Notes on the distribution and status of small carnivores in Gabon

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Abstract

The distribution and status of small carnivore species in Gabon have never been comprehensively assessed. We collated data from general wildlife surveys, camera-trap and transect studies and analyses of bushmeat consumption and trade, to map their country-wide occurrence and assess current exploitation levels. Records of Common Slender Mongoose *Herpestes sanguineus* and Cameron Cusimanse *Crossarchus platycephalus* represent the first confirmation of their occurrence in Gabon. Cameron Cusimanse was believed to extend into north-east Gabon, but the Slender Mongoose records extend its known range well outside that previously suspected. We furthermore extended the known range for Egyptian Mongoose *Herpestes ichneumon*. Crested Genet *Genetta cristata* has also been proposed to occur in Gabon but our records were not suited to evaluating this possibility given the difficulties of separation from Servaline Genet *G. servalina*. Most species appear to be distributed widely across the country. While several are commonly recorded in hunter catch and bushmeat markets, they form only a small proportion (3.4% and 3.1%, respectively) of all bushmeat records. However, in proximity to settlements, small carnivore exploitation, for bushmeat and use of body parts in traditional ceremonies, appears to have adverse effects on species richness and abundance.

Keywords: bushmeat, camera-trap, *Crossarchus platycephalus*, distribution, *Herpestes ichneumon*, *Herpestes sanguineus*

Notes sur la distribution et le statut des petits carnivores au Gabon

Résumé

La distribution et le statut des petits carnivores n’ont jamais été évalués en détails au Gabon. Nous avons utilisé des données provenant d’études de suivi de la faune, par pièges-photos et transects, ainsi que des analyses sur la consommation et le commerce de la viande de brousse, afin de cartographier leur présence au Gabon et d’évaluer leur niveau d’exploitation actuel. Nos résultats établissent la présence de la Mangouste rouge *Herpestes sanguineus* et du Crossarque à tête plate *Crossarchus platycephalus* au Gabon, représentant les premières données confirmées de ces deux espèces dans ce pays. Si la présence du Crossarque à tête plate au nord-est du Gabon était déjà soupçonnée, celle de la Mangouste rouge n’était pas connue au Gabon et nos données élargissent considérablement son aire de répartition. Nous avons également enregistré une extension de la distribution de la Mangouste d’Égypte *Herpestes ichneumon*. La Genette à crête *Genetta cristata* fut proposée comme présente au Gabon, mais nos observations ne permettent pas de confirmer cette hypothèse compte tenu de la difficulté de la différenciation morphologique de la Genette servaline *G. servalina*. La majorité des espèces semblent être largement diffusées dans tout le pays, et bien que plusieurs espèces soient couramment observées dans les prises des chasseurs et les marchés de viande de brousse, elles ne constituent qu’une petite partie (3,4% et 3,1%, respectivement) des espèces capturées. Cependant, à proximité de villages, l’exploitation des petits carnivores pour la consommation de viande de brousse et l’utilisation de parties du corps dans les cérémonies traditionnelles semble avoir des effets défavorables sur la diversité et l’abondance des espèces.

Mots clés: *Crossarchus platycephalus*, *Herpestes ichneumon*, *Herpestes sanguineus*, piège-photo, répartition, viande de brousse

Introduction

The African rainforest harbours a diverse guild of small carnivores, of which several species are endemic to Equatorial such forests (Ray 2001). Gabon is on the west coast of Central Africa (Fig. 1), with a low human population density and large tracts of rainforest that cover 85% of the country (Ernst et al. 2012). The importance of Gabon for the conservation of threatened taxa has been highlighted for a number of larger species (e.g. Walsh et al. 2003, Blake et al. 2007, Henschel et al. 2011), and it might be equally important for the conservation of small carnivores. While several studies investigated the feeding habits of individual small carnivore species (e.g. Charles-Dominique 1978, Emons et al. 1983), there have been no comprehensive efforts to date to assess the status and distribution of all small carnivore species occurring in Gabon.

