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A zoo-led study of the great ape bushmeat commodity chain in Cameroon

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Current levels of bushmeat hunting in west and central Africa are largely unsustainable, and will lead to the loss of an important natural resource and cause the extinction of threatened species. Worryingly, great apes are hunted for their meat despite being protected across their range. In this paper, we highlight the main actors involved in the trafficking of great ape meat around the Dja Biosphere Reserve (DBR) in Cameroon, and describe the commodity chain associated with the trade. In total, 78 hunters, porters, traders and consumers were interviewed. Hunters, all men, were primarily driven by profit, encouraged by middlemen, though some hunt for their own consumption. However, we identify that great ape hunting is undertaken by specialized hunters along a relatively short supply chain. Gorilla and chimpanzee meat is sold to restaurants and wealthy buyers via few intermediaries. The price of great ape meat varied at different stages of the chain. Middlemen obtained the greatest financial gain, whereas wholesale traders profited least. Movement of ape meat to markets was predominantly by public transport and facilitated by the use of vehicles that can pass through checkpoints without being examined. Based on our study we recommend potential interventions, including support of law enforcement, investments in conservation and development initiatives, and monitoring and research.

Key-words: bushmeat; chimpanzees; commercial trade; conservation; gorillas; hunting; illegal meat; primates; supply chain; zoos.

INTRODUCTION

Bushmeat is the term given to the meat of wild animals that are hunted, captured and killed for their meat. Countless rural communities (including many indigenous people) inhabiting rainforests worldwide depend on hunting wildlife for food and income (Elliott *et al.*, 2002). In some cases, bushmeat can account for almost all the animal protein in the diets of some peoples and rural inhabitants show a consistent partiality for wild meat in taste-preference tests (Fa *et al.*, 2003; Schenck *et al.*, 2006). However, the rapid urbanization of tropical forest regions has increased the demand for bushmeat from towns and cities (De Merode & Cowlishaw, 2006; Wright & Priston, 2010; Martin *et al.*, 2012; Obioha *et al.*, 2012). Moreover, improvements in hunting technology as well as the greater availability of guns have boosted bushmeat extraction levels and the bushmeat trade (e.g. Dounias, 2016). The overall result is that bushmeat hunting has rapidly become unsustainable in many parts of the world

and some wildlife species, especially large-bodied mammals, are seriously threatened with extinction (Robinson & Bodmer, 1999; Barnes, 2002; Gandiwa *et al.*, 2013; Fa *et al.*, 2016; Ripple *et al.*, 2016). There is also growing evidence that as species that play an important function in ecosystems (e.g. seed dispersers) are eliminated through overhunting, this leads to cascading alterations of ecosystems and the loss of ecological interactions which, in turn, impact upon other ecosystem and social services (Dirzo *et al.*, 2014; Petrozzi *et al.*, 2016).

In total, 504 primate species in 79 genera are found worldwide. Of these, *c.* 60% are threatened with extinction from hunting and trapping (Estrada *et al.*, 2017); monkeys and apes constitute one of the three most-hunted animal prey groups (along with ungulates and rodents) (Fa & Tagg, 2016). As a result, many primate populations across the world are declining in number, especially when hunting occurs alongside other threats, such as habitat loss and disease (Kormos & Boesch, 2003; Walsh *et al.*, 2003; Linder & Oates, 2011; Cronin *et al.*, 2017). In the case of great apes, even comparatively low hunting levels can severely impact their populations because these species have relatively slow life-history strategies and are vulnerable to hunters, especially as most great apes live in large, noisy groups (e.g. Marshall *et al.*, 2009; Linder & Oates, 2011).

African great apes, chimpanzees (*Pan* spp) and gorillas (*Gorilla* spp), are hunted primarily for their meat, but sometimes for trophies, medicines or even pets. Great ape body parts are also used in traditional beliefs: for example, gorilla hair is employed to boost the production of fruit and pistachio trees, and chimpanzee skulls are placed in a river to provoke rainfall if the dry season persists for too long (Authors, pers. obs). Ape meat is considered highly desirable by the wealthy in most countries where great apes are found, and because of its higher price (and greater 'return per cartridge') these species become a target for specialist hunters (Starkey, 2004). However, pursuing, capturing, keeping and killing of chimpanzees and gorillas is prohibited across their range countries.

