Common Cusimanse *Crossarchus obscurus* in Ghana and Flat-headed Cusimanse *C. platycephalus* in Nigeria: a tentative comparison between habitat parameters affecting their distribution

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Abstract

Common Cusimanse *Crossarchus obscurus* and Flat-headed Cusimanse *C. platycephalus* are two taxa (species or subspecies) found in West and Central Africa. Their ranges are close to each other, probably as a result of allopatric speciation. This preliminary work compares some environmental parameters relative to the locations where they were both trapped by local hunters (respectively, in Ghana and Nigeria), to compare their habitat use. *Crossarchus platycephalus* appears more tolerant of mosaic or partially-degraded environments than *C. obscurus*, although overall the two taxa show rather homogeneous patterns.

Keywords: ecology, geographic range, Ghana, Nigeria

Le Crossarque commun *Crossarchus obscurus* au Ghana et le Crossarque à tête plate *C. platycephalus* au Nigeria: une comparaison préliminaire des paramètres environnementaux relatifs à leur répartition

Résumé

Le Crossarque commun *Crossarchus obscurus* et le Crossarque à tête plate *C. platycephalus* sont deux taxons (espèces ou deux sous-espèces d'une même espèce) présentes en Afrique occidentale et centrale. Leurs aires de répartition sont proches l'une de l'autre, ce qui reflète probablement le résultat d'une spéciation allopatrique. Dans ce travail préliminaire, certains paramètres environnementaux ont été comparés sur la base des localisations où les deux taxons ont été capturés par les chasseurs locaux, respectivement (respectivement, au Ghana et au Nigeria), pour mettre en évidence les différences et/ou les similitudes dans leur utilisation de l'habitat. A partir de ces premiers résultats, les principales données qui émergent sont la probablement plus grande tolérance de *C. platycephalus* à des environnements fragmentés ou partiellement dégradés en comparaison avec *C. obscurus*, même si globalement les deux taxons présentent des préférences écologiques relativement homogènes.

Mots clés: écologie, Ghana, Nigeria, répartition géographique

Introduction

The study of aphanic or sibling species (*sensu* Mayr 1970, Dobzhansky 1972, Steyskal 1972) is of particular interest because, both in allopatry or sympatry, it can provide information on their eventual ecological divergence (Ridley 1993). Scientists traditionally considered pairs or groups of species as sibling species based upon morphology, biogeography and anatomy, but recent advances in DNA analyses and molecular phylogeny have allow more confident determination whether two or more species are in reality sibling species (Puillandre *et al*. 2011). In mammals, various examples of sibling species have been described (e.g. Dobigny *et al*. 2003).

In the genus *Crossarchus* (family Herpestidae), endemic to the Afrotropical (or Ethiopian) region, four species are generally now recognised: Common Cusimanse *Crossarchus obscurus* F. G. Cuvier, 1825; Flat-headed Cusimanse *C. platycephalus* Goldman, 1984; Alexander's Cusimanse *C. alexandri* (Thomas & Wroughton, 1907); and Ansorge's Cusimanse *C. ansorgei* (Thomas, 1910). All are morphologically very similar (see Hunter & Barrett 2011). Common Cusimanse (Fig. 1a–b) is widespread in West Africa from eastern Guinea to the Dahomey Gap; its eastern range extends just east of the River Volta (Dunham *et al*. 2008). Flat-headed Cusimanse (Fig. 1c–d) occurs from Nigeria to north Gabon and Congo (Goldman & Hoffmann 2008, Hunter & Barrett 2011), and in southern Benin (Djagoun & Gaubert 2009, Djagoun *et al*. 2009). The two are often considered conspecific, under the name *C. obscurus* (e.g. Wozencraft 2005). They differ in some dimensions and shape of skull bones, but external morphological differences are almost insignificant and hardly detectable (cf. Goldman 2013, Goldman & Dunham 2013) (Fig. 1). The two seem to have allopatric ranges, although we cannot exclude their co-occurrence in the contact and/or border areas (Fig. 2). Of the other two species, *C. alexandri* is endemic to central Africa and *C. ansorgei* is widespread in north Angola and south-east Congo (Wozencraft 2005); *C. alexandri* is believed to overlap slightly with *C. platycephalus*, but *C. ansorgei* is apparently geographically separate, although not by much. Neither shows any overlap with *C. obscurus* (Gilchrist *et al*. 2009).

