

A reassessment of the distribution of the rare *Genetta johnstoni* (Viverridae, Carnivora) with some newly discovered specimens

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ABSTRACT

The rare Johnston's Genet (*Genetta johnstoni*) is one of the least known small carnivores inhabiting the West African rain forest. Some newly discovered specimens collected from the field (Guinea and Ivory Coast) and several rediscovered specimens resulting from re-investigating collections, have permitted us to reconsider the distribution of the species. Coupled with a bibliographic review and a census of specimens kept in public collections, a reassessed distribution map is proposed, extending the previous estimated range 400 km to the West (Kolenté Plates, Guinea) and more than 600 km to the East (Tarkwa, Ghana). The majority of collected specimens have come from the inland forests of northern Liberia and south-eastern Guinea, while the surroundings of Mt. Nimba also support numbers of this species. We suggest that the supposed restriction of *G. johnstoni* to rain forest be re-evaluated because a specimen was collected in a region of moist woodlands and savannah (Kolenté Plateau). With regard to these new distributional data, conservation implications for the whole Upper Guinean block population are discussed.

Keywords: collections, conservation, distributional range, *Genetta johnstoni*, Upper Guinean block, Viverrinae

INTRODUCTION

Like many Viverridae and Herpestidae species inhabiting African rain forests, Johnston's Genet (*Genetta johnstoni*; Pocock, 1908) is a poorly known taxon. The distribution of this species, based on a few collected specimens (Pocock, 1908; Kuhn, 1960, 1965; Crawford-Cabral, 1981; Lamotte & Tranier, 1983), is thought to be restricted to the 'Liberian subregion' (Happold, 1996), roughly including the inland forests of eastern Liberia, western Ivory Coast and south-eastern Guinea (Schreiber *et al.*, 1989).

Johnston's Genet is traditionally considered within the genus *Genetta* as the only representative of the subgenus *Paragenetta*, erected by Kuhn (1960) (Wozencraft, 1993). This species exhibits several distinctive morphological characteristics (Gaubert, Veron & Tranier,

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2001). The elongated narrow-shaped skull (Kuhn, 1960; Lamotte & Tranier, 1983), constriction of the zygomatic arch (Rosevear, 1974), flattening of the mandible (Kuhn, 1960; Lamotte & Tranier, 1983) and reduction of the upper teeth (Kuhn, 1960; Rosevear, 1974; Lamotte & Tranier, 1983) have justified the subgeneric status of *Paragenetta*. Aspects of the skull (and especially dental peculiarities) have incited several authors to attribute an insectivorous diet to the animal (Kuhn, 1960; Rosevear, 1974, Crawford-Cabral, 1981; Lamotte & Tranier, 1983). Pocock (1908) gave an accurate description of the coat pattern of the type specimen. However, some additional characters should also be emphasized, as they are crucial in the identification of the species. The spots are blackish-brown to rufous-brown and strongly contrast with the dark mid-dorsal line. The first two rows of spots often coalesce into complete or partial lines, and the nuchal stripes tend to fuse in a manner such that the pattern becomes irregular. The annulation of the tail is also distinctive; the pale rings are present to the tip, and the dark rings lengthen towards the distal part of the tail.

Using these distinctive character states, several previously misidentified specimens were re-identified in natural history museums holding large collections of mammals from the Upper Guinean region, either through reinvestigating collections or photograph-based identification. Information was also provided through current museum identifications (personal commentaries of collection curators) and newly found specimens. Here we reassess the distribution of *G. johnstoni* based on this survey and a review of bibliographic material.

BIBLIOGRAPHIC SURVEY

Johnston's Genet is classified 'data deficient' by IUCN's Red List of Threatened Animals (The IUCN Species Survival Commission, 1996; the 2001 IUCN Red List of Threatened Species is also available on the web). It has rarely been the subject of any particular field surveys and few reports have been made of Johnston's Genet in the wild. The compilation by Schreiber *et al.* (1989) omitted some localities where the genet was collected and assigned the erroneous number of eight available museum specimens (also reported in Kingdon, 1997). In fact, the uncertain distributional status of the species appears to be the result of numerous omissions in the literature and incorrect identifications of collected specimens. After the publications of Pocock (1908; two genets from Liberia, including the holotype and paratype specimens) and Kuhn (1960; two specimens from Liberia), Crawford-Cabral (1981) was only the third to mention the presence of a Johnston's Genet (from Guinea) in a public collection (Table 1), from the Natural History Museum of Paris (MNHN), France. However, Lamotte & Tranier (1983) omitted Crawford-Cabral's record in their report of a new specimen of *G. johnstoni* from Ivory Coast. On the other hand, they confirmed the identification by Schlawe (1980) of a specimen from Ghana kept at the British Museum of Natural History (BMNH), London, UK, as a representative of the species. Roth & Mertz (1986) supposed the genet to be present in Taï National Park, Ivory Coast, but without mentioning any sightings. Hoppe-Dominik (1990) erroneously cited Lamotte (1942), stating Johnston's Genet had been recorded in the International Reserve of Mt. Nimba, Ivory Coast. However, the paper of Lamotte only dealt with the Guinean part of Mt. Nimba and did not mention the presence of *G. johnstoni* during his field survey.

The published data on Johnston's Genet have not been used consistently in compiling recent books and guides, resulting in a lack of consensus concerning the distribution. For instance, Schreiber *et al.* (1989) mentioned 'Known from a small area of rain forest in Liberia and from one specimen from Macenta, Guinea', while Nowak (1991) indicated 'Liberia, Ivory Coast, Ghana' and Kingdon (1997) slightly differed from Schreiber *et al.* (1989) by stating 'Known from rainforest in Liberia and Guinea (but may also occur in W Ivory Coast)'.