Although there is considerable information available on the biological impacts of the bushmeat trade, information is generally lacking on how bushmeat reaches its point of consumption from its place of extraction (Robinson *et al.*, 1999; Cowlishaw *et al.*, 2005). This, components of what is known as the commodity chain, is defined as 'the ensemble of activities and relations in and around the production, exchange, transport and distribution' of a specified commodity (Ribot, 1998). Bushmeat commodity-chain analyses have been undertaken for multiple species traded in markets and, more specifically, for animal groups such as pangolins and fruit bats (Mendelson *et al.*, 2003; Cowlishaw *et al.*, 2005; Kamins *et al.*, 2011; Boakye *et al.*, 2016). In contrast, for great apes, whose hunting and killing is an 'illegal wildlife crime', no trade is permitted. Despite this, buying and selling of great ape meat is actively carried out on the black market and through closely guarded networks. Thus, understanding the stages and actors involved in the great ape meat commodity chain becomes even more important for pinpointing ways of enforcing cost-effective, realistic measures to break, weaken or replace parts of the chain (Cowlishaw *et al.*, 2005). To our knowledge, there have been no commodity-chain analyses for African great ape meat.

We studied the great ape meat commodity chain at a number of sites in the northern and western periphery of the Dja Biosphere Reserve (DBR) in south-eastern Cameroon. The DBR (5260 km^2), mostly lowland rainforest, is noted for its rich biodiversity, in particular important populations of the Western lowland gorilla *Gorilla gorilla gorilla* and Central chimpanzee *Pan troglodytes troglodytes*, among other species (IUCN, 2014; Betti, unpubl.). Despite this, managing the conservation of the area continues to be hugely challenging because

its wildlife is heavily hunted. Led by a consortium of zoos (Royal Zoological Society of Antwerp, Belgium; Bristol Zoological Society, UK; Zoological Society of London, UK), together with the African Wildlife Foundation (Kenya) and Living Earth Foundation (UK), we determined the main actors involved in the ape meat trade and identified the existing links along the chain. We also investigated, as far as possible, the income received by the different actors involved in the trade. Our ultimate aim is to stimulate debate and discussion among decision makers and find ways of tackling the illegal trade of great apes in the region. Finally, we provide recommendations on how zoos can better support the mitigation of the illegal great ape meat trade.

DATA COLLECTION AND ANALYSIS

In order to obtain information on the bushmeat commodity chain, a total of 78 face-to-face questionnaires were applied in six villages and three bushmeat markets along the east, and seven villages in the west of the periphery of the DBR (Fig. 1). Suppliers [hunters (n = 51), including 31 opportunistic hunters, 7 specialist hunters and 13 hunters who declined to answer the question], traders [(n = 22), including wholesalers and retailers in villages, markets and restaurants] and consumers (n = 5) were interviewed.

Within each community, information was obtained on hunting and the movement of meat by interviewing people in their own homes. Access to villages was granted after consultation with the village chiefs. An initial mission presented the study objectives to the village officials (chiefs and notables) but giving different reasons for our visit to avoid biased responses or hostility. A second mission involved spending several days in the villages observing and listening, and identifying key actors; followed by discreet interviews and observations of the respondent. As the interviews evolved, questions were added to the questionnaire. When a respondent developed a certain mistrust of a question, a banal question was immediately introduced to restore confidence. Another route of access to the community, developed through previous initiatives in the region, was via 'community guides' who not only introduced researchers to other participants but also provided direct information on hunting and trade of great apes within the community.