Most wildlife surveys in Gabon have concentrated on general biodiversity monitoring, with several focusing on primates, elephants *Loxodonta* and cats (Felidae). Fortunately, data on small carnivores have been collected opportunistically over the course of several such surveys. In addition, a recent boom in the use of remotely-triggered camera-traps for wildlife surveys in Gabon has meant that many carnivore data have been gathered incidentally. Here we collate opportunistic observations of small carnivores obtained during general wildlife and species-specific surveys and data from 16 different camera-trap study sites across Gabon, to assess the current distribution of small carnivores in this country. To explore how these
species may be affected by the bushmeat crisis sweeping West
and Central Africa (see Fa & Brown 2009), we investigated avail-
able bushmeat offtake data from 65 villages across Gabon and
bushmeat trade data from 11 towns throughout the country.

Methods

Study area
Gabon is a central African country that straddles the equator
and borders the Atlantic Ocean (Fig. 1). The habitat in Gabon
consists predominantly of moist tropical forest, with savan-
ah, swamps and mangroves making up about 15% of the land
area (Fig. 1) (Lahm 2001, Ernst et al. 2012). The human popu-
lation is small (1.6 million) and largely urban (86% of popula-
tion) (CIA 2012). This, coupled with a relatively strong econo-
my supported by natural resource extraction, has meant that
Gabon has not suffered from landscape degradation similar to
that experienced in some other countries in the region (CIA
2012). In 2002, 13 national parks were created, encompass-
ing 30,000 km², or 11% of the country’s land surface (Fig. 1).

Study species
Of the species under the remit of the IUCN SSC Small Car-
vore Specialist Group, nine had been recorded in a faunal
inventory of Gabon prior to its independence (Malbrant &
Maclatchy 1949). Malbrant & Maclatchy (1949) furthermore
speculated about the occurrence of Long-nosed Mongoose
Herpestes naso, Cameroon Cusimanse Crossarchus platyceph-
alus and Common Slender Mongoose Herpestes sanguineus in
Gabon. All 12 species (Table 1) are currently listed as Least
Concern on The IUCN Red List of Threatened Species (IUCN
2012). As well as these 12, two otter species occur in Gabon,
Congo Clawless Otter Aonyx congicus and Spotted-necked Ot-
ter Lutra maculicollis, but these are not discussed here except
for within the bushmeat data used to make an overall assess-
ment of the hunting pressure on carnivores. Finally, Gaubert et
al. (2006) recorded Crested Genet Genetta cristata for Gabon
(and Congo), more than 500 km south of the Sanaga River.
These records were considered “equivocal” by Hunter & Bar-
rett (2011: 90) and were mapped only as “?” by Van Rompaey
servalina are morphologically similar and perhaps hybridise
(Gaubert et al. 2006). Thus, their identification requires care
and often they cannot be distinguished on camera-trap im-
ages such as form the bulk of our records. Hence, it is possible
that the records presented here as ‘Servaline Genet’ include
some that are in fact of Crested Genet, or of hybrids between
these two.

![Vegetation map of Gabon, showing population centres, protected areas and locations of the various surveys included in this study.](image-url)
Mapping of species distribution
We collated data from 33 wildlife field surveys and 16 camera-trap studies (Table 2, Fig. 1), and plotted confirmed small carnivore records to assess the distribution of each species. In addition, we used bushmeat hunting records for which the species and the site of catch could be confirmed, as well as faecal DNA records from a study in Moukalaba-Doudou National Park (NP). Faeces were identified to species level using a part of the mitochondrial cytochrome b which was amplified according to the method of Veron & Heard (2000).

Field survey sites were distributed across large parts of Gabon (Fig. 1). Some surveys used line transects conducted by day and at night, with observers walking at about 1 km/h (see Lahm 1993). Camera-trap studies used various camera-trap models and trapping protocols, depending on their aims (Table 2). These differences affect the likelihood of capturing each species and we therefore could not use non-detection (sites where the species were not photo-captured) as strong evidence of absence. We do discuss, however, trends that appear from consistent non-detection in certain areas or habitat types.

