

**REPORT TO THE
DEPARTMENT OF WILDLIFE AND NATIONAL PARKS,
BOTSWANA
ON
AN AERIAL CENSUS OF BLACK AND SQUARE-LIPPED
RHINOCEROS IN NORTHERN BOTSWANA
18 SEPTEMBER to 2 OCTOBER 1992**

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Discussions between the Rhino and Elephant Foundation (REF) and the Department of Wildlife and National Parks (DWNP) on rhinoceros conservation were initiated during 1988 when it was recognized that there was an urgent need to know more about the status and distribution of both species of rhinoceros in northern Botswana before an effective strategy for their long-term conservation could be developed. The proposed strategy would cover several phases of which this aerial survey constitutes the first phase.

OBJECTIVE

To determine numbers and distribution of the black rhinoceros *Diceros bicornis chobiensis* and the square lipped rhinoceros *Ceratotherium simum simum* in northern Botswana.

BACKGROUND

DISTRIBUTION OF BLACK RHINOCEROS IN BOTSWANA

The earliest records of the distribution of black rhinoceros in Botswana indicate that the species was fairly wide spread in the north and east of the country where rainfall exceeds 400 mm per annum, but absent from the low rainfall areas like the Kalahari (Harris 1838, Cumming 1850, Anderson 1856). By the end of the 19th century the black rhinoceros had disappeared over most of its range in Botswana and only low numbers of scattered individuals survived in the area north of the Okavango, along the upper Chobe drainage and along the Kwando river (Selous 1881, Bryden 1893). While excessive hunting of the species was undoubtedly a major factor in its decline, a contributory cause was very likely also the extent of habitat change, and especially the drying-up of permanent rivers and fountains over much of the black rhinos former range in Botswana (Campbell and Child 1971, Cooke 1983, Campbell 1983).

During most of the present century occasional reports of sightings of black rhinoceros have been published (Child 1968). These range from sightings on the western Caprivi border, the Kwando/Linyanti, Chief's Island in the northern Okavango and the area west of Savuti. Smithers (1971) published records of nine sightings in this area derived from the period 1963 - 1970 in an area of approximately 40 000 square kilometres. The estimates of numbers of black rhinoceros in northern Botswana has varied from about 10 to 20 animals (Smithers 1968, 1971; von Richter 1973, Western and Vigne 1985), though all estimates are largely guesses.

In 1990 it was known that there were some black rhinoceros in northern Botswana as sightings were made during 1987 and 1988 (Gavor 1988). During 1988 a cow and calf were seen and photographed west of the Mababe Depression (Potgieter and Walker 1989) but tragically in May 1991 the calf was shot by poachers (D. Joubert and G. Blair pers. comm.) and the horns removed; it is also suspected that the female was shot at the same time and as yet her remains have not been found.

TAXONOMIC STATUS OF BLACK RHINOCEROS IN NORTHERN BOTSWANA.

The black rhinoceros of the upper Chobe/Linyanti/Kwando region in Botswana, Caprivi (Namibia) and south east Angola was described by Zukowsky (1964) as the subspecies *Diceros bicornis chobiensis*. This nomenclature was supported by Groves (1967) and further substantiated by Rookmaker and Groves (1978) on the basis of skull measurements. Recent taxonomic work on the restriction fragment patterns produced from DNA extracted from tissue cultures indicated that two black rhinoceros captured in the Caprivi/Kwando area in 1989 differed, even if only slightly, from the black rhinoceros of Etosha National Park, Namibia (*Diceros bicornis bicornis*) and animals of East African origin. They were very similar to animals from Natal (*D.b. minor*) on the basis of the tissue cultures, but specimens differed markedly from the Natal animals on the basis of skull size.

On balance, therefore, there is still sufficient evidence to recognise the subspecies *D.b. chobiensis*, however tenuously, and to seek to conserve these animals as a genetic unit pending some definitive taxonomic work of the future.

DISTRIBUTION OF SQUARE-LIPPED RHINOCEROS IN BOTSWANA.

The historical record indicates that square-lipped rhinoceros (*Ceratotherium simum simum*) were also fairly wide spread in northern and eastern Botswana (Anderson 1856, Selous 1881, Bryden 1893) in areas largely above the 400 mm isohyet. Between 1880 and 1890 the species became extinct (Bryden 1893). Again, hunting was most likely the major cause of decline, but habitat change and desiccation may well also have contributed to the demise of the species.

The square-lipped rhinoceros re-appeared in Botswana during the 1960's when stragglers wandered over the border from Hwange National Park in Zimbabwe (von Richter 1973) where they had been re-introduced from the Republic of South Africa from 1962 onwards (Smithers and Wilson 1979)

The square-lipped rhinoceros was formerly brought back from extinction in Botswana with the introduction of two males and two females in June and July 1967 to the Serondella area in Chobe National Park. The introductions continued during 1974, 1976, 1980 and 1981 with a total of 71 animals re-introduced to Chobe National Park, 19 animals to Moremi Game Reserve (1974 - 1982) and 4 to the Maun Nature Reserve (December 1976) (Hitchins 1988) by the Department of Wildlife and National Parks, Okavango Wildlife Society and the Natal Parks, Game and Fish Preservation Board.