Village interviews were supplemented with direct observations and interviews carried out in local markets (such as Lomié, Abong-Mbang and Mindourou). To establish a relationship of trust in markets, access was sought via the president of the shopkeepers, with whom discussions were held to present our objectives and seek access to bushmeat traders. Subsequently, several days were spent interacting and listening to the traders, counting the different species on sale, daily, where possible. In cases where suspicious traders refused to interact, researchers posed as consumers and obtained information through role play with the traders.

Given that great ape hunting and consumption is illegal, some interviewees may have provided inaccurate information. Information received, however, was triangulated as much as possible, via discussions with other groups. For example, informal discussions were held whenever an opportunity arose with individuals and groups in transport agencies in bushmeat-collection areas, as well as with motorbike taxi drivers, heads of transport agencies, coach drivers, members of local monitoring committees, village leaders, passengers in public buses, and consumers in villages and restaurants. Representatives of the government's forestry and conservation services were also interviewed, including forest guards, the Conservator of the DBR, the district wildlife-management supervisor, as well as district forestry-management supervisors. Information was readily gained through such discussions, and was useful in confirming facts and figures obtained directly from

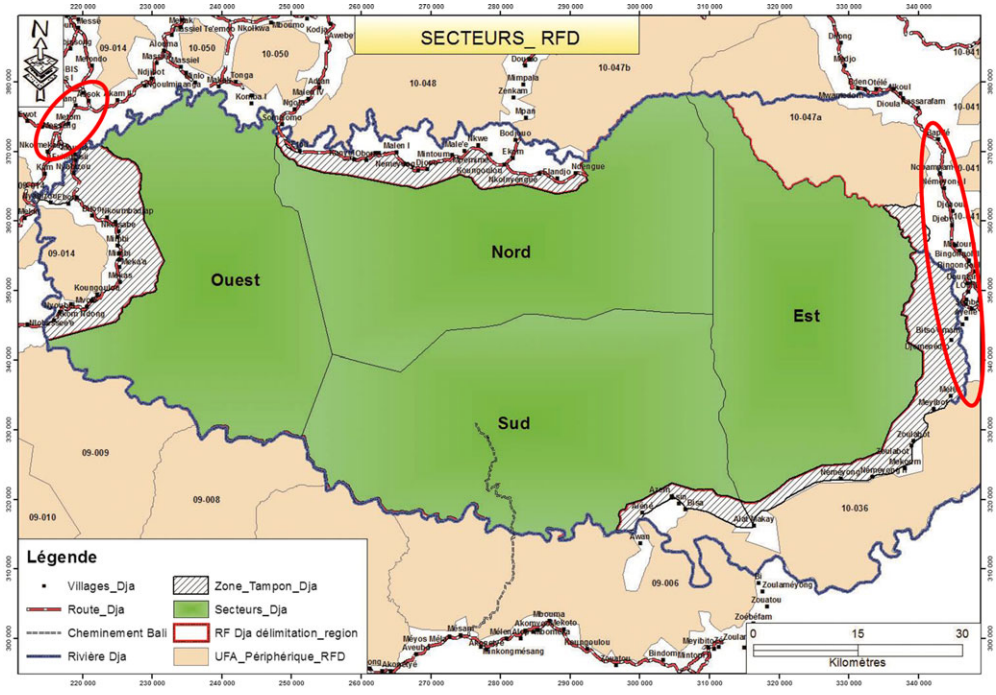

Fig. 1. Map of the study area in the northern and western periphery of the Dja Biosphere Reserve (DBR) in south-eastern Cameroon, showing where interviews were carried out with 78 hunters, porters, traders and consumers in 13 villages and three bushmeat markets at Lomié, Abong-Mbang and Mindourou (red circles). © *Fondation Camerounaise de la Terre Vivante* **(FCTV).**

interviews. In addition, information was, to some extent, 'ground-truthed' given the long-established activity of the researchers in the region.

For this study, the focus was only on actors and ape-meat transactions within rural areas. The flow of ape meat to urban centres (such as the capital city Yaoundé or beyond) or to members of the wealthier elite or the higher echelons of society was not investigated, partly for reasons of personal safety. All interviews were conducted between May and December 2014, with a follow-up period during 2015.

