Philantomba monticola – Blue Duiker

Regional Red List status (2016)	**Vulnerable B2ab(ii,iii,v)+C2a(i)*†‡**
National Red List status (2004)	Vulnerable C1+C2a(i)
Reasons for change	No change: Same category, different criteria
Global Red List status (2016)	Least Concern
TOPS listing (NEMBA) (2007)	Vulnerable
CITES listing (1975)	Appendix II
Endemic	No

*Watch-list Data †Watch-list Threat ‡Conservation Dependent

The name duiker is derived from the Afrikaans word "duik", which means to dive. This is a characteristic habit that they exhibit when threatened. They jump and dive for cover. The southern African populations of the species have a bluish sheen to the coat, when viewed in a certain light and hence they are referred to as blue duikers.

Taxonomy

Philantomba monticola (Thunberg 1789)

ANIMALIA - CHORDATA - MAMMALIA - CETARTIODACTYLA - BOVIDAE - *Philantomba* - *monticola*

Synonyms: *Cephalophus monticola* (Thunberg 1789)

Common names: Blue Duiker (English), Blou Duiker (Afrikaans), Ipunzi Ehlaza (Ndebele), Phuti (Sepedi), Phuthi (Sesotho), Photi (Setswana), Imphunzi (Swati), Mhunti (Tsonga), Iphuti (Xhosa), Iphiti (Zulu)

Taxonomic status: Species

Taxonomic notes: The recognition of *Philantomba* as a separate genus to *Sylvicapra* and *Cephalophus* is contentious, but recent molecular evidence supports the genus as a basal clade (van Vuuren & Robinson 2001; Johnston & Anthony 2012). Thirteen subspecies have been named (Hart & Kingdon 2013), where *P. m. monticola* is isolated from the others, occurring from northern KwaZulu-Natal (KZN) to the Eastern and Western Cape provinces of South Africa.

Assessment Rationale

This sub-Saharan African species has a disjunct distribution between the eastern coastal forests of South Africa and the rest of its range. Within the assessment region, the species is inferred to be declining due to forest habitat loss from ongoing development along the coastal belt, illegal sand mining (which may represent an emerging threat) and indigenous timber extraction. Increasing bushmeat poaching and hunting with domestic dogs are also suspected to be directly causing a decline in the number of mature individuals. Preliminary data indicate that around half the subpopulations on protected areas and private lands are declining or have unknown trends (see **Population**). The estimated area of occupancy (AOO) ranges from 1,415–2,858 km^2, depending on whether we include only currently occupied forests or all potentially viable forests within the extent of occurrence (EOO). Population estimates range widely: using a density range of 5–35 individuals / km^2 yields a total mature population estimate of 3,538–50,015 individuals (using a 50% mature population structure). Blue Duiker are estimated to be unable to disperse further than 0.88 km between forest patches. Using forest clusters that fall within this dispersal distance as proxies for subpopulations, the largest cluster is estimated to be 314–687 km^2, which yields 785–12,023 mature individuals. Under a precautionary purview, we suspect the lower estimates are more realistic given the wide variation in density and occupancy between patches on fine spatial and temporal scale, combined with multiple ongoing threats that may be causing local subpopulation decline or extinction.

Thus, we list Blue Duiker as Vulnerable B2ab(ii,iii,v) and C2a(i) using the lower estimates of AOO and mature population size. Further surveys, density estimates and occupancy levels across its range are necessary to more accurately calculate key parameters. This species should be reassessed when such data are available. Key interventions include effective management of the inter-patch matrix by minimising poaching rates; enforcement of legislation prohibiting illegal sand mining, development and timber harvesting; and coastal forest conservation and restoration through biodiversity stewardship schemes. As such, this species remains conservation dependent.

Regional population effects: There are no confirmed records from Swaziland or southern Mozambique, which suggests a gap in distribution between South Africa and the rest of its range. Hence, there is no rescue effect possible. Unlike the central African scenario, Blue Duiker in the assessment region occur in relatively small patches of suitable habitat within a forest/non-forest mosaic, which makes recolonisation of locally depleted patches difficult.

