

Short communication: Enhanced enrichment is inevitable to carry on the legacy of African civet (*Civettictis civetta*) captive farming

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Manuscript received: 29 January 2019. Revision accepted: 12 May 2019.

Abstract. Desta TT. 2019. *Enhanced enrichment is inevitable to carry on the legacy of African civet (Civettictis civetta) captive farming.* Biodiversitas 20: 1575-1579. African civet secretes an aromatic compound called civet musk. Ethiopia has a long-lasting production and trading history of civet musk. Ethiopia holds about 90% of the international market share. Irrespective of economic importance and histocultural significance; inadequate enrichment and suboptimal management have been increasingly threatened the welfare of captive civets. To carry on with the legacy of captive civet farming, current management practice should have to be improved and additional civet and civet musk derived use values should have to be sought after.

Keywords: Civet musk, Ethiopia, opportunities and threats, use values, welfare

INTRODUCTION

Civets are grouped under order *Carnivora*, family *Viverridae* and subfamily *Viverrinae* (Gray 1821) and genus *Civettictis* (Pocock 1915). They are amid of four mammalian species secreting aromatic compounds (Dannenfeldt 1985). There are fifteen species of civets' native to the tropical and the subtropical old world. Though rarely sighted (Djagoun and Gaubert 2009; Negeri et al. 2015; Kiros et al. 2016), the African civet occupies a wide home range (Dannenfeldt 1985; Abebe 2003; Ray 2013; Do Linh San et al. 2015). African civet *Civettictis civetta* is the only species found in Africa (Ray 1995). However, the African civet belonged to Ethiopia (*a.k.a.* Abyssinian cat, Brechbill 2006) has been at least once recognized as a unique race (Wenzel and Haltenorth 1972 as cited in Yalden et al. 1980).

In Ethiopia, captive civet farming is an ancient practice (Abebe 2003; Ishihara 2003; Eniang and Wondmagegne 2007; Taye 2009). Civet musk has been one of the exports and diplomatic gift items in Ethiopia's trade and political history (Abebe 2003). Ethiopia is the world's main supplier of civet musk (Dannenfeldt 1985; Homes 1999) and it has been monopolized about 90% of the international market share (Taye 2009). Other countries that have been known to export civet musk are Niger and Senegal, whereas Ghana and Zanzibar once were amongst exporting countries now quitted this business (see Abebe 2003 for a review). This may associate with declining demand in the international market and loss of competitive advantage of captive civet farming. Approximately, 98% of the civet musk produced in Ethiopia is used for export (as reviewed in Ishihara 2003); consequently, domestic use accounts for merely 2% (Abebe 2003).

Although it has not been sufficiently documented, there is a wealth of traditional knowledge and wisdom associated with management of captive civet which requires extensive research and proper documentation. Traditional knowledge and wisdom can be used as a stepping stone to innovate on improved management practices of captive civet farming. Despite long-lasting history, civiculture (civet farming) has been operated under commercial secret. Captive civet owners believe that publicizing of civet reduces musk yield (Eniang and Wondmagegne 2007). It has been realized that this traditional belief has been systematically excluded the national research system from documenting pros and cons of traditional practices and wisdom (Abebe 2003).

In Ethiopia, instead of captive breeding, captive civet farming relies upon wild population as replacement stock, which imposes an extra burden on the wild population. Naturally, African civets are wild in Ethiopia (Dannenfeldt 1985); however, there are more than 200 small-scale farms that have been kept around 4000 captive civets (FAO 2000). However, recently, a sort of large-scale farm for its kind and with more than 120 captive civets was established in Bishoftu town (*a.k.a.* Debre Zeit), which is located 45km southeast of the capital Addis Ababa. However, there is no evidence about the incidence of captive breeding even in this commercial farm. On the other side, in south-western Ethiopia, there is a practice of catching civets from the wild and let them escape after extracting their musk (Taye 2009).