Table 1. Specimens of *Genetta johnstoni* kept in collections. BMNH: British Museum of Natural History, London, UK; ZFMK: Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany; MNHN: Muséum National d'Histoire Naturelle, Paris, France; USNM: National Museum of Natural History, Washington, USA; AMNH: American Museum of Natural History, New York, USA; IRSNB: Institut royal des Sciences naturelles de Belgique, Brussels, Belgium; MFNB: Museum für Naturkunde, Humboldt University, Berlin, Germany; RMNH: National Museum of Natural History, Leiden, the Netherlands (formerly Rijksmuseum van Natuurlijke Historie)

Museum	Catalogue number	Material	Locality	Time of collection	Publication
BMNH	1908.8.23.1* (type of <i>Genetta johnstoni</i>)	Skin	25 km west of the Putu Mountains, Liberia	1907†	Pocock (1908)
BMNH	1930.3.3.10* (paratype of <i>G. johnstoni</i>)	Skin	Cavally River, Liberia	1907†	Pocock (1908)
BMNH	1927.8.12.1*	Skin + skull	Tarkwa, Ghana	1927	Schlawe (1980), Lamotte & Tranter (1983)
ZFMK	57.11 (type of <i>Paragenetta lehmanni</i>)*	Skull	Kpeape, Liberia	1956	Kuhn (1960)
ZFMK	61.966 (paratype of <i>P. lehmanni</i>)*	Skull	Kpeape, Liberia	1959	Kuhn (1960)
ZFMK	95.007*	Skin	Ziama Forest, Guinea	1994	
ZFMK	95.008*	Skin	Ziama Forest, Guinea	1993–94	
ZFMK	95.009*	Skin	Ziama Forest, Guinea	1993–94	
MNHN	1901-1069*	Skin	Alindja (?), Ivory Coast	?	
MNHN	1936-995*	Skin	Kolenté Plateau, Guinea	1936	
MNHN	1961-417*	Skin	Macenta, Guinea	1958	
MNHN	1982-1007*	Skin	Yalé, Ivory Coast	1964	
MNHN	1986-246*	Skin + skull	Mt. Nimba, Ivory Coast	1964	
MNHN	2000-683*	Skin + skull	Mt. Nimba, Guinea	2000	
MNHN	2001-523	Skin + skull	Tai National Park, Ivory Coast	2000	
USNM	270075	Skin	Harbel, Liberia	1940	
USNM	270076	Skin	Harbel, Liberia	1940	
USNM	270077	Skin	Harbel, Liberia	1940	
USNM	270078	Skin	Harbel, Liberia	1940	
AMNH	167502*	Skin	Liberia	?	
AMNH	165697*	Skin	Liberia	1944	
IRSNB	16426*	Skin	Sapo National Park, Liberia	1965	
MFNB	44532*	Skin	Gbarnga, Liberia	1886–88	
RMNH	41102*	Skin	Liberia	?	

*Specimen examined by one of the authors (P. Gaubert).

†According to Rosevear (1974).

‡Previously identified as *G. pardina* by Rode (1937).

§Previously identified as *G. tigrina* by Roche (1971).

Finally, only the work of Wozencraft (1993), compiling the previous publications, mentioned: 'Ghana, Guinea, Ivory Coast, Liberia', but he supplied no further details.

GENETTA JOHNSTONI IN COLLECTIONS AND NEW SPECIMENS

Table 1 compiles an updated list of Johnston's Genet remains kept in collections (some of which have never been published), creating a temporary total of 24 individuals.

After the examination of its skull and its skin by one of us (P. Gaubert), we confirmed that the specimen from Ghana (BMNH 1927.8.12.1; collected by G. Hall in January 1927), mentioned by Schlawe (1980) and Lamotte & Tranier (1983) but identified as '*Genetta genetoides*' in the BMNH collections, belongs to the species *G. johnstoni*.

Two additional specimens come from the MNHN Viverrinae collection, found among other genet skins during reinvestigation of the collection by P. Gaubert. The first specimen (CG 1936-995), which was labelled '*Genetta maculata*', is a skin collected during the Rode Expedition in January 1936, in the Kolenté Plateau, Guinea (labelling: 'Plateaux de Kolenté – près du Sierra Leone'; Fig. 1a). This specimen was in fact mentioned by Rode (1937) but identified as '*Genetta pardina*'. Its habitus is almost identical to the description given by Pocock, (1908) for the type specimen. We encountered difficulties in trying to locate the geographical origin of the second specimen (a skin numbered CG 1901-1069; Fig. 1b) as the label only indicated the erroneous identification name '*Genetta maculata*'. Its catalogue number unfortunately refers to a specimen of African civet ('*Viverra civetta* var. *poortmani*') which has apparently disappeared from the collections. The next specimen recorded in the *Catalogue Général* is a skin of '*Genetta pardina*' (CG 1901-1070), given to the Bougie Museum (Algeria) in 1904. These two Viverrinae belong to a set of three mammals listed as originat-

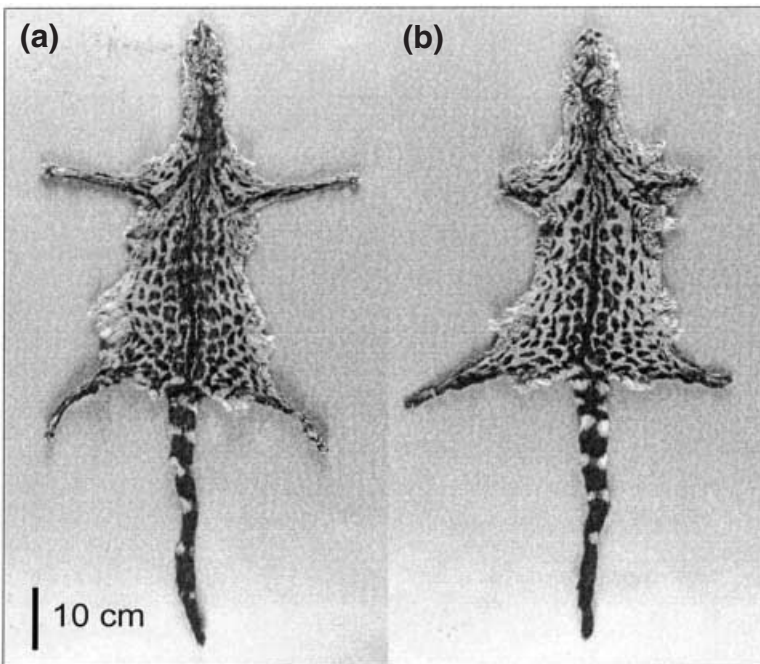


Fig. 1. Tanned skins of *Genetta johnstoni* kept at the MNHN (photographs: P. Gaubert): (a) CG 1936-995 and (b) CG 1901-1069.

