Case Study:

Death of a Trapped Chimpanzee: Survival and Conservation of Great Apes in Unprotected Agricultural Areas of Uganda

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Abstract: Rural, human-dominated landscapes present substantial risks to chimpanzees and other primates. In western Uganda, some farmers guard against crop losses to wildlife by placing large steel leg-hold traps (‘mantraps’) near their agricultural fields. Chimpanzees (Pan troglodytes schweinfurthii) can step in these illegal devices, resulting in severe injury or death. Here, we report a case of trapping and subsequent death of a wild chimpanzee from the Bulindi community (Hoima District). The elderly female chimpanzee died 13 days after being injured by a mantrap. Her injury could have contributed to the cause of death by impacting her balance in low trees above a stream; her body was subsequently found in the water. Behavioural observations prior to death and evidence from physical inspection of her injured hand suggest she may have otherwise recovered from her injury. Together with previous reports of chimpanzee trappings regionally, this case underlines the urgent need for a dedicated conservation program to reduce risks of inhabiting unprotected agricultural areas for chimpanzees. We propose an integrated strategy including (1) increased presence of wildlife authorities outside protected areas, (2) strengthening of existing legislation prohibiting use of mantraps, (3) targeted education programs and media campaigns, (4) and increased engagement of local people in chimpanzee conservation.

KEY WORDS: Poaching; crop protection; leg-hold traps; injury description; agriculture; anthropogenic landscapes; human–wildlife conflict

Résumé: Les environnements ruraux et anthropisés présentent des risques importants pour les chimpanzés et les autres espèces de primates. À l’ouest de l’Ouganda, certains agriculteurs préviennent le pillage de leurs cultures par la faune sauvage en plaçant de larges pièges à mâchoires à l’abord de leurs champs. Les chimpanzés (Pan troglodytes schweinfurthii) peuvent marcher sur ces dispositifs illégaux, entraînant de graves blessures aux individus et pouvant conduire à leur mort. Dans cette étude, nous rapportons le cas d’un piégeage et de la mort consécutive d’un chimpanzé de la communauté de Bulindi (District d’Hoima). La vieille femelle chimpanzé est morte 13 jours après avoir été blessée par un piège. Sa blessure pourrait avoir contribué à sa mort en entraînant une perte d’équilibre dans les arbres alors qu’elle était au-dessus d’une rivière, son corps ayant été retrouvé dans l’eau. Les observations comportementales avant sa mort et les lésions mises en évidence lors de l’inspection physique de sa main blessée suggèrent qu’elle aurait pu guérir de ses blessures. Nos données soulignent l’urgent besoin de mettre en place des programmes de conservation afin de réduire les risques pour les chimpanzés d’habiter des zones agricoles non protégées. Nous proposons une stratégie intégrative incluant (1) une augmentation de la présence des autorités de protection de la faune sauvage...
INTRODUCTION

Across the tropics nonhuman primates increasingly inhabit modified environments dominated by agriculture (Estrada et al. 2012; McKinney 2015), especially outside of formally protected areas. Among African great apes, chimpanzees (*Pan troglodytes*) appear most resilient to agricultural expansion and can persist in mosaic habitats alongside rural farming communities (Reynolds et al. 2003; Hockings & McLennan 2016; Garriga et al. 2018), owing in part to their propensity to integrate agricultural foods into their diets (commonly termed ‘crop raiding’; Hockings & McLennan 2012; McLennan & Hockings 2014). Rural, human-dominated landscapes present substantial risks to chimpanzees and other primates, however. Risks include encounters with domestic dogs (Anderson 1986; Waters et al. 2017), power lines (Moore et al. 2010; Katsis et al. 2018), roads (Cibot et al. 2015; McLennan & Asiimwe 2016), exposure to pesticides (Krief et al. 2017) and novel pathogens (Parsons et al. 2015; McLennan et al. 2018), persecution or retaliatory hunting (Paterson 2005; Hyeroba et al. 2011) and other crop protection methods (Osborn & Hill 2005; Warren 2008).

