

A review of evidence for the presence of Two-spotted Palm Civet *Nandinia binotata* and four other small carnivores on Bioko, Equatorial Guinea

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Abstract.

Several standard reference works report the presence of Two-spotted Palm Civet *Nandinia binotata* on Bioko Island, Equatorial Guinea. However, numerous field and bushmeat market surveys over the past 30 years have failed to record this species, hence raising concerns that it is either extremely rare or extirpated. This article reviews evidence for presence of *N. binotata* on Bioko and simultaneously remarks on the occurrence of four other small carnivores on this island. There is strong evidence that *N. binotata*, King Genet *Genetta poensis*, Large-spotted Genet *Genetta maculata (sensu lato)*, and an otter (initially described as *Lutra poensis*) never occurred on Bioko. Central African Oyan *Poiana richardsonii* is the only mammalian carnivore (small or large) unequivocally recorded for Bioko. Anecdotal observations suggest that a second, unidentified, species of small carnivore may occur. Future field workers on Bioko are encouraged to obtain photographs of small carnivores, and to collect, preserve, and make known, any dead small carnivores they encounter.

Keywords: Bioko Island, bushmeat, carnivore, *Genetta*, *Nandinia*

Una revisión de la evidencia de la presencia de la *Nandinia binotata* y otros pequeños carnívoros en Bioko, Guinea Ecuatorial

Resumen.

Varios trabajos de referencia estándar reportan presencia de *Nandinia binotata* en la Isla de Bioko, Guinea Ecuatorial. Sin embargo, numerosos estudios de campo y de mercados de carne de animales silvestres en los últimos 30 años no han logrado registrar esta especie, por lo tanto, aumentando las preocupaciones de que o bien es muy raro o fue extirpado. Este artículo revisa la evidencia de la presencia de *N. binotata* en Bioko y, simultáneamente, comenta sobre la aparición de otros cuatro pequeños carnívoros en esta isla. Hay una fuerte evidencia de que *N. binotata*, Ginetas Real *Genetta poensis*, Ginetas de Manchas Grandes *Genetta maculata (sensu lato)*, y la nutria (descrito inicialmente como *Lutra poensis*) nunca ocurrió en Bioko. El Oyan *Poiana richardsonii* es el único carnívoro mamífero (pequeño o grande) inequívocamente registrado en Bioko. Observaciones anecdóticas sugieren que una segunda especie, no identificada, de pequeño carnívoro pueda ocurrir. Se anima a los futuros trabajadores de campo en Bioko que obtengan fotografías de los pequeños carnívoros, y que recojan, preserven y divulguen sus resultados así como los pequeños carnívoros muertos que encuentren.

Palabras clave: Isla de Bioko, carne de animales silvestres, carnívoro, *Genetta*, *Nandinia*

Introduction

Bioko (formerly Fernando Pó or Poo, after its Portuguese discoverer) is a 2,017-km² continental-shelf island in the Gulf of Guinea. The island lies 37 km off the coast of Cameroon having been separated from the mainland 10,000–12,000 years ago by rising sea levels (Eisentraut 1965, Jones 1994, Butynski *et al.* 1997, Oates *et al.* 2004, Cronin *et al.*

2014). Bioko shares with the African mainland most of its mammal fauna, although it harbours several endemic mammal species, including Eisentraut's Mouse Shrew *Myosorex eisentrauti* and Pennant's Red Colobus *Procolobus pennantii*. Five small carnivore species, all originally described from Bioko, are documented to occur (see Harrington *et al.* 2002 for a review).

The Two-spotted Palm Civet *Nandinia binotata* is the only species in the family Nandiniidae. In the past, the species was considered a member of the Asiatic subfamily Paradoxurinae – and, indeed, is sometimes called ‘African Palm Civet’ – or of the subfamily Nandiniinae in the family Viverridae. However, morphological and molecular studies conclusively demonstrated that the species is basal to all other feliforms, and belongs in its own family (see Gaubert 2013a and references therein).