The translocation was initially successful with the first birth of a square-lipped rhino calf in Botswana this century being reported in 1971 (von Richter 1973). However, by the mid 1980's the species was no longer found along the Chobe river flood plains which is undoubtedly the best habitat for the species in northern Botswana. The decline in numbers has not been clearly documented (Gavor 1988) but poaching is believed to be the main cause. There has also been a change in distribution of the species from the main release areas along the Chobe river to areas further south and east along the Ngwezumba valley (Gavor 1988).

With normal recruitment and without the impact of poaching, the square-lipped rhino population in Chobe National Park should number about 216 animals.

STUDY AREA

The census area was determined by suitable habitat, available water and recent signs and sightings of predominantly black rhinoceros. The Ngwezumba area where square-lipped rhinoceros were known to occur was also included as part of the census area.

The census was undertaken in the predominantly water-less areas of Ngamiland, northern Botswana and incorporated parts of the Chobe National Park, Maikaelelo and Chobe Forest Reserves and the hunting/safari concession areas to the west of Chobe National Park between the perennial Linyanti and Kwando rivers in the north and the Khwai river in the south. The predominantly dry Savuti channel and the Magwegqana (or Selinda spillway) run from the Linyanti swamp and the Okavango delta respectively; the former periodically drained into the Savuti Marsh which is part of the large Mababe depression. Similarly, the ephemeral Ngwezumba river also drains into the depression in exceptionally high rainfall years. Bisecting the study area is a sand ridge that runs from the northern side of the Mababe depression, southwards to the eastern side of the Okavango delta. (Figure 1)

The region is semi-arid receiving 500 - 650 mm of rain annually. The wet season lasts from October to March, with the greatest proportion falling in the latter half of the season. The remainder of the year is dry. Ambient temperatures show wide daily and seasonal fluctuations.

The vegetation consists predominantly of deciduous dry woodland and scattered grasslands on Kalahari sands. The vegetation ranged from grasslands in association with eight large pans in the Nogatsi area in the east, through open stands of *Baikiaca plurijuga*, *Burkea africana* and *Pterocarpus angolensis* on deep Kalahari sands in the interior and north of the CNP and to the west of the Kwando river. These stands were interspersed with *Acacia erioloba*, *A. leuderitzii*, *Terminalia sericea*, *Lonchocarpus capassa*, *L. nelsii*, *Cornbreum imberbe*, *Adansonia digitata* and *Guibourtia coleospermum*. West of the Kwando river *G. coleospermum* became more common than in the east. Surrounding these on shallower soils with a higher clay component, particularly to the west of the sand ridge lies dense stands of *Colophospermum mopane* and patches of open grasslands. The Mababe Depression consisted of nutritious grassland with *Panicum maximum*, *Cynodon dactylon*, and *Brachiaria* with scattered trees and shrubs of *Acacia hebeclada*, *A. mellifera*, *A. tortilis*, *L. capassa*, *L. nelsii*, *C. mopane* and *Croton megalobotrys*. Along the Savuti Channel large trees of *A. erioloba*, *A. nigrescens* and *C. imberbe* were found. The riparian vegetation along the Kwai, Linyanti and Kwando rivers appeared similar with stands of *Kigelia africana*, *Garcinia livingstonei*, *Ficus natalensis*, *F. sycomorus*, *A. nilotica*, *Hyphaene benguelensis* and *Phoenix reclinata*, in association with short green grazing lawns of *Cynodon dactylon* and *Sporobolus spicatus* (see Tinley 1966; Smith 1976). Along the water edge dense stands of *Cyperus*, *Papyrus*, and *Phragmites* spp. occurred.

METHODS

The census area, 14 752 km², was divided into blocks ranging in size from 547 to 1 452 km² (Figure 2). Blocks (n=19) were flown where possible in sequential order from east to west. (Figure 3)

Due to the difficulty of censusing black rhinoceros from a fixed-wing aircraft (Hitchins 1990), and the high costs involved in using the more accurate rotor-wing aircraft (helicopters) over such a large area, it was decided to use two Cessna 210 aircraft simultaneously during the survey. The flying formation

consisted of the leading aircraft flying at between 60 to 70 m above ground level (AGL) to create a disturbance

to which black rhinoceros generally respond. The second aircraft flew at 140 m AGL and maintained a track 300 - 400 m to the right of the leading aircraft and trailed by 600 - 700 m (or a 15 second separation). Both aircraft maintained a ground speed of 90 knots (166,8 km/hour).

The leading aircraft was manned by a pilot, navigator and three or four observers (Appendix I), depending on flying conditions; the navigator and one observer were always seated on the right hand side of the aircraft, with their door removed, looking into the track of the following second aircraft. The objective of the leading aircraft was to navigate the predetermined transects for both aircraft, observe for rhinoceroses, both dead and alive, and, in addition, to flush any individual potentially obscured by vegetation or directly in the blind spot directly under the aircraft for the second aircraft to detect. All navigation was done with a Ground Positioning System or GPS (Pronav AV 100).

