

ORIGINAL CONTRIBUTION

Novel photographic and morphometric records of the Western Falanouc *Eupleres major* in Ankarafantsika National Park, Madagascar

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ISSN 1019-5041**Abstract.**

Long-term research on Fosa *Cryptoprocta ferox* has been conducted in Ankarafantsika National Park since 1999, with rare sightings of the forest's second elusive carnivore, the Western Falanouc *Eupleres major*. During annual carnivore live-trapping from 1999-Present, a single Falanouc was captured on the 30th of March 2002. Since this capture, two photographs have been taken of the Falanouc. In June 2011, a project volunteer photographed a Falanouc during the day whilst conducting trap-checks. Recently, a second photograph was recorded during the largest systematic camera-trapping study of Madagascar's western carnivores. From April – July 2014 eighty paired camera-traps operated on average for 79 days, recording a sole image of the Western Falanouc at 01h18 on the 19 April 2014. Herein we discuss the morphometrics and photographic records of the Western Falanouc from Ankarafantsika National Park.

Keywords: Ankarafantsika, camera-trapping, Eupleres, Eupleridae, Falanouc.

Titantarana ara-tsary sy refy samihafa voangona mikasika ny Fanaloka Andrefana Eupleres major ao amin'ny Valanjavaboahary Ankarafantsika, Madagasikara

Notanterahana nanomboka ny taona 1999 tao amin'ny Valanjavaboahary Ankarafantsika ny fikarohana lavitrezaka mikasika ny Fosa *Cryptoprocta ferox*. Tamin'izany no nahitana tsindraindray karazambiby mpihinankena iray hafa izay tsy mbola fahita, dia ny Fanaloka Andrefana Eupleres major. Nandritra ny fisamborana velona ireo karazam-biby mpihinankena izay fanao isan-taona nanomboka ny taona 1999 ka hatramin'izao dia indray mandeha ihany no nahazoana Fanaloka Andrefana, ny 30 Marsa 2002. Nanomboka teo dia sarina Fanaloka Andrefana roa no azo. Tamin'ny Jona 2011 dia nisy mpikaroka mpilatsaka antsitrano iray nahazo sarina Fanaloka Andrefana anankiray nandritra ny andro mazava tamin'ny fisafoana ireo fandrika napetrany. Vao tsy ela akory, nisy sary faharoa azo tamin'ny fakantsary fandrika nandritra ilay fikarohana lehibe indrindra mikasika ny biby mpihinankena miaina amin'ny ilany andrefan'i Madagasikara. Ny volana Aprily ka hatramin'ny Jolay 2014 dia fakantsary fandrika miisa 80 no napetraka tao anaty ala nandritra ny 79 andro ka sary tokan'ny Fanaloka Andrefana no azo ny 19 April 2014 tamin'ny 01 ora sy 18mn maraina. Eto isika dia hiady hevitra mikasika ny refy samihafa sy ny sarin'ny Fanaloka Andrefana araka ny tahirinkevitra vao nanganona tao amin'ny Valanjavaboaharin'Ankarafantsika.

A paucity of information currently exists on the two proposed sub-species of the Genus *Eupleres*: *Eupleres goudotii* and *Eupleres major* (Albignac 1972). Each sub-species is typically confined to the geographically distinct landscapes of the eastern rainforests and western deciduous forests respectively (Hawkins 2008), despite proposed distributional overlap in the northerly rainforest of Montagne d'Ambre (Goodman & Helgen 2010). Much of our knowledge of the Falanouc has been derived from museum specimens or personal communications, anecdotal reports from rural villagers, and several published studies (Goodman & Helgen 2010). Across its geographic range, sightings and trappings of the Falanouc have been rare, which may be due to its specialized diet of earthworms and nocturnal habits (Hawkins 2008). Recent technological advances in remote camera sensing now afford greater opportunities to document this enigmatic species.

The first camera-trap image of a Falanouc was recorded in Ranomafana National Park (RNP) in 1997 (Dollar 1999). Over a decade later in the same forest Gerber *et al.* (2012a) conducted the first systematic survey of Madagascar's carnivores using camera-traps, again documenting the eastern *E. goudotii*. This study was followed by Farris *et al.*

(2014)'s documentation of the Eastern Falanouc during their extensive carnivore camera-trapping studies in the Masoala-Makira protected complex in north-eastern Madagascar. Conversely, Madagascar's western dry deciduous forests have received considerably less attention with only one recent camera-trapping study of the Mariarano forest, located approximately 80 km northwest of Ankarafantsika National Park (Evans *et al.* 2013). During this survey, the first camera-trap image of *E. major* was recorded from Madagascar's west coast.