ing from 'Africa' and sent by Mgr Le Roy, bishop of 'Alinda' (the other specimens sent by Le Roy consist of birds coming from Africa and the Americas). Although we were unable to find the locality named Alinda in any current geographical atlas, a town called 'Alindja' was once located in southern Ivory Coast, as mentioned in the *Atlas des Colonies Françaises* (Pelet, 1901). Alindja, also named 'Grand-Jack', was situated a few kilometres west from Jackville (5°12'N; 4°25'W) and south of the Ebrié Lagoon. However, confusions in labelling and the impossibility of finding the exact locality name, coupled with other animals in the same set originating from the Americas, make us consider very cautiously the supposed collection locality of specimen CG 1901-1069. The coat pattern of this genet fits with the usual habitus of the species, even if the ground colour is more greyish and the spots of the first two rows appear to be less coalesced, for instance, than those of the two correctly labelled MNHN specimens CG 1982-1007 (Lamotte & Tranier, 1983) and 1986-246 (P. Gaubert, this study) from Mt. Nimba, Ivory Coast, collected by M. Lamotte in 1964.

Three other misidentified specimens of *G. johnstoni* were discovered after the examination of slides provided by the Zoologisches Forschungsinstitut und Museum Alexander Koenig of Bonn (ZFMK), Germany. These two skins (ZFMK 95.008 and 95.009), incorrectly referred to as the *G. maculata* 'complex', belong to a set of individuals from the Zياما Forest, Guinea, in which a specimen (ZFMK 95.007), localized from Gboda, was already identified as *G. johnstoni* but not previously quoted in any literature. All four skins come from the Zياما Forest, and were collected between 1993 and 1994 (24 February 1994 for ZFMK 95.007) by W. Bützler during the Projet de Gestion des Ressources Rurales (PGRR) Guinean survey. Despite all being from a restricted area, the four specimens exhibit extremes in coat colour variation. The coloration of the dorsal spots varies from red-rufous to dark brown, and the ground colour from yellowish to dirty grey. The head is absent from specimen 95.009, while the tail is half-cut for the genet 95.008.

Another genet from the Institut Royal des Sciences Naturelles de Belgique (IRSNB) of Brussels, Belgium (catalogue number 16426), was reidentified following the examination of photographs. This complete flat skin was collected in Liberia by J. Verschuren in July 1965. First identified as '*Genetta tigrina*', the individual was attributed a corrected label '*Genetta johnstoni* Poc. = *Genetta maculata* (Gray)' by L. Schlawe in 1975, leading to a confused identification. Additionally, the specimen has never been registered as *G. johnstoni* in the IRSNB collections. According to the collector himself, the origin of the genet is actually 'Chien', in Sapu National Park, Liberia (locality labelled 'Chou(?)' on the specimen in the collection). The biotope was either dense rain forest or a part of its clearing zone at an altitude of 600–700 metres (G. Lenglet, personal communication). Habitus is strikingly similar to specimens CG 1982-1007 and 1986-246 (MNHN) in the way that the coat is so densely spotted that the two or three first dorsal rows constitute an irregular red-rufous pattern, strongly contrasting with the dark mid-dorsal line and the yellowish ground colour.

One specimen from the Museum für Naturkunde of Berlin (MFNB), Germany, a skin confusingly labelled '*G. maculata* = *G. johnstoni*' (catalogue number 44532), is here confirmed to belong to the species *G. johnstoni*. It is a native skin from Liberia purchased at 'Gbangu, Pesseland' by K. Noltze, without any indication concerning its time of collection (prior to 1936; M. Ade, personal communication). The German name 'Pesseland' corresponds to the 'Pessy Country' as indicated in the map of Büttikofer (1888), and is roughly delimited by the St Paul's (west boundary) and St John's (east boundary) rivers. In this region, Gbarnga is very likely to constitute the town referred as 'Gbangu' by the specimen label. This genet has brown-rufous dorsal spots, with the first row mostly coalesced into a longitudinal stripe. The general coat pattern is very clear. Ground coloration is a pale yellowish grey.

The National Museum of Natural History (formerly Rijksmuseum van Natuurlijke Historie; RMNH) in Leiden, the Netherlands, holds a newly identified specimen of Johnston's Genet (RMNH 41102). This skin was stored without information but for a handwritten label indicating that it had been found in a box containing animals collected by J. Büttikofer in Liberia. Büttikofer made two collecting trips to Liberia: one from 1879 to 1882 (with C.F. Sala), the second in 1886–87 (with F.X. Stampfli). This 'left-over' (along with another genet skin) is almost certainly from his second expedition. However, whereas Büttikofer returned to the Netherlands in May 1887 due to ill-health, his companion Stampfli continued collecting in Liberia until he returned to Switzerland in June 1888. So the unlabelled skins could have come from Stampfli's additional material, but there is no way of ascertaining this (C. Smeenk, personal communication). The paper relating the last trip by Büttikofer and Stampfli provides a map of collection sites (Büttikofer, 1888: plate 5) that allowed us to restrict the specimen's origin within a zone roughly defined by the four following points: 06°35'N, 11°25'W (Grand Cape Mt.); 07°10'N, 11°10'W (region of Cobolia); 07°10'N, 10°20'W (near Soforé Place); and 06°10'N, 10°15'W (east of Marshall and Du Queah River). Büttikofer (1888) specified that, after his return from Liberia, Stampfli was collecting on Farmington River (i.e. just beyond the eastern border of the above-mentioned area) until spring 1888. Coat pattern and coloration of this nearly adult specimen are similar to those of IRSNB 16426.

