

# A CENSUS OF THE HIPPOPOTAMUS POPULATION IN THE ZAMBEZI RIVER FROM KARIBA DAM WALL TO KANYEMBA IN ZIMBABWE

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## Abstract

A total count of hippopotamus in the Zambezi River below the Kariba Dam Wall to the Mozambique border at Kanyemba opposite the Luangwa/Zambezi River confluence was carried out by aircraft in 1996, 1998 and 2002. The 1996 count was carried out using a fixed wing aircraft whilst the 1998 and 2002 surveys were made using a helicopter. The length of river surveyed was 259 kilometers. This river length was divided into easily identifiable stretches using river tributaries into the Zambezi River as division markers.

The counts were carried out in winter when the Zambezi River was clear and visibility of hippopotamus in the water was good, in addition many hippopotamus were partially submerged and some were lying on river banks due to the mild weather. For the three surveys, a mean of 6130 hippo (range 5763-6320), in 818 groups (range 718-927) was obtained. The population growth rate per annum was 1.5%. Hippo density was 24,74/kilometer of river in 1996; 26,61/kilometer in 1998 and 26,60/kilometer in 2002. Mean group size was 3,05, 3,42 and 3,98 consecutively for 1996,1998 and 2002.Overall hippo density was 24,4 in 2002.

## **Introduction**

The common hippopotamus (*Hippopotamus amphibious* L.) is described by Owen-Smith (1998) as a "megaherbivore" which are defined as "plant-feeding mammals that typically attain an adult body mass in excess ... of 1000 kg." Due to its large size, and the fact that an adult hippopotamus will consume an average of 40 kg of grass per 24 hour period (Skinner and Smithers, 1990), the effects that they exert on the terrestrial eco-system surrounding the aquatic environment is considerable. Hippopotamus will move up to 10 kilometers from water to forage (Mackie, 1976). Along the Zambezi River on the Zimbabwean side, the alluvium is a narrow stretch averaging 2 kilometers in width. There is severe grazing pressure on the floodplain during the critical months of September-November and hippo will compete for available grazing with herds of buffalo, impala, zebra and waterbuck. Despite the obvious effect that hippo exerts on the floodplain and on other grazing species, there have been no recent systematic surveys carried out to count the hippo in the mid-Zambezi Valley (Kariba Dam-Kanyemba opposite the Luangwa River confluence). Hippo contribute to the degradation of terrestrial vegetation surrounding aquatic bodies and Olivier and Laurie (1974) note that hippo play an important role in reversing grassland to woodland – the opposite effect that elephant will exert on the habitat. From Zimbabwe National Parks records, it appears that in 1968 a survey was carried out (presumably by air) and a total of 1000 hippo counted. In 1970 another survey (by air) was carried out and 1687 hippo were counted. Mackie (unpublished project proposal, 1994) reports that a count of hippo was made by boat in 1982 and a total of 1334 hippo were counted. There have been other casual counts made by canoe but no systematic counts using an aircraft was made after the 1970's count.

In Zimbabwe, the principal hippopotamus habitat is the Zambezi River/Kariba system. In the past, large numbers of hippopotamus occurred in the Save/Runde and Sanyati/Umfuri and Limpopo River systems (Skinner and Smithers, 1990). These river systems have silted up considerably due to human pressure and agriculture, and the hippopotamus habitat has been reduced to a number of isolated pools. At present, hippos are only found in those river systems where they are protected, such as in wildlife conservancies and in some National Parks where there is a suitable aquatic environment. The Zambezi River/Kariba Dam aquatic systems

provides the principal hippopotamus habitat in Zimbabwe, and with the numbers decreasing outside of this water body, hippos can be classified as “vulnerable”.

The Zambezi River below the Kariba Dam wall provides an ideal hippopotamus habitat. The river flow is regulated by the Kariba Dam upstream, and only during the wet season (November-April) does the river increase slightly in height and flow as tributaries bring in water and silt. The Kariba Dam flood gates were last opened in 2001 when one and a half gates were opened. The river rose to about one and a half meters above normal level, and only in the Mupata gorge area where the river narrows, did the Zambezi flood dramatically as it used to pre-impoundment, due to the bottle-neck back-wash from the narrow gorge.

The Zambezi River below the Kariba Dam wall flows 260 kilometers through the mid-Zambezi Valley. On the Zimbabwean side of the river, the area of land from Kariba Dam wall to near the Mozambique border (10,500 km<sup>2</sup> in area) is administered as a protected area by the Zimbabwe Parks and Wildlife Management Authority (ZPWLMA). On the Zambian side of the Zambezi, the river runs through communal lands, Game Management Areas and the Lower Zambezi National Park. Wildlife, including hippopotamus are utilized in Zimbabwe on a sustainable basis only in the Safari Areas and given total protection in the National Park. In Zambia the hippopotamus are utilized in the communal land area (problem animal control) and in the Game Management Area for sport hunting on a sustainable use basis.