Information on financial costs of participation and profits was derived from interviews with the hunters and traders (n = 73) targeted by this survey; no actual transactions were observed. We calculated the net profit (NP) of a transaction as $NP = GP - TC$, where GP is gross profit and TC is total costs; the gross profit was calculated as $GP = SP - PP$, where SP is sales price and PP is purchase price.

ACTORS AND TRADE ALONG THE COMMODITY CHAIN

Those involved in the ape meat trade undertake various roles: participants (hunters, carriers, traders) supply great ape meat to the final consumer, while others facilitate the trade in different ways (middlemen, forestry administration, consumers) (Fig. 2).

Hunters

All hunters were men (n = 51) who either hunted opportunistically [61% (n = 31) of our sample], pursuing all prey types primarily for their own consumption but selling

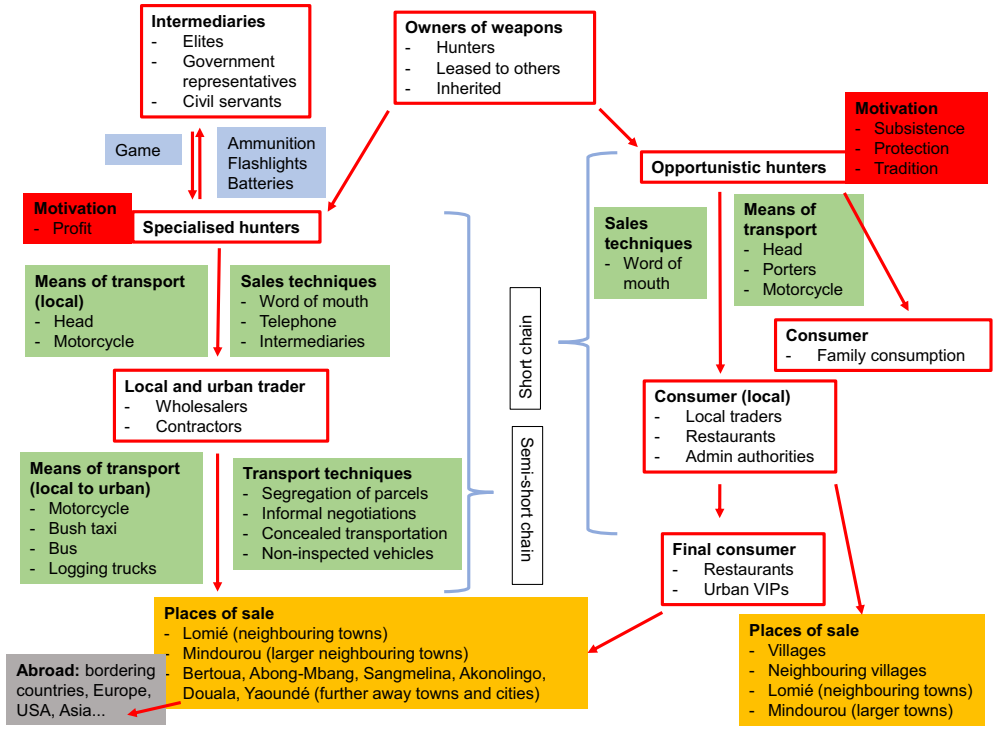

Fig. 2. A simplified diagram of the great ape meat commodity chain in the rural target area, as identified from interviews with participants in the northern and western periphery of the Dja Biosphere Reserve (DBR) in south-eastern Cameroon.

the surplus, or were specialized hunters [14% (n = 7)] who targeted apes for profit. Twenty-five per cent (n = 13) of hunters refrained from categorizing themselves. Great apes were chiefly hunted for their meat, and consumers can pay a premium price for this because it is considered very tasty (Box 1). Great ape hunters declared themselves as part of a well-structured trade network that included the highest local-government spheres.

