

Ecology of African Civet (*Civettictis civetta*) in Arba Minch Forest, Arba Minch, Ethiopia

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Abstract

The population density, diet and scent-marking of African civets (*Civettictis civetta*) were assessed at Arba Minch Forest within Nechi Sar National Park in Arba Minch, Ethiopia. The Civet population was estimated over a 5-months period to be 0.27/ha, of which 0.16 were adults and 0.11 young. Civet diet was analyzed by examining 578 scats during the same period to determine preference of adult Civets to plant material over animal material and vice versa. This viverrid can be termed a generalist omnivore as per these findings. Civets were found to use plants, metallic objects and poles to mark scent. Out of the 92 scent marking sites observed, a vast majority were within 100 m radius of civetries or latrine sites. In the wild, the amount of civet – the perineal gland secretion collected from each marked site varied from 0.0047 g to 0.98 g, but in captivity 0.034 g to 2.0 g was collected. Much as Ethiopia is the world's largest supplier of civet musk to perfumery industry in Europe, its Civet farming practices needs to be regulated for acceptable welfare standards.

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INTRODUCTION

The African Civet (*Civetticus civetta*) is an elusive, nocturnal, omnivorous and territorial scent marking viverrid, distributed throughout sub-Saharan Africa; usually close to perennial wetlands (Ray, 1995; Bekele Tsegaye *et al.*, 2008a, 2008b). Not only is it the largest representative of Viverridae, but also a bioindicator of forest habitat dynamics akin to most other Civet species (Mudappa *et al.*, 2010; Rabinowitz, 1991). *Civettictis civetta* is a stocky animal with a long body, and is short-legged for its size although its hind limbs are noticeably larger and more powerful (Figure 1).



Figure 1: African Civet in Arba Minch forest

Understanding the ecology of the African Civet is important for its conservation, management, and husbandry as this species is increasing farmed for its 'civet' – a waxy and musky secretion of the perineal glands of both sexes much in demand in the perfume

industry (Ralls, 1971; Ray, 1995; Eisenberg and Kleiman, 1972). This study addressed the following questions: (a) what is the population density of the African civet in Arba Minch Forest? (b) What are the food items of plant and animal origin consumed by them? (c) How important is scent marking for their communication? The results of the study are used to address its husbandry aspects given the commercial importance of the species.

MATERIALS AND METHODS

Study Site

The study was carried out between August 2012 and January 2013 in Arba Minch Forest, which is part of Nechi Sar National Park (NSNP), and covers about 2120 ha. NSNP is a mix of woodlands, grasslands, and both groundwater and riverine forests located between 5051'-6005'N Latitude and 37032'-37048'E Longitude in the Southern Nations, Nationalities and Peoples Regional State (SNNPRS), in the Rift Valley floor between two lakes namely Abaya and Chamo (Aramde Fetene *et al.*, 2011; Bolton, 1973) (Figure 2).

Population Density

A counting of dung pellets from civetries or latrines where Civets habitually defecate was conducted from 5 civetry sites namely Ashewa, Kella, Kontir-ketana, Biretidly and Walo. The number of fresh droppings and their sizes were recorded on a daily basis to record age and structure of the population (Putman, 1984).

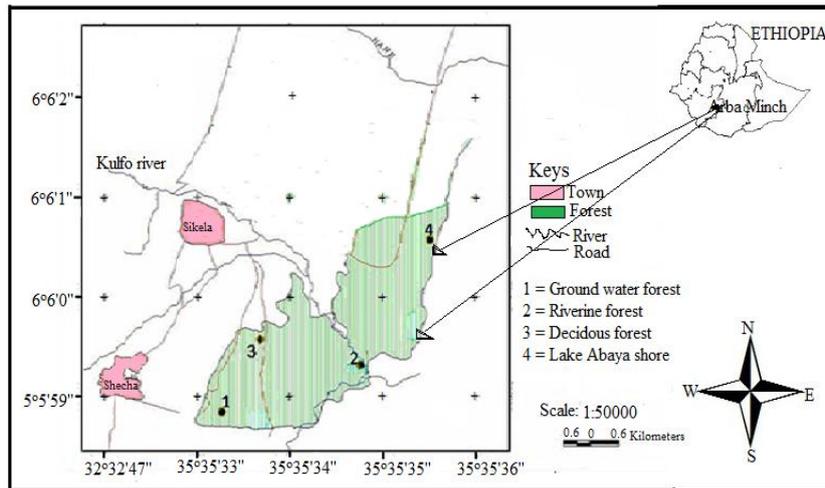


Figure 2: Map of the study area

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Diet Composition

Gross and microscopic examination was conducted on 578 scat samples collected during the study period from the aforesaid civetry sites. The food items identified from the droppings of Civets were grouped under 7 categories viz., fruits, insects, invertebrates (millipedes and centipede) mammals (hare and rodent jaw, hair, limb, and skin), birds (feather, claw and beak), shrubs and non-food items (plastic material).