Ankarafantsika National Park (ANP; 16°12' S, 47°09' E) has been the focus of long-term Fossa capture surveys since 1999. The rarity in sightings of Ankarafantsika's second elusive carnivore, the Falanouc, has been described by one of the authors (L. Collar), whose team have rarely encountered Falanouc with only a few confirmed sightings, one physical capture and one volunteer photograph that are reported in this article. From May to July 2014 we undertook the largest systematic camera-trap study in West Madagascar to document the effects of anthropogenic habitat disturbance upon Fossa occupancy. This study forms part of a wider investigation documenting the major anthropogenic threats to the conservation of the Fossa (Merson 2017).

ANP is located approximately 105km from the port hub of Mahajanga. At 1350 km² ANP is the largest remaining tract of dry deciduous forest. The region is characterized by an average temperature of 26°C, with a dry season from May to November, and a wet season from December to April. The Route Nationale 4 (RN4) bisects the south-western portion of the forest and is flanked by six rural villages. These villages have a major influence upon the surrounding forest, with large tracts of primary forest converted to savannah through slash and burn agriculture, rice fields and raffia plantations. Ampijiroa, the former name of the Special Reserve adjacent (and now incorporated within) Ankarafantsika, is also the home to the local Madagascar National Park's headquarters, which operates tourism throughout the surrounding area.

Volunteer photograph

Since 1999, typically during the dry season, trapping surveys for Fossa within a transect grid surrounding the Ampijiroa research station are conducted on an annual basis as part of a long-term monitoring program. With the aid of volunteers, traps are baited and checked during the early morning and late afternoon. In June 2011, the first known photograph of a Western Falanouc was taken by an Earthwatch volunteer in ANP (Figure 1). Despite the Falanouc's proposed highly nocturnal-crepuscular activity pattern (Gerber *et al.* 2012b, Goodman & Helgen 2010) this individual was photographed during the day; such diurnal sightings are particularly rare.



Figure 1. Photograph of the Western Falanouc *Eupleres major*, taken by an Earthwatch volunteer in June 2011, Ankarafantsika National Park, Madagascar.

Camera-trap record

From May to July, eighty pairs of camera-traps (Cuddeback Ambush IR 1187) were placed along trails encompassing an area of approximately 40 km². Trail systems were chosen intentionally mindful of the target species (*Fossa Cryptoprocta ferox*), frequent use of trails whilst traversing forest, as demonstrated by previous capture studies (Dollar 2006) and the frequent presence of faeces along trails. Camera trap stations were spaced approximately 750 m apart, allowing an equal trapping effort across the sampling area. Site placement along trails was chosen to maintain equal distance from the nearest station but also to maximize chances of detecting passing animals and humans. At each camera-trap station, a pair of Cuddeback Ambush IR 1187 were placed flanking the trail, approximately 20-30 cm above the ground. This method allowed captured individuals to be photographed on both sides, improving species identification (Gerber *et al.* 2012a), whilst additionally accounting for individual camera failure.

At 01h18 on 19 April 2014 a singular photograph captured an individual Western Falanouc (Figure 2). The camera-trap station (16°15' S, 46°49' E) was located in riverine degraded forest, nearby to a dry seasonal riverbed, and approximately 2.25 km from the nearest village, Ampombalava. The camera-trap station was in operation for 82 nights

(night being defined as one 24-hour period in which one of the two cameras was in operation) from the 14 April – 4 July 2014, collecting a total of 1,594 images. Within these images, 188 humans, 5 Dogs *Canis lupus familiaris*, 33 Zebu *Bos taurus*, and 9 Fossa were most notably observed.



Figure 2. Camera-trap image of the Western Falanouc *Eupleres major* taken at 01h18 on the 19 April 2014, at Ankarafantsika National Park, Madagascar. Note: the photograph is inverted.

Physical Capture

Trapping was conducted during the wet season from February to April 2002. A total of 38 cage traps (Tomahawk Live Trap, Tomahawk, USA) were placed evenly along trails at two sites surrounding Ampijiroa, bisected by the Route National 4. These sites were chosen as to encompass the two major local microhabitats, a riparian forest and a drier deciduous forest. Traps were baited with earthworms, sardines, corned beef, dry fish and chicken. When an individual Falanouc was captured, it was blow darted (Pneu-Dart Inc., Williamsport, USA) containing the anesthetising agent Telazol (Fort Dodge Animal Health, Fort Dodge, USA) and moved to the campsite for the recording of morphometric measurements.

During approximately three months of trapping, a single adult male Falanouc was captured on the 30 March 2002. Weighing approximately 2.4 kg, the male was on the lower

scale of their proposed weight range from 2–4 kg (Albignac 1974). As documented in museum specimens (Goodman & Helgen 2010), the male's pelage was brownish, whilst the under fur was dense and covered by long guard hairs. Local villagers reported that females of this subspecies are greyish in colour.

