



Illegal bushmeat hunters compete with predators and threaten wild herbivore populations in a global tourism hotspot



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ABSTRACT

Illegal bushmeat hunting is a global threat to wildlife, but its secretive and unregulated nature undermines efforts to mitigate its impacts on wildlife and wildlife-based industries. We investigated the scale of illegal bushmeat hunting in the Okavango Delta, Botswana (~20,000 km²) to assess its potential contribution to wildlife population declines. Approximately 1,800 illegal hunters each harvest an average of 320 kg of bushmeat annually, though some reported harvesting ≥ 1000 kg. While impala were the most commonly hunted species, buffalo and greater kudu accounted for most bushmeat. Hunters remove ~620,000 kg of medium-large herbivore biomass (equivalent to 15,500 impala) annually from the delta and humans are the fourth most prominent predator in the delta. Cumulative harvest by humans and other predators likely exceeds the intrinsic population growth rate of several species of ungulates in the delta, and helps explain purported declines in ungulate populations. Competition between humans and other apex predators for limited prey reduces the ecosystem's carrying capacity for large carnivores. Illegal bushmeat hunting represents an economically inefficient use of the delta's wildlife and a threat to the region's tourism industry. Strategies are required that provide clearer avenues for communities to benefit legally from wildlife, while concurrently curbing illegal hunting through effective law enforcement.

1. Introduction

Hunting wild animals to consume or sell their meat (“bushmeat hunting”) is one of the most intensive and extensive threats to wildlife in African protected areas, with ecological and economic consequences (Lindsey et al., 2017). Bushmeat hunting drives declines in wildlife that locally extirpate populations and threaten many species with extinction (Brashares et al., 2004; Hilborn et al., 2006; Ripple et al., 2015, 2016; Harrison et al., 2016). Hunting pressure and corresponding wildlife declines are typically most severe close to human settlements or reserve boundaries (Henschel et al., 2011; Lindsey et al., 2011a; Mgawe et al., 2012; Koerner et al., 2016). Where hunting is most intensive, however, negative impacts permeate even large protected areas (Kiffner et al.,

2013; Midlane, 2013). Other impacts from bushmeat hunting include skewed sex ratios and altered community composition (Holmern et al., 2006; Marealle et al., 2010; Koerner et al., 2016). These outcomes, coupled with non-lethal effects such as increased prey vigilance and altered habitat use, induce secondary population impacts (Setsaas et al., 2007; Marealle et al., 2010). By disproportionately killing rare species (Martin et al., 2013), bushmeat hunting affects vulnerable species most.

The impacts of bushmeat hunting extend far beyond species targeted for bushmeat. Indiscriminate hunting methods such as snaring kill non-target species (Becker et al., 2013). By removing prey, bushmeat hunting limits the abundance and distribution of apex predators, and thus their ecological role. (Henschel et al., 2011; Ripple et al., 2014). Excessive hunting drives trophic cascades, which

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Nomenclature

CBNRM	Community-based Natural Resource Management
DWNP	Department of Wildlife and National Parks
EWB	Elephants Without Borders
MGR	Moremi Game Reserve
NGO	Non-governmental organization
WMA	Wildlife Management Area

Galetti and Dirzo, 2013). Handling bushmeat increases risks of disease spillover to humans and livestock (Karesh and Noble, 2009; Kock et al., 2009; Alexander et al., 2012). While bushmeat contributes to food security (Rentsch and Damon, 2013; Schulte-Herbrügen et al., 2013), the benefits are unlikely to persist in the face of increasing demand and declining wildlife resources (Bennett, 2002). Unfettered hunting can harm human communities by restricting ecosystem services, wildlife-based industries, and sustainable yields of wild meat (Lindsey et al., 2013).