The 1996 Uganda Wildlife Act prohibits the possession, sale or use of traps, snares, or ‘similar substance or device capable of killing, capturing or wounding any protected species’ (Government of Uganda 1996). Thus, steel leg hold traps (or ‘mantraps’) are illegal in Uganda. Nevertheless, in parts of western Uganda, it is not uncommon for farmers to use mantraps to protect crops from wildlife (Figure 1). As with snares, mantraps may also be used by hunters to procure wild game (Weeden 2016); however, unlike snares which are usually set within forests, mantraps are most often set by agricultural fields (Webber et al. 2007; Tumusiime et al. 2010; McLennan et al. 2012). Mantraps weigh 10–15 kg or more and are extremely strong. The parallel jaws are held open by a spring mechanism; when stepped in the jaws snap shut, entrappping the animal’s limb firmly and causing severe injury or death. Traps are typically concealed beneath vegetation making them difficult to detect and avoid by animals. Mantraps are non-selective, i.e., an animal is vulnerable to trapping regardless of whether it is the intended target or not.

The threat to chimpanzees from mantraps in Uganda, especially in farming areas in Hoima and Masindi districts, was highlighted in several previous publications (Munn & Kalema 1999–2000; Waller & Reynolds 2001; Reynolds 2005; McLennan 2008; McLennan et al. 2012). For example, McLennan et al. (2012) reported that at least five chimpanzees in Bulindi (representing ca. 20% of this small group) were trapped during 2007–2011. Despite this, little concerted effort has been made to mitigate the problem of chimpanzee trappings in agricultural habitats outside or at the edge of protected areas – besides direct interventions to treat victims once a trapping incident has occurred (see McLennan et al. 2012). Here, we (i) report a new case of trapping and subsequent death of an elderly female chimpanzee – a member of the long-term study group at Bulindi, and (ii) offer suggestions to reduce...
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use of these inhumane and nonselective devices by farmers, to increase the welfare and conservation of chimpanzees and other wildlife in rural landscapes in Uganda.

METHODS

Bulindi (1°29’N, 31°28’E) is situated in Hoima District, 25 km south of the nearest main forest block, Budongo Forest, in neighbouring Masindi District (Figure 2). South of Budongo, the landscape is a mosaic of unprotected and degraded riverine forest fragments amid farmland and villages. Since the 1990s unprotected forest throughout Hoima and Masindi was converted to farmland (Mwavu & Witkowski 2008). Despite this, 260–320 chimpanzees in at least nine resident groups (‘communities’) survive across this dynamic human-dominated landscape (McCarthy et al. 2015), including the Bulindi chimpanzee community. Additional chimpanzee populations occur in farming areas further south (e.g., Kagadi and Kibaale districts).

At Bulindi, ca. 80% of forest was lost between 2006 and 2014 alone, shrinking the chimpanzees’ home range, depleting wild food resources and reducing opportunities for female dispersal. In response, the chimpanzees’ use of farmland for

Figure 2. Map showing the location of Bulindi (encircled) in relation to the Budongo Forest Reserve in Masindi District (western Uganda) and the Bugoma Forest Reserve in Hoima District. Between these two government forest reserves is a network of unprotected, highly degraded riverine forest fragments surrounded by farmland and villages. These disappearing forest fragments support a sizeable population of 260–320 wild chimpanzees (McCarthy et al. 2015), including the Bulindi chimpanzee community.
travel and foraging has increased (McLennan 2013). While the local Banyoro people do not traditionally eat chimpanzees or other primates, chimpanzees at Bulindi – as elsewhere regionally – encounter humans daily, often when foraging on agricultural crops, and associated ‘human–wildlife conflicts’ are commonplace (McLennan 2008).