The second aircraft with pilot, observer/recorder (seated directly behind the pilot) and three or four observers (one of which was always seated on the left hand side behind the recorder) was to record all sightings of rhinoceroses, noting their position on a separate GPS system. The positioning of the second aircraft was designed to cover the obscured zone beneath the leading aircraft, in addition to enhancing the chances of detecting animals disturbed by the lower flying leading aircraft. On spotting a rhinoceros, the second aircraft would maintain its altitude and circle the position, while guiding the lower aircraft in to age and photograph the animal/s if possible. In the event of rhinoceros carcasses being detected, the presence or absence of the horns was also noted. As the population size of both black and square-lipped rhinoceros was suspected at the outset to be small, it was decided to include sightings of other important or rare species such as elephant *Loxodonta africana*, buffalo *Syncerus caffer*, sable antelope *Hippotragus niger*, roan antelope *H. equinus*, hippopotamus *Hippopotamus amphibius* and giraffe *Giraffa camelopardalis*. All species, with the exception of elephant, occur at relatively low densities, thus not detracting too much attention from the principle objective of locating rhinoceroses. These details and results will be submitted as a separate report (Knight *et al*).

Given the financial and time restraints placed on surveying the large area of northern Botswana, a close as possible coverage of the prime areas for rhinoceros in the study area was decided upon. The selection of prime areas was based upon the availability of drinking water, the presence of human settlements and past sightings of animals or their dung and tracks (*pers. comm* M. Slogrove, L. Wilmot, D. Joubert, G. Calef, M. van der Waller and L. Gavor).

Potential areas were to be searched up to 30 km from drinking water. It was decided not to undertake sample counts within restricted strips, delimited by streamers, as this may reduce the chances of detecting rhinoceroses beyond the strip. From trial runs undertaken by both aircraft prior to the survey, estimates of the optimum detection range for single elephants, as seen from the second aircraft, were determined. Animals seen from the second aircraft were marked on the perspex windows. The distances were then determined on the ground by driving a vehicle to features recorded on the ground. The optimal detection range for single elephants in the open, leafless savannah was about 900 m on either side of the second aircraft, while for rhinoceros it was estimated to be about 700 m.

Each block was divided into straight transects, 2 km apart, that were orientated in an east-west direction. Flight paths averaged 32,6 km long (range 7 to 124 km). It was thus estimated that about 70% coverage of the transect was being undertaken for rhinoceroses with 50% of that area being covered simultaneously by the two aircraft with five observers.

Daily flights were planned starting within 45 minutes of sunrise when flying and light conditions were at their best. Short afternoon flights were also catered for from 1515 to 1645 hours. Ferry

flights to and from the census blocks were all treated as census time in that all personnel were continually searching for rhinoceros during these flights.

RESULTS: CENSUS

The total flying time, over the 14 day census period, from take-off to landing was 56 hours 8 minutes which included ferry time to and from the census blocks as well as a flight to Chinamba and to Ngwezumbe.

The actual block census time, that is start to end for the nineteen blocks (Figure 3) was 43 hours 8 minutes in fourteen morning flights (37 hours 17 minutes) and four afternoon flights (5 hours 51 minutes).

The census area, 14 752 km², was covered by both aircraft at an average rate of 5,7 km² per minute. A total of 220 flight legs were flown (in total approximately 7 167 km) with an average length of 32,6 km (range 13 - 124 km).

SQUARE-LIPPED RHINOCEROS

Prior to the census four square-lipped rhino (2 adult females and 2 calves) were found by the authorities to have been poached during mid August 1992 in the census area. In addition, the census team located, on 19 September, another carcass from the air that had its horns removed.

At the time of writing the report an adult male was poached along the Chobe river during mid-October. The distribution of poached animals is shown in Figure 4.

Four groups of square-lipped rhinoceros were recorded during the census:

TABLE 1: Sex and age composition of square-lipped rhinoceros recorded during the aerial census : 19 September - 2 October 1992

DATE	ADULT	SUBADULT		IMMATURE	TOTAL
	Female	Male	Unsexed	Unsexed	
26 September	1	1			2
28 September	1			1	2
			1		1
	1			1	2
TOTAL	3	1	1	2	7

During the census, reports were received of the presence of square-lipped rhinoceros in widely scattered groups out of the census area.

Northern Botswana	Group size	No. animals
Eastern section	3,2,1	6
Western section	1	1
Northern section	3	3
TOTAL	5	10

BLACK RHINOCEROS

Black rhinoceros were not seen during the census nor were there any reports of their presence including tracks and dung from the northern parts of the country.

CONCLUSIONS

1. SQUARE-LIPPED RHINOCEROS

There is little doubt that the square-lipped rhinoceros population in northern Botswana is at an extremely low level due to illegal hunting for their horns. With normal recruitment since their introduction, the population should be somewhere in the region of 216 animals.

It is estimated from the aerial census ($n = 7$) and from various reports of the presence of square-lipped rhino from both within ($n = 1$) and out of the study area ($n = 9$) the population estimate is **17** animals. It must be borne in mind that six animals have been reported from the boundary area with Zimbabwe, and are probably individuals that move between both countries.

The total Botswana population is higher than the estimate of 17 as the Moremi Wildlife Reserve, where square-lipped rhino still occur, was not covered by the current study.

Between August 1974 and August 1982 a total of 19 animals were introduced to Moremi; this population with normal recruitment should number about 45 animals to date. Reports of rhino sightings from this region are few and far between, however, from these rare sightings it is estimated that the remaining Moremi population does not exceed 10 animals.