Where the species identity was in question, data were discarded. Marsh Mongoose Atilax paludinosus and Long-nosed Mongoose posed the greatest difficulty, being closely related and difficult to tell apart in the field (Ray 1997). The best diagnostic feature is the lack of webbing between the toes in Marsh Mongoose (Baker & Ray 2013, Van Rompaey & Colyn 2013c). More visible on images, Marsh Mongoose has a blunt, triangular face, whilst Long-nosed Mongoose has a long muzzle and prominent nose (Hunter & Barrett 2011). The latter also has a longer and brushier tail (Baker & Ray 2013) that can be seen on certain images (Fig. 2).

Analysis of small carnivore offtakes through bushmeat hunting
Data on village hunting offtakes in Gabon were collated from a number of existing studies, as part of an ongoing study of hunting offtakes across West and Central Africa (Taylor 2012), including data from published and grey literature, as well as unpublished data. We included only studies that provided complete village hunting offtake data (not those covering only a particular family or genus), and that identified animals to species level. Village offtake data were collected using two methods: 1) ‘bag counts’: hunter offtake was directly recorded on their return to the village from hunting; 2) ‘3-day recall’: households were asked, using a questionnaire, what they had caught in the last three days. Offtakes provided as biomass were converted into number of animals using empirical weights for Gabon in Abernethy et al (2006) and Coad (2007) or, where empirical weights were not available, published weights from Kingdon (1997) or the Pantheria database (Jones et al. 2009). For a few bird and rodent species, expert opinion from Gabon was solicited to provide an estimate.

We identified three studies from Gabon (Wilkie et al. 2006, Carpaneto et al. 2007, Coad 2007), comprising offtake data for 65 villages (Fig. 1). Data from the ‘Parks and People’ study (see Wilkie et al. 2006) accounted for most of these villages (n = 56), and come from the surrounds of the then newly-created national parks of Birougou, Monts de Cristal and Ivindo. Sample sizes per village were small (mean of 10 days’
cover rare species, we are confident that these sample sizes provide a representative depiction of the catch in each village/protected area (Taylor 2012). Village hunting studies in Gabon (e.g. Starkey 2004, Coad 2007) suggest that hunters have

<table>
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<th>Study site1</th>
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<th>Camera-trap type/ model</th>
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1Locations of camera-trap study sites are shown on Fig. 1. SEGC = Station d’Études des Gorilles et Chimpanzés.

2Species: Leopard Panthera pardus; Lion Panthera leo; African Golden Cat Proelis aurata; African Elephant Loxodonta africana; Chimpanzee Pan troglodytes; Spotted Hyaena Crocuta crocuta.

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Statistical analyses

We calculated the proportion of the village offtake represented by each order, for each of the 11 village samples. From this we then calculated the mean proportion (and associated standard errors) of the catch represented by each order (n = 11 villages). We then repeated this at the species level within Carnivora, to examine the proportion of the village offtake represented by individual carnivore species. We repeated this for the market samples (n = 11 markets).

Results

Species occurrence and distribution

We recorded 12 small carnivore species in Gabon and used a total of 1,028 records to map species occurrences across the country (Fig. 3). We obtained the first records of Common Slender Mongoose in Gabon, >350 km outside its range on The IUCN Red List of Threatened Species (IUCN 2012) (Fig. 3). We furthermore produced the first definitive records of Cameroon Cusimanse in Gabon, and recorded Egyptian Mongoose Herpestes ichneumon about 105 km north of its current IUCN Red List range (Fig. 3). Most species are distributed across the country, although Cameroon Cusimanse was recorded only in the north-east and Egyptian Mongoose only in the south (Fig. 3).

Small carnivore offtakes and trade

Carnivores comprised 3.4% of village offtakes and 3.1% of all sales in bushmeat markets (Fig. 4). Village offtakes and market sales were both dominated by ungulates, rodents and primates, with all other taxa making up <5% of all hunter catch and sales, respectively (Fig. 4). Among the carnivores recorded, Marsh/Long-nosed Mongoose were the most numerous (group of) species caught in villages (Fig. 5). African Palm Civets Nandinia binotata were the second most numerous species in village offtakes and the most numerous species in bushmeat markets, where they were three times more common than any other carnivore species (Fig. 5).