Chimpanzees at Bulindi were first studied during 2006–8 (McLennan 2013). Since 2014 the chimpanzees have been monitored continuously; in March 2018 the Bulindi community comprised 21 chimpanzees. On 18 March 2018, a field assistant received a call from an unidentified person informing him that a chimpanzee had been caught in a mantrap the day before (the exact location of the trap remains uncertain). The trapped individual was subsequently confirmed to be ‘Joyce’, an elderly adult female first identified in 2007 and estimated to be ca. 50–55 years old in 2018. Researchers located her on 23 March when she presented wounds on her right hand that appeared consistent with a trap injury. The trap was not attached to her hand, but how or when she was able to free herself is unknown. Thereafter, maximum efforts were made to monitor Joyce daily and, where possible, throughout the day. Veterinary clinical inspections were performed including (i) monitoring the evolution of the injury, and (ii) looking for possible associated pathology of respiratory, digestive, urinary and locomotive functions, in addition to (iii) behavioural indicators of ill health such as decreased appetite, lethargy, and isolation from the rest of the group.

Joyce's dead body was discovered on 30 March 2018. An external bodily examination, including dissection of the injured hand, was subsequently performed on the same day. However, a full necropsy was not conducted since researchers were not fully equipped and incising the body to evaluate the internal organs carried a significant risk of contamination (cf. Gilardi et al. 2015).

RESULTS

Behavioural observations
At 11:00 am on 19 March 2018, Joyce was observed in a small patch of forest resting in a low nest. As an old female who often spent long periods in nests, researchers were not initially concerned about her and, unfortunately, did not wait for her to leave the nest or attempt to assess her physical condition. Between 20 and 22 March, Joyce was not observed with other community members. On 23 March, researchers discovered that Joyce was evidently the chimpanzee reportedly trapped ca. 6 days previously. She had re-joined the group and presented a swollen right hand with wounds visible on both sides: on the medial side of the palm, a circumscribe lesion with an exteriorisation of flesh; and on the dorsal side, an extended lesion which appeared more superficial (Figure 3a, b). Joyce walked slowly and tripodly, stopping regularly to rest. Senior veterinarians from Budongo Conservation Field Station and Chimpanzee Sanctuary and Wildlife Conservation Trust were called to intervene. After observing Joyce, it was decided that she did not need to be anaesthetised, in part owing to her advanced age, but also because she was moving with the group, feeding, and attending to her wounds, which were positive signs. However, it was decided it would be beneficial to administer her antibiotics (by darting her from a distance of 5–7 m without anaesthesia) to counter any infection. Nevertheless, despite efforts over two days (23 and 24 March), the veterinary team could not get close enough to Joyce to dart her safely and without other chimpanzees in close proximity.

On 25 March, researchers could not find Joyce. From 26 to 28 March, she was again observed travelling with other individuals, walking tripodally. Although her right hand remained swollen, she was observed using her right wrist to climb small trees to eat young leaves and cultivated jackfruit (Artocarpus heterophyllus). She even transported a heavy jackfruit (weighing up to 20 kg) using her mouth, occasionally stabilising the fruit with her injured hand, and walking tripodally or bipedally (Figure 3c). Joyce often attended to her wounds by licking them and removing the whitish dead parts (Figure 3d). She was once observed cleaning her wounds using leaves. On 29 and 30 March, researchers located all the chimpanzees, except Joyce. Following a search, they discovered her dead body at 11:05 am on 30 March 2018, i.e., ca. 13 days after she was injured.

Clinical and pathological observations
The carcass was found in a small stream, 2 m below a low, fresh night nest (Figure 4a). To access this nest, a chimpanzee had to use a horizontal branch of 12 cm diameter, while climbing above the water. Joyce died in a huddled posture with half her face submerged in water. Her body appeared fresh. She was found holding a dry and broken branch (Macaranga Schweinfurthii) with her healthy left hand (Figure 4b). The second half of this dry branch was discovered floating 1 m from her. Extraction of the body from the water and physical inspection was performed on the same day at 17:00 pm, directly at the site.
External body examination

No anomaly was noted on the external body, except for the injured right hand (see below). All teeth were present and appeared worn, as expected in an aged chimpanzee. While the buccal mucosa appeared pale on the gums close to the teeth, the rest of the mucosa was pink, with an inflammatory area (ca. 2 cm x 1 cm) on the right side of the upper jaw (Figure 5a). Joyce also presented signs of bilateral cataract.