The American Museum of Natural History (AMNH) of New York, USA, has two skins of Johnston's Genet from Liberia, without further details concerning their collection localities. The specimen 165697, a headless skin, was collected in 1944 by H. H. Burgess, while 167502 is a skin missing the head and part of the shoulders without information (T. Pacheco, personal communication). Coat patterns are very similar to specimen 16426 (IRSNB).

Four Johnston's Genets from Harbel, Liberia, collected in March–July 1940 by William Mann as part of the Smithsonian Firestone Expedition, are kept at the National Museum of Natural History (USNM) of Washington, USA (USNM 270075-270078; M. Carleton, personal communication). All were prepared as flat skins. Although we were unable to check their identification, we will consider their coastal location in further discussion.

A new subadult specimen (skull and skin) was collected at the Seringbara native market, Mt. Nimba, Guinea, by S. Dufour (SYLVATROP/IGG) in May 2000. This specimen is deposited at the MNHN (CG 2000-683). The dorsal view of the skull shows characters induced by the young age of the individual, e.g. slight flattening of the muzzle and insertion crests of the masseter muscles quasi unmarked (Fig. 2a,b). The specimen also exhibits the distinctive character states of the species, including light and narrow shaped dentition, flattened mandible and broken curvature at the middle (on a longitudinal axis) of the lower canines. Milk teeth are still present and the second pairs of molars are emerging. The skin (head and part of the tail lacking) has an irregular pattern of fused spots and stripes, often observable in young and subadult genet specimens (Gaubert *et al.* 2001). However, the blackish-brown colour of the spots contrasting strongly with the black mid-dorsal stripe confirms the identification of the specimen.

Finally, two new specimens coming from Ivory Coast must be mentioned. The first genet (Fig. 3a) was found dead by one of us (S. Shultz) on a dirt road near the Institut d'Ecologie Tropicale (IET) research station of Taï National Park, in January 2000. The individual, a male pathologically thin and affected by cataracts, had probably been killed by a Crowned Eagle (*Stephanaetus coronatus*), which was still standing on top of it when discovered. Its skull, postcranial bones (tail vertebrae missing) and skin are now deposited at the MNHN (CG 2001-523). The first live specimen of *G. johnstoni* (Fig. 3b) was trapped 1.5 km east of

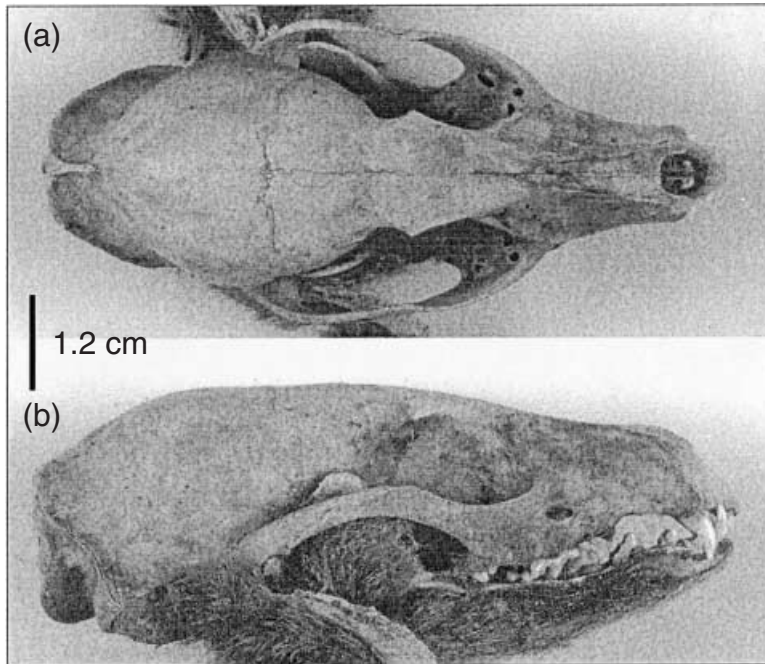


Fig. 2. Skull of the juvenile *Genetta johnstoni* deposited at the MNHN (CG 2000-683) (photographs: P. Gaubert): (a) dorsal view and (b) lateral view.

the IET station by one of us (A. Dunham) in July 2000. The animal was captured using a box trap baited with nylon fishing worms and placed within a drift fence made of raffia leaves. It was an adult female that appeared to have just finished lactating. The animal was anaesthetized with Telazol (half of the veterinarian recommended dosage), resulting in no complications. Like the *Ziama* specimens, these two genets have quite divergent habitus. The ground colour of the dead male was ochre-yellow with red-rufous rows of spots, while the live specimen exhibited a yellowish-grey coat associated with dark-brown less coalesced spots. These two new specimens allowed us to observe that the tip of the tail is constituted by a dark ring with a distal tuft of pale hairs (more distinguishable in Fig. 3b); this observation is often impossible in commonly tip-cut museum specimens (Heard & Van Rompaey, 1990). Note that the number of dark rings varies from eight to nine. Also notice the upper labial spots, which are small and less contrasting in comparison with other genet species (Gaubert *et al.* 2001).