While most research into the ecological impacts of bushmeat hunting has focused on tropical forest ecosystems, bushmeat hunting

disrupt ecosystem processes and services (Abernethy et al., 2013;

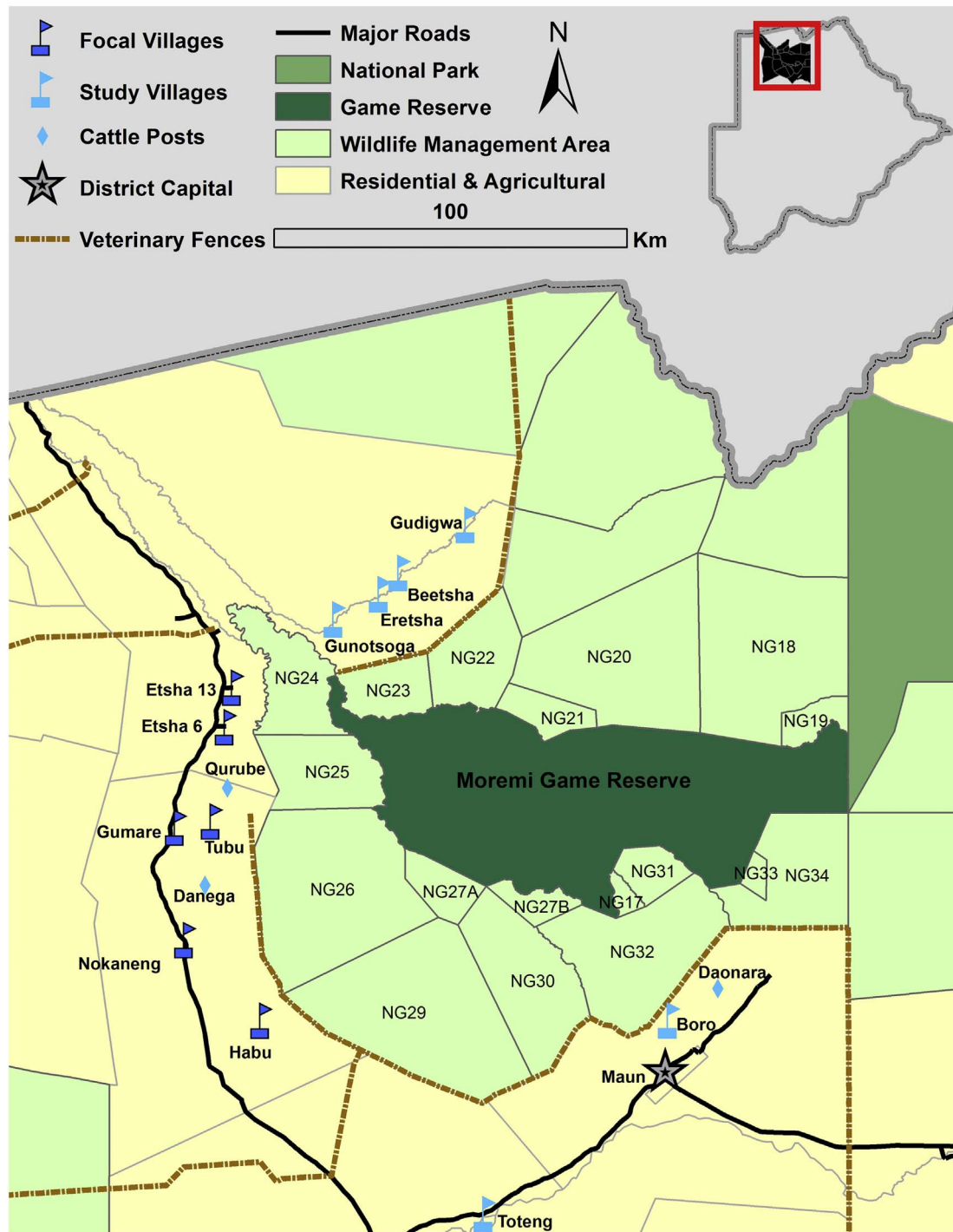


Fig. 1. Map of the Okavango Delta and study villages. In focal villages and noted cattle posts, research assistants worked intensively to identify and interview bushmeat hunters. In non-focal villages, research assistants interviewed hunters opportunistically.

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