

Short Communication

A new population of the Critically Endangered Aders' duiker *Cephalophus adersi* confirmed from northern coastal Kenya

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Abstract Aders' duiker *Cephalophus adersi* is a small antelope endemic to the coastal forests of east Africa. Threatened by habitat loss and hunting, the species is categorized as Critically Endangered on the IUCN Red List. Until recently Aders' duiker was known to persist only on Zanzibar, Tanzania, and in the Arabuko-Sokoke Forest National Reserve, Kenya. However, in 2004 a sighting of a single individual was reported from the Dodori forest in northern coastal Kenya, raising the possibility that the species survives elsewhere. Subsequently, an opportunistic camera-trap survey was conducted in September and October 2008 to establish the occurrence of Aders' duiker in Kenyan coastal forests north of the Tana River. One hundred and fifty six images of Aders' duikers were obtained from 12 of 28 camera-trap sites (46 of 358 camera-trap days), confirming the existence of a population of Aders' duiker in the Boni–Dodori forest both inside and outside the National Reserves. In addition, we sighted individuals of the species on three occasions. The relatively high encounter rates per unit effort compared to similar data from Arabuko-Sokoke forest suggest the Boni–Dodori population is significant. Initial surveys of the local Awer community revealed that Aders' duiker is well known by the name *guno*. These findings significantly improve the conservation prospects for Aders' duiker and highlight the need for greater research and management efforts in the poorly known Boni–Dodori forest.

Keywords Aders' duiker, Boni National Reserve, camera-trap, *Cephalophus adersi*, Dodori National Reserve, forest antelope, Kenya

Aders' duiker *Cephalophus adersi* was referred to over 10 years ago as one of the most threatened antelope species (East, 1999) and since then as Africa's most threatened antelope (Baldus, 2004). The species is categorized on the IUCN Red List as Critically Endangered, primarily because of habitat loss and hunting (Finnie, 2008). Formerly considered widespread in the coastal forests of Kenya and Unguja Island, Zanzibar (Kingdon, 1982; Swai, 1983), by the mid 1990s Aders' duiker was thought to be restricted to a small number of forest patches on Unguja Island and one site in Kenya, the Arabuko-Sokoke Forest National Reserve (Finnie, 2008). The coastal forests of east Africa have high species richness and endemism (Burgess & Clarke, 2000; Mittermeier et al., 2005). The continuing threats to east African coastal forests are deforestation and habitat fragmentation from clearance for agriculture and unsustainable use of forest resources, such as for charcoal production (CEPF, 2005). Less than 10% of the original coastal forest vegetation remains in pristine condition (Mittermeier et al., 2005).

Since 1999 research on Aders' duiker in Kenya has concentrated on the population in Arabuko-Sokoke forest (Kanga, 1995, 2002; Table 1). These studies did not produce robust data on population density or habitat requirements because of the difficulty of studying such a rare, cryptic animal. However, infrequent sightings confirm the presence of Aders' duiker and the first camera-trap pictures of this species were taken in 2006 (Anon., 2007). Similarly, in Zanzibar little is known about the species' ecology (Finnie, 2002) but population estimates indicate a steep decline (Williams et al., 1996; Kanga & Mwinyi, 1999).

A single sighting of Aders' duiker from the edge of the Dodori National Reserve (c. 250 km north of Arabuko-Sokoke forest) was reported in 2004 (Andanje & Wacher, 2004), raising the possibility that populations may exist outside the known distribution on the mainland. Whilst conducting other surveys in Boni–Dodori forest in 2008 further sightings were reported to GWN. These sightings prompted us to attempt to confirm the presence of Aders'

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TABLE 1 Camera-trapping results for Aders' duiker *Cephalophus adersi* in Kenyan coastal forests (Fig. 1). Digital and film camera results are shown separately as different trigger speeds and settings may affect trap rate. The results presented for Boni–Dodori forest do not include the single camera deployed in Witu. See text for details of calculation of capture rate.