The population estimate of square-lipped rhinoceros for Botswana is 27, distributed as follows:

N. Botswana 17
Moremi 10

2. BLACK RHINOCEROS

Although no black rhinoceros were seen, nor were there any reports of their presence in the region, it is believed that due to the vastness of the area covered and the difficulty of locating them from the air, albeit with two aircraft, that this sub-species (*D.b. chobiensis*) is as yet not extinct but probably occurs in extremely low numbers.

RECOMMENDATIONS

With both black and square-lipped rhinoceroses at critical levels in Botswana the census report would not be complete if some guidelines were not given to ensure the survival of the extremely rare black rhinoceros (*D.b. chobiensis*) and the square-lipped rhinoceros that was brought back from extinction in Botswana and now stands a chance of becoming extinct for the second time. This, on its own, is indeed a rare membership to which very few countries have this distinction !

Discussions between the Rhino and Elephant Foundation and the Department of Wildlife and National Parks on rhino conservation were initiated during 1988 when it was recognised that there was a need to know more about the status and distribution of both species of rhinoceros in northern Botswana before an effective strategy for their long-term conservation could be developed (Hitchins 1989, Hall-Martin 1990).

1. Long-term strategy

- *In situ* protection of both species of rhinoceros in the vast areas of northern Botswana are probably logistically and financially impossible in the longterm. The ultimate goal is the capture of the free living rhinoceroses and placing them in a well managed sanctuary (or sanctuaries) that have suitable habitat, a rhino proof peripheral fence and adequate protection by the law enforcement agencies.
- In order to achieve the above it is imperative that adequate bomas be provided at the sanctuary in order to hold the animals in a well managed, healthy condition prior to release.

2. Short-term strategy

- In the case of black rhinoceros, intensive ground work is required to establish their presence in Northern Botswana.
- Whilst the Sanctuary and its holding boma infrastructure is being developed, free roaming black and square-lipped rhinoceros should be captured, de-horned, radio collared and released.
- Provision must be made for the daily monitoring and surveillance of radio collared animals with effective protection
- The dehorning should be followed by an extensive media release which has apparently proved successful in Namibia where poaching activities declined as a result of this action.
- Consideration should be given to determining rhinoceros numbers and distribution in the Moremi Wildlife reserve.
- As the holding bomas reach completion a carefully planned capture and trans location programme needs to be developed and initiated. Expertise from various conservation organisations is available if required.

It is recommended that the above be given urgent attention as neighbouring Zimbabwe is currently subjected to massive poaching pressures. The dehoming programme in Zimbabwe is likely to put more pressure on the remaining rhinoceroses in Botswana. Nevertheless the illegal trade in rhinoceros horn continues unabated in the Southern African sub-region and as rhinoceros numbers decrease the price of the product increases with more pressure being brought to bear on the remaining free roaming rhinoceroses.

ACKNOWLEDGEMENTS

An operation of this nature could not possibly have been undertaken without the considerable support of many individuals and organisations. The Rhino and Elephant Foundation, on behalf of the Department of Wildlife and National Parks, Botswana, would like to express their- grateful appreciation to the following

World Wide Fund for Nature, Hong Kong, who provided the funding, which enabled the Rhino and Elephant Foundation to carry out the project.

Lieutenant General Ian Khanna, Chief of the Botswana Defence Force, for his considerable cooperation and that of his staff.

Mazda Wildlife Fund for the provision of a four wheel drive vehicle, which enabled the Foundation to transport to Botswana all the logistical requirements for accommodating and feeding 15 people over a period of eighteen days. The vehicle proved invaluable during the survey.

Lloyd and June Wilmot, who very generously provided facilities at their base at Savuti, giving logistical support and the much appreciated assistance of their staff.

Century Avionics, Lanseria very generously provided the ground positioning system (GPS), at no cost. A detailed census of this nature could not have been carried out accurately without the provision of this equipment and a special word of thanks goes to the company concerned.

Alan Smith of the Marang Hotel in Francistown for providing free of charge the camping facilities and the generous discounted provisions for the survey.

Wildlife broking Services for organising all aspects of insurance pertaining to the survey.

Canvas and Tent, Ladysmith, provided tents and camping equipment.

The assistance of the Carr-Hartleys of Kasane as well as various members of the Chobe Wildlife Trust.

The Foundation is indebted to Dave Tindall and his son Brendan, who provided a third aircraft to enable members of the team to be ferried from Lanseria, together with equipment, to Botswana. This was an extremely generous contribution and one which was greatly appreciated

Petra Mengel and John Ilsley of the Rhino and Elephant Foundation are to be warmly thanked for all their behind-the-scenes activities and assistance and especially Petra, who took time off to assist in the driving of the Mazda vehicle to the survey area at Savuti.

An operation of this nature is not unlike an army that cannot march on an empty stomach and here, the culinary skills of Alison Forrest surprised everyone. It was absolutely remarkable that a woman could maintain her sanity for such a lengthy period of time with an all-male survey team.

Last but not least thanks to Johan Kotze who very ably and efficiently kept the aircraft in the air.

Special thanks to Natal Parks Board, National Parks Board and the Ministry of Wildlife, Conservation and Tourism of Namibia for allowing the participation of their staff.