Hunting was practised all year round, although hunters also engaged in agriculture (66·7%), fishing (7·8%), harvesting forest products, domestic farming or traditional healing (2% each), or were employed in nearby forestry companies (13·7%). Hunting of great apes was carried out with home-made shotguns or commercially produced twelve-bore guns. Guns are owned by the hunter (purchased in the hunter's village, purchased further afield, inherited from grandparents or received as gifts from family members who are retired uniformed personnel; e.g. military, gendarmes, police officers) or were leased from others. The research team also recorded the presence of 'Simplex' weapons (a local term), which are specifically intended for big-game hunting, especially elephants. Regardless of the type of weapon used (home-made shotgun or twelve-bore), the main ammunition used was buckshot, locally called 'two-zero', or other cartridges, locally known as 'one-zero'.

Almost half of all hunters (25 of 51: 49%) claimed they would cease hunting if they had a viable alternative, such as paid employment, or were funded to carry out agricultural or livestock activities. The

Box 1. The price of great ape meat in Cameroon.

A captured great ape is butchered into pieces which are subsequently smoked; a chimpanzee produces in the region of 10–12 'cuts' of meat and a gorilla 18–20. Depending on the type of cut, smoked chimpanzee or gorilla meat fetches 1500–2000 XAF (*c.* 2–3 Euros) or 2000–3000 XAF (*c.* 3–5 Euros) per piece, respectively, when sold locally by an opportunistic hunter. A specialist hunter, who has acquired or purchased his own firearm and ammunition, can receive in the region of 5000–6000 XAF (*c.* 8–9 Euros) per smoked piece of ape meat. Generally, a piece of gorilla weighing *c.* 1 kg costs 2500 XAF (*c.* 4 Euros). These findings support those of Dethier & Ghiurghi (2000). An opportunistic hunter can therefore receive an average of 40 000–50 000 XAF (*c.* 61–76 Euros) per slaughtered gorilla and 15 000–20 000 XAF (*c.* 23–30 Euros) per chimpanzee. These results are lower than those published by Stiles *et al.* (2013), which indicated that a poacher can sell a chimpanzee for between US$50 and US$100 (equivalent to 30 000–60 000 XAF or 46–90 Euros). Our study found that a specialized hunter, on the other hand, may derive an income of *c.* 80 000–100 000 XAF (*c.* 122–152 Euros) for a gorilla and between 30 000 and 35 000 XAF (*c.* 46–53 Euros) for a chimpanzee. As a point of comparison, of Class B and C species that are commonly sold at the markets, a duiker can return 8000 XAF (*c.* 12 Euros), a porcupine 2500 XAF (*c.* 4 Euros) and a small monkey 3000 XAF (*c.* 5 Euros). Furthermore, in restaurants, the cost of a dish of gorilla meat can range between 9000 XAF and 15 000 XAF (*c.* 14–23 Euros).

* The Central African Franc (XAF) converts as follows: 1000 XAF = 1·52 Euros or US$1·80.

remaining 51% stated they did not intend to stop hunting even if there was an alternative, because of the considerable income accrued from this activity and the importance of tradition. Among the seven specialist great ape hunters, most [71·4% (n = 5)] of those interviewed reported that they would not stop hunting.

Carriers

After an opportunistic hunter shoots a gorilla or a chimpanzee, it is butchered in the forest and inconspicuously carried back to the village, possibly with the help of porters. In contrast, specialist great ape hunters may enter the forest already accompanied by porters. In these cases, the meat is preserved by smoke-drying *in situ*, after which porters carry it on their heads or by motorbike, often through hard-to-access areas, to the customer or to be deposited at a predetermined location for a middleman or trader to collect. Other carriers involved include drivers of bush taxis, buses, logging trucks and even some private cars. Porters can also be hired by middlemen and are paid in cash or in kind (e.g. meat). As the ape-meat trade is illegal, actors develop undercover strategies to transport their produce without being arrested; for example, by hiding it inside car body panels or in the cargo areas of trucks using separating panels. Perpetrators will also seek to enlist unofficial collaboration with Ministry of Forests and Wildlife (MINFOF) guards, or use cars that cannot be stopped and searched, such as those with '*immatriculation temporaire*' (IT) or '*corps administratif*' (CA) licence plates, used by international organizations and by senior executives of the Cameroonian administration, respectively.