	No. of photographs	Photo-capture days (total days)	Successful camera-trap sites (total sites)	Capture rate (%)
Boni–Dodori, digital cameras	131	28 (97)	7 (20)	28.9
Boni–Dodori, film cameras*	25	18 (237)	6 (9)	6.9
Arabuko-Sokoke, film cameras (Tollington & Edwards, 2008)	0	0 (190)	0 (10)	0
Arabuko-Sokoke, film cameras (Neelakantan & Jackson, 2007)	10	8 (626)	1 (14)	1.3

*Two sites were surveyed with digital and, subsequently, film cameras (in one case both models captured Aders' duiker, in the other case only the film camera did so)

duiker in these little studied northern coastal forests of Kenya.

Nineteen cameras were deployed within and around the Boni and Dodori National Reserves (1,339 and 877 km², respectively; Fig. 1) between 15 September and 21 October 2008 for a total of 334 camera-trap days. The habitat comprises a mosaic of forest, dry thicket and savannah, with small-scale farms near villages. Detailed descriptions are given by Kuchar & Mwendwa (1982) and Andanje et al. (2010). A single camera-trap was also deployed in Witu forest (2°22' S, 40°30' E) from 28 September to 22 October 2008 (24 trap-days).

Camera-traps were set along prominent tracks or animal trails under closed canopy forest or thickets. Locations were selected to maximize the probability of detecting medium to large forest mammals using trails to traverse dense vegetation. Cameras were set at a height of 30–60 cm and positioned at a distance from, and angle to, trails with the aim of obtaining full body lateral images of small antelopes. We used Stealth Cam STC-1590IR (Stealth Cam LLC, Grand Prairie, USA) digital cameras, set to take two pictures per trigger followed by a 1-minute delay, for our initial fieldwork (15–27 September 2008). We also used a combination of CamTrak (CamTrak South Inc., Watkinsville, USA), DeerCam DC300 (Non Typical Inc., Park Falls, USA) and Stealth 35 mm Game Surveillance cameras. Film cameras were set to take pictures 24 hours per day on 400 ASA colour print film, with a 1-minute delay between exposures.

Camera-trap capture rate was calculated as the number of days on which Aders' duiker was photographed divided by number of trap-days, multiplied by 100. This measure was employed rather than calculating independent photo-capture events per trap day (Bowkett et al., 2008) to allow us to combine and compare data from different camera models including the Stealth 35 mm cameras, which do not have the option to record time in addition to date. We also noted any opportunistic sightings of Aders' duiker.

From an overall total of 465 animal photographs (358 trap-days including Witu), 156 pictures of Aders' duiker

were obtained from in and around the Boni and Dodori National Reserves (Fig. 1, Table 1), confirming the existence of a population of Aders' duiker (Plate 1) in northern coastal Kenya. No photographs of the species were obtained from the single camera in Witu forest. In addition to photographs, we sighted Aders' duiker three times (Fig. 1). Community surveys revealed that the species is well known to the local Awer people (also known as Boni) who were able to describe it accurately prior to recognizing it in an illustrated field guide (Kingdon, 1997). In the Kiawer language Aders' duiker is called *guno*, distinguishing it from the two other commonly encountered small antelope species: *wadimoi* (Harvey's duiker *Cephalophus harveyi*) and *chale* (sunii *Neotragus moschatus*). No information was

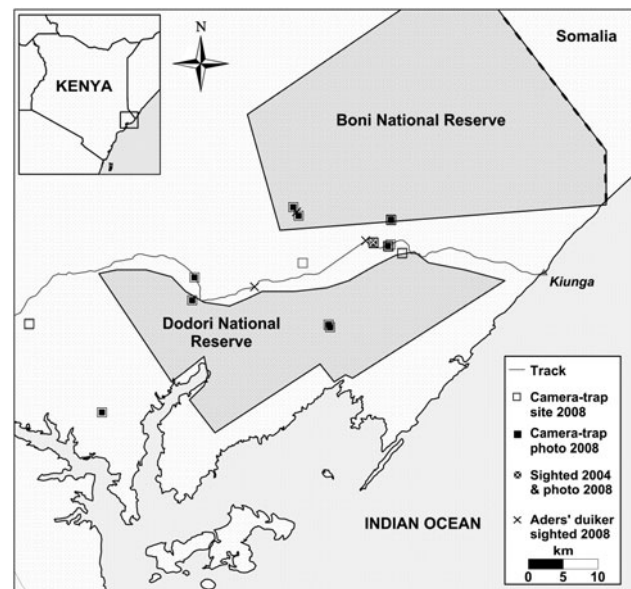


FIG. 1 Location of all camera traps used to survey Aders' duiker *Cephalophus adersi* in September–October 2008, showing where photographs were obtained, and locations of our sightings of the species in the Boni–Dodori forest area in 2004 and 2008. Rectangle on the inset indicates the location of the main map in south-east Kenya.