It must be obviously clear to everyone that the survey was a team effort. The Rhino and Elephant Foundation could not have carried it out without the assistance of all those people mentioned and, in particular, we would like to thank the Department of Wildlife and National Parks, Botswana for their support and for agreeing to this joint project in determining the status of both black and square lipped rhino in northern Botswana.

APPENDIX I

PARTICIPATING PERSONNEL IN THE AERIAL CENSUS

AIRCRAFT 1		
Pilot	A. Pelser	African Air Tours
Navigator	A. Walker	
Observers	P. Hitchins	Rhino and Elephant Foundation
	G. Skinner	Natal Parks, Game and Fish Preservation Board
	J. Tagg or K. Hillan	Ministry of Wildlife, Conservation and Tourism, Namibia
	C. Walker	Rhino and Elephant Foundation

AIRCRAFT 2		
Pilot	C. Strydom	Ministry of Wildlife, Conservation and Tourism, Namibia
Observer / recorder	Dr M. Knight	National Parks Board, R.S.A.
Observers	J. Forrest	Natal Parks, Game and Fish Preservation Board
	G. Smith	Natal Parks, Game and Fish Preservation Board
	P. Erb	Ministry of Wildlife, Conservation and Tourism, Namibia
	Dr G. Calef	Department of Wildlife and National Parks, Botswana
	Dr P. Morkel	Veterinary Consultant, formerly with Ministry of Wildlife, Conservation and Tourism, Namibia