An African endemic, Two-spotted Palm Civet is found in lowland, mid-altitude and montane forests from Gambia in West Africa to south-western South Sudan, Uganda and central Kenya in East Africa, and south through Central Africa to northern Angola and north-western Zambia. In the east, it occurs in a narrow belt southwards to around the Chimanimani Mountains between Zimbabwe and Mozambique (van Rompaey & Ray 2013). Besides the African mainland, the species occurs on Zanzibar, Tanzania (Perkin 2004).

Despite reports of Two-spotted Palm Civet on Bioko, Equatorial Guinea, in standard reference works (*e.g.*, Coetzee 1977, Haltenorth & Diller 1980, Kingdon 1997, Gaubert 2009, van Rompaey & Ray 2013), numerous field and bush-meat market surveys over the past 30 years have failed to record the species, hence raising concerns that it is either extremely rare or extirpated.

Here, evidence for the presence of Two-spotted Palm Civet on Bioko is reviewed and an alternative hypothesis proposed, namely that the species never occurred on Bioko. Simultaneously, evidence for the possible presence of the four other documented carnivores on Bioko is discussed.

Does Two-spotted Palm Civet occur on Bioko?

Despite inclusion in recent major reference works, most early authors focusing on Bioko do not list Two-spotted Palm Civet as part of the island's fauna. Thomas (1904), for example, provided a list of the known indigenous mammal fauna on Bioko, based primarily on Bocage (1903), to the exclusion of Two-spotted Palm Civet. Cabrera (1908) listed it, noting only that Thomas (1904) had excluded it while other authors presumed its existence. Later, Cabrera (1929) remarked only that confirmation of the species from Bioko was required. Krumbiegel (1942), who analysed materials collected on Bioko by Hermann Eidmann, makes no reference to any carnivores in Eidmann's collection and only lists “*Nandinia binotata*” in passing as part of the fauna.

Eisentraut (1973), in his monograph on the mammals of Bioko, considered Two-spotted Palm Civet to be very rare and never recorded a specimen. Indeed, he was ready to remove the species from his inventory except that “Padre Basilio” told him of a young female captured in January 1956 near Moca in the Southern Highlands. Eisentraut conducted faunal surveys in Moca Valley, and the eponymous Father Basilio’s Striped Mouse *Hybomys basillii* is described from specimens collected by Eisentraut in this valley. Padre Aurelio Basilio was a priest who lived on Bioko (then still Fernando Pó) from the mid-1940s until about 1972. Basilio’s (1952) treatise on the wildlife of Equatorial Guinea notes only that the species occurs but gives no further comment. Oddly, Basilio’s (1962) second edition of his work makes no mention of his own 1956 record of Two-spotted Palm Civet from Moca.

Field surveys on Bioko have increased considerably since 1986 (*e.g.*, Butynski & Koster 1994, Cronin *et al.* 2014). Several hundred researchers and their students have undertaken tens of thousands of hours of field research on Bioko over the past 30 years; thousands of kilometres of diurnal and nocturnal surveys along transects have been walked, and thousands of hours of fixed-points have been conducted. In addition, researchers and students have logged several thousand ‘camp nights’ in the field. These surveys and camps have occurred at numerous sites on Bioko, including many of the most remote sites. All of these activities present good opportunities for encounters with small carnivores. Yet, despite the extensive field research that has been undertaken on Bioko since 1986, Two-spotted Palm Civet has not been encountered.

Surveys of bush-meat markets have also increased in the past few decades. On the mainland, Two-spotted Palm Civet is commonly recorded in bush-meat markets; indeed, the species was the most common carnivore recorded (*i.e.*, 60% of 121 carcasses) in two markets in Río Muni, on Equatorial Guinea’s mainland (Juste *et al.* 1995). On Bioko, bush-meat market surveys conducted during 1997–2000 recorded nearly 38,000 animals, but no Two-spotted Palm Civets (Harrington *et al.* 2002). The species also was not recorded on Bioko in bush-meat surveys by other researchers through much of the 1990s and early 2000s (*e.g.*, Fa *et al.* 1995, 2000, 2002, Albrechtsen *et al.* 2007), despite continuing to be reported in markets in Río Muni (*e.g.*, Kümpel 2006).

