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Use of Tame Elephants to Find, Immobilize, and Collar Wild Elephants in a Sumatran Rainforest

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Abstract. Despite the importance of telemetry data for developing effective conservation strategies for many endangered species, successful capture and radio-collaring of wild Asian elephants in tropical rainforests is difficult due to low elephant population density and dense habitats. Here we describe the advantages of using tame elephants to search for wild elephants and helping in their immobilization in Sumatra, Indonesia.

Introduction

In many areas of Africa and South Asia where elephants live in open semi-arid savannah habitats, researchers immobilize study elephants from helicopters, vehicles, or on foot (Kock *et al*. 1993; Thouless 1996; Osofsky 1997; Horne *et al*. 2001; Williams *et al*. 2001). Open areas with long-range visibility provide optimum conditions for researchers to identify target animals and increase darting success rate. In high-density elephant areas such as Dzanga-Ndoki National Park, Central Africa, researchers also search for forest elephants (*Loxodonta cyclotis*) on foot and dart them from the ground (Blake *et al*. 2001). This situation, however, is uncommon in Asian rainforest habitat where wild elephant densities are low, and dense vegetation, closed canopy cover, and sometimes hilly terrain often limits researchers' ability to find animals and get close enough to successfully deliver immobilizing drugs. Historically, wild Asian elephants (*Elephas maximus*) intended for domestic use were captured singly in pit traps and, with the use of domestic elephants, en mass in stockades or, for young animals, by noosing (Sukumar 1989). Notably, no published radio telemetry studies describe methods for capturing Asian elephants (e.g. Stüwe *et al*. 1998; Fernando & Lande 2000; Venkataraman *et al*. 2005; Campos-Arceiz *et al*. 2008; Fernando *et al*. 2008).

Here we report the use of tame elephants to search for and help immobilize wild elephants for attachment of telemetry collars in the lowland tropical rainforest habitat of Sumatra.

Study area

The two study locations lie in northern Bengkulu Province on the west coast of Sumatra, Indonesia. The Seblat Elephant Conservation Center (SECC) located at Lat 3.09ºS and Long 101.71ºE and the Air Ipuh ex-logging concession at Lat 2.89ºS and Long 101.51ºE, 30 km north of the SECC. The annual rainfall in the study area typically exceeds 3000 mm and the mean elevation is less than 50 m above sea level, though there is some hilly terrain. The natural cover consists of regenerating forests, following selective logging operations in the late 1980s. Extensive palm oil plantations, small-scale agricultural areas and human settlements comprise the majority of non-forested lands surrounding both areas.

Although the SECC is designated a protected area, the Air Ipuh concession is not protected and there is much human encroachment. Twenty-three captured elephants are kept at the SECC as part of the government's human-elephant conflict mitigation program, and an additional 40-60 wild elephants are believed to occur on the SECC. With extensive agriculture and human

settlements surrounding much of the SECC, there is high human-elephant conflict in the area.

Use of tame elephants to locate wild elephants

In the 1980s, the policy of the Indonesian Government was to capture "problem elephants" and hold them at Elephant Training Centers (ETCs) (Santiapillai & Ramono 1993; Lair 1997). The original purposes of ETCs were to reduce human-elephant conflicts, increase ecotourism activities and use tame elephants to patrol protected areas (McNeely 1978; Lair 1997). Most of the ETCs in Sumatra are located near protected elephant habitat such as national parks, wildlife sanctuaries or nature reserves. The formerly wild elephants held at an ETC are trained by mahouts for regular daily activities (e.g. drinking, feeding, bathing) and periodic health care checks. Some of the adult tamed elephants at ETCs that are well controlled by mahouts can be used to search for wild elephants, providing several advantages for darting wild elephants in rainforest. First, tame elephants can help researchers safely cover larger areas of forest and increase researcher visibility when searching for wild elephants. Second, wild elephants are less wary of persons riding an elephant versus one walking, thereby facilitating closer approach of wild elephants by researchers. Lastly, more field supplies used in darting and collaring can be brought into the field on elephant back.

Wild elephants are commonly found by following their tracks in the forest or other sign of their recent occurrence (e.g. fresh dung, broken/eaten vegetation). Information from local people around elephant habitat (such as from human-elephant conflict incidents) can also be useful for locating wild elephants. Despite these sources of information, searching for wild elephants can be extensive and can last several days.

Locating wild elephants for immobilization

The use of 3-4 adult tame elephants, either male or female, is optimum for immobilizing wild elephants. Typically, there are 6-7 people involved in the darting and collaring, including a mahout for each elephant, a veterinarian, a ranger with the dart gun, and the researcher. Considering the high potential for injury to tame elephants and personnel, it is critical that mahouts are experienced and able to maintain control of their tame elephants when confronted by aggressive wild elephants. Team members must also remain calm and maintain their balance on top of elephants; if they fall off, there is a high likelihood that a wild elephant will attack them.

Several immobilization drugs are typically used with elephants in Africa (etorphine HCl with hyaluronidase [M99]; Kock *et al*. 1992; Osofsky 1997) and in India (etorphine HCl with ACP [Immobilon LA®]; Cheeran 2008). However, these drugs typically cause the elephant to fall down, preventing a "standing sedation" (Fowler *et al*. 2000). Considering the risks of injury to sedated elephants posed by hilly terrain and close proximity of rivers in our study area, we used the standing sedation technique.