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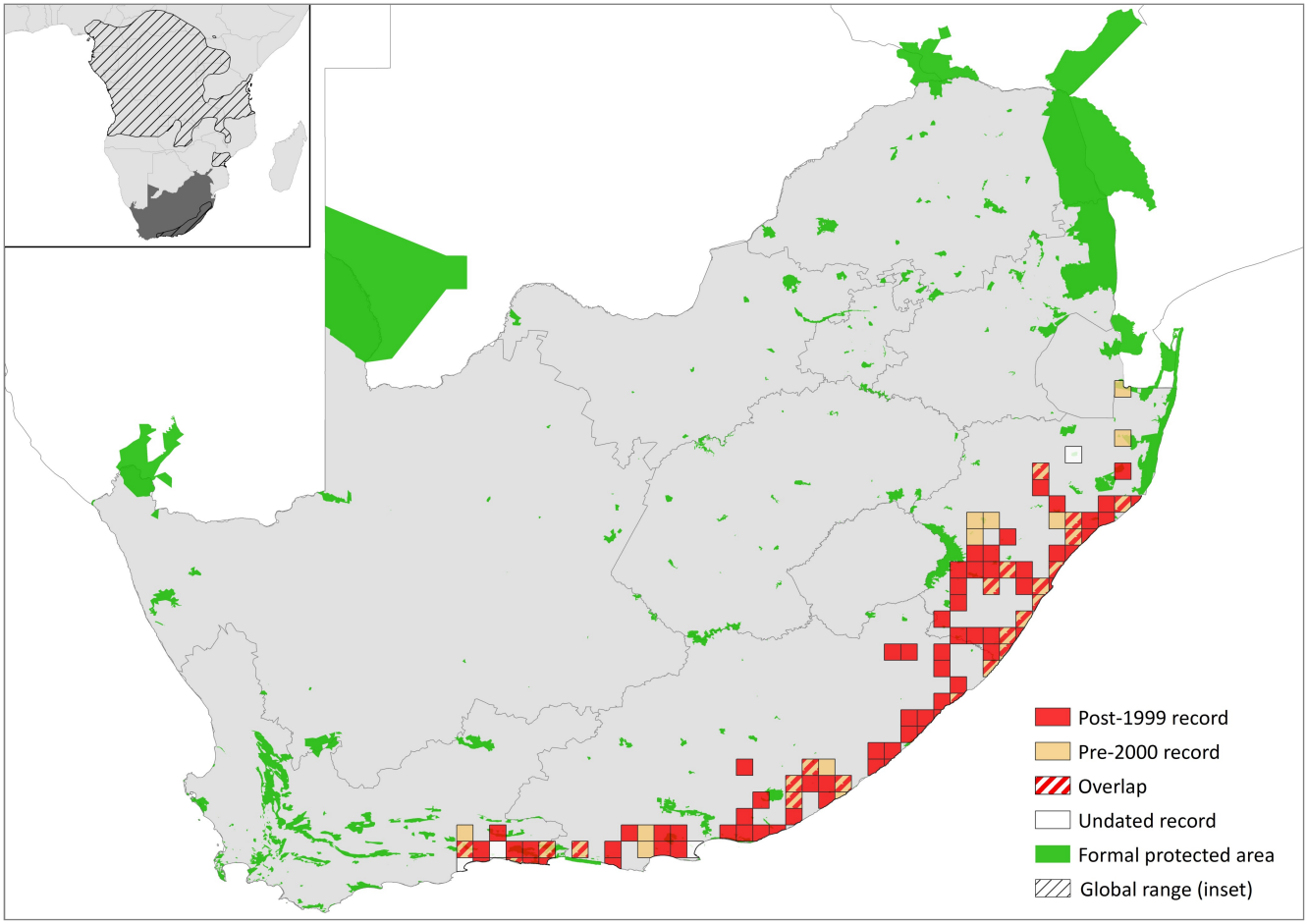

Figure 1. Distribution records for Blue Duiker (*Philantomba monticola*) within the assessment region

Table 1. Countries of occurrence within southern Africa

Country	Presence	Origin
Botswana	Absent	-
Lesotho	Absent	-
Mozambique	Extant	Native
Namibia	Absent	-
South Africa	Extant	Native
Swaziland	Absent	-
Zimbabwe	Extant	Native

Distribution

This species occurs in forested areas throughout western, central, eastern and southern Africa. Within southern Africa, it occurs in eastern Zimbabwe, parts of central Mozambique (IUCN SSC Antelope Specialist Group 2016), and along the eastern seaboard of South Africa (Table 1). Although once recorded in Inhambane Province, Mozambique, in 1952, extensive deforestation and civil unrest have resulted in no recent records in the region (Skinner & Chimimba 2005).

Within the assessment region, it is confined to the evergreen coastal and scarp forests and thickets along the coast from the iMfolozi River in northern KZN southwards to the eastern parts of the Western Cape Province (Figure 1). Additionally, although few data exist, this species is suspected to have been introduced into captive-breeding systems across many areas of the country, with confirmed presence in North West Province at least (Power 2014). There are no confirmed records from Swaziland or Lesotho (Lynch 1994; Monadjem 1998), and none from southern Mozambique, which suggests a discontinuous distribution between South Africa, eastern Zimbabwe and central Mozambique. The South African population is thus isolated.