Common Cusimanse has been recorded in dense undergrowth of rainforest, but also in farm bush, logged forest, plantations, humid savannah areas of savannah gallery forests, and even in dry open grassland and thicket. The known range extends from sea level to about 1,500 m a.s.l. (Gilchrist *et al*. 2009, Goldman & Dunham 2013). Flat-headed Cusimanse was recorded or trapped by local hunters in bush, abandoned farmland, marshy areas, primary and secondary rainforests, and

Fig. 1. Left: Common Cusimanse *Crossarchus obscurus*, 15 June 2008, near Bekwai (Ashanti Region, Ghana); right: Flat-headed Cusimanse *Crossarchus platycephalus*, 28 August 2009, surroundings of Port Harcourt airport (Rivers State, Nigeria).

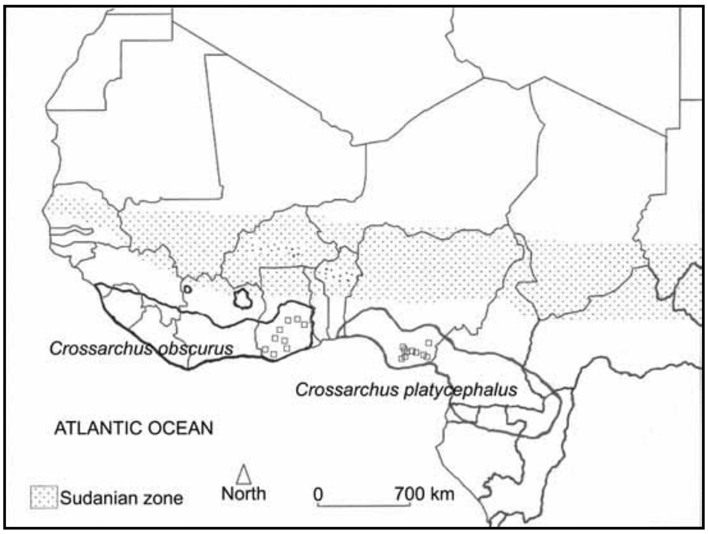

Fig. 2. World ranges of Common Cusimanse *Crossarchus obscurus* (western) and Flat-headed Cusimanse *C. platycephalus* (eastern). The squares indicate trapping localities of animals used in the present investigation.

even close to upper mangrove and in largely deforested lowland zones, overall from sea level up to 1,600 m a.s.l. (Powell 1997, Angelici *et al*. 1999a, 1999b, 1999c, Goldman & Hoffmann 2008, Gilchrist *et al*. 2009, Goldman 2013).

This study compares, on a preliminary basis, components of the habitats where Common Cusimanse and Flat-headed Cusimanse were captured, to highlight differences or similarities in their selected environments. Knowledge of species distribution patterns and identification of factors influencing them are crucial to species conservation (Channel & Lomolino 2000, Whitfield 2005). Both species are listed Least Concern (LC) in *The IUCN Red List of Threatened Species*, i.e. they are considered not to be at short- to mid-term risk of extinction, even if the population trend is unknown for both (Dunham *et al*. 2008, Goldman & Hoffmann 2008).

Study area and methods

Study area

Animals were studied in Ghana for *C. obscurus* in 2005–2012, and in Nigeria for *C. platycephalus* in 1997–2011 (Fig. 2). No animal was captured or killed expressly for this research: the individuals were sold on the roads as bushmeat (see Angelici *et al*. 1999c). Like many other species of carnivores and of mammals in general, local hunters trapped them in locally-built traps, almost always consisting of metal loop snares, made of brake or clutch wire for bicycles or motorcycles.

We used only data for those specimens where the vendor who was also the captor, showed us the exact location of capture. We visited all places of capture, noting the environmental variables (Table 1) and scoring them as (1) semi-natural or (2) natural habitat.

Statistical analysis

We analysed the correlation between variables through the use of *r* Pearson statistic (Cox & Hinkley 1974, Edwards 1976). We applied the *t* statistic to test the differences between the two species, using the elevation a.s.l. and habitat composition as variables. We used Generalized Linear Models (GzLMs) to model the species habitat preferences (see Agresti 1996, Hosmer & Lemeshow 2000, Whittingham *et al*. 2006) using elevation a.s.l., land use, and the distribution of other mammals and other species of carnivores as predictors. The trapping data (occurrences) were used as the independent variable and normal logit design was used.