Anesthetizing wild elephants

Elephants were darted from behind in the posterior part of dorsal ilium to avoid potential injury to internal organs. Our goal was to conduct a standing sedation in which the elephant still stands after initial immobilization (Fowler *et al*. 2000) to avoid respiratory depression that may result from the elephant laying on its side or sternum. Hypoxemia is a significant risk factor for sternally-recumbent immobilized elephants (Harthoorn 1973; Honeyman *et al*. 1992), and it is near impossible to move an elephant from a sternal to a lateral position once fully sedated and recumbent on the forest floor because of dense trees. Standing sedation also reduces the risk of drowning if a darted elephant runs into a river.

When first darted, we used 7 ml xylazine HCl (Rompun®, 100 mg/ml; Hsu 1981) in a dart fired from a long-range tranquilizer gun or a jab stick. First signs of immobilization of elephants by xylazine usually involve a combination of slow movement or stopping, snoring, mild head weaving, and for bull elephants, penis relaxation (Cheeran 2008). Of two elephants we successfully darted, one was standing and the other leaning against a tree. To prevent the

immobilized elephant from falling to the ground, a tame elephant was positioned to one side of the wild elephant (Fig. 1). If there was a risk of falling in the other direction, a second tame elephant could be positioned on the other side, or an adjacent tree used for added support. To reduce the risk of attack from other elephants in the vicinity, the other tame elephants were used to guard team members.

Once the position of the standing wild elephant was secured with tame elephants, the veterinarian confirmed whether the elephant was fully immobilized (i.e. unable to move its trunk or legs). If not, then a second sedative of 4 ml ketamine HCl (100 mg/ml) was administered intra muscular using local injection (Jessup *et al*. 1983).

Case studies of darting and capture from elephant back

We encountered and approached four wild adult female elephants, two in August 2007 and two in April 2008, of which two were darted successfully.

The first of these (presumably a matriarch) charged, hitting the lead tame elephant repeatedly with her head and trunk. One of the three tame elephants used in this first encounter became frightened and ran away, with the mahout eventually regaining control of his elephant within 10 min. The mahouts on the other two tame elephants were able to stand their ground against the attacking elephant. The attacks of this single wild elephant continued for upwards of 10 min before the combined efforts of the three tame elephants and shouting by the team stopped the attacks and the wild elephant retreated. No attempts were made to dart this elephant.

Figure 1. Collaring wild elephant using "standing sedation" technique in Seblat Sumatra.

Within 15 min, another lone adult female was encountered. We approached from behind within 20 m without her turning to observe our approach. A dart was fired, she trumpeted and ran away, and we did not pursue her for approximately 10-15 min. We followed her trail (trampled vegetation) but encountered several other elephants. Within 30 min, we re-sighted her within 200 m of the darting site. She was standing, but immobilized.

The third elephant encountered for collaring in April 2008 was an adult female with a ~2-year-old calf. Similar to the second elephant, we approached from behind to within 20 m without her turning. A dart was fired; she trumpeted and ran to her calf <30 m away. She stopped briefly to look at us, raised her trunk to smell the air, and then ran away with her calf. We noticed that the dart had hit her rump at an angle, appearing not to be fully inserted. We were unable to relocate this darted female after searching for 30 min and suspect that the drug was not fully injected.

While searching for this female, we encountered another single sub-adult female. She did not turn to look at us upon our approach. Without a second loaded dart for the rifle, we approached within 2 m and used an aluminium jab stick to inject her; she immediately trumpeted and ran away. After waiting for 10 min, we followed her trail and re-sighted her on the top of a ridge leaning against a tree, approximately 200 m from the immobilization location.

Post-darting procedure

Once immobilized and supported by a tame elephant, sterile ophthalmic ointment was applied to the eyes of the elephants prior to blindfolding them with a soft towel (Osofsky 1997). While the team attached a GPS (Global Positioning System) collar, the veterinarian followed an anaesthesia protocol, including: cardiothoracic auscultation,

palpation of auricular pulse for quality and regularity, checking of rectal temperature, and monitoring respiratory and heart rates (Osofsky 1997). We also injected 500,000 IU potassium penicillin G and 1,000,000 IU procaine penicillin, and applied 500 mg neomycin at the injection and dart locations to reduce risk of infection (Osofsky 1997).

We recorded morphometric measurements to estimate elephant age (circumference of front and rear leg, shoulder height, total body length and chest circumference). We also collected a blood sample for genetic and parasitological study. Once the collar was attached, we administered yohimbine (2 mg/ml) 0.125 mg/kg body size to reverse the effect of xylazine (Jessup *et al*. 1983; Hatch *et al*. 1985). After administering the reversal drug, the tame elephants were repositioned 10-20 m from the wild elephant to confirm recovery before leaving the area. Both elephants recovered successfully, but one collar failed whereas the movements of the second elephant were monitored for nine months (Sitompul 2011).

Conclusion

Locating and capturing wild elephants in tropical rainforest environments are difficult and high-risk tasks. Using tame elephants improves the search efficiency of finding wild elephants and reduces risks to staff and target elephants during the immobilization process. Use of standing sedation technique greatly reduces the risks of elephant injury while immobilizing elephants. Tame elephants with experienced mahouts and veterinarians increase the success of elephant collaring studies in forested areas, the safety of wild elephants and personnel during immobilization, and the value of tame elephants for elephant conservation programs.

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