Regardless of this, poor welfare of captive civets remains the issue of great concern (Pugh 1998). Mistreatments among others include inadequate nutrition, poor enrichment, high parasite load, and mortality rate, inadequate health care, inappropriate trapping, transporting, handling, restraining and civet musk collection techniques

(Pugh 1998; FAO 2000; Tolosa and Regassa 2007). In response to this concern, some efforts have been made by the national research system, for example, to improve the traditional cage (Oliy and Garesu 2017). However, this improvement might be insufficient by itself given the wide scope of cruelty observed on captive civet's management. Moreover, captive civet farming is a labor-intensive venture and it may lose its competitive advantage with emergence of lucrative businesses. Therefore, to improve the welfare of captive civets, captive farms should operate under carefully managed disease prevention and control methods and with enhanced enrichment. On the other side, civet farming in Ethiopia has histocultural significance. Consequently, there is a conflicting interest between stakeholders who are greatly concerned about poor management of captive civets and those groups who are interested to maintain the legacy of captive civet farming. Indeed, ways should have to be devised to deal with conflicting interests. Therefore, enhancing the existing enrichment and exploring for additional civet and civet musk derived values may help to keep going the tradition of captive civet farming by enhancing and diversifying the source of civet-derived income while providing improved enrichment to captive civets. This work suggests improvement of suboptimal management and poor welfare of captive civets and diversification of the use values of civet and civet musk.

MATERIALS AND METHODS

This work navigates through plausible resource materials and persons to propose a win-win solution that may resolve the conflict observed between poor management of captive civet and the historical value attached to unique and ancient practice of captive civet farming. To draw a unifying concept, literatures was consulted, informal discussions were made with stakeholders and secondary data was analyzed. The analyzed data was used to observe the recent trend of civet musk production and marketing and its potential impact on feasibility of captive civet farming. In line with this effort, in a national meeting organized by Ethiopian Wildlife Conservation Authority in 2017 in Addis Ababa open-ended discussion was made with Ethiopian civet musk exporters and officers who have been working on wildlife conservation and management. This discussion elucidates the current status and threats and opportunities of captive civet farming and marketing of civet musk. The information gathered from this discussion was used to suggest some of the proposed improved management practices.

Google search engine was used to access relevant literature using African civet, civet musk, welfare, and Ethiopia as key search terms. However, only those literature with high relevance and fall within the scope of this work were used to produce this report. The secondary data used in this analysis was obtained from Degefa (2015). Plotting, descriptive statistics and correlation test were performed using the functions built in the base R (R Core

Team 2016). Statistical outputs have been used to interpret and to map the status of production and marketing of civet musk in Ethiopia. These outputs were also used to associate the prevailing threats with the fate of captive civet farming. However, the result and discussion section largely rely upon review of literature. Based on core findings and literature review a concise recommendation has been produced to enhance the welfare of captive civets and to diversify their use values. Photographs showing African civet and its natural geographic range in the sub-Saharan Africa region were adapted from Wikipedia (https://en.wikipedia.org/wiki/African_civet) and are presented in Figure 1 and Figure 2, respectively.



Figure 1. Captive African civet (Wikipedia)



Figure 2. Home range of African civet across sub-Saharan region (Do Linh San et al. 2015; Wikipedia)

RESULTS AND DISCUSSION

A number of studies including the investigative ones consistently confirmed poor management of captive civets in Ethiopia (Pugh 1998; FAO 2000; Tolosa and Regassa 2007). In light of this fact, enhancing the existing traditional management practice is inevitable. For example, following the strong complaint made by the international community (Pugh 1998), a modification made on a traditional cage alone has increased civet musk production per individual from 7.2 to 10g (28% increase) within collection season of 10 to 12 days. Moreover, mortality was reduced in civets that had been kept in an improved cage (Oliy and Garesu 2017). Therefore, with provision of adequate enrichment, civets may live long in captive environment (Jones 1977) than they do in the wild (Shalu 2000).

An analysis performed on a secondary dataset showed that Pearson's product moment correlation showed statistically highly significant association between the amount of civet musk exported and the income earned ($t_{25} = 24.502$, $p < 2.2e^{-16}$, $r = 0.98$ (95% C.I = 0.96, 0.99)). Figure 3 also shows a similar trend; however, the amount of civet musk exported and the income earned has fluctuated across the study period. This shows poor predictable nature of captive civet farming, which may negatively affect its feasibility. It might be due to the fact that some of captive civet farmers have been shifted to alternative farm activities (Tolosa and Regassa 2007). The overall trend in Figure 3 shows a gradual decline in the amount of civet musk exported and the income earned. This trend counteracts with the feasibility of captive civet farming. However, the price has been remained almost fixed except for 1998 during which it hits the highest peak. The price increase may associate with fear of banning of captive civet farming following the release of Pugh (1998) report and consequently importers may have decided to purchase the civet musk at higher price.