Scent Marking

The study area was searched extensively to locate the scent marking sites of Civets (Balakrishnan and Alexander, 1985; Balakrishnan, 1987; Bekele Tsegaye *et al.*, 2008b). The height of the marking sites on the signpost was measured to identify suitable height at which Civets scent marked. The species of plants or type of objects marked were identified. Distance from civetries and tracks were measured to analyze the distribution of scent marks in the home range of the animal. Civet musk was collected in plastic bags from the scent marked sites and weighed. The time and site collected were recorded to assess the frequency of scent marking in the Civet's habitat (Wondimagegn Daniel, 2006). The preference of Civets to scent marked objects was assessed by 70 quadrants of 20 X 10 m² placed in the proximity of the civetries, as suggested by Wemmer (1977) and by observing the association of marking with the species of plant in the study area. The distance between each successive quadrat was 100 m, and trees/plants on which Civets scent marked were identified to species level (Ranadll, 1977).

Statistical Analysis

SPSS software, Version 16.0, was used to identify the statistical significance of the results. Diet choice was calculated using frequency of occurrence of each of the food items expressed as percentage. Absolute frequency (n/N) was the number of food items (n) in relation to the scats analyzed (N). Relative frequency (r/R) was the

relation of identified food items and the number of food items observed during analysis (R). One-way ANOVA test was used to identify the most preferred food item. Chi-square test of relative percentage frequency was performed to see significant food items in the diet. The total scent marked objects were identified. The level of preference to scent mark on these objects was calculated using frequency of occurrence of each of the objects expressed as percentage. The variation between scent marked objects was tested by using Chi-square test. The height of each of the scent marks was measured from the ground. The mean height at which scent marks were observed was calculated. The distance of scent marks from civetry sites and Civet paths were measured by a measuring tape.

RESULTS

Population Density

A total of 578 scats (adult (n) = 348 and young (n) = 230) were obtained from five different civetries. Figures 3 show the nature of droppings at civetries. The population density of the African Civets was 0.27/ha., out of which 0.16 were adults and 0.11 young. There was a statistically significant variation between adult and young population ($\chi^2 = 24.09$, df = 1, $P < 0.05$). The variation in the population estimates among the sites was also highly significant ($\chi^2 = 25.89$, df = 4, $P < 0.05$) (Table 1). Civets in bush land habitat were fewer in January and more in November and this difference was statistically significant ($\chi^2 = 14.33$, df = 5, $P < 0.05$).



Figure 3: One of the civetries in the study area. Note the presence of large number of intact seeds and remains of invertebrates in the droppings

Table 1: Population density estimate of Civets in the 5 Civetries of study area

Site	Number of Civets					
	Wet season			Dry season		
	Adult	Young	Total	Adult	Young	Total
Ashewa	2.07±0.16	1.89±0.16	3.96±0.325	2.03±0.14	1.95±0.18	3.98±0.32
Kella	2.32±0.16	1.8±0.16	4.12±0.329	1.46±0.13	1.82±0.17	3.28±0.29
Kontir-ketena	2.22±0.10	1.79±0.15	4.01±0.258	1.93±0.11	1.62±0.21	3.55±0.32
Biret dildy	2.15±0.14	1.72±0.13	3.87±0.268	1.73±0.13	1.88±0.16	3.61±0.29
Walo	2.37±0.16	2.3±0.19	4.67±0.354	1.72±0.15	1.5±0.17	3.22±0.32
Total	11.13±0.72	9.5±0.80	20.63±1.53	8.87±0.65	8.77±0.9	17.64±1.54

Diet Composition

Twelve common food items were identified from Civet scats and a total of 688 occurrences of 13 items (including plastic from carry bags discarded from human areas) (Table 2). There was a statistically significant variation in food preference of Civets ($\chi^2 = 1.27$, $df = 12$, $P < 0.05$). Fruits of *Ficus spp.*, *Euclea divonorum*, *Diospiros abyssinica*, *Tamarindus indica*, *Balanites aegyptiaca* and banana (48.85%) constituted the largest portion of the diet of the Civets. The fruits of *Ficus spp.* was the most frequent food item (13.1%) found in the scats. Hair with bone accounted for 11.92% of the diet, followed by millipedes and centipedes (11.48%); insects (11.05%); *Balanites aegyptiaca* (9.01%); *Tamarindus indica* (8%); banana (7.7%); *Diospiros abyssinica* (6.54%); bird claw (5.54%); snail (5.52%); *Euclea divonorum* (4.5%); shoots and leaves (3.34%) and plastic (2.47%) were the other items found in the scats.