The Two-spotted Palm Civet began sporadically occurring in the Malabo market in 2004, roughly corresponding with the start of a period of rapid market growth and demand and increased numbers of carcasses imported from the mainland (Cronin *et al.* 2015). During the period 1997–2010, 1,241 Two-spotted Palm Civet carcasses were recorded in the Malabo market, relative to 588 Central African Oyan *Poiana richardsonii* (which have appeared in low numbers consistently since 1997). Based on interviews with hunters and personal observations, Cronin *et al.* (2015) reported that none of the Two-spotted Palm Civet carcasses were from Bioko. Available evidence suggests that the costs and risks associated with carcass transport to Bioko are largely negated by higher profit potential in

the Malabo market relative to markets in Nigeria, Cameroon or Río Muni (Morra *et al.* 2009, Cronin *et al.* 2015).

The questionable presence of Two-spotted Palm Civet on Bioko was discussed decades earlier by Rosevear (1974) whose argument hinged on the origin of the only two known specimens of the species, both supposedly from Bioko. The first, the type, *Paradoxurus hamiltoni* (see additional note after references: #1), described by Gray (1832) from a living specimen in the Surrey Zoological Gardens, had been in the possession of Edward Cross for two years. It had its type locality given, wrongly, as India, and was subsequently amended by Gray (1843) to “Fernando Poo”, presumably based on information provided by Cross. Rosevear regarded this revised provenance with great suspicion, and considered it likely that knowledge of the origin of the type had merely crystallized itself into Fernando Pó, given its importance at the time as a port of call for merchant ships. Indeed, during Fernando Pó’s period of British administration, a steady stream of skins and skeletons from Africa’s wildlife passed through the capital of Fernando Pó, Port Clarence (now Malabo), bound for presentation at meetings of the Zoological Society of London (Hearn & Morra 2001). The second specimen remarked on by Rosevear is a British Museum skin (No. 55.12.24.413) that apparently formed part of a parcel of more than 1,000 specimens purchased in 1855 by the British Museum from the Zoological Society of London. The provenance of this skin is also unclear.

What evidence for other documented small carnivores on Bioko?

Besides Two-spotted Palm Civet, four other small carnivore species are documented as occurring on Bioko. Central African Oyan was originally named from a specimen (deposited in the British Museum as No. 41.10.18.1) collected by T.R.H. Thomson from Bioko. Thomson (1842) notes in his description that he “...received it from the Bobys [Bubi’s] or natives of the island, and they had skinned it through the mouth without making any other incision in the skin”. This bears remarking on because, unlike any of the other carnivores described from Bioko, the Central African Oyan appears to be the only one whose provenance is unequivocally demonstrated in its original description. This species has been frequently encountered on the island, both in the wild and in bush-meat markets, by many researchers (including TMB, DC, and GH).

Prior to the description of the Central African Oyan, Waterhouse (1838) described two species of carnivores from Bioko, an otter *Lutra poensis* (see additional note #2) and the King Genet *Genetta poensis*, both of which today remain known for Bioko only from their type specimens. According to the original description, the specimens “...had been given to the [Zoological] Society’s Museum by George Knapp, Esq., who in turn had received them from the island of Fernando Poo”. As with Two-spotted Palm Civet, the precise origin of these two specimens has been in some doubt and several authors have questioned whether they may, in fact, have come from the mainland (*e.g.*, Pousargues 1896,

Pocock 1908, Cabrera 1929, Basilio 1952, Eisentraut 1973, Rosevear 1974). In his original description, Waterhouse (1838) also described several additional species from Bioko from specimens from the same collection, including *Colobus (Procolobus) pennantii*, Black Colobus *Colobus satanas*, Red-eared Monkey *Cercopithecus erythrotis*, and Ogilby's Duiker Antelope (*Cephalophus*) *ogilbyi*. All species are still found on Bioko, albeit all in decline (Hearn & Morra 2001, Hearn *et al.* 2006). Waterhouse was Curator of the Zoological Society of London's museum from 1836 to 1843. He selected the specimens upon which his descriptions were based from a larger number of skins. Some of these skins must have originated from Bioko but, as elaborated upon above for Two-spotted Palm Civet, it is possible that many of these specimens originated from the mainland (indeed all except Pennant's Red Colobus also have mainland distributions).