DISTRIBUTION

The revised inventory of Johnston's Genet specimens in collections, the newly collected and trapped specimens, and the field data from Kuhn (1965) allow us to reconsider the range of the species. New information extends the range 400 km to the west (Kolenté Plateau, Guinea) and more than 600 km to the east (Tarkwa, Ghana), although the core of collected specimens is located in south-eastern Guinea and central and north Liberia (Fig. 4). No information is available concerning the native origins of the skins collected from Kolenté and Tarkwa, but as genets are not subject to important trade considerations, their transport for very long distances is unlikely, except in the case of bush meat markets located in important cities. For instance, a specimen seen at the market of Man, Ivory Coast, in February 2001 (P.

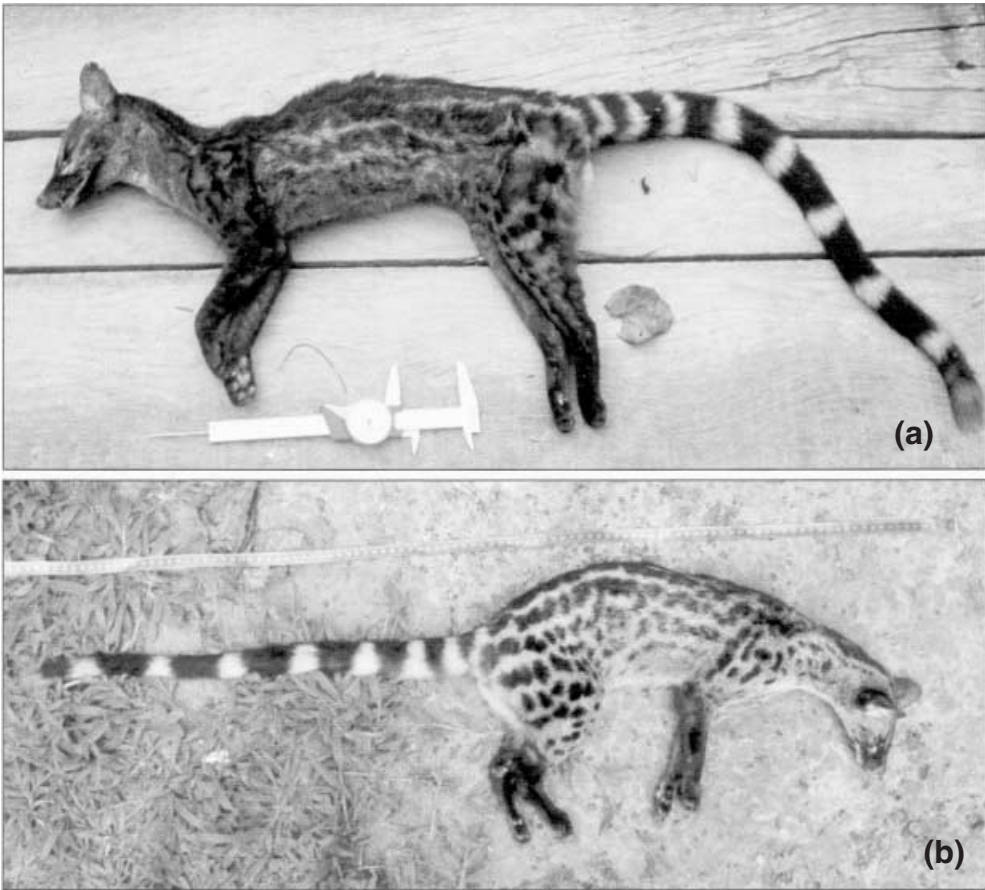


Fig. 3. (a) Dead male specimen of *Genetta johnstoni* found by S. Shultz (photograph: S. Shultz). (b) Drugged female specimen of *Genetta johnstoni* trapped by A. Dunham (photograph: S. Shultz).

Gaubert & C. Crémère, personal observation), was not attributed any precise place of collection, the native salesman just being able to suggest Liberia, Guinea or Ivory Coast as the country of origin of the genet. The localization of the specimen BMNH 1927.8.12.1 in the 'Ghanaian subregion' (Happold, 1996) demonstrates that the Sassandra river does not constitute a biogeographical barrier for the species. Moreover, the notion that *G. johnstoni* is restricted to dense rain forests should be re-evaluated, as the genet may appear in a drier and more open region of 'moist woodlands and savanna' (Kolenté, Guinea; Moreau, 1969; White, 1983). A comparison can be made with another Viverrinae species, *Osbornictis piscivora*, which is generally thought to be located in heavily forested districts of eastern and north-eastern Democratic Republic of Congo (formerly Zaire). However, a native skin was collected in Butembo by Prigogine (quoted in Verheyen, 1962; Colyn & Gevaerts, 1986), more than 600 km west from Niapu (type locality), in a densely human-inhabited region 'covered with vegetation unlike the lowland forest' (Van Rompaey, 1988). Hart & Timm (1978) questioned the plasticity of the species and preferred to locate its capture in the lowland forest region to the west, 'where people from Butembo have trade contacts'. But this scenario is doubtful in the case of the *G. johnstoni* specimen from Kolenté, as the nearest rain forest area is quite remote (northern Sierra Leone) from the Plateau and no important cities are reported in the