Results

Cusimanse records are shown in Table 1. For both *C. obscurus* ($r = 0.83$, $P = 0.004$) and *C. platycephalus* ($r = 0.91$, $P < 0.001$), we found a significant correlation between the total number of trapped individuals and the total number of trapped carnivores. The *t* test results show significant differences between the two species in elevation ($t = -2{,}60$, $df = 36$, $P = 0.013$) and habitat composition ($t = 603.88$, $df = 36$, $P < 0{,}001$). *Crossarchus platycephalus* appears linked to semi-natural environments, i.e. at least partly degraded (68.2% of records), while *C. obscurus* tends to use natural environments (61.11% of

Table 1. Locality and habitat data for the specimens examined of Flat-headed Cusimanse *Crossarchus platycephalus* and of Common Cusimanse *C. obscurus*.

Locality	Habitat code[1]	Habitat score	Altitude (m)	A[2]	B[3]	C[4]
Flat-headed Cusimanse *Crossarchus platycephalus* (Nigeria)						
Surroundings of Port Harcourt airport (4°51′05″N, 7°00′59″E)	2 for agric	1	27	5	6	16
Abarikpo (5°03′40″N, 6°39′49″E)	Abb agr bush	1	220	2	2	8
Otari (4°51′18″N, 6°50′13″E)	1 for, marsh degr	2	178	1	2	4
Tombia forest (4°47′19″N, 6°53′35″E)	2 for, marsh, bush,farm	2	355	1	2	5
Orashi river (4°44′18″N, 6°38′46″E)	1 for, marsh degr agrabband	2	270	3	5	7
Omoku (Upper Orashi Forest reserve) (5°21′06″N, 6°39′07″E)	1 for low degr	2	17	1	1	3
Billebokiri (4°51′29″N, 6°55′15″E)	Riv mangr-agr and 2 for	1	5	4	6	9
Abia surroundings (5°06′53″N, 7°22′01″E)	Frag bush agr	1	400	1	2	4
Akampka (5°18′07″N, 8°21′29″E)	Mixfor	2	160	1	2	6
4 km east of Ikot-Ekpene (5°10′50″N, 7°42′43″E)	Frag bush agr	1	155	3	5	8
Common Cusimanse *Crossarchus obscurus* (Ghana)						
Surroundings of Obuasi (6°11′29″N, 1°39′43″W)	frag bush agr, dec for	1	101	2	4	6
5 km west of Bekwai (6°26′48″N, 1°34′52″W)	Guinea Forest	2	172	2	5	7
Oda (5°54′30″N, 0°59′22″W)	Everfor	2	127	1	2	4
Atwidie (6°35′22″N, 1°04′41″W)	semdecfor	2	225	3	5	6
12 km north of Kikam (4°55′34″N, 2°19′18″W)	2 for and 1 for	2	71	1	2	4
5 km east of Gyema (5°25′21″N, 2°41′22″W)	1 for degr areas	2	54	3	3	5
Begoro (6°23′02″N, 0°22′38″W)	Preserv for	2	447	1	2	3
Dunkwa (5°21′10″N, 1°40′33″W)	2 for frag farm wat	1	118	4	7	9
Nkawkaw (6°33′09″N, 0°46′01″W)	Semdecfor farm wat	1	271	1	3	7

[1]**Habitat codes**. **2 for agric:** secondary rainforest, fragmented with agricultural areas; **Abb agr bush:** abandoned agricultural area, with fallow bush, oil palms and colonising arboreal species; **1 for, marsh degr:** primary rainforest in a marshy area, degraded through human activities; **2 for, marsh, bush, farm:** mature secondary forest situated close to a brackish marsh, near secondary rainforest, bush, secondary swamp forest, lower mangrove and farmland; **1 for, marsh degr agrabband:** primary rainforest partially degraded to secondary rainforest, near secondary rainforest, bush, farmland, water bodies and some formations of upper mangrove; **1 for low degr:** primary rainforest with large trees, but moderate degradation through human activity; **Riv mangr-agrand 2 for:** riverine area with mangroves, cassava, banana and oil palm fields, and patches of secondary forest; **Frag bush agr:** fragmented altered bush with farmland; **Mixfor:** mixed primary and secondary rainforest; **Frag bush agr:** bush, fragmented farmland, degraded forest; **Frag bush agr, dec for:** bush fragmented with some farmland (palm oil, cocoa), bordering semi-deciduous forest; **Guinea forest:** Guinea (moist semi-deciduous) forest; **Everfor:** evergreen forest near semi-deciduous forest; **Semdecfor mois:** semi-deciduous forest; **2 for and 1 for:** secondary rainforest with fragment of primary rainforest; **1 for degr areas:** primary rainforest with small open degraded areas; **Preserv for:** moist deciduous forest well preserved (secondary); **2 for frag farm wat:** secondary rainforest fragmented with small farmland, some water bodies; **Semdecfor farm wat:** semi-deciduous forest, palm oil farmland, water bodies.