PLATE 1 Aders' duiker photographed on 26 September 2008 in the Boni National Reserve (Fig. 1).

obtained on local names for blue duiker *Cephalophus monticola* or bush duiker *Sylvicapra grimmia*.

Camera-trap rates for Boni–Dodori forest were higher than from pilot studies using similar opportunistic camera-trap methods in Arabuko-Sokoke forest (Table 1). This result should be treated with caution as methodological differences between sites, including season, trap-site selection and camera-trap model, make comparisons difficult. However, the large difference in trap-rate between areas, and the comparative ease of seeing the species, indicates a greater population density in Boni–Dodori forest, especially given the positive relationship between density and camera-trap rates demonstrated for other duiker species (Rovero & Marshall, 2009). Given the rarity of Aders' duiker observations in Arabuko-Sokoke forest and the small size of the remaining populations on Zanzibar, the Boni–Dodori forest may be the largest surviving population of Aders' duiker.

The geographical extent of this newly confirmed population is unknown. Forest areas inland of Boni National Reserve and north into Somalia may be suitable for Aders' duiker. Southwards, Witu forest and the privately owned Nairobi Ranch merit further investigation, although opportunistic camera-trap surveys failed to record Aders' duiker in Nairobi Ranch in 2004 and 2007 (T. Wachter & S.A. Andanje, unpubl. data, 2004; Tollington & Edwards, 2008). Similarly, no photographs of the species were obtained in several small forest patches south of Mombasa in 2007 where it seems highly unlikely that Aders' duiker survives (Tollington & Edwards, 2008). The discovery of a population of Aders' duiker north of the Tana River suggests that future surveys should also be made in the zone between Boni–Dodori forest and the Arabuko-Sokoke forest, specifically in coastal habitats between the Galana/Sabaki and Tana rivers.

While these results improve the conservation prospect for Aders' duiker, we caution against reassessing the species' Red

List status until further research has been undertaken. The populations in Arabuko-Sokoke forest and Zanzibar remain under severe threat from hunting and habitat disturbance. The evolutionary relationship between Aders' duiker from Kenya and Zanzibar also requires investigation, as suggested by Cotterill (2003).

Confirmation of the presence of Aders' duiker highlights both the importance and the poor state of current knowledge of the Boni–Dodori forest and the wider ecosystem. Several other mammal species of conservation concern occur in this area (S.A. Andanje et al., unpubl. data; Githiri et al., 2007), including a potentially new elephant shrew (Andanje et al., 2010) and African wild dogs *Lycaon pictus* (Githiri et al., 2008), and the biodiversity value of this area appears, therefore, to have been underestimated.

To document this biodiversity and promote conservation of the northern coastal area Kenya Wildlife Service and partners are undertaking further surveys in the Boni–Dodori forest, including camera-trapping with standardized methodologies (O'Brien, 2010) to establish the extent of occurrence and relative abundance of Aders' duiker. This will create a standardized index of conservation status for this Critically Endangered antelope and the associated mammal community, a key tool to monitor progress and support implementation of a conservation strategy for the species across its range.

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Biographical sketches

SAM ANDANJE has extensive research experience in Kenyan forest and savannah ecosystems, particularly with rare species of antelope, including Aders' duiker and hirola. ANDREW BOWKETT coordinates overseas conservation programmes for Whitley Wildlife Conservation Trust (WWCT) and is studying the genetics of East African duiker species. BERNARD AGWANDA specializes in the taxonomy and distribution of Kenyan mammals. GRACE NGARUIYA previously studied the distribution of Kenyan giant elephant shrews and is now studying ecosystem services in the Amboseli Basin. AMY PLOWMAN oversees conservation and research for WWCT and has worked on duiker ecology in Zimbabwe, Zanzibar and Kenya. TIM WACHER specializes in conservation and research programmes for antelopes and desert ecosystems. RAJAN AMIN has an interest in African and Asian grassland and forest ecosystems and in developing long-term conservation projects for threatened species.