Detailed description of the trapped hand

Two major lesions were observed on either side of the hand: (1) a large wound on the dorsal side (7x5x2 cm) from the distal part of the 4 metacarpi up to the metacarpo-phalangeal joints, and (2) a circumscribe wound (2x2x2 cm) on the medial side of the palm of the hand (likely the former place of one tooth of the trap) (Figure 5b, c). These lesions were semi-recent, largely damaged with loss of substances, and with ulcerative and fibrino-necrotic tissue at the bottom of the wounds. The edges of the wounds were contused on the back of the hand but sharp on the palm of the hand. One finger suspensory ligament was visible (finger 4) (Figure 5b). After incision of the medial side of the hand, we noticed that the metacarpus of the forefinger (finger 2) was broken and displaced (Figure 5d). No broken bones were observed elsewhere. Tendons were present and not affected, and no pus was noticed. Tissues
were in the phase of regenerating and healing at the edges of the lesions (Figure 5b, c). Some black spots were observed, but because of the extended period spent in the water (likely up to 36 or 48 hours), we could not determine whether these were gangrenous necrosis or post-mortem putrefaction (Figure 5d). The degloving lesions observed on fingers are linked to maceration in water (Figure 5b). There is no doubt that these injuries resulted from a large steel mantrap.

DISCUSSION

Cause of death

Since an examination of internal organs was not performed, it is impossible to determine the exact cause of death. However, Joyce may have died either from exhaustion, coldness, and/or drowning after falling into the stream. Indeed, it appears that she tried to get out of the water by grabbing hold of a branch, which unfortunately broke. We cannot explain the origin of the inflammatory patch in Joyce's mouth but we could hypothesise that, when she was in the water, she attempted to grasp branches with her mouth and damaged her buccal mucosa. Her severe hand injury could have contributed to the cause of death by impacting her balance as she climbed in small trees above the water. In addition, her bilateral cataract could have impacted her ability to negotiate branches above the stream; this pathology may also have contributed to her failure to see the trap. Finally, since (1) Joyce had resumed travelling with the group, (2) ate, (3) provided care to her wounds, (4) used her injured hand to climb into small trees and to carry heavy food items, and since (5) the lesions showed signs of gradual healing, we could have expected her to recover from her injury had she not nested above water and fallen.

Anthropogenic threats to chimpanzee survival in unprotected areas

Data from Bulindi indicate that human actions are a primary cause of mortality in this community of chimpanzees, and presumably in other ‘village chimpanzee’ communities regionally. All three confirmed deaths of independent chimpanzees at Bulindi since 2012 (when all community members were identified) were human-caused, including the present trapping case (2018), the trapping of a young adult male (2015), and the death of an adult female (and her infant) in a vehicle collision in 2015 (McLennan & Asiimwe 2016). A fourth individual – a wide-ranging adult male who disappeared in 2014 – is suspected to have been killed by villagers outside the community range (M.R. McLennan, unpublished data). Thus, long-term research at Bulindi confirms the risks of inhabiting unprotected agricultural areas for chimpanzees.

Mantraps are not a problem at Bulindi only: evidence indicates they pose a threat to chimpanzee conservation regionally (i.e., cases have been reported from multiple agricultural areas in Hoima and Masindi districts; McLennan et al. 2012). Mantraps are most often set to trap animals regarded as agricultural pests including other primates (**Papio**...
anubis, Colobus guereza and Chlorocebus tantalus) and wild pigs (Potamochoerus sp.). Although most chimpanzee trappings are probably unintentional, some farmers also consider chimpanzees serious pests, especially of jackfruit and commercial crops such as sugarcane and cocoa (Reynolds et al. 2003; McLennan & Hill 2012). Thus, occasional deliberate trapping of chimpanzees likely occurs. Many chimpanzee trappings in rural areas probably go unreported; as noted by McLennan et al. (2012) cases at Bulindi are known primarily because the chimpanzees there are subjects of long-term research and monitoring, increasing both the likelihood that local persons will report a trapping and the likelihood that researchers or other concerned individuals will discover an injured chimpanzee.