Discussion

Species extensions of known range

Malbrant & Maclatchy (1949) speculated that Slender Mongoose might occur in Gabon and neighbouring Congo. However, to date, there had been no confirmed records of the species from the northern bank of the lower Congo River, its presumed western range limit in Central Africa (IUCN 2012). We recorded this species through direct observations at 26 locations, spread across almost the entire country (Fig. 3). While no hard evidence (e.g. photographs or specimens) for the species in Gabon was obtained, observations were made independently by five experienced field biologists (KA, NB, PH, SL and FM). Most records came from a forest–savannah mosaic in northern Lopé NP, where KA, PH and FM made close to 100 independent observations of the species. Observations here were restricted to daytime hours and open savannah habitats, and included multiple observations at close range (<5 m), lasting up to 1 minute. We are therefore confident that our records represent H. sanguineus.

The presence of Cameroon Cusimanse in north-east Gabon had been suspected (Hunter & Barrett 2011, IUCN 2012).
Fig. 3. Distribution maps for the small carnivores of Gabon, showing detection points. Grey shading represents generalised range according to The IUCN Red List of Threatened Species, both in the Gabon and the inset Africa maps (Data type: HC = hunter catch; CT = camera-trap record; Obs = direct observation; DNA = faecal DNA).
the extensive savannahs in south-east and south-west Gabon (Fig. 1). The record from Fougamou, near the northern tip of the south-western savannahs, aligns well with this pattern. Egyptian Mongoose might thus occur in all extensive savannah areas in southern Gabon.

Species distribution and habitat preferences
Marsh Mongoose, Black-footed Mongoose *Bdeogale nigripes*, Long-nosed Mongoose, African Civet *Civettictis civetta*, Servaline Genet and African Palm Civet were recorded throughout Gabon, and across most habitat types. Although Rusty-spotted Genet *Genetta maculata* appears to have a country-wide distribution, it was generally recorded in or near savannah areas. Extensive camera-trapping in more pristine, dense forest in the Lopé-Ivindo region yielded no record of the species. Although Rusty-spotted Genet occurs in rainforest, it generally prefers open corridors and secondary growth (Angelici & Gaubert 2013). This habitat preference may explain the lack of but not confirmed anywhere in the country (Goldman 2013). As with Slender Mongoose, we were not able to collect hard evidence for this species’s occurrence, but cusimanses were observed directly at five locations by experienced field biologists (PH and SL). Observations included one observation in broad daylight and at close range (<5 m) by PH in September 1998 in what is now Minkébé NP, of a group of four individuals in an open-understorey riparian forest, over about two minutes. Cusimanses are difficult to identify to species in the field, but the location of the observations and suspected range limits of Cameroon Cusimanse (Hunter & Barrett 2011, IUCN 2012), indicate that our observations represent that species.

In Gabon only the south-western tip is currently recognised as within the range of Egyptian mongoose by IUCN (2012). Our camera-trap records place the species 105 km north of its IUCN Red List range, and Malbrant & Maclatchy (1949) listed one record about 100 km further north, near the town of Fougamou (Figs 1, 3). All our records were in or near the extensive savannahs in south-east and south-west Gabon (Fig. 1). The record from Fougamou, near the northern tip of the south-western savannahs, aligns well with this pattern. Egyptian Mongoose might thus occur in all extensive savannah areas in southern Gabon.

**Fig. 4.** Proportion of carnivores out of all animals (above) harvested in villages and (below) sampled at bushmeat markets during several surveys in Gabon (error bars represent the SE).

**Fig. 5.** Proportion of carnivores out of (above) total catch (number of animals) in villages and (below) total sample (number of animals) at bushmeat markets (error bars represent the SE). Scientific names are given in Table 1, save: African Golden Cat *Profelis aurata*; Leopard *Panthera pardus*; Congo Clawless Otter *Aonyx congicus*; Spotted-necked Otter *Lutra maculicollis*; Serval *Leptailurus serval*
Egyptian Mongoose range and Rusty-spotted Genet habitat associations.