Traders

Traders sold bushmeat in markets, restaurants or from home. Traders were either retail sellers (selling pieces rather than whole animals), wholesalers, wholesale/

retail sellers (those who sell both), or only sold meat to restaurants. Most traders practiced other income-generating activities, such as agriculture (82%), but some carried out small trade (9%), beekeeping (4·5%) or poultry farming (4·5%). Traders would buy meat from hunters or from middlemen, but usually meat from species other than great apes. Great ape meat was sold clandestinely to well-known buyers and restaurants, or transported directly to urban areas.

Middlemen

Middlemen (also referred to as 'intermediaries' or 'contractors'), included forestry-administration personnel, and were known to subsidize hunting expeditions by specialized hunters. They supply hunters with equipment (ammunition, flashlights, batteries and, sometimes, weapons) and money, and also assist them in extracting bushmeat out of rural areas. Middlemen are typically motivated by market demand and, in some cases, supply urban restaurants. Middlemen were also motivated to supply persons from the upper echelons of Cameroonian society, including those in political office. These middlemen are often an invisible part of the supply chain, but have a pervasive sense of impunity (Mbété *et al.*, 2011). Furthermore, specialist hunters noted that they are not particularly fearful of denunciations made in the villages (unlike opportunistic hunters) because they may be protected by the cover offered by middlemen, who ordered the meat. These middlemen may themselves be representatives of the elite and are influential members of the local administration, and in turn can prevent the arrest of hunters.

Government officials, especially the forest administration, play a role in the commodity chain. As law enforcers, they administer control barriers, undertake lightning-strike operations and generate intelligence from within communities. When great ape meat is seized, it is officially disposed of and the offender referred to the prosecutor's office. However, seizures were said to have decreased dramatically in the area according to informants because great apes have become scarcer. Weapons can also be seized during crackdown operations and are transferred to the territorial administration.

Consumers

The final link in the chain comprises the consumers. This part of the chain can vary in length, either being very short in cases when the hunter brings the meat directly to the consumer's home (if for family consumption or local sale) or longer in cases where meat is transported to a nearby village or town, and subsequently traded by various actors before consumption. Our results indicate that ape meat is mainly consumed close to where animals are killed, and within the local communities and neighbouring small towns. While there is evidence of specific ape-meat orders being placed by members of the higher elite, because of the likely personal security risk in directly addressing this group, it was safer for this study to focus on the commodity chain at the forest and village level.

Consumers source bushmeat either from the hunter who decides to sell surplus, from retailers who sell discreetly, from restaurant retailers, or from middlemen on command. A common message received from consumers interviewed informally in villages and markets was that great ape meat is mainly consumed for its flavour. Some parts of the gorilla are popular because of their perceived effect on the skills and strength of people. Interviews in the Lomié area revealed that the chest, hands and ribs of the gorilla are considered symbols of respect, courage, strength and skill, and afford superiority to the person who consumes them.

FINANCIAL GAINS AND PROFIT

Net profits varied significantly between actors, where the greatest returns from the trade of great ape meat are attained by the