Adult Civets preferred to feed on plant materials (57.35%) to animal materials (42.55%). This variation in food choice of adult Civets was statistically significant ($\chi^2 = 9.58$, $df = 1$, $P < 0.05$). Young Civets preferred to feed on animal materials (57.06%) more than plant materials (42.82%) items. This variation in food choice of young Civets was also statistically significant ($\chi^2 = 4.96$, $df = 1$, $P < 0.05$).

Table 2: Diet composition of Civets in Arba Minch forest based on scat analysis

Food items	Parts eaten	No. of observation	Percent (%)
<i>Ficus spp.</i>	Fruit	90	13.1
<i>Euclea divonorum</i>	Fruit	31	4.50
<i>Diospiros abyssinica</i>	Fruit	45	6.54
<i>Tamarindus indica</i>	Fruit	55	8.00
<i>Balanites aegyptiaca</i>	Fruit	62	9.01
Banana	Fruits	53	7.70
Hair with bone	-	82	11.92
Bird claw	-	37	5.54
Insects	Whole	76	11.05
Millipede and centipede	Whole	79	11.48
Snail	Whole	38	5.52
Leaves and fibres	-	23	3.34
Plastic*	-	17	2.47
Total		688	100

Scent Marking

A total of 92 scent marked objects were identified from the study sites in Arba Minch forest. The Civets used plants, metallic objects and poles to scent mark (Figure 4). There was a high level of preference to mark on *Balanites aegyptiaca* (38.04%), followed by metallic items (19.56%). The variation between *Balanites aegyptiaca* and other marked objects was statistically significant ($\chi^2 = 70.38$, $df = 7$, $P < 0.05$). The mean height at which scent

marks were observed was 32 cm. In the wild, the mean amount of civet musk that could be collected from each marked site (Table 3) varied from 0.0047 to 0.98 (g), but in captivity, 0.034 to 2 (g) civet musk was measured. Most scent marked sites (96.72%) were within 100 m radius of civetries.



Figure 4: Scent mark of African Civets on a metallic object for many times

Table 3: Amount of Civet musk collected from scent marked sites

Marked object	Species	No. of marked objects	Amount of civet secretion Mean ± S.D., g
Plants	<i>Balanite aegyptica</i>	35	0.154 ± 0.044
	<i>Acacia polyacantha</i>	13	0.0489 ± 0.00185
	<i>Kigelia africana</i>	7	0.0391 ± 0.000926
	<i>Acalypha fruticosa</i>	6	0.0814 ± 0.0107
	<i>Tamarindus indica</i>	7	0.0318 ± 0.00091
Metallic materials		18	0.3384 ± 0.1026
Pole		2	0.318 ± 0.116
		Total=92	Mean=0.1088 ± 0.033

DISCUSSION

Much as the African Civet is known for its fecundity, a population density estimate of 0.27/ha in Arba Minch forest, as hitherto determined, reinforces the shy and elusive nature of this nocturnal viverrid that renders the task of direct count quite difficult (Hongfa and Helin, 1995). Although scats can provide ample data for ecological research (Putman, 1984), a population density estimate of this civet using scat counts has its drawbacks including sporadic use, overlap and disturbance of civetries. Scats of adults and young Civets were observed throughout the study period – a pointer that Civets breed throughout the year.

This study reiterates that African Civets are generalist omnivores as evidenced by the presence of 13 items on scat analysis. African Civets are known to eat diverse food items (Smithers, 1986). Fruits of *Ficus spp.* were a major food items for an extended time. Fruits of *Ficus spp.* were also at a higher proportion in the diet of the African Civets in South Africa (Bothma, 1971). Pieces of bone with mammalian hair constituted the second highest proportion of the food in Civet scats, and the study area has a good population of rodents. Sixteen species of small mammals including two species of shrews were recorded from the study area (Demeke Datiko, 2007) and small mammals contribute to a major proportion the food of civets. Invertebrates such as insects, millipedes, and centipedes also formed Civet food and protein source (Pugh, 1998; Wondimagegn Daniel *et al.*, 2011). The presence of non-food items in its diet, such as plastic from littered carry bags, can be associated with non-selective foraging habit of the animal.

Scent marking in Civets forms an intricate signaling and olfactory (Wondimagegn Daniel *et al.*, 2011) communication system as evidenced from the location of scent marks and civetries in proximity to their movement paths. The Civets showed a preference in the use of *Balanites aegyptiaca* as sign post, and metallic objects came next. The use of scent marking by Civets could also be related to territory defense and to show case their reproductive status. Out of the 92 scent marks observed during the present investigation, only 32 were found to be re-marked. The low rate of re-marking might reflect the long lasting nature of the odor (Wondimagegn Daniel *et al.*, 2011). In captive Civets, good diet seems to enhance the secretion of musk from their perineal glands.

CONCLUSIONS

The African Civet occupies a definite niche in Arba Minch forest, is resilient in wake of human disturbances, and can produce more musk in captivity than in wilderness. Good husbandry practices and welfare standards are needed to justify Civet farming given its high economic importance in Ethiopia.

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