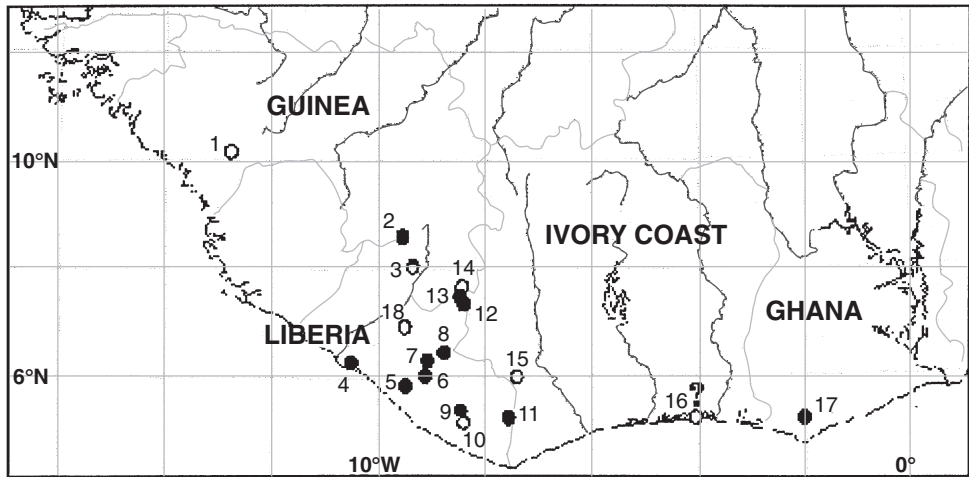


Fig. 4. Records of the Johnston's Genet (*G. johnstoni*). 1, Kolenté Plateau (MNHN CG 1936-995); 2, 'Cercle de Macenta' (MNHN CG 1961-417); 3, Zياما Forest Reserve (ZFMK 95.007-95.010); 4, Harbel (USNM 270075-5-270075-8); 5, forest south of Freemantown (Kuhn, 1965); 6, Bo (Kuhn, 1965); 7, Tappita (Kuhn, 1965); 8, Kpeape (ZFMK 57.11 and 61.966); 9, west of the Putu Mountains* (BMNH 1908.8.23.1); 10, Chien (IRSNB 16426); 11, Cavally River* (BMNH 1930.3.3.10); 12, Yalé (MNHN CG 1982-1007); 13, Mt. Nimba (MNHN CG 1986-246); 14, Seringbara (MNHN CG 2000-683); 15, IET Station (present article); 16, Alindja (MNHN CG 1901-1069); 17, Tarkwa (BMNH 1927.8.12.1); 18, Gbarnga (MFNB 44532). *No more precise localization. Open symbols, new locations; closed symbols, records from collection specimens and bibliographic resources.

area of its collection. The record of four specimens in Harbel (Liberia) is also discordant with all previously cited localities, which are situated well inland from the Atlantic coast (Rosevear, 1974). The collection of a Johnston's Genet near Alindja is questionable but this coastal location is of interest as it could constitute first evidence for a continuum of populations throughout Ivory Coast, also suggested by the confirmation of its presence in Tai National Park. The collection of a Johnston's Genet in the Guinean part of Mt. Nimba suggests that the area surrounding the mountain may also provide a favourable habitat for the species. This last remark should be tempered by the fact that the majority of mammalogical studies in Guinea have been conducted in the region around Mt. Nimba (Barnett *et al.*, 1996; Barnett & Prangley, 1997). The four specimens from the Zياما forest confirm the assumption of Bourque & Wilson (1990; cited in Barnett & Prangley, 1997), who also suspected the presence of the genet in the Diécké reserve. Finally, the collection of a specimen from the Kolenté Plates indicates that Johnston's Genet may exist in a few forested habitats still present in the northern Sierra Leone.

CONSERVATION IMPLICATIONS

The area inhabited by Johnston's Genet is threatened by intense forest disturbance and hunting pressures (for a global review related to the Guinea-Congo rain forest, see Barnes, 1990; Happold, 1996). It is of prime importance to collect ecological data in order to determine which biotopes are effectively occupied by the species and whether secondary growth provides suitable habitat for this animal, presumed restricted to primary rain forest. For instance, no data are available regarding 'forest islands' that are scattered over the southern part of Ivory Coast; we hope that the new specimens of *G. johnstoni* discovered in the Tai National Park will promote such field surveys. It is crucial to determine if these island forests allow a con-

tinum between the Guinea block population and the supposed existent Ghanaian population, as for some other mammals (Mühlenberg *et al.*, 1990). The decline of forest cover in the Upper Guinean block (Liberia: Verschuren, 1982; Kofron & Chapman, 1995; Sierra Leone: Thompson, 1993; Wood, 1993; Guinea: Barnett & Prangley, 1997; Ivory Coast: Terru-Cholet, 1996; Ghana: Hall & Swaine, 1981; Hawthorne & Abu-Juam, 1995) is alarming for the survival of the species, especially as deforestation (Barnes, 1990; more recent data are available from the World Conservation Monitoring Centre) and hunting activities are still intense, even in protected areas such as Mt. Nimba (Lamotte, 1998), Ziama Forest (Wilson, 1992) and Tai National Park (Hoppe-Dominik, 1990, 1997). For example, *G. johnstoni* is not 'listed in either the completely protected or licence required appendices of République de Guinée (1988), the national hunting and wildlife protection legislation' (Barnett & Prangley, 1997).

Even if the number of collected specimens may suggest abundance of this species in some restricted sites (Mt. Nimba, Ziama Forest), the relative area of occurrence of Johnston's Genet is trifling in comparison with other forest-inhabiting genets such as *Genetta pardina* (at least with regard to museum collections). But it cannot be excluded that some localized populations with high densities may appear within the range of the species, as stated by Charles-Dominique (1978) for the rare *Poiana richardsonii* in Gabon. No Johnston's Genets are bred in the zoological parks listed in the International Species Information System or have ever been recorded in captivity. This genet was not considered by the Global Captive Action Plan (GCAP) group members to be a prime candidate for a captive breeding programme (Glatston, 1993). We support the recommended action of Schreiber *et al.* (1989), i.e. field surveys in forested biotopes, but including both unprotected and protected areas, especially as other small Carnivora (e.g. the Leighton's Linsang *Poiana leightoni* and the Liberian Mongoose *Liberiictis kuhni*) are in need of similar attention (reviewed by Schreiber *et al.*, 1989; Taylor, 1989; Colyn *et al.*, 1998). Localities for which presence data are relatively dated (Kolenté Plateau, Liberia, Ghana) should be visited as a priority if possible. Longer term field studies may be better undertaken, as field experience has shown the limits of brief expeditions (Taylor, 1989) and, in the present case, the relative success of long-term surveys (A. Dunham, unpublished data; PGRR, SYLVATROP/IGG). Native markets can provide useful data concerning rare species (*Poiana leightoni* and *Liberiictis kuhni*: Taylor, 1989; *Genetta cristata*: Angelici *et al.*, 1999) and should be visited (i.e. just observed) regularly. The proposal of Marks (1994), which consists of assessing wildlife from local hunter surveys and oral reports, is useful for some species but seems inappropriate for genet surveys as misidentifications among different genet species can easily occur, even by experienced hunters (Angelici, Luiselli & Politano, 1999).