Recommendations for a targeted strategy to outlaw use of mantraps in agricultural areas of Uganda

To effectively address the problem of mantraps in agricultural areas of Uganda, we propose an integrated strategy including (1) increased presence of wildlife authorities outside protected areas, (2) strengthening of existing legislation prohibiting use of mantraps, (3) targeted education programs and media campaigns, (4) and increased engagement of local people in chimpanzee conservation.

Conservation conflicts associated with chimpanzees are widespread in village areas in Hoima and Masindi districts (Reynolds et al. 2003; McLennan 2008; McLennan & Hill 2012). The Uganda Wildlife Authority (UWA) is mandated

Figure 5. Physical examination: a) Worn teeth and an inflammatory patch on right side of upper jaw; b) wound on back of right hand; c) wound on palm of right hand; d) the back of the hand after incision. Photographs by M. Cibot.
to conserve wildlife outside as well as inside protected areas. However, chimpanzee conservation programs including conflict mitigation outside protected areas are currently implemented mostly by nongovernment organisations. Thus, greater allocation of resources to enable UWA to protect chimpanzees and other wildlife and mitigate conflicts in agricultural areas is recommended, similar to the dedicated anti-poaching programs and snare removal patrols implemented in partnership with research and conservation organisations within government managed protected areas (i.e., Kibale National Park: Wrangham & Mugume 2000; Kalinzu Forest Reserve: Hashimoto et al. 2007; Budongo Forest Reserve: Babweteera et al. 2008).

Mantraps are illegal in Uganda (Government of Uganda 1996). Nevertheless, the law is unenforced and mantraps are sold openly in markets regionally (Figure 1). Strengthening existing legislation to outlaw the use of mantraps including their manufacture, possession, transport and sale at a national level is thus urgently needed; clearly, for legislation to act as an effective deterrent, violations must be punishable by heavy fines or prosecution.

Targeted conservation education programs for local schools and villages where farmers interact daily with chimpanzees are vital. Media including photographs and video should be utilised to promote understanding of chimpanzee behaviour and encourage empathy towards them. Local people are traditionally tolerant of chimpanzees (McLennan & Hill 2012), and most residents consider that killing and wounding chimpanzees is unacceptable (M.R. McLennan, unpublished data). Therefore, conservation education can utilise this traditional tolerance to increase awareness about the suffering inflicted by mantraps. Education outreach should be implemented in partnership with scientists, educators and local administrators, and evaluated carefully to assess impact and potential changes in attitudes and behaviour (e.g., Kuhar et al., 2010). Additionally, a dedicated media campaign involving programs and announcements on local radio (widely listened to by farmers in western Uganda) and articles in national newspapers would raise awareness substantially regarding legislation surrounding use of traps and their impact on chimpanzee welfare and conservation.

This proposed strategy must involve local people as partners in proposing and integrating solutions. Indeed, as indicated above, while use of traps is not uncommon regionally, only a very small minority of farmers actually use mantraps to target chimpanzees. However, a large number of farmers throughout Hoima and Masindi districts suffer from chimpanzees eating their crops (McLennan 2008; McLennan & Hill 2012), which generates anger and resentment towards chimpanzees and those organisations involved in their conservation. Meetings and programs need to be set up to support farmers and help them develop and improve the effectiveness of non-lethal crop protection methods (including systematic evaluation of techniques; e.g., Hill & Wallace 2012; O’Brien & Hill 2018). These methods must integrate local people’s knowledge and be conducive to their own needs.

These actions require involvement of government agencies at the district level and increased coordination between them and nongovernment organisations. The programs proposed here are essential for the sustainability of a strategy to outlaw the use of mantraps by farmers, but will require large funds given the wide area of farmer–chimpanzee coexistence, i.e. >1200 km² in Hoima and Masindi districts alone (McCarthy et al. 2015, 2018), with further chimpanzee populations known to occur outside of protected areas in additional farming districts to the south (e.g., Kibaale and Kagadi districts).

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