GROUND TEAM	
Aircraft mechanic	J. Kotze
Camp Manageress	A. Forrest

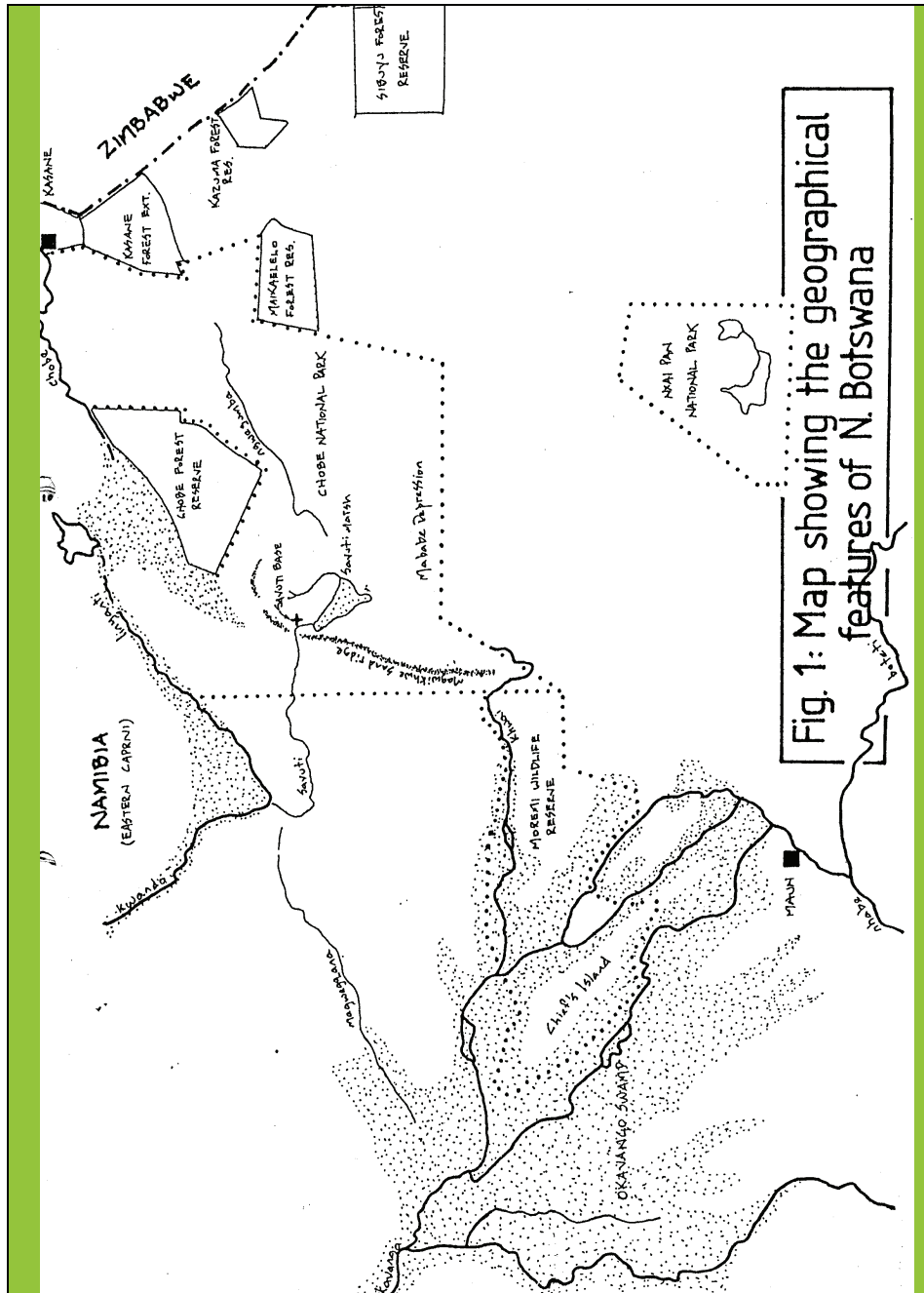