Finally, this preliminary study should promote the systematic reinvestigation of collections involving genets from the Upper Guinean block in order to favour the discovery of 'new' specimens, and thus potential information related to the ecology and distribution range of the species.

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REFERENCES

- Angelici, F.M., Luiselli, L. & Politano, E. (1999) Distribution and habitat of selected carnivores (Herpestidae, Mustelidae, Viverridae) in the rainforests of southeastern Nigeria. *Zeitschrift für Säugetierkunde*, **64**, 116–120.
- Angelici, F.M., Luiselli, L., Politano, E. & Akani, G.C. (1999) Bushmen and mammal-fauna: a survey of the mammals traded in bush-meat markets of local people in the rainforests of south-eastern Nigeria. *Anthropozoologica*, **30**, 51–58.
- Barnes, R.F.W. (1990) Deforestation trends in tropical Africa. *African Journal of Ecology*, **28**, 161–173.
- Barnett, A.A. & Prangley, M.L. (1997) Mammalogy in the Republic of Guinea: an overview of research from 1946 to 1996, a preliminary check-list and a summary research recommendations for the future. *Mammal Review*, **27**, 115–164.
- Barnett, A.A., Prangley, M., Hayman, P.V., Diawara, D. & Koman, J. (1996) A survey of the mammals of the Kounounkan Massif, south-western Guinea, West Africa. *Journal of African Zoology*, **110**, 235–240.
- Büttikofer, J. (1888) Note II. Zoological researches in Liberia. A list of birds, collected by the author and Mr F.X. Stampfli during their last sojourn in Liberia. *Notes from the Leyden Museum*, **10**, 59–106.
- Charles-Dominique, P. (1978) Ecologie et vie sociale de *Nandinia binotata* (Carnivores, Viverridae): comparaison avec les Prosimiens sympatriques du Gabon. *La Terre et la Vie*, **32**, 477–528.
- Colyn, M. & Gevaerts, H. (1986) *Osbornictis piscivora* Allen, 1919, deux nouvelles stations de récolte dans la Sous-Région de la Tshopo (Haut-Zaïre). *Bulletin de l'Institut Royal Des Sciences Naturelles de Belgique: Biologie*, **56**, 9–11.
- Colyn, M., Barrière, P., Formenty, P., Perpete, O. & Van Rompaey, H. (1998) First confirmation of the presence of the Liberian mongoose, *Liberiictis kuhni*, in Côte d'Ivoire. *Small Carnivore Conservation*, **18**, 12–14.
- Crawford-Cabral, J. (1981) The classification of the genets (Carnivora, Viverridae, genus *Genetta*). *Bolletim Da Sociedade Portuguesa de Ciências Naturals*, **20**, 97–114.
- Gaubert, P., Veron, G. & Tranier, M. (in press) An investigation of morpho-anatomical characters within the genus *Genetta* (Carnivora, Viverridae), with a remark on *Osbornictis*, the aquatic genet. In: *African Small Mammals* (Ed. by C. Denys, L. Granjon & A. Poulet), pp. 81–89. IRD ed., collection Colloques et Séminaires, Paris, France.
- Glatston, A.R. (1993) Small carnivore 'GCAP' meeting report. *Small Carnivore Conservation*, **9**, 1–2.
- Hall, J.B. & Swaine, M.D. (1981) *Distribution and Ecology of Vascular Plants in a Tropical Rain Forest: Forest Vegetation in Ghana*. Dr W. Junk, The Hague, the Netherlands.
- Happold, D. (1996) Mammals of the Guinea-Congo rain forest. *Proceedings of the Royal Society of Edinburgh*, **104B**, 243–284.
- Hart, J.A. & Timm, R.M. (1978) Observations on the aquatic genet in Zaire. *Carnivore*, **1**, 130–132.
- Hawthorne, W.D. & Abu-Juam, M. (1995) *Forest Protection in Ghana*. IUCN/ODA/Forest Department Republic of Ghana, Gland and Cambridge.
- Heard, D. & Van Rompaey, H. (1990) Rediscovery of the crested genet. *Mustelid and Viverrid Conservation*, **3**, 1–4.
- Hoppe-Dominik, B. (1990) On the occurrence of the honey-badger (*Mellivora capensis*) and the viverrids in the Ivory Coast. *Mustelid and Viverrid Conservation*, **3**, 9–13.
- Hoppe-Dominik, B. (1997) *Suivi et analyse des résultats du travail de la Cellule 'Suivi faune' sur l'état actuel des effectifs des grands mammifères dans l'ensemble du Parc National de Tai-Propositions et mise en oeuvre*