Harrington *et al.* (2002), commenting on the presence of *L. poensis*, make reference to Mary Kingsley's (1897) "Travels in West Africa" in which she notes "Elephants, though plentiful on the adjacent mainland, are quite absent from Fernando Po, as are also hippos and the great anthropoid apes; but of the little gazelles [presumably a reference to duikers], small monkeys, porcupines, and squirrels he has a large supply, and in the rivers a very pretty otter (*Lutra poensis*) with yellow brown fur often quite golden underneath". This description closely matches that given by Waterhouse. Harrington *et al.* (2002) surmised that the species may have been hunted to extinction for its fur in the 1800s before its presence was properly documented. However, we suspect that Kingsley did not observe the animal herself and was merely borrowing from published knowledge (Waterhouse's description and the Latin name) in stating that *L. poensis* existed on Bioko. Indeed, if Kingsley had seen this species, and considered it common enough to mention, it would suggest a rapid extirpation given its apparent absence by the time Eidmann, Basilio, Eisentraut and others visited the island. In any event, there is little doubt that no otter survives on Bioko today.

King Genet continues to be treated as part of Bioko's fauna (*e.g.*, Jennings & Veron 2009, Gaubert 2013b) despite it being based on a single specimen of disputed provenance. Interestingly, the type specimens of the otter and the King Genet were catalogued in the British Museum as No. 55.12.24.414 and No. 55.12.24.412, respectively. As such, they likely formed part of the aforementioned shipment that was purchased in 1855 by the British Museum from the Zoological Society of London.

Besides King Genet, a second genet species has been described from Bioko: Cabrera (1921) described *Genetta insularis* based on a specimen apparently taken in Rebola (north Bioko) and held in the National Museum of Natural History (No. 20-VII-22-6), Madrid, Spain. This form has invariably been treated as a synonym of other 'large-spotted' forms, most recently with Large-spotted Genet *Genetta maculata (sensu lato)*; Gaubert 2003). Hence, Bioko is invariably included in the range of this species. As with King Genet, this form remains known only from the type specimen, and Cabrera himself

suggested that it was not possible to confirm its origin. No native genet has ever been documented for Bioko, despite numerous diurnal and nocturnal field surveys over almost the entire island during the past 30 years.

Conclusions

Assuming Two-spotted Palm Civet, a genet, or an otter did historically occur on Bioko, what could have caused their extirpation? There is no biogeographic reason why they should not occur given, for example, presence of the Central African Oyan. Nevertheless, there are a large number of mammals with distributions on the continent in the Gulf of Guinea that do not occur on Bioko, including any species of herpestid (Herpestidae), lorisoid (Lorisidae), baboon-mangabey (*Lophocebus* spp.), drill-mangabey (*Cercocebus* spp.), pig (Suiformes), or antelopes in several tribes (see Bioko Biodiversity Protection Program 2007 for a comparison of mammals inhabiting Bioko with those inhabiting Mt Cameroon during the latter half of the 20th Century; see Additional note #3).

The only species with a mainland distribution conclusively documented to occur on Bioko and that is no longer present is the African Forest Buffalo *Syncerus caffer nanus*. This species was likely extensively hunted, its elimination from Bioko probably facilitated by introduction of firearms by Europeans in the 1800s and an increasing demand for meat as the island's population grew alongside increased cacao production (Butynski *et al.* 1997). TMB suspects that the buffalo was introduced to Bioko by Europeans. If so, there appears to be no example of the extirpation of a native species from Bioko. While a small carnivore species may have been subjected to localized, targeted hunting, there is no obvious explanation why it should be extirpated, while larger – arguably more preferred (Fa *et al.* 2002) and more targeted (Cronin *et al.* 2015) – species, such as duikers and primates, were not. It should be noted that:

1. Much of the human population on Bioko is concentrated in Malabo and at a few villages along the coast. Even today there are large areas on Bioko, some of them very difficult to access (including deep, steep, river valleys) and/or remote, where hunting of smaller-bodied mammals appears to be at low levels. It seems inconceivable that any small carnivore could have been extirpated from Bioko as a result of hunting by humans.
2. The Two-spotted Palm Civet and some other *Genetta* spp. do well in and near human-altered habitats and landscapes, such as scattered croplands and secondary forest (Gaubert *et al.* 2015a, b). They are also, typically, readily observed, particularly at night as they give much reflective eye-shine and are not particularly shy. In the case of Two-spotted Palm Civet, the loud call is also very distinctive and can be heard up to 1 km by the human ear (this call can be downloaded at www.wildsolutions.nl).

3. In the case of otter, there remain several near-pristine rivers in remote areas on Bioko, particularly over the southern one-third of the island. There is little, or no, human activity along these rivers, all of which are very difficult of access over most of their length. It is hard to imagine that a species that is as difficult to hunt as the otter, could have been extirpated from these rivers.

In summary, although it cannot be conclusively ruled out that Two-spotted Palm Civet, two species of genet or an otter once occurred on Bioko, the evidence available to support their historical presence is scant and cannot be validated. In the absence of any records of these species in during numerous field or bush-meat surveys (more than 195,000 carcasses from the Malabo market have been observed since 1997) over the past 30 years, and their likely persistence in the face of hunting pressure and habitat change, it seems appropriate to reject all four species as being part of Bioko's fauna.

Despite the evidence presented above, one cannot discount the possibility that, besides Central African Oyan, another small carnivore species occurs on Bioko. Harrington *et al.* (2002) reported what appeared to be an unidentified arboreal carnivore sighted on two occasions in the Gran Caldera (remote south-western Bioko) in January 2000. GH recalls a third fleeting encounter in January 2006 with a mammal more heavier-set than a Central African Oyan, moving along a stream-bed at the northern end of the Gran Caldera. If another small carnivore does occur on Bioko, then it can only be said that it is very rare and probably localized in occurrence.

It is hoped that this note will encourage future field workers to be vigilant for small carnivores on Bioko. They are urged to obtain photographs of small carnivores, and to collect, preserve, and make known, any dead small carnivores they encounter.

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Additional Notes

- #1 - Most authors (*e.g.*, Allen 1939, Wozencraft 2005) attribute the original description of the species to Gray (1830) based on a specimen in the Netherlands Museum in Leiden in *Spicilegia Zoologica* (p. 9) under the heading *Viverra binotata*, and to which the type locality “Africa, Ashantee” (present day Ghana) is given. However, Rosevear (1974) notes that the type was missing and could not be traced.
- #2 - Precise taxonomic status of the otter Waterhouse described is unclear. Rosevear (1974) included it in African (Cape) Clawless Otter *Aonyx capensis*, noting that it might not even be *Aonyx* at all, but a *Lutra*. He further notes that the skin is likely of a young animal, without feet, and that characters of colour are without diagnostic value. Indeed, Wozencraft (2005) treated it as a subspecies of Spotted-necked Otter *Lutra (Hydrictis) maculicollis*.
- #3 - Although not a small carnivore, it is worth noting that some faunal treatises list Giant Pangolin *Smutsia gigantea* from Bioko (*e.g.*, Kingdon *et al.* 2013). However, the species is not mentioned by Thomas (1904), Cabrera (1908, 1929), Krumbiegel (1942), Basilio (1952), or Eisentraut (1973), all of whom consistently only mention White-bellied Pangolin *Phataginus tricuspis*. Giant Pangolin also has not been recorded by any recent field workers on the island. The only explanation for supposed occurrence of Giant Pangolin on Bioko is related to records of carcasses in bushmeat markets, transported from the mainland to Malabo.