Hunting pressure on small carnivores in Gabon

African Palm Civet makes up an important proportion of carnivores found in village offtakes and market sales (Fig. 5). This may result from its relative abundance (estimated to occur at a minimum of about five individuals per km² in Gabon; Van Rompaey & Ray 2013), and ease of location through its loud, distinctive call. Coad (2007) found that most small carnivores, excepting Palm Civet, were much more frequently caught than sold to towns. This was certainly the case for Marsh/Long-nosed Mongoose, which was ten times more numerous, proportionally, in hunter catches than in market sales (Fig. 5). Central African Oyan made up a large proportion of market sales (Fig. 5), but this figure was inflated by one particular site: the species was found infrequently in all other markets.

Overall, carnivores do not represent a large proportion of bushmeat sales or village offtakes in Gabon. They may be underrepresented in market surveys, because certain ethnic groups have social restrictions against their consumption. The Bakota of northeast Gabon, for example, have restrictions against eating carnivore meat (Mazzucchetti 2005). While traditional restrictions appear to be fading, the consumption of carnivores remains taboo for many ethnic groups, and in par-
ticular for women (Lahm 1993, Starkey 2004, Mazzochetti 2005). While small carnivores may not be targeted for their meat, they may, however, be caught for their skins and body parts, which are used in traditional ceremonies (Lahm 1993). Small carnivores may furthermore be targeted to prevent, or in retribution for, predation on small livestock, mainly poultry (Mazzochetti 2005).

While no in-depth study has focused on the effects of hunting on small carnivore populations in Gabon, Lahm (1993) found in north-east Gabon that a significantly higher richness of small carnivore species occurred in remote areas than near villages where hunting took place. Carnivores were also observed ten times more frequently in remote areas (Lahm 1993). Contrary patterns were observed near the town of Gamba (Fig. 1), where the abundance of small ground-dwelling carnivores (mainly African Civet and unidentified mongooses) was not negatively affected by proximity to settlements, and where higher abundances for those species were associated with proximity to plantations (Vanhomme et al. in press). Similarly, studies of trap off-takes in the villages of Dibouka and Kouagna, central Gabon (Coad 2007), showed higher catch-per-unit-effort (CPUE) of African Civet and mongooses in plantation areas than in adjacent hunted forests. However, hunters interviewed in these villages (Coad et al. 2013) reported that Marsh Mongoose and unidentified genet species had become rare within their hunting territories over their lifetimes, and recounted general declines in hunted species. These three studies highlight that while, overall, small carnivore species richness and the abundance of certain species may be negatively affected by village hunting, some species may adapt more readily to (and even benefit from) land conversion to agriculture. However, differences in relative abundance of carnivores within different habitat types may mask longer-term declines over all habitats due to over-hunting, and care must be taken in the interpretation of these data.

Future considerations
Given Gabon’s low human population density, its largely intact forest and savannah biomes, and its extensive protected area network, its small carnivore populations are unlikely to be imperilled at this time. However, Gabon is entering a new phase of industrial development, with changes in land use and human disturbance anticipated. In the face of such potential change, national parks are Gabon’s first line of defence against biodiversity loss. All 12 small carnivore species known unequivocally from the country inhabit at least one, and up to five, national parks. Species confirmed in only one or two parks may merit recognition in park management plans: Cameroon Cusimanse in Minkébé NP, and Egyptian Mongoose in Loango NP. In addition, changes in habitat may influence the distribution of species across Gabon. Under new development, parks could become increasingly important refuges for species that might depend on contiguous forest or other little-degraded habitat conditions, such as Black-footed Mongoose, Servaline Genet and Central African Oyan. On the other hand, new developments might expand suitable habitat for species favouring anthropogenic conditions, such as African Civet or Rusty-spotted Genet, if hunting is controlled.

Our study represents the first synthesis of collective knowledge about observations of small carnivores in Gabon. Much is still unknown about these species: continued assimilation of new information, in research studies as well as environmental impact studies, will help manage for viable wildlife populations under future development scenarios.

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