Summary statistics of the analyzed variables are presented in Table 1. The coefficient of variation (CV) is high for the amount of civet musk exported and the income earned, which shows volatility of the international market and the uncertain future of captive civet farming. Similarly, Ethiopian exporters reported a declining trend and poorly predictable nature of civet musk demand. The box plots (Figure 4) also show high level of dispersion, which indicates high variability across the study period in production and marketing of civet musk. The CV for unit price of civet musk might be within acceptable range.

Despite increase in the price of perfumes (e.g. Soundararajan et al. 2015), the price of civet musk has been remained constant for decades (Figure 3). This has kept back captive civet farming from competitive business ventures operating in captive civet farming catchment areas. For example, 50% of the civet keepers in south-western Ethiopia decided to quit farming of captive civet (Tolosa and Regassa 2007), with some proportion already shifted to alternative income generating activities (Eniang and Wondmagegne 2007). Moreover, farmers have been earned disproportionately less compared to middlemen and exporters (Pugh 1998). Consequently, civet keepers have been discouraged to carry on with their business.

Ethiopia has remained the major exporter of civet musk which might be associated with high quality of African civet musk (Anitei 2007). However, as civet musk is the only or major source of income for civet keepers, fluctuation in the international market demand (Figure 3 and 4) negatively affects its economic feasibility. Therefore, effort has to be made to diversify the use of values of African civet. In this regard, the use of civet should have to be explored further for medicinal uses (Dannenfeldt 1985; Eniang and Wondmagegne 2007; Tsegaye et al. 2008) and for special uses like civet coffee. Civet farming has historical significance (Eniang and Wondmagegne 2007). Historically, civet musk had been used as an article of diplomatic gift in Ethiopia (Abebe 2003; Eniang and Wondmagegne 2007).

Civets produce a highly-flavored and the most expensive coffee which is commonly referred to as "civet coffee" (Marcone 2004). A coffee bean fed to and defaecated by civets produces a highly-flavored civet coffee (Marcone 2004; Lee et al. 2015). In Ethiopia, African civet produces greener coffee bean compared to Indonesian palm civet (Marcone 2004), which may make a civet coffee from *C. civetta* more preferable due to maintenance of the natural color (green) of the coffee bean. However, being an arboreal species, climbing habit of the palm civet makes it an efficient picker of high-quality coffee cherries; while *C. civetta* being a poor tree climber, presumably, it subsists on of less quality fallen cherries. However, the sole source of civet coffee should have to be the wild-sourced one and as much as possible using captive civets perhaps through forcible feeding of coffee cherries to produce civet coffee should have to be highly discouraged though naturally, civets have a revealed interest towards feeding of coffee cherries.

Table 1. Descriptive statistics of civet musk exported (kg), income earned ('000 USD) and price (USD/kg)

Description	Minimum	Maximum	Median	Mean	Std. Dev	CV
Exported civet (kg/ year)	337.0	1858.0	880.0	981.5	466.8	47.6
Income earned (US\$ '000/ year)	151.2	836.1	395.1	450.0	217.9	48.4
Price of civet musk (USD/kg)	448.7	645.4	450.0	457.1	37.6	8.2

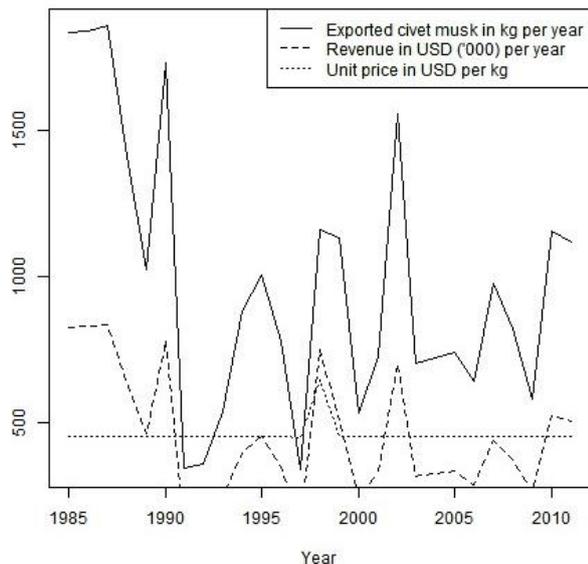


Figure 3. Line chart showing the trend of civet musk exported (kg), foreign currency earned (USD) and price (USD/ kg) of civet musk from 1985 to 2011.

