor the latter. It is possible that the springbok lag behind in adjacent areas to utilize the herbs outside the reserve, moving in after the zebra and wildebeest have gone to the river. Then the springbok graze herbs that were hidden by the grass until it was grazed by the zebra and wildebeest. This also shows the possibility that facilitation, as explained by Maddock (1984), might be taking place between the three species, which are separated by the difference in their food requirements. In addition, by moving to the pans, which provide seasonal grazing, they avoid competition with other ungulates for a large part of the year. Maddock further states that the main factor determining both the animal movements and variation in them is rainfall, through its effect on food supply.

CONCLUSION

Makgadikgadi Pans Game Reserve offers suitable habitat to the ungulate species usually found there. These species use the reserve's habitats in varying degrees, with zebra and wildebeest the most widely distributed and most often encountered. Springbok and gemsbok are more localized in herds. The effect of the 1981-1987 drought varied among the species, and there were wide differences in the seasonality of use of the reserve.

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