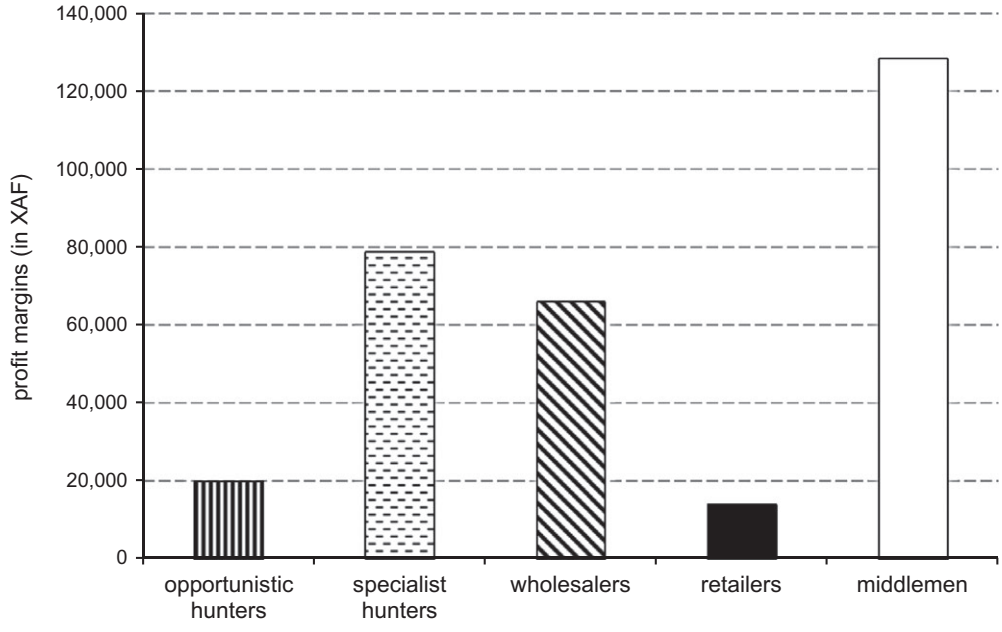

Fig. 3. The relative monetary gain (in XAF, Central African Franc, per gorilla carcass) of the main actors (hunters, middlemen and traders) involved in the great ape meat commodity chain in the rural target area in the northern and western periphery of the Dja Biosphere Reserve (DBR) in south-eastern Cameroon. Information was obtained via interview with various actors: hunters n = 51 (31 opportunistic; 7 specialist); traders n = 22 (6 wholesalers; 16 retailers). No interviews were held with middlemen but information about their relative monetary gain was ascertained through interview and discussion with other actors in the commodity chain.

middlemen (see Fig. 3 for an example for gorillas). Middlemen received 128 400 XAF (*c.* 196 Euros), resulting from the fact that their financial costs of participation in the trade chain were relatively low; similar to the results in Libreville, Gabon (Binot & Cornelis, 2004). Middlemen not only make significant profits but also use the meat to feed their families. Similarly, specialist hunters earn a considerable profit [78 750 XAF (*c.* 120 Euros)], but they also incur the risks of the hunt. In contrast, opportunistic (subsistence) hunters will sell great ape meat relatively quickly but for very low prices [20 250 XAF (*c.* 31 Euros)] to avoid being caught in possession of illegal meat. Thus, these hunters do not benefit substantially from the great ape commodity chain.

Wholesaler profits are lower than those of middlemen and specialist hunters [66 000 XAF (*c.* 101 Euros)] as these latter actors in the chain have the greatest financial outlay and also risk losing money. These traders earn a smaller profit on the sale of great ape meat because profits are directly linked to expenses incurred. As a result, they typically buy different species, including small game which has much higher profit margins, so as to spread the costs associated with transport and 'informal taxes' (Bahuchet & Loveva, 2000). These expenses are linked to transport costs, harassment by law-enforcement agents, and to compensate for the number of days spent in the forest by the hunter and/or trader. Thus, wholesale traders prefer to spend several days in villages on one trip to collect a larger quantity of produce and thus reduce costs.

Financial gain by local retailers and restaurateurs calculated in this study was the lowest of all groups [15 000 XAF (*c.* 23 Euros)]. However, their net profit margins depended upon the number of pieces

of meat and meat dishes sold, which in turn affected the sale value of the produce. Net-profit margins fall to the lower end of the range when there is more meat on the market; for example, when a whole animal is sold locally within 1 month.

RECOMMENDATIONS ARISING FROM THE STUDY

The findings of the study led to the formulation of a number of recommendations.