The estimated EOO is 269,584 km^2. Although previous assessments have asserted that the species exists inland in montane forest (Friedmann & Daly 2004; IUCN SSC Antelope Specialist Group 2008), there are no confirmed records for Afromontane forests along the foothills of the Drakensberg Mountains. Thus, this area is excluded from the AOO, which is estimated to be a maximum of 2,858 km^2 (which includes all remaining forest patches, as of 2013, within the EOO). Furthermore, they are patchily distributed within remaining forest patches, where Lawes et al. (2000) found that only 18% of the forest patches of Balgowan and Karkloof forests in KZN were occupied. Blue Duiker were not present in small forest patches further than 0.88 km from mainland populations, and smaller than 0.045 km^2 in area. The probability of patch occupancy was > 50% if the patch was > 0.05 km^2 and the distance between patches and a mainland forest was < 0.25 km (Lawes et al. 2000). Correspondingly, we fitted a 0.44 km buffer around patches larger than 0.045 km^2 and merged patches that intersected into clusters. From 1,528 patches, we estimate there to be 637 viable clusters across the entire EOO. The largest cluster is 687 km^2 with the largest single patch being 314 km^2. However, not all available patches are occupied. For example, there are no current records of the species in the Kosi Bay area (S. Kyle pers. comm. 2015). Similarly, while the species was

once described as “numerous” in Hluhluwe-iMfolozi and Mkhuze areas (Province of Natal 1935; Bourquin et al. 1971), they currently appear to be absent from these areas (Ezemvelo KZN Wildlife unpubl. data). Using only recent distribution records (post-2000) the estimated area of currently occupied forest clusters is 1,415 km^2 (comprised of 350 forest patches within 51 clusters), assuming that any forest patch within 0.88 km^2 of another forest patch is occupied.

Population

Blue Duikers are rare and secretive, making population counts and trend estimates difficult. The subpopulation in the Knysna forests declined to low levels between 1970 and 1980 and after 1992 in the Tsitsikamma Forest (Seydack et al. 1998). Before the decline (in the Knysna Forest) relatively high densities were encountered in moister forests, whereas after the decline population persistence was associated with drier forests (Seydack 1984; Seydack et al. 1998). This is not suspected to be caused by habitat loss or fragmentation. Instead, nocturnal warming negatively affecting digestible non-structural carbon contents of forage items is being implicated and currently investigated (A. Seydack et al. unpubl. data). It is not known whether the subpopulations have or will stabilise at current low densities. They occur in at least 27 formally protected areas in the Western and Eastern Cape provinces. The largest subpopulation is estimated to be between 400–800 individuals (based on 1–2 individuals / km^2 over 400 km^2 of forest cover) in the Garden Route National Park (Seydack et al. 1998); and, if we use forest clusters (defined above) as proxies for subpopulations, the largest forest cluster (687 km^2) yields 344–687 mature individuals. Blue Duiker have a mean group size of four individuals (and are not limited to seasonal reproduction, but breeding occurs throughout the year). Considering the average family group in a home range, on average, consists of an adult male and female, one subadult (dispersal at about 18 months) and one infant/juvenile (Y. Ehlers-Smith unpubl. data), we infer a 50% mature population structure. There is a large overlap in offspring due to relatively short lambing interval (265 days) and they have a gestation period of 207 days (range = 196–216) (Bowland 1990; references within Skinner & Chimimba 2005). This, however, may not be applicable for moderate to lower quality habitats with lower fertility rates. Using 1–2 individuals / km^2 to extrapolate across the AOO (1,415–2858 km^2), yields a total population size range of 1,415–5,716 individuals (708 –2,858 mature individuals).

However, other recorded densities are higher: throughout its continental range, densities encompass 5–35 individuals / km^2 (references within Hart & Kingdon 2013). Using these densities reveals a much larger potential population size of 3,538–50,015 mature individuals within the assessment region and a largest subpopulation of 785–12,023 mature individuals (Table 2). These densities are similar to recorded densities of 9–55 individuals / km^2 in southern Cape forests and 13–19 individuals / km^2 in the Tsitsikamma Forest specifically (Hanekom & Wilson 1991). Highest densities recorded are from Bowland (1990) and Bowland and Perrin (1995) in KZN coastal forests, ranging between 90–320 individuals / km^2. The lower estimation is based on four survey methods, which had multiple repeats over eight years, whereas the upper limit is based on two survey methods that were not repeated (Bowland 1990), which equates to 2.38 individuals / ha on average. These upper values are clear outliers and cannot simply be extrapolated across the AOO as there is large amounts of variability in density and occupancy between forest patches across the range (Y. Ehlers-Smith pers. obs. 2014), and within patches between years (Bowland 1990). Recent (post-2000) density estimates suggest a density range between 11 and 24 individuals / km^2 (Nakashima et al. 2013).