The hindlimbs were more developed than the forelimbs, whilst the forefoot consisted of two carpal pads that were notably separated, with the hindfoot featuring a bare metatarsal zone with short hair in the centre. The cranium was 70 mm long (Table 1). There were two canines on the upper jaw and one on the lower jaw. The teeth were extremely specialized and very small/fragile; the carnassials were not very well developed which is likely explained by their diet of earthworms, insects and small invertebrates.

Table 1. Morphometric and cranium and dental measurements of the captured male adult Western Falanouc from Ankarafantsika National Park, Madagascar.

Morphometric measure	Value (mm)	Cranial and dental measures	Value (mm)
Total length	790	Cranium length	70
Head and body length	550	Cranium width	41.33
Neck circumference	155	Snout length	55
Chest circumference	330	Snout width	36.5
Tail length	245	Inter orbital distance	21.06
Tail circumference (base)	175	Mandible length	70
Tail circumference (mid)	100	Mandible height	15.12
Tail circumference (tip)	30	Upper canine n°1 length	3.13
Ear length	39.17	Upper canine n°1 width	1.3
Forelimb length	165	Upper inter canine distance (n°1)	3.53
Hind limb length	212.5	Upper inter canine distance (n°2)	5.29
Biceps circumference	97.5	Lower canine length	3.23
Thigh circumference	150	Lower canine width	1.67
Forefoot length	40	Lower inter canine distance	5.4
Forefoot width	32		
Hind foot length	57		
Hind foot width	37		
Right testicle length	14.38		
Right testicle width	14.43		
Left testicle length	22.14		
Left testicle width	13		
Prepuce length	12.46		

This is the first photographic and morphometric documentation of the Western Falanouc in Ankarafantsika. The rarity of physical sightings has also been confirmed for the eastern sub-species. An observational recording of opportunistic Malagasy carnivore sightings in Analamazaotra forest in Andasibe from 1992–2010, documented only one Eastern Falanouc (Dolsch 2011). In addition to these anecdotal recordings, Goodman and Helgen (2010) provided an exhaustive literature review to describe the species' geographic distribution through published records, unpublished records, and museum specimens. This review served to highlight the lack of data currently available on this little-known species.

To our knowledge our study provides the first (and more detailed) morphometric record of a live wild captured falanouc. This allows comparison against the rare museum measured records of Albignac (1973) and Goodman and Helgen (2010). Our

measurements of head and body length (550mm) and tail length (245mm) are all comparable to those of the museum specimens, whilst some other records such as the cranium length (70mm) differed significantly than previously reported in adult specimens (92.9 and 97mm). These discrepancies could be due to differences in measurement technique and/or the condition of museum versus wild animal specimens. Our records provide important data for future studies to examine morphological differences between the two potential *Eupleres* species (*E. major* and *E. goudotii*), something that has yet to be proven genetically (Goodman & Helgen 2010).

Given the obvious inefficacies of traditional methods for observing and/or physically capturing Falanouc, camera-trapping provides a more suitable non-invasive alternative. Gerber *et al.* (2012a) established a camera-trapping grid of approximately 27 paired cameras for a minimum of 5,565 nights across four sites of increasing habitat degradation. Within the primary and selectively-logged sites, a total of 2 and 16 *E. goudotii* were photographed, respectively. In the other major camera-trapping study of East Madagascar's carnivores Farris *et al.* (2015) amassed a total of 202 images of *E. goudotii* in Masoala-Makira. This large number of photographs was in part due to an increased sampling effort of 15,253 nights across seven sites from August 2008–2013. Within the western forests of Madagascar, the sole camera-trapping study of Malagasy carnivores captured six *E. major* across 24 sites during 227 nights in June–August 2012 (Evans *et al.* 2013). In contrast, our total camera-trapping grid was in collective operation for a total of 6,269 nights, capturing a single image of *E. major* from April–July. Insofar as this low success rate is indicative of very low population density, this raises at least the possibility that anthropogenic pressures in Ankarafantsika could be responsible.

E. major and *E. goudotii* are currently listed as Vulnerable by the IUCN (Hawkins 2016). Much of Madagascar's large fauna currently face significant pressures, predominately deforestation and hunting (Ganzhorn *et al.* 2001, Harper *et al.* 2008, Golden 2009, Schwitzer *et al.* 2014, Farris *et al.* 2015b, Merson 2017), two threats that are under current investigation in our study in Ankarafantsika. Within our study site, much of the landscape has been altered to savannah, agricultural fields, or experiences severe human and invasive species encroachment (Merson 2017). Our camera-trap grid encompassed a balanced mixture of these different habitats and it could be expected that these factors collectively act as a strong Falanouc deterrent. This baseline information should be helpful in ongoing estimations of their population, distribution and ultimately in informing their conservation.

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