Improve law enforcement

Improved law enforcement is required to deter and prevent specialist hunters who are unlikely to be susceptible to change via social programmes (these are often termed 'stick' solutions) (Milner-Gulland & Bennett, 2003). This is ideally carried out via close collaboration with wildlife authorities, with a view to capacity building and training of existing or new ministry-appointed game guards to ensure a regular and effective anti-poaching effort on the ground. Simultaneous sensitization and awareness-raising programmes within communities can facilitate a rapid understanding of the implications of such law-enforcement interventions.

In particular, stopping transport routes that facilitate the trade in great ape meat would involve addressing both the capacity of game guards and the effectiveness of law enforcement. This could be approached by setting up effective and thorough roadside checks both on main-road networks that serve neighbouring towns and cities, and on smaller, less well-known trails between villages. Furthermore, the lack of 'will' to make changes to traditional behaviour and related corruption issues inherent in the system of game guards and their law enforcement, hamper progress in this area. Zoos can be involved in law-enforcement activities by providing technical, logistic or financial support to in-country organizations that work closely with national and local authorities.

Develop social programmes

Programmes should be developed to investigate the provision of alternative sources of income for hunters/traders, in order to link them to conservation objectives (i.e. reduced trade of great apes), including the development of conservation agreements. These sources of income should comprise 'carrot' solutions to complement the harsher 'stick' solutions which, as mentioned in the law-enforcement section above, are necessary for specialist hunters who are less likely to be susceptible to change via social programmes. Carrot solutions target those hunters and traders who have stated that they are prepared to stop hunting great apes if they had an alternative way to make a living. Zoo consortiums can seek to support agencies on the ground in order to work with communities to obtain community participation in local wildlife management. For example, local authorities and experts can assist community-appointed groups to assign hunting and no-take areas, and set restrictions on when and how much hunting is permitted, and of which species. These measures could lead to regulation of sustainable hunting of only the permitted species, which may result in an increase in understanding and motivation to adhere to restrictions (Milner-Gulland & Bennett, 2003). Such initiatives can include reward systems for informants. It should be noted, however, that zoning and quota are hard to enforce.

Improve monitoring and research

Additional monitoring and research, specifically on urban consumers and intermediaries, as well as on the volume of the trade and the rates of harvest, are necessary to identify and understand the drivers of the consumption of great ape meat. It is also necessary to ascertain chimpanzee and gorilla population densities across their range, in order to monitor trends and evaluate the effectiveness of any interventions in the trade of great ape meat, particularly in areas

where data are lacking (Brashares *et al.*, 2011). Appropriate indicators are required to monitor the impact of law-enforcement interventions and social programmes, including those pertaining to the socio-economics of local communities, their access to basic necessities, and their actions and attitudes around conservation and hunting. Zoos can contribute in myriad ways, via offering support or expertise in the range countries of great apes.

CONCLUSION

Many primate species, including great apes, are increasingly threatened across their range as a result of hunting and trading. Understanding more about the actors and stages involved in the chain of this trade can inform and guide conservation interventions. To respond to this need, this study offers important information on the actors involved, their respective financial gains, and the main trade routes involved in the commodity chain of integrally protected and Critically Endangered species (e.g. chimpanzees and gorillas). Zoos worldwide increasingly invest more in the *in situ* species conservation of taxa they manage at their institutions. If the long-term preservation of wild great apes is to be achieved, addressing and mitigating the massive, widespread and accelerating threat from hunting and trading is essential. Efforts must be stepped up, by raising or pledging financial contributions to *in situ* conservation efforts, and by communicating appropriately with the public who can be informed and educated during their visits to zoos. Similarly, zoos should strive to raise awareness within the public with a view to gathering and channelling additional funds into research, solutions for alternative employment and law enforcement. Various means can be used to instigate such changes, including campaigns in zoos, information boards, activities, themed days, web blogs, posts and news bulletins, to name a few. Zoos have a responsibility to consider a holistic approach to the well-being and preservation of the animals they care for, and are well placed to take a leading role in such conservation initiatives.

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