## **Methods**

The length of river from Kariba Dam wall to Kanyemba (Luangwa/Zambezi confluence) was flown when the river was clear and at normal height and flow. The river was systematically traversed and all hippo were counted and GPS readings taken of their location. The aircraft flew at 200 feet above the river and submerged animals were seen clearly. During the survey by fixed wing (Bianca two-seated aircraft), where large groups of hippo were seen, the aircraft circled the group and a number of counts were made. When the total count agreed the survey continued. As a further measure to ensure accuracy, photographs were taken of the group and the group number confirmed later. The surveys carried out by helicopter were easier since large groups of hippopotamus could be counted and recounted and numbers confirmed by hovering above the group at a height of about 200 feet. The observer was the same for the 1996, 1998 and 2002 surveys and recording was standardized using printed data sheets. In 1998 the survey was made in a two-seater Robinson 22 craft, and in 2002 it was made in a four-seated Raven helicopter R44. The R44 provided the best method of doing the count as the observer could concentrate on spotting and counting (although the pilot also assisted in spotting), whilst the recording was done by the third party in the aircraft.

The river was divided into convenient stretches by using river tributaries entering the Zambezi as demarcation zones (see Figure 1). Where the river was narrow (e.g. Kariba and Mupata gorges – about 150 meters wide), the flight path of the aircraft was down the Zimbabwean side of the river so that the observer had a clear view of the river. Outside of the gorges the river width varies but reaches a width of about 4 kilometers, with interspersed islands, in the area opposite the Sapi River. In the wider stretches, the aircraft traversed the river in systematic transects. Hippopotamus were judged to be one discrete group if the individuals were closely clumped together, and groups were judged to be separate from others if there was at least 50 meters between them. Individuals alone such as territorial males were considered to be one group. The survey took two days to complete and the break off point was made at an easily identifiable portion of the river where the count could be resumed without double counting of individuals. Due to logistics and availability of aircraft and support staff, the surveys were carried out during different months (1996 – July; 1998 – August; 2002 – September).

## Results (Tables 1-2)

In July, 1996 the survey was made using a fixed wing aircraft and a total of 5,763 individuals in 718 groups were counted. In August 1998, a Robinson 22 two-seater helicopter was used. A total of 6,320 individuals were counted in 809 groups. In September 2002 the survey was carried out in a Raven 44 four-seated helicopter and 6,307 individuals in 927 groups were counted. The portion of river having the highest density of hippopotamus was the Mana Pools National Park frontage between the Rekomeche and Sapi Rivers where 2501, 2813 and 2621 hippos were counted in 1996, 1998 and 2002 respectively. For the entire length of river surveyed, the crude density of hippo per kilometer of river was 24,74 (1996), 26,61 (1998) and 26,60 (2002). The mean number of hippo groups per kilometer of river was 3,05 (1996), 3,42 (1998) and 3,98 (2002). The Rekomeche-Sapi stretch had the highest density of groups being 6,02 (1996), 7,09 (1998) and 7,69 (2002). The gorges had the least number of individuals and groups (11,29 individuals/km and 1,20 groups in the Kariba Gorge and 6,36 individuals; and 7,14 individuals and 1,13 groups in the Mupata Gorge over the three years). The lowest density of hippopotamus was found in the stretch of river between Chewore River and the end point at the Luangwa River confluence where the river narrows in the Mupata gorge, opening up downstream to settlements on both sides of the river.

Group size ranged from 1-74 animals (1996), 1-44 animals (1998) and 1-48 animals (2002). Nearly 50% (49,3%) of hippo fell into the group size class 2-10. Single hippo were seen 25,5% of the survey, followed by size class 11-20 which was seen 17,2% of the time. Other size classes were seen less than 6% of the surveys while outliers like the group of 74 seen during the 1996 survey were encountered for less than 1% of the survey.

Hippopotamus were distributed along the entire stretch of river surveyed although from the Kariba Dam wall to the bottom end of Kariba Gorge no hippos were seen. In the Mupata gorge hippo were found upstream and downstream of the narrowing but not in the actual gorge itself. Where there was heavy habitation such as in Chirundu town in Zimbabwe, and where there were extensive agricultural settlements in Zambia, there were very few hippo. Hippo density appeared to closely related to human habitation and also suitable habitat. (Figure 2)

Table 1. Hippo numbers in the Zambezi River below the Kariba Dam Wall in the mid-Zambezi Valley