Totals

[2]**A:** Total of trapped individuals of *Crossarchus* in one trapping section.

[3]**B:** Total of trapped carnivores in one trapping section.

[4]**C:** Total of trapped mammals in one trapping section.

Each 'trapping section' comprises the results from a single session (24-hr period) at a single location (defined as the operating area of a trapper, or of a group of trappers). It is believed that all individuals trapped in each trapping section were offered for visible sale, rather than there being any bias introduced through some species being consistently discarded through lack of sales or domestic value, being kept for home consumption, or being traded directly to middlemen.

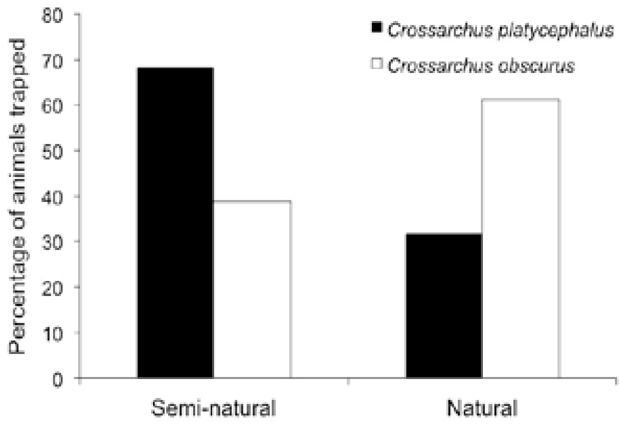

Fig. 3. Broad habitat use of Common Cusimanse *Crossarchus obscurus* and Flat-headed Cusimanse *C. platycephalus*.

records) (Fig. 3). However, the GzLM analysis shows statistically significant results for only *C. platycephalus*: its capture probability grew with decreasing elevation (B = –0.002, Wald χ^2 = 7.20, P = 0.07) and with presence of semi-natural areas (B = 0.041, Wald χ^2 = 7.15, P = 0.01).

Discussion

These preliminary results suggest that in the capture localities, both species are among the carnivores (and in the case of *C. platycephalus*, among all medium-sized mammals) most prone to capture with snares, and thus may be among the most common carnivores there (Table 1). This is consistent with perceptions that the two species are still fairly common, and with their present *IUCN Red List* category (Least Concern; see above). All this is consistent with fragmentary data previously reported on the ecology of the species (see e.g. Angelici *et al*. 1999b, Goldman 2013).

The most interesting result, albeit requiring confirmation, is the apparent greater tolerance of Flat-headed Cusimanse to partially degraded or fragmented environments, such as patches of primary or secondary forest alternating with small agricultural areas, deforested areas and also to areas of tall mangrove forest and other wetlands. Common Cusimanse appears to need less-degraded environments such as primary and secondary forests with dense undergrowth. If confirmed by further investigation, this contrasts with previous opinions that this species is rather ubiquitous (see Gilchrist *et al*. 2009, Goldman & Dunham 2013).

The habitat ranges of the two species appear similar. This may be interpreted using two hypotheses that should be investigated in the future:

a) Either the two taxa are conspecific (subspecies of *C. obscurus*). In this case the range of the two forms may be continuous, with the apparent small gap in distribution resulting from patchy survey and/or unfavourable habitats, e.g. populated coastal areas of Togo and Benin;
b) or the two taxa are different species, as some elements suggest. The two ranges seem likely to be, on current knowledge, allopatric or almost so, separated at least largely by a barrier, possibly the Volta River (geographic barrier) and/or the Dahomey Gap (ecological barrier). This region, which originated at the end of the Holocene, has for its latitude unusual environmental and climatic conditions and vegetation (Salzmann & Hoelzmann 2005) which influence the distribution and the presence of species (Booth 1958; see, e.g., Nicolas *et al*. 2010).

It would be interesting to examine in more detail the various aspects of the two taxa's ecology (e.g. diet; space and habitat use). It is desirable to promote further research in the Dahomey Gap region, where at least one of the two species is present (Raynaud & Georgy 1969, Djagoun & Gaubert 2009, Djagoun *et al*. 2009).

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