An alternative method of estimating population size is to differentiate between coastal and inland forests and incorporate forest patch occupancy (based on habitat quality), which reveals a total mature population of 607 mature individuals in seven protected forests (Table 3). Using these density splits (238 individuals / km^2 for all coastal and lowland forests and 20 individuals / km^2 for all inland forests) across all currently occupied coastal and inland forest patches (1,415 km^2 in total, Table 2) yields an estimated mature population size 27,621 individuals. However, further density estimates from various forest types are needed to refine this estimate.

Blue Duikers have very small territories (0.6 ha in coastal forests, Bowland & Perrin 1995) and live in small family groups, so large numbers can persist if there are no threats (for example, on private land, with active anti-poaching measures; Y. Ehlers-Smith unpubl. data). Clearly, there is a wide range in possible overall population estimates as the density estimates vary depending on the habitat type and habitat quality. While population estimates and densities may be higher than previously thought, this may reflect previous underestimates rather than an increasing population. Further field surveys are urgently needed to validate subpopulation sizes in various regions, forest types and land-uses across the range of the species. Thus, while there is no robust evidence to validate a mature population of fewer than 2,500 mature individuals, it is probable that the population is fewer than 10,000 mature individuals. For example, Rowe-Rowe’s (1994) total population estimate for KZN was 2,200 in 60 subpopulations.

Subpopulations also exist in suitable habitat outside of protected areas. A study currently taking place within southeastern KZN is showing that Blue Duikers occur in

Table 2. Population and largest subpopulation size estimates of Blue Duiker (*Philantomba monticola*) based on forest patch occupancy and density estimates of 5 (min) to 35 (max) individuals / km^2

	Area (km^2)	Population size (min)	Population size (max)	Mature population range
AOO (max)	2,858	14,290	100,030	7,145–50,015
AOO (min)	1,415	7,075	49,525	3,538–24,763
Largest occupied cluster	687	3,435	24,045	1,718–12,023
Largest occupied patch	314	1,570	10,990	785–5,495

Table 3. Summary of subpopulation size estimates of Blue Duiker (*Philantomba monticola*) for a sample of protected areas across two forest types in southern KwaZulu-Natal Province. Calculations are based on Bowland (1990), forest occupancy as per Y. Ehlers-Smith (unpubl. data) and forest sizes as per GeoTerraImage (2015).

Protected Area	Coastal forest size (ha)	Population estimate (2.38 individuals / ha)	Adult population (50% of total)	Calculated % occupancy	Total estimated number of individuals
Skyline Nature Reserve	2.00	4.76	2.38	0.94	2.24
Vernon Crookes Nature Reserve	426.25	1,014.48	507.24	0.70	355.07
Mpenjati Nature Reserve	12.00	28.56	14.28	0.75	10.71
TOTAL	**440.25**	**1,047.80**	**523.90**	**-**	**368.01**

Protected Area	Scarp forest size (ha)	Population estimate (0.2 individuals / ha)	Adult population (50% of total)	Calculated % occupancy	Total estimated number of individuals
Umtamvuna Nature Reserve	945.00	189.00	95.00	0.59	56.05
Mbumbazi Nature Reserve	1,399.00	280.00	140.00	0.56	78.40
Oribi gorge Nature Reserve	1,074.00	215.00	107.00	0.59	63.13
Vernon Crookes Nature Reserve	587.16	117.00	59.00	0.70	41.30
TOTAL	**4,005.16**	**801.00**	**401.00**	**-**	**238.88**
GRAND TOTAL	**4,445.41**	**1,848.80**	**924.90**	**-**	**606.89**

forest patches within residential areas and local conservancies, and many privately-owned patches of Indian Ocean Coastal Belt Forest (Y. Ehlers-Smith unpubl. data). Similarly, in a study of mesocarnivores and duiker species by Jones (2015), of 63 conservancies and private land owners surveyed across KZN, 47% confirmed Blue Duiker presence on their property, and 53% suspected the subpopulation trend to be either unknown or decreasing over the past five years (Jones 2015). Similarly, of 92 protected areas in the species' range, only 36% confirmed Blue Duiker presence and 42% suspect an unknown or decreasing subpopulation trend (Jones 2015). Thus, it is possible that there is a continuing decline in mature individuals. The overall population is suspected to be declining due to ongoing habitat loss and habitat deterioration, especially within coastal forests. This is corroborated by long-term game count data in KZN protected areas, which generally show declining subpopulations from the 1980/90s to present (Ezemvelo KZN Wildlife unpubl. data). Generation length has been estimated at 4.9 years (Pacifici et al. 2013), which makes the three generation window *c*. 15 years. Subpopulation trends on a national scale should be calculated over this time period when such data are available. Similarly, throughout the continent, this species is thought to be declining (and may have already reached the threshold for Near Threatened) due to bushmeat hunting on both a subsistence and commercial scale (IUCN SSC Antelope Specialist Group 2016).

