

# Impacts on transboundary elephant movements between Queen Elizabeth Conservation Area, Uganda and Parc National des Virunga, Democratic Republic of Congo

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## Introduction

The Albertine Rift includes one of Africa's largest network of protected areas, which interfaces to the west with the Virunga National Park (VNP), Democratic Republic of the Congo (DRC) and to the east with Queen Elizabeth Conservation Area (QECA), Uganda. Human impacts have dramatically influenced this landscape. In the 1920s competition for land between agriculture and hunting resulted in the formation of QECA and the subsequent advancement of agriculture and rising human population densities left QECA surrounded by subsistence agriculture. War, poaching, and agriculture have led to significant changes in mega-herbivore numbers and distribution. Queen Elizabeth Conservation Area (QECA) in Uganda and Virunga National Park (VNP) in Democratic Republic of Congo (DRC) are contiguous and have a shared elephant population. Both countries have experienced periods of large scale poaching and instability.

Here we examine movements of elephants across the Ishasha River separating DRC and Uganda and how the direction of these movements was influenced by asymmetries in poaching between these two countries. We hypothesize that elephants avoid areas with high levels of poaching. The region was once recognised for supporting the largest biomass of mega-herbivore in Africa (Coe et al. 1976). Since independence in the DRC in 1960 and in Uganda 1962, both countries experienced severe poaching, but at different times (Douglas-Hamilton et al. 1980; Eltringham and Malpas 1980; Verschuren 1993). The elephant population in QECA declined from 4,755 individuals in 1967 (Eltringham 1977) to 150 individuals by 1980, with 346 elephants recorded moving across the Ishasha River into VNP (Douglas-Hamilton et al. 1980). Poaching was brought under

control in QECA in 1980 (Eltringham and Malpas 1980; Kayanja and Douglas-Hamilton 1983) and populations recovered (Olivier et al. 1989). By 2006, the QECA population was 2959 (Keigwin 2005) and in 2012, Wanyama et al. (2014) reported 3018 elephants. In VNP elephant numbers crashed from 3293 in 1959 to 650 in 2001 (Mertens 1983; Sikubwabo and Mubalama 2003). However, following the civil war in Rwanda in 1994 between 1.5-2 million refugees fled into DRC resulting in uncontrollable poaching and deforestation, which culminated with VNP being placed on the List of World Heritage Sites in Danger (UNEP-WCMC 2011).

During the 2001-2003 research period, poaching in the VNP was very high (Wasser et al. 2015) and we heard 50 to 120 gun shots/day. Rangers in VNP were unpaid between 1996 and 2004 and in that time a fifth of the 500-rangers were killed (UNEP-WCMC 2011). Between 1998 and 2007, the International Rescue Committee recorded 5.4 million human deaths above the norm in eastern DRC (90% due to malnutrition and disease). The local population in the DRC were very unsupportive of the park, as the park prevented them from obtaining needed food. Poaching at this time was largely under control in QECA (Mulalama 2000; Keigwin 2005; Mushenzi 2002). Migration of elephants across the small Ishasha River that separates QECA and VNP has likely always occurred (Eltringham and Malpas 1980; Keigwin 2001; 2005). However, recently such transboundary movements likely served as a strategy by elephants to avoid poaching by taking refuge in the more protected area (Wanyama et al. 2014; Table 1).

Counts from aerial surveys have been carried out across QECA and VNP since the 1960s. A summary of published and unpublished counts has been compiled (Wanyama et al. 2014).

Table 4. Comparison of home range size (ha), food diversity (no. of plants), and number of wallow holes

Year	Protected Area	
	VNP	QECA
1959	3425	
1963		1758
1967		4139
1973		2447
1980		150
1981	751	
1992		525
2000		1086
2002		998
2006	348	2959
2010	347	2502
2014	35	2913

## Elephant trans migratory pattern

We evaluated elephant movements between DRC and Uganda weekly along a 35km stretch covering over two thirds of the Ishasha River and 113 weekly walks covered over 4,000km. A small section of the Ishasha River was not covered due to poor accessibility (downstream of Lulimbi Ranger Camp in VNP). Counting elephants was not possible because of the large distance over which they crossed, thick vegetation, crossing at night, and monitors facing bullet fire. We determined the number, direction, and established from foot print or spoor sizes whether the elephants were bulls, bachelor or family groups, or larger aggregations of elephants. Track counts should be viewed with caution (Barnes 2002, Bouche et al. 2012), thus we view our data as an index of the number and direction of elephants crossing. Tracks were classified as being from males if only one size of prints existed and/or large and limited numbers (one-four) of sets of individual tracks could be counted. Four or more sets of foot prints that varied in size were classified as a family group or groups. On most occasions we confirmed the estimate by following tracks until a complete set of prints could be counted. The relationship between footprints assumed to belong to different individuals and actual counts involves a bias towards overestimation (Olivier 1978); however, we assume a consistent bias as a basis of statistical comparisons.