River section	Distance (Km)	% of total Distance	Individuals			Groups		
			1996	1998	2002	1996	1998	2002
Kariba Dam wall-Chirundu	65	25,1	572	725	902	63	78	93
Chirundu-Rekomeche	41	15,8	674	663	731	58	56	65
Rekomeche-Sapi	54	20,8	2501	2813	2621	325	383	415
Sapi-Chewore	35	13,5	1609	1591	1612	200	222	280
Chewore-Luangwa	64	24,7	407	528	441	72	70	74
<b>TOTALS</b>	<b>259</b>		<b>5763</b>	<b>6320</b>	<b>6307</b>	<b>718</b>	<b>809</b>	<b>927</b>

Table 2. Mean group sizes, number of individuals and groups of hippopotamus per kilometer of Zambezi River in the study area

River section	Mean group size			Individuals/km			Groups/km		
	1996	1998	2002	1996	1998	2002	1996	1998	2002
Kariba Dam wall-Chirundu	9,10	9,29	9,69	8,80	11,15	13,88	0,97	1,20	1,43
Chirundu-Rekomeche	11,62	11,84	11,25	16,44	16,17	17,83	1,41	1,37	1,59
Rekomeche-Sapi	7,69	7,34	6,32	46,31	52,09	48,32	6,02	7,09	7,69
Sapi-Chewore	8,05	7,17	5,76	45,79	45,46	46,06	5,71	6,34	8,00
Chewore-Luangwa	5,65	7,54	5,96	6,36	8,25	6,89	1,13	1,09	1,16
<b>Means</b>	8,42	8,64	7,80	24,74	26,61	26,60	3,05	3,42	3,98

Table 3. Known counts of hippopotamus made from Kariba-Kanyemba (Luangwa River confluence)

Year	Population figures obtained	Method used	Author
1968	1000 plus	Fixed wing aircraft	Report of the National Parks Advisory Board and Director of National Parks and Wildlife Management for 1968
1970	1687	Fixed wing aircraft	Report of the National Parks Advisory Board and Director of National Parks and Wildlife Management for 1970
1982	1334	Boat	Reported by Mackie (unpublished report)
1996	5736	Total count by fixed wing aircraft	Monks <i>et al.</i>
1998	6320	Total count by helicopter	Monks <i>et al.</i>
2002	6307	Total count by helicopter	Monks <i>et al.</i>

## Discussion

The hippopotamus population in the surveyed section of the Zambezi River appears (if the 1970 survey methodology was similar to the 1996-2002 surveys) to have increased by 273,86% in the thirty-two years covered by this time period. Annual growth rate was 4,5% per annum). From 1996-2002 the population growth slowed considerably with an increase of 544 animals (9% over 6 years) giving an annual population growth rate of 1,5% per annum. O'Connor and Campbell (1986) noted that the hippo population increased by 330% between 1958 and 1980 in the Lundi River (now Runde) in Gonarezou National Park, Zimbabwe.

Atwell (1970) hypothesized that hippo numbers would decrease in the Zambezi River below the dam wall due to the changing vegetation structure on the floodplains. This has not happened although it is surprising that it has not, since the floodplain is devoid of grass from July-November, coupled with the fact that there are heavy concentrations of wildlife on the floodplain from September-November, including other grazers. Jarman (1972) states that at the height of the dry season, concentrations of ungulates on the Mana Pools National Park floodplain (part of the Zambezi in this survey) are the highest in Southern Africa. Smuts and Whyte (1981) found that in Kruger National Park, hippo conception rates dropped from 36,7% to 5,6% when hippo were faced with adverse environmental conditions, two of which were a dwindling of the pools in which they inhabited and lack of food. Unfortunately during the present survey it was not possible to identify age groups when counting the hippo due to logistical and equipment issues. However

with the growth rate dropping from 4,5% to 1,5%, conception rates have probably dropped in the study area since there have been no reports of significant mortalities. The Zambezi River in the mid-Zambezi Valley, provides a perennial refuge for hippo. The Zambezi River below the Kariba Dam wall has only slight variations in flow strength and height so basking areas and congregational resting areas in the river on ledges, are not disturbed. Probably the only adverse environmental factor that they would face is the lack of grazing for about four months of the year in a normal rainy season. In the mid-Zambezi valley, available graze is scarce in the dry months (June-November) and hippos have been noted to move off the floodplain into *Colophospermum mopane* woodland (in some places over 6 kilometers from the river) where there is poor quality grass remaining during most of the critical period of the dry season (*pers.ob.*). Hippos in Mana Pools National Park, Zimbabwe, have been noted eating *Faidherbia albida* pods and the exotic aquatic plant *Eichornia grassipes*. (*pers.obs.*) Low-lying islands in the Zambezi produce a constant supply of *Cynodon dactylon* which sustains a number of grazers including buffalo, waterbuck and hippo.

## REFERENCES

Atwell  
Jarman  
Mackie  
Monks  
O'Conner and Campell  
Owen Smith  
Parks records  
Skinner and Smithers  
Smuts and Whyte