Blue Duikers are forest specialists and are sensitive to land-use change and anthropogenically transformed landscapes, although they appear to be capable of moving through plantations (Lawes et al. 2000) and well-wooded residential estates (Y. Ehlers-Smith pers. obs. 2014). However, plantations are considered to be low quality dispersal routes, with consequences such as increased mortality rates, and may act as a demographic sink for vulnerable populations, which may have impacts on regional abundance (references within Lawes et al. 2000). Blue Duikers are also sensitive to isolation (Lawes et al. 2000) and therefore limited connectivity between forest patches or large isolation distances results in small, fragmented subpopulations, which are suspected to not be genetically viable in the long-term (Y. Ehlers-Smith unpubl. data). Effectively, many of the remnant subpopulations will not be able to contribute to the continuation of the regional genetic variety of this species.

Current population trend: Declining. Both *in situ* and from ongoing habitat loss and degradation.

Continuing decline in mature individuals: Yes. Snaring and dog-hunting leading to loss of individuals.

Number of mature individuals in population: 3,538–50,015

Number of mature individuals in largest subpopulation: 785–12,023

Number of subpopulations: Unknown, but possibly as many as 51 (using occupied forest clusters as a proxy).

Severely fragmented: Yes. Fragmented forest habitats throughout the Eastern Cape and KZN provinces. Also occurs in coastal and dune thickets which are separated by coastal developments.

Habitats and Ecology

Across the continent, Blue Duikers exist in a wide range of forested and wooded habitats, including primary and secondary forests, gallery forests, dry forest patches, coastal scrub farmland and regenerating forest (Hart & Kingdon 2013). Within the assessment region, they occur mainly within scarp and coastal forests, thickets or dense coastal bush (Skinner & Chimimba 2005), although they can occupy modified habitats (Y. Ehlers-Smith unpubl. data). They frequent forest glades and open areas but need dense underbrush to rest or take cover. They are selective foragers which mainly feed on fruit, dicots and a small percentage of monocots (Hanekom & Wilson 1991;

Gagnon & Chew 2000). They are a diurnal species, commonly living in pairs, with small mean home ranges varying between 0.74 ha (Bowland and Perrin 1995) and 5.86 ha (Mockrin 2010). A large proportion of subadults disperse due to intra-specific social interactions (Bowland 1990; Lawes et al. 2000). Camera trapping has shown that in high-disturbance areas there has been a shift towards nocturnal foraging (Y. Ehlers-Smith unpubl. data). Substantial spatiotemporal variation in Blue Duiker population densities has been recorded in the Garden Route National Park, Western Cape, and subpopulation densities were found to be affected by features of forest structure, moist versus dry forest types and geological substrate (Seydack et al. 1998).

Ecosystem and cultural services: Frugivores are very important seed dispersers in forest ecosystems (Brodie et al. 2009; Abernethy et al. 2013) and, due to the presence of Blue Duiker in many of South Africa's coastal and scarp forests, the ecosystem service they provide is crucial for ecosystem functioning. Blue Duikers also comprise a significant proportion of forest carnivore diets (Hanekom & Wilson 1991; Braczkowski et al. 2012) and are also an important source of bushmeat for many rural people in Africa (Abernethy et al. 2013; Lindsey et al. 2013). It is also suspected that Blue Duikers play a role in pruning tree seedlings, thus shaping forest succession.

Use and Trade

Off-take under controlled trophy hunting is not suspected to be high enough to have any effect on the population, especially if trophies are increasingly sourced from introduced captive-bred subpopulations. This supposition needs to be verified with empirical data. However, Blue Duikers are suspected to be adversely affected by bushmeat hunting. The species is subject to extensive hunting for bushmeat throughout its range, and is arguably the most important wild ungulate economically and ecologically in Africa (Wilson 2001). The bushmeat trade in Africa is increasing and could, in many cases, not be considered as subsistence hunting anymore but rather commercial (Robinson & Bennett 2004; Lindsey et al. 2013). Demand tends to exceed supply, which puts tremendous pressure on wild populations of forest animals (Robinson and Bennett 2004). For example, 47% of traders at the Faraday market in Johannesburg (N = 32) sold duiker products such as horn and skin (Whiting et al. 2011), however, the species were not identified.

