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Photographic Documentation of Rare Enggano Palm Civet *Paradoxurus hermaphroditus enganus* (Carnivora: Viverridae)

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Abstract
Enggano Palm Civet *Paradoxurus hermaphroditus enganus* is a subspecies of Common Palm Civet *Paradoxurus hermaphroditus* that range limited in Enggano Island, Bengkulu Province, Southwest Sumatra. Since a specimen collection on 11 November 1904, the occurence *P. hermaphroditus enganus* has not ever been reported again. There are two recent observations of *P. hermaphroditus enganus* in 2011 and 2020. These observations are represent recent records of this rare endemic taxa after 107 years.

Keywords: nocturnal, Palm Civet, Paradoxurinae, *Paradoxurus hermaphroditus*, Sumatra.

Introduction

Early mammal research was done mainly by a select few individuals depositing specimens in museums and publishing in journals with limited readership, new tools and technologies have increased the number of individuals participating in data collection and increased availability of biodiversity data (Burgin *et al.* 2020). More than 4.400 species of mammals occur around the world, and Southeast Asia is particularly rich in mammals with over 500 species in the region (Francis 2013). A much greater number of mammal species are now facing extinction, many other less threatened species, may turn soon be endangered if recent rates of habitat destruction and human population growth continue unabated (Duff & Lawson 2004).

Order Carnivora or carnivores are most of mammal species eat meat, with a great deal of diversity among exists more than 11 families and over 270 species in this order (Feldhamer *et al.* 1999). Viverrids or Family Viverridae are small carnivores ranging from the 0-6 kg, sexual dimorphism is not very evident in many species, generally females and males appear to be similar in size (Jennings & Veron 2009). Many of them are arboreal, with rather unspecialized dentition and omnivoroues diet, including fruit and invertebrates as well as small vertebrates (Corbet & Hill 1992).

Sumatra is home for many species of mammals in Sundaland (Whitten *et al.* 2000; Iqbal *et al.* 2023; Setiawan *et al.* 2023). Enggano Island is one of two smaller islands that presumably never had

land connected with the mainland Sumatra (Iqbal *et al.* 2022; Iqbal *et al.* 2023A total of 15 species of mammals has been reported from Enggano Island, and few of them are endemic subspecies (Sody 1940; Maryanto *et al.* 2017). Enggano Palm Civet *Paradoxurus hermaphroditus enganus* Lyon, 1916 is a subspecies of veverrids that only found in Enggano (Miller 1906; Sody 1940; Wozencraft 2005). Due to the limited number of researchers visit Enggano Island, the information about *P. hermaphroditus enganus* is very little known. Here, we report our documentations of *P. hermaphroditus enganus* in Enggano Island.

Methods

Situated in Indian Ocean, Enggano is an isolated small island located approximately 100 km from major island of Sumatra (Iqbal *et al.* 2020a, b, c; Iqbal *et al.* 2021). Two field biodiversity surveys have been conducted in Enggano Island, Bengkulu Province, Sumatra (Fig. 1). First, a survey was carried out in 2011 in Kaana, southwest Enggano. Second, a visit was conducted in 2020 in Banjarsari, northern Enggano. During these surveys, we observed and documented *P. hermaphroditus enganus* (Fig. 2 and 3). As *P. hermaphroditus* is nocturnal mammal, all of our observations are found at night.

We compile our observations of *P. hermaphroditus enganus* with available information of historical records. There are only two historical records of *P. hermaphroditus enganus* (Miller 1906; Lyon 1916). All records of *P. hermaphroditus enganus* are presented in table 1, and distribution of the sites are displayed in figure 1.

Results and Discussion

Two arboreal nocturnal mammals are identify as *P. hermaphroditus enganus* because it has a long body and short dark legs, dark long tail; the upperpart greyish brown with three dark broken lines running down the back, irregular dark spots along the sides, sometimes forming lines as well; the underpart are lighter grey; the forehead is lighter grey to whitish, as are the cheeks and the fore-part of the muzzle; a broad mask-like band covers the face, including the base of the pointed muzzle and ears. These morpholological characters are fitted well with Palm Civet *Paradoxurus hermaphroditus* according to approriate references (Jennings & Veron 2009; Shepherd & Shepherd 2012; Francis 2013, 2016).

Lyon (1916) summarized description of one specimen collected from Enggano Island as follow: type-specimen number 141026, USNM (United States National Museum); skin and skull of adult female (maxillary teeth much worn); collected on Enggano Island, November 11, 1904, by Dr. W. L. Abbott with original number 3782; a small form of the widely ranging *P. hermaphroditus*, its size the same as that of *P. hermaphroditus parvus*, but distinguished by a less rounded brain case, somewhat smaller teeth, a longer (antero-posteriorly) upper canine, and probably by brown or lighter colored hind feet; aside from the feet the color of *P. hermaphroditus enganus* does not differ from that of *P. hermaphrodites parvus*; the single specimen is of the brownish type of coloration; the brown color of the hind feet may be the result of wear as the brown hairs covering them look worn; the entire tail is brownish, but is obviously worn; head and body length, 495 mm; tail length 410 mm; hindfoot length, 77 mm; condylobasal length, 97 mm; zygomatic width length, 53 mm; specimens examined: one, the type. The morphological character of two recent civets observed from Enggano Island are very similar with Common Civet *P. hermaphroditus* from mainland Sumatra (Fig. 2 and 3).

There are two observations of *P. hermaphroditus enganus* from Enggano Island after specimen collected on 11 November 1904. These observations represent recent discovery of *P. hermaphroditus enganus* after 107 years (from 11 November 1904 to 26 February 2011). The historical records of *P. hermaphroditus enganus* in Enggano Island is presented in Table 1.

Table 1. Available information records of *Paradoxurus hermaphroditus enganus* in Enggano Island. Number in bracket symbols are number in the map (figure 1). Note for abbreviation: MI = Muhammad Iqbal, AK = Adi Kuswanto and RRR = Rendra Regen Rais. Number on the table refer to the map (Figure 1).

Date	Location	Remarks	Sources
29 Feb 2020	Banjarsari [1]	One individual observed	MI and AK *Pers. Obs*
11 Nov 1904	Mainland Enggano, not specified [2]	Specimen Collection	Lyon 1916; GBIF 2024
Undated	Pulo Duo or Pulau Duo [3]	Specimen Collection	Miller 1906
26 Feb 2011	Kaana [4]	One individual observed	RRR *Pers. Obs*, iNaturalist 2024