Fig. 1: Map showing the geographical features of N. Botswana

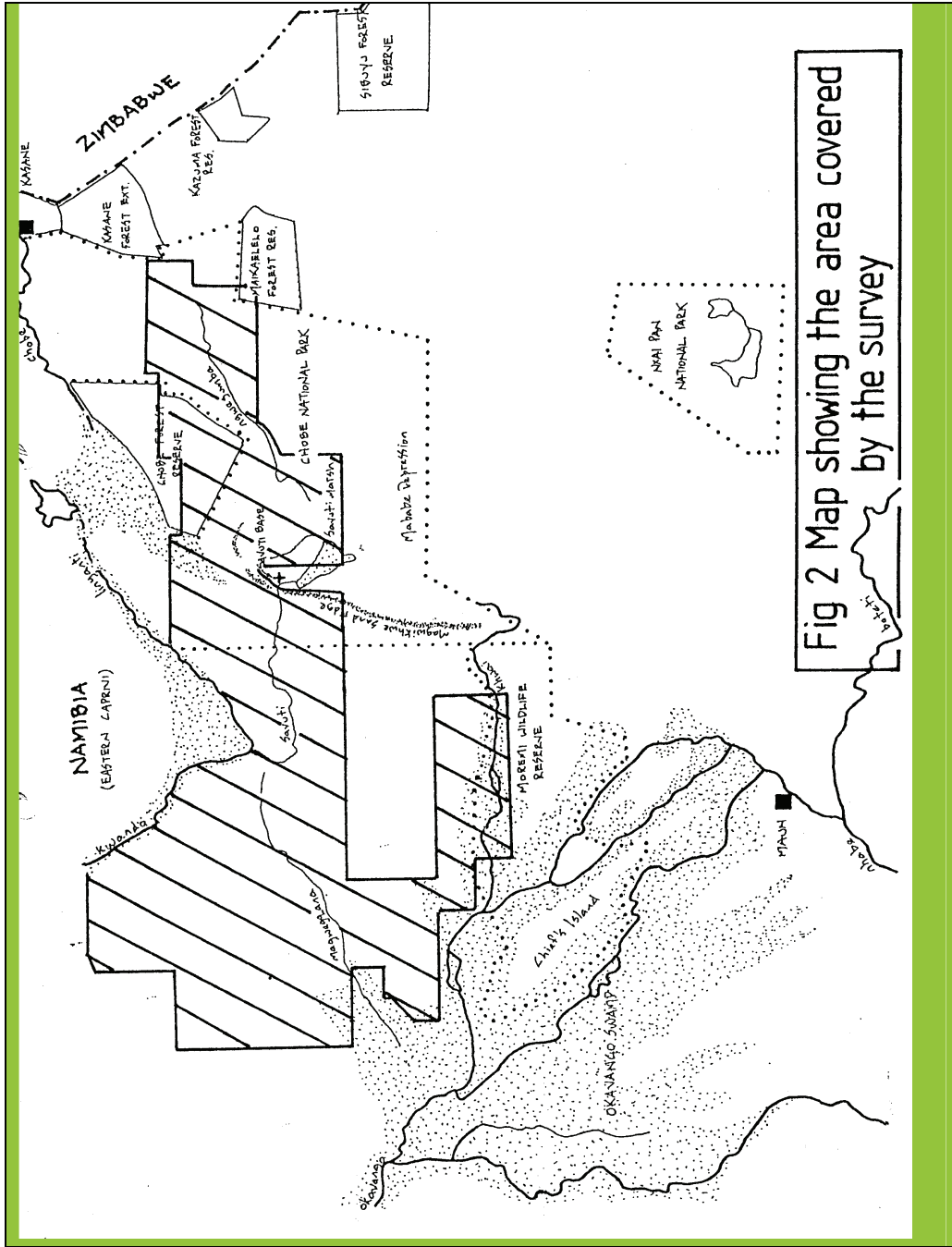
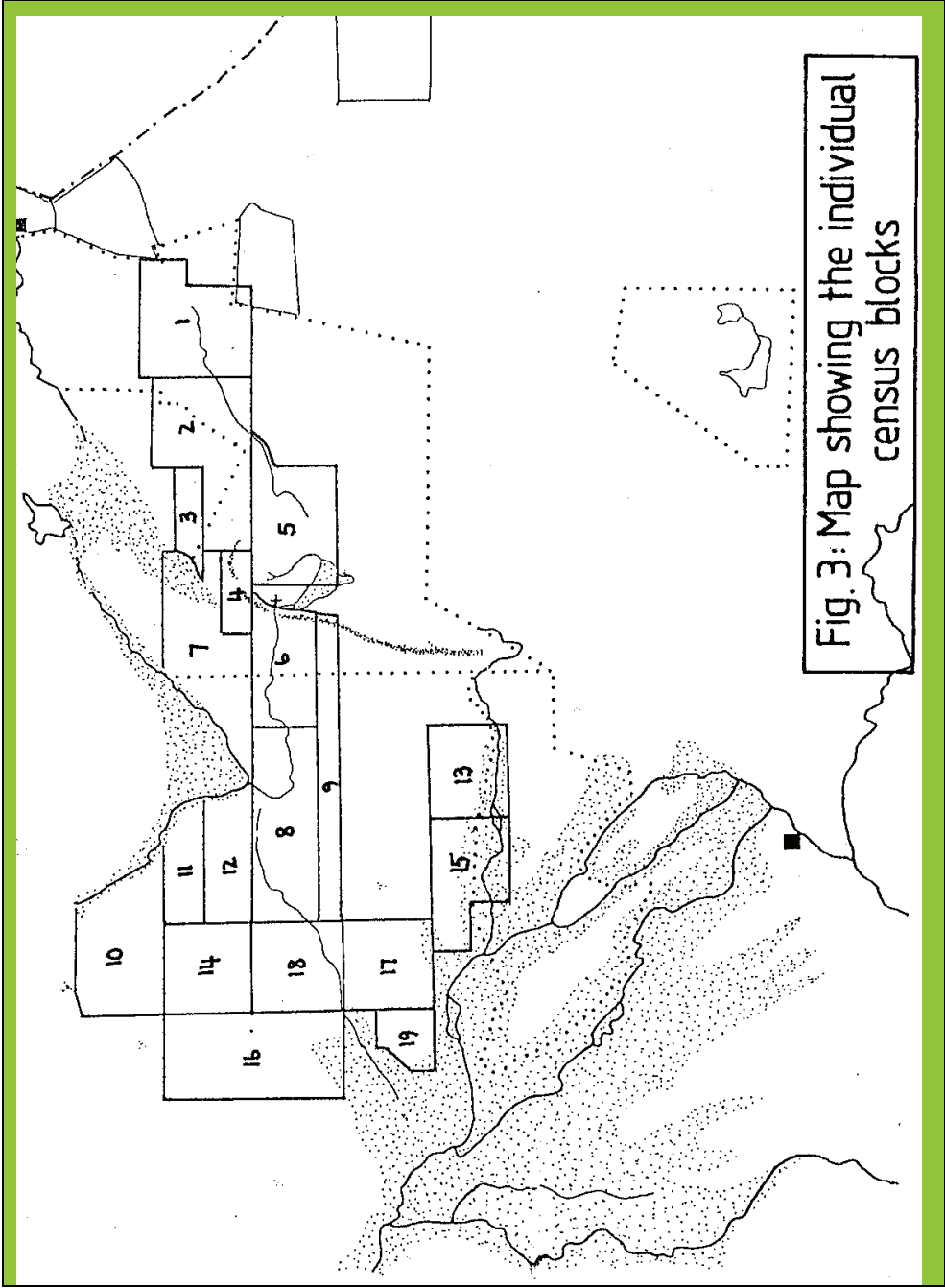