Illegal taxi-hunting (organised hunting using dogs), *sensu* Grey-Ross et al. (2010), has been observed in two of the major reserves in southeastern KZN, which showed considerably fewer duiker present possibly as a result of these hunting pressures (Y. Ehlers-Smith unpubl. data). Conversely, in areas where dog hunting practices are absent due to anti-poaching measures, Blue Duikers displayed 100% occupancy (Y. Ehlers-Smith unpubl. data). In the absence of dog racing in the province, taxi-hunts may become a business in the region and is a source of income for many (Y. Ehlers-Smith pers. obs. 2014). When poachers are caught hunting with dogs in the Eastern Cape and parts of KZN (for example, the Umzimkhulu valley), they are often in possession of a Blue Duiker. Blue Duiker are also frequently caught in snares in areas where bushpig are the target species (D. de Villiers pers. comm. 2016).

Although conservancies and private wildlife areas could benefit this species in terms of habitat conservation and protection from poaching, landowners should be careful not to introduce or maintain high stocking rates of Bushbuck (*Tragelaphus sylvaticus*), or extra-limital species like Nyala (*Tragelaphus angasii*), as this potentially negatively affects Blue Duikers through increased interspecific competition and opening up of forest habitat, exposing them to predation (Coates & Downs 2005; Y. Ehlers-Smith unpubl. data).

Threats

Within the assessment region, the main threat to the species is habitat loss. This occurs through farming, particularly sugar cane, and plantation forestry, as well as expanding human development and urban sprawl, particularly along the KZN coast. Indigenous timber harvesting is mainly a threat if it results in habitat destruction or is associated with heavy hunting pressure. In some rural regions of the Eastern Cape and KZN, habitat degradation due to illegal sand mining (*sensu* Masalu 2002), alien invasive plant invasions, and indigenous timber harvesting are causing significant habitat loss and habitat degradation.

However, Blue Duikers can exist on mixed land-use areas. For example, forest patches surrounded by plantations seem to have less of a negative effect on Blue Duikers than other forest-dwelling species, where probability of patch occupancy when the patch was surrounded by plantations was twice that of Tree Hyraxes (*Dendrohyrax*

Table 4. Use and trade summary for the Blue Duiker (*Philantomba monticola*)

Category	Applicable?	Rationale	Proportion of total harvest	Trend
Subsistence use	Yes	Bushmeat hunting which is prevalent in the former Transkei and Ciskei regions as well as certain regions in Kwazulu-Natal.	Majority	Increasing with urban and rural expansion (suspected).
Commercial use	Yes	International and national trophy hunting.	Minority	Unknown
Harvest from wild population	Yes	Majority of harvest comes from the wild and free-roaming population.	Majority > 90%	Increasing with urban and rural expansion (suspected).
Harvest from ranched population	Unknown	No extensive systems for Blue Duiker production are known.	-	-
Harvest from captive population	Suspected	Anecdotal evidence suggests extensive captive-bred subpopulations across the country.	-	-

Table 5. Threats to the Blue Duiker (*Philantomba monticola*) ranked in order of severity with corresponding evidence (based on IUCN threat categories, with regional context)

Rank	Threat description	Evidence in the scientific literature	Data quality	Scale of study	Current trend
1	*2.1 Annual & Perennial Non-timber Crops*: habitat loss of forest and thickets through agricultural expansion, especially sugar cane. Current stresses *1.3 Indirect Ecosystem Effects*: fragmentation of remaining habitat into small patches.	Lawes et al. 2000	Simulation	Regional	Ongoing
		Jewitt et al. 2015	Indirect	Regional	Patches < 0.05 km^2 unoccupied.
2	*2.2.2 Agro-industry Plantations*: habitat loss and degradation from pine plantations. Current stresses *1.2 Ecosystem Degradation* and *1.3 Indirect Ecosystem Effects*: fragmentation and degradation of remaining habitat into small patches.	Jewitt et al. 2015	Indirect	Regional	Ongoing
3	*3.2 Mining & Quarrying*: habitat loss from illegal sand mining.	Jewitt et al. 2015	Indirect	Regional	Increasing with rural settlement expansion.
4	*1.1 Housing & Urban Areas*: habitat loss through expanding human settlements. Current stresses *1.2 Ecosystem Degradation* and *1.3 Indirect Ecosystem Effects*: fragmentation and degradation of remaining habitat into small patches.	GeoTerraImage 2015	Indirect	National	Ongoing; 5–8% increase since 2000.
		Lawes et al. 2000	Simulation	Regional	Patches < 0.05 km^2 unoccupied.
5	*5.3.3 Logging & Wood Harvesting*: may decrease food availability and increase hunting pressure. Current stresses *1.2 Ecosystem Degradation* and *1.3 Indirect Ecosystem Effects*: fragmentation and degradation of remaining habitat into small patches.	Hanekom & Wilson 1991	Indirect	Local	Increasing with rural settlement expansion. Frequencies of palatable tree species are low in certain forests. It is suspected that food availability may then be further reduced by illegal wood harvesting.
6	*5.1.1 Hunting & Collecting Terrestrial Animals*: traditional medicine and bushmeat use.	Whiting et al. 2011	Empirical	Local	Increasing. Duiker spp. found in Faraday market in Johannesburg, Suspected to be widespread in KZN markets too.
		Y. Ehlers-Smith unpubl. data	Empirical	Regional	High snaring rates in conservancies suggest increase in bushmeat poaching.
7	*5.1.2 Hunting & Collecting Terrestrial Animals*: illegal dog hunting sport and incidental snaring.	Grey-Ross et al. 2010	Indirect	Regional	Increasing
		Jones 2015	Attitudinal	Regional	