We designated four major clusters of frequently used crossing points: Bukorwe, Kyemale, River Track, and Ishasha Flats. Crossing points were checked weekly with trained researchers walking the same route each time. We categorized observations into two dry seasons (December–February; June–July) and two wet seasons (March–May; August–November) (van Orsdol 1981). The annual average rainfall in Ishasha between 1968 and 1974 was 860 mm (van Orsdol 1981), while in 2002 it was 1350 mm. Elephants avoided crossing the Ishasha River when it was high.

We used a Wilcoxon Rank Sum analysis to test whether elephant movements from Uganda to the DRC were significantly different the reverse. Seasonal differences in movements across the Ishasha border were analysed using the Kruskal Wallis test and test for differences in use of the four crossing points.

## Discussion and recommendations

More elephants crossed from DRC to Uganda than the reverse and this difference progressively increased between 2001 and 2003 (Figures 1, 2). Elephant movements increased in both directions in 2001 and 2002; however, only in 2003 did the number of elephants crossing into Uganda increase, whereas elephants crossing to the DRC decreased. The large increase in elephants moving into Uganda in 2003 was partly comprised of a ‘mega-aggregation’ numbering approximately 1000 animals (MK pers. observ.). Overall, there was a 354% increase in elephants migrating to Uganda from the DRC between 2001 and 2003, compared to a 72% decrease in elephants crossing from Uganda to the DRC, thus most of the elephants crossing from the DRC to Uganda stayed in Uganda (Wilcoxon Rank Sum test,  $z = 4.50$ ,  $p < 0.001$ ). The Ishasha Flats was consistently the most frequently used crossing point, followed by Bukorwe, River Track, and Kyemale (Kruskal Wallis = 43.10,  $p < 0.001$ ).

More elephants moved from DRC to Uganda than vice versa, which we speculate resulted from the higher levels of poaching in VNP than QECA. This is supported by ivory seizures between 1996 and 2005 (Wasser et al. 2015). Additionally, 50 to 120 shots were heard a day from the DRC (MK unpub. data), anti-poaching was far less resourced in DRC, and the Mai Mai, Interhamwe, and M23 rebels, and the Ugandan and Rwandan armies were all active in VNP.

Elephants moving from the River Track and Ishasha Flats appear to move further into QECA and into the Ntungwe River system. These crossing points are in low lying areas providing easy passage and with the Lulimbi Ranger Post on the VNP side, a relatively safe passage. The elephants also appeared not to move as frequently as those crossing the Bukorwe and Kyemale areas. The Ishasha Escarpment provides a barrier forcing elephants to enter the Ishasha valley from either upstream of escarpment or downstream towards the Ishasha Flats. The Bukorwe and Kyemale crossing points are in the middle of the escarpment and valley. Once elephants were using the Bukorwe and Kyemale areas they commonly remained and fed within the Ishasha River system.

With elephants moving from areas with high poaching to relatively small areas of safety, impacts management considerations. For example, habitat degradation and crop raiding in Ishasha were among the highest in Africa (Keigwin, 2004). It is ironic that human elephant conflict is the most common argument used by elephant range countries to support their petitions to CITES to sell their stockpiled ivory to authorized buyers. However, if legal ivory sales increase poaching (Wasser et al. 2010), and poaching can increase human elephant conflict, legal ivory sales could do more to increase human elephant conflict than to curb it.

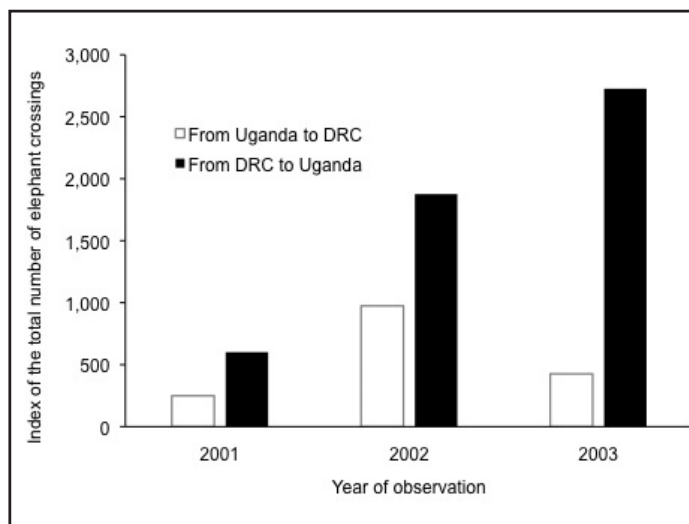


Figure 2. Total footprints as an index of the total annual number of elephants crossing from Uganda to the DRC and DRC to Uganda along the Ishasha River between 2001 and 2003.

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