Fig 2 Map showing the area covered by the survey



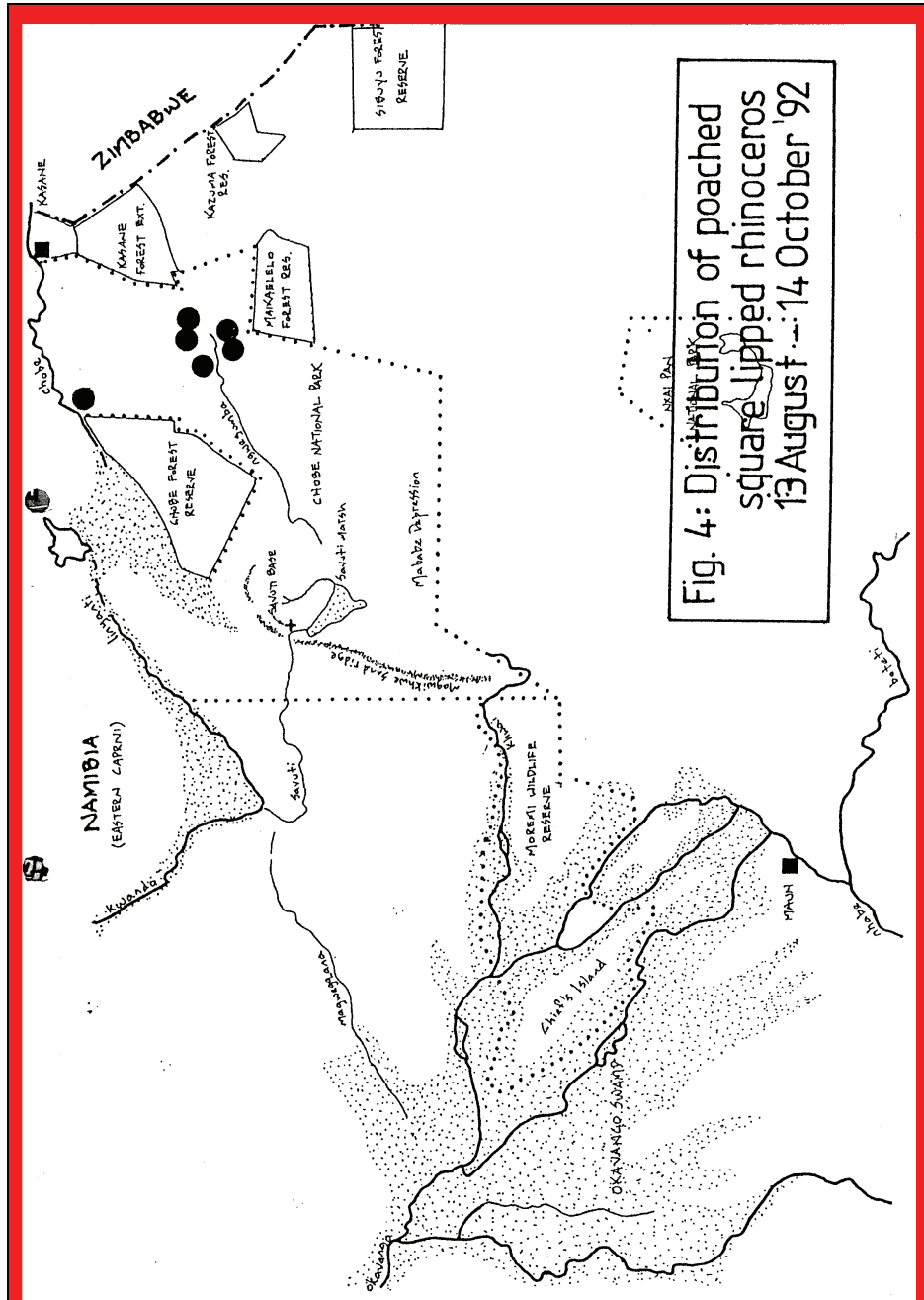


Fig. 4: Distribution of poached square lipped rhinoceros 13 August - 14 October '92

BIBLIOGRAPHY

- ANDERSON, C.J. 1856** Lake Ngami. Hurst and Blackett, London
- BRYDEN, H.A. 1893** Gun and camera in Southern Africa. Stanford, London
- CAMPBELL, A.C. 1983** Traditional wildlife populations and their utilisation (pp 12 - 19) in 'Which way Botswana's wildlife'. Kalahari Cons. Soc., Gaborone
- CAMPBELL, A.C. AND G. CHILD 1971** The impact of man on his environment in Botswana. Botswana Notes and Records 3 : 91 – 110
- CHILD, G. 1968** An ecological survey of north-eastern Botswana. FAO, Rome.
- COOKE, H.J. 1983** Environmental change in Botswana (pp 7 - 12) in 'Which way Botswana's wildlife'. Kalahari Cons. Soc. Gaborone.
- CUMMING, R. GORDON 1850** Five years of a hunter's life in the far interior of South Africa. Murray, London.
- GAVOR, I.K.N. 1988** Status report on rhinos in Botswana. Typescript ms. Department of Wildlife and National Parks, Botswana.
- GROVES, C.P. 1967** Geographic variation in the black rhinoceros *Diceros bicornis* (Linn. 1758) Z. Säugetierk 32 : 267 – 276
- HARRIS W. CORNWALLIS 1838** Narrative of an expedition into Southern Africa. American Mission Press, Bombay.
- HALL-MARTIN, A.J. 1990** Project proposal to the Rhino and Elephant Foundation and Department of Wildlife and National Parks, Botswana. Typescript MS, 8 pages.
- HITCHINS, P.M. 1989** Square-lipped rhino in Botswana and Mocambique - A strategy for their survival.. Typescript ms. Rhino and Elephant Foundation, Johannesburg.
- 1989** Project proposal to the Rhino and Elephant Foundation. Typescript MS, 6 pages.
- 1990** Census and marking systems for black rhinoceros *Diceros bicornis* with special reference to the Zululand game reserves. The Game Ranger, December 1990; 1 – 12.
- POTGIETER, H AND C WALKER 1989** Okavango from the Air. Struikhof, Cape Town
- ROOKMAKER, L.C. AND C.P. GROVES 1978** The extinct Cape rhinoceros *Diceros bicornis bicornis* (Linnaeus, 1758) Säugetierk Mittel 26(2) : 117 – 126
- SELOUS, F.C. 1881** A hunters wanderings in Africa. Richard Bentley, London.
- SMITH, P.A. 1976** An outline of the vegetation of the Okavango system, pp 93 - 1. 12 in : Proceedings of the Symposium on the Okavango delta and its future utilization. Botswana Society, Gaborone.

SMITHERS, R.H.N. 1968 A check list and atlas of the Mammals of Botswana. Trustees of the National Museums of Rhodesia, Salisbury.

1971 The mammals of Botswana. Museum Memoir 4. National Museums of Rhodesia, Salisbury.

TINLEY, K.L. 1966 An ecological reconnaissance of the Morerni Wildlife Reserve, Northern Okavango Swamps, Botswana. Okavango Wildlife Society.

SMITHERS, R.H.N. AND V.J. WILSON 1979 Check list and Atlas of the Mammals of Zimbabwe Rhodesia. Museum Memoir 9. National Museums of Zimbabwe Rhodesia, Salisbury.

VON RICHTER, W. 1973 Black and square-lipped rhinoceros in Botswana. Biol Conserv. 51: 59 - 60

ZUKOWSKY, L. 1964 Die systematik der Gattung *Diceros* Gray 1821. Zool. Garten, N.F. Leipzig 30: 1 - 178

WESTERN D. AND L. VIGNE 1985 The deteriorating status of African rhinos. Oryx 19 : 215 - 220.

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