arboreus) (Lawes et al. 2000). Similarly, the likelihood of patch occupancy increased when the patch was closer to human habitation (Lawes et al. 2000). Subpopulations on private land are mostly wild and free-roaming and thus count towards this assessment. However, the numbers on private land are unknown. Conservancy chairs in KZN have confirmed that numbers are on the increase since there has been a private initiative to remove snares from conservancy managed land and undeveloped municipal stands (C. Hoskins, Crags View Rehabilitation Centre, pers. comm. 2015). However, snare removal is ongoing, which suggests continuous trapping effort within semi-urban areas. Snaring within the rural and farming communities is a big problem, with continual snare removal on a bi-weekly basis necessary to keep poaching at bay. Often animals are left in snares, dead or dying, suggesting that the practice of snaring is not out of desperation. Snaring may be the major cause of a continuing decline in mature individuals. They are easily caught in snares as they create well-marked paths between bed sites and feeding sites, over which snares can be laid (Skinner & Chimimba 2005). For example, locals claim disappearance of Blue Duiker from Ingele Forest (Weza), KZN, and researchers have yet to confirm their presence in the forest after 30 km of transect surveys (Y. Ehlers-Smith pers. obs. 2015). Similarly, illegal dog hunting for sport is suspected to be causing localised subpopulation declines or extinctions (see **Use and Trade**).

In a recent survey of private landowners within Blue Duiker range (Jones 2015), respondents listed poaching and dogs as common threats. Natural predation (for example, Caracal, *Caracal caracal*) was rarely listed and only two respondents had heard of incidents of Caracal preying on Blue Duiker in KZN (Jones 2015), which corroborates a study from Tsitsikamma National Park that found resource availability, rather than predation, to be the limiting factor (Hanekom & Wilson 1991).

Current habitat trend: Declining in extent and quality. Deforestation from agriculture, firewood and charcoal production, and coastal development continues to threaten Blue Duiker habitat. Recent satellite imagery data confirm an ongoing loss of forest habitat within the assessment region between 1990 and 2014 (A. Skowno unpubl. data). For example, in KZN, there was a 20.4%

loss of natural habitat from 1994 to 2011, with an average loss of 1.2% per annum (Jewitt et al. 2015), due primarily to agriculture, but also plantations, built environments and settlements, mines and dams. Additionally, between 2000 and 2013, there has been a 5–8% urban expansion in Eastern Cape, Western Cape and KZN provinces (GeoTerraImage 2015), which we infer to be causing a reduction in habitat quality. For example, habitat quality is reduced by changes in the understory forest structure through heavy grazing. A recent dry spell has also resulted in many thickets being burnt down (Y. Ehlers-Smith pers. obs. 2014).

Conservation

The Blue Duiker occurs in several protected areas and state forests within the assessment region: Mkambati Nature Reserve (NR), Silaka NR, Hluleka NR, Dwesa-Cwebe NR (Hayward et al. 2005), East London Coast NR, Ongoye Forest NR, Dlinza Forest NR, Entumeni NR, Nkandla Forest NR, Harold Johnson NR, Enseleni NR, Addo Elephant National Park (NP), Garden Route NP, Mpofu NR, Fort Fordice NR, Thomas Baines NR, Groendal NR, Durban Bluff NR, Mpenjati NR, Kenneth Stainbank NR, Oribi Gorge NR, Mount Currie NR, Krantzkloof NR, Vernon Crookes NR, Umdoni Park Forest, Umtamvuna NR and Mbumbazi NR. As such, protected area expansion will benefit the species but is not the key intervention.

They are generally resilient to moderate anthropogenic disturbance, and can live in small forest patches, if the matrix is managed correctly (Lawes et al. 2000). Reducing disturbance in the matrix through enforcement of trespassing and illegal hunting regulations is a key intervention, and should improve connectivity between forest patches. The land-use of the matrix needs to be considered too. Although commercial plantations are used by the species as corridors (Lawes et al. 2000), they are unable to live there and plantations cannot be used as corridors for most species. Thus, the use of plantations as corridors is not recommended and instead conservancies are suggested as a land-use type conducive to connectivity. As such, biodiversity stewardship agreements may be crucial in conserving high-quality corridors for Blue Duikers and other species.