- d'un système plus efficace de surveillance*. Project No. 91.2204.5. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), San Pedro, Ivory Coast.
- The IUCN Species Survival Commission (1996) *1996 IUCN Red List of Threatened Animals*. IUCN, Gland and Cambridge.
- Kingdon, J. (1997) *The Kingdon Field Guide to African Mammals*. Academic Press, San Diego, CA.
- Kofron, C.P. & Chapman, A. (1995) Deforestation and bird species composition in Liberia, West Africa. *Tropical Zoology*, **8**, 239–256.
- Kuhn, H.-J. (1960) *Genetta (Paragenetta) lehmanni*, eine neue Schleichkatze aus Liberia. *Säugetierkunde Mitteilungen*, **8**, 154–160.
- Kuhn, H.-J. (1965) A provisional check-list of the mammals of Liberia. *Senckenbergiana Biologica*, **46**, 321–340.
- Lamotte, M. (1942) La faune mammalogique du Mont Nimba (Haute Guinée). *Mammalia*, **6**, 114–119.
- Lamotte, M. (1998) *Le Mont Nimba – Réserve de Biosphère et Site Du Patrimoine Mondial (Guinée et Côte d'Ivoire)*. UNESCO, Paris, France.
- Lamotte, M. & Tranier, M. (1983) Un spécimen de *Genetta (Paragenetta) johnstoni* collecté dans la région du Nimba (Côte d'Ivoire). *Mammalia*, **47**, 430–432.
- Marks, S.A. (1994) Local hunters and wildlife surveys: a design to enhance participation. *African Journal of Ecology*, **32**, 233–254.
- Moreau, R. (1969) Climatic changes and the distribution of forest vertebrates in West Africa. *Journal of Zoology*, **158**, 39–61.
- Mühlenberg, M., Galat-Luong, A., Poilecot, P., Steinhauer-Burkart, B. & Kühn, I. (1990) L'importance des îlots forestiers de savane humide pour la conservation de la faune de forêt dense en Côte d'Ivoire. *Revue d'Écologie (Terre Vie)*, **45**, 197–214.
- Nowak, R.N. (1991) *Walker's mammals of the world*, 5th edn. The Johns Hopkins University Press, Baltimore and London.
- Pelet, P. (1901) *Atlas Des Colonies Françaises*. A. Colin, Paris, France.
- Pocock, R. (1908) Report upon a small collection of Mammalia brought from Liberia by Mr Leonard Leighton. *Proceedings of the Zoological Society of London*, **1907**, 1037–1047.
- République de Guinée (1988) *Code de la Protection de la Faune Sauvage et Réglementation de la Chasse*. Ministère de l'Agriculture et des Ressources Animales, Direction Générale des Eaux, Forêts et Chasses, Conakry, Guinea.
- Roche, J. (1971) Recherches mammalogiques en Guinée forestière. *Bulletin du Muséum National d'Histoire Naturelle, Zoologie*, **16**, 737–780.
- Rode, P. (1937) Etude d'une collection de mammifères de l'Afrique occidentale. *Bulletin du Muséum National d'Histoire Naturelle*, **2**, 234–246.
- Rosevear, D. (1974) *The Carnivores of West Africa*. Trustees of the British Museum (NH), London, UK.
- Roth, H.H. & Mertz, G. (1986) Vorkommen und relative Häufigkeit von Säugetieren in Tai – Regenwald der Elfen beinküste. *Säugetierkunde Mitteilungen*, **33**, 171–193.
- Schlawe, L. (1980) Zur geographischen Verbreitung der Ginsterkatzen, Gattung *Genetta* G. CUVIER, 1816 (Mammalia, Carnivora, Viverridae). *Faunistische Abhandlungen Des Staatlichen Museums für Tierkunde Dresden*, **7**, 147–161.
- Schreiber, A., Wirth, R., Riffel, M. & Van Rompaey, H. (1989) *Weasels, Civets, Mongooses, and Their Relatives – an Action Plan for the Conservation of Mustelids and Viverrids*. IUCN, Gland, Switzerland.
- Taylor, M. (1989) New records of two species of rare Viverrids from Liberia. *Mammalia*, **53**, 122–125.
- Terru-Chollet, L. (1996) *Protection de la Faune Sauvage en République de Côte d'Ivoire*. Thesis No. 64. Ecole Nationale Vétérinaire de Lyon, Université Claude Bernard, Lyon I, France.
- Thompson, H.S.S. (1993) Biodiversity and conservation needs in Sierra Leone. In: *Birds and the African environment: proceedings of the 8th Pan-African Ornithological Congress*. *Annales Du Musée Royal d'Afrique Centrale (Zoologie)*, **268**, 213–216.
- Van Rompaey, H. (1988) *Osbornictis piscivora*. *Mammalian Species*, **309**, 1–4.
- Verheyen, W. (1962) Quelques notes sur la zoogéographie et la crâniologie d'*Osbornictis piscivora* Allen, 1919. *Revue de Zoologie et de Botanique Africaine*, **65**, 121–128.
- Verschuren, J. (1982) Hope for Liberia. *Oryx*, **1982**, 421–427.
- White, F. (1983) *The Vegetation of Africa: A Descriptive Memoir to Accompany the UNESCO/AETFAT/UNSO Vegetation Map of Africa*. UNESCO, Paris, France.
- Wilson, R. (1992) Guinea. In: *The Conservation Atlas of Tropical Forests: Africa* (Ed. by J. A. Sayer, C. S. Harcourt & N. M. Collins), pp. 193–199. IUCN, Gland and Cambridge.
- Wood, P. (1993) The Gola rain forest conservation program in Sierra Leone. In: *Birds and the African environment: proceedings of the 8th Pan-African Ornithological Congress*. *Annales Du Musée Royal d'Afrique Centrale (Zoologie)*, **268**, 217–222.

Wozencraft, W.C. (1993) Order Carnivora. In: *Mammal Species of the World – A Taxonomic and Geographic Reference* (Ed. by D. E. Wilson & D. M. Reeder), pp. 279–348. Smithsonian Institution Press, Washington and London.

INTERNET SOURCES

International Species Information System (ISIS): <http://www.isis.org>

World Conservation Monitoring Centre (WCMC): <http://www.unep-wcmc.org/forest/data>

2001 IUCN Red List of Threatened Species: <http://iucn.org/redlist/2001/index.html>

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