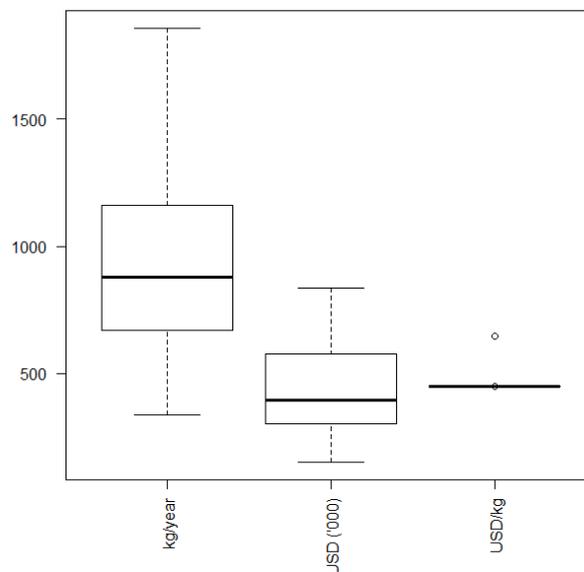


Figure 4. Box plot showing the trend of civet musk exported (kg/year), foreign currency earned (USD '000) and price (USD/ kg) of civet musk from 1985 to 2011

There is a competition on the international market from other natural substitutes such as musk from Muskrat, and *Viverricula* and *Viverra* species (Homes 1999). Regardless of this, opportunities also exist because civet musk is difficult to reproduce artificially, hence the demand may continue to persist for unforeseen future (Anonis 1997; Ishihara 2003). Perfumeries producing high-end quality products prefer civet (Anonis 1997). Nevertheless, impurity, adulteration and improper storage condition may result in low demand to natural product. Regardless of this, a new market has been emerged for civet musk in Far East region, presumably, to use civet musk as ingredient in pharmaceutical industries producing traditional products. Due to their nocturnal habit, civets are actively fed at night; therefore, feeding of civets competes less with daytime activities. The solitary African civet may be amenable to captive management relying upon solitary confinement as it may not leave behind a strong social bond.

African civet has a wide range of geographical distribution across sub-Saharan Africa region (Figure 1) implicating its importance in maintaining the natural equilibria of the highly diversified tropical ecosystem of sub-Saharan Africa. However, its distribution density may vary across its natural home range. Its wide geographic range may lead to population substructure, hence genetic studies may be required to uncover the level of species heterogeneity, population status, and demographic histories. From conservation point of view, African civet is grouped under least concern category of African carnivores (FAO 2000). However, planning for captive breeding may contribute to scientific studies. There is evidence for kitting in captive civets (e.g., Shalu 2000). Therefore, to intensify this small-scale industry and to transform it into commercial business, a demonstrative breeding program needs to be initiated. Keeping both sexes at experimental civiculture and/or in zoological gardens and allowing them

to mate freely may help to initiate a captive breeding. This may help to study their behavioral ecology and may serve as a stepping stone to start domestication. However, understanding the breeding requirements is essential to reproduce civets in captivity (Blackshaw 1986). Civets usually inhabit human landscape; thus, they may be easily adapted to taming (Ray 1995).

In line with Pugh (1998) and Abebe (2003), appropriate trapping, handling and transporting mechanism should have to be devised while relocating civets from wild to a captive environment. Moreover, improved feeding, health care, hygiene and using friendly restraining and civet musk collection equipment and techniques should have to be adapted. Captive civets can be kept in a spacious runner attached to a cage and they should have to be confined in an appropriate cage during civet musk collection only. As theoretical guideline, the smallest cage size (runner) should have to have a diameter twice as the flight distance of the animal (Blackshaw 1986). African civet naturally polishes its musk on sign-posts by squeezing its perineal gland; therefore, collection of civet musk by squeezing civet's pouch in a natural and humane way may not impose a serious threat. A rewarding system should have to be developed to encourage those farmers improving their management practices. Besides what has been known so far, other use values of civet and civet musk should have to be explored further. Moreover, civet musk deposited at scent-mark can be used as additional or alternative source of income. However, the economic feasibility of this approach and the quality of civet musk produced from scent marks would be the subject of future studies.

This work recommends ways for improving the welfare of captive civets and proposes diversified use values of civet and civet musk. To improve the welfare of captive civet, extensive comparative studies should have to be conducted on behavioral ecology of wild and captive

civets. Traditional knowledge and wisdom should have to be extensively studied and validated and it has to be considered while developing appropriate interventions. Due to special demand attached to civet coffee, collection of civet coffee from wild civetries might be considered among alternative sources of civet-derived incomes.

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