Increasing education and awareness in local communities adjacent to key remaining forest patches should be employed to highlight the plight of this species and curb sport-hunting and snaring. Alternative livelihoods can be trialled in such communities to stem poaching rates.

From a policy perspective, increased enforcement by government agencies on illegal development, sand mining and indigenous timber harvesting needs to be effected. Researching and setting quotes for the sustainable trophy hunting of this species should be undertaken.

Recommendations for land managers and practitioners:

- Secure all suitable remaining habitat under some form of formal or semi-formal conservation legislation to prevent further habitat loss.
- Develop and implement a metapopulation strategy to ensure the continued genetic integrity of the regional variety of this species. A precautionary approach to reintroductions and translocations should be employed due to unknown subpopulation structure.
- Develop trophy hunting quotas that reflect local subpopulation size and recruitment rates.
- Systematic long-term monitoring at key sites across its range to quantify population trends over three generations.
- Registration and control of external breeding programs.
- Increased efforts to monitor population status and effects of threats.
- Maintain other browsing ungulates (for example, Bushbuck) at moderate densities in small fenced estates or properties.

Table 6. Conservation interventions for the Blue Duiker (*Philantomba monticola*) ranked in order of effectiveness with corresponding evidence (based on IUCN action categories, with regional context)

Rank	Intervention description	Evidence in the scientific	Data quality	Scale of evidence	Demonstrated impact	Current conservation
1	*1.2 Resource & Habitat Protection*: forest conservation and connectivity through biodiversity stewardship schemes.	Jones 2015	Attitudinal	Regional	48% private landowners (N = 63) report Blue Duiker presence.	Ezemvelo KZN Wildlife
2	*2.1 Site/Area Management*: training forest managers and increased prosecution rates of people found with snares or Blue Duiker bodies/parts.	-	Anecdotal	-	-	Ezemvelo KZN Wildlife
3	*6.1 Linked Enterprises & Livelihood Alternatives*: development and implementation of sustainable resource extraction practices from forests for local communities.	-	Anecdotal	-	-	None known
4	*5.4 Compliance & Enforcement*: lobbying government agencies to enforce legislation restricting illegal development, sand mining and timber harvesting.	-	Anecdotal	-	-	None known
5	*1.1 Site/Area Protection*: Protected area expansion for large forest patches to ensure viable subpopulations.	-	Anecdotal	-	-	None known

Research priorities: The main research priority is generating taxonomic information. Little is known about subpopulations or ecotypes. Another data deficiency is accurately estimating the rate of perceived population decline. Specifically:

- Taxonomic investigation into the species to clarify whether the species within South Africa is a regional endemic or similar to those recorded elsewhere in Africa.
- Surveys to refine population estimates, utilisation and distribution. Once this information has been acquired then future Population and Habitat Viability Analyses (PHVAs) can be considered. Baseline monitoring with camera trap surveys are currently being conducted by Eastern Cape Parks and Tourism Agency in protected areas within the Eastern Cape. Ezemvelo KZN Wildlife conducts drive counts in Kenneth Stainbank and North Park nature reserves and has attempted camera trapping and home range mapping, but none have proved reliable methods given the resources required to implement them.
- Quantifying the effects of habitat degradation and bushmeat hunting on the South African population.
- Research on the impacts of changing land-use on biodiversity, particularly for mammals such as Blue Duiker, using camera trapping. Metapopulation dynamics of forest mammals in the fragmented subtropical coastal forests of southern KZN is being conducted by the University of KZN in collaboration with Ezemvelo KZN Wildlife (June 2014–June 2016).
- Research investigating Blue Duiker as prey for Caracal is currently being conducted in KZN through the University of KZN in collaboration with Ezemvelo KZN Wildlife.

Encouraged citizen actions:

- Report sightings on virtual museum platforms (for example, iSpot and MammalMAP) and the KZN Wildlife Watch application, especially outside protected areas.
- Create conservancies that provide better quality habitat for this species.
- Create biodiversity stewardship sites through the National Biodiversity Stewardship Programme that gives key sites legal recognition.

Data Sources and Quality

Table 7. Information and interpretation qualifiers for the Blue Duiker (*Philantomba monticola*) assessment

Data sources	Field study (literature, unpublished), indirect information (literature, unpublished)
Data quality (max)	Estimated
Data quality (min)	Inferred
Uncertainty resolution	Maximum/minimum values
Risk tolerance	Precautionary

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Details of the methods used to make this assessment can be found in *Mammal Red List 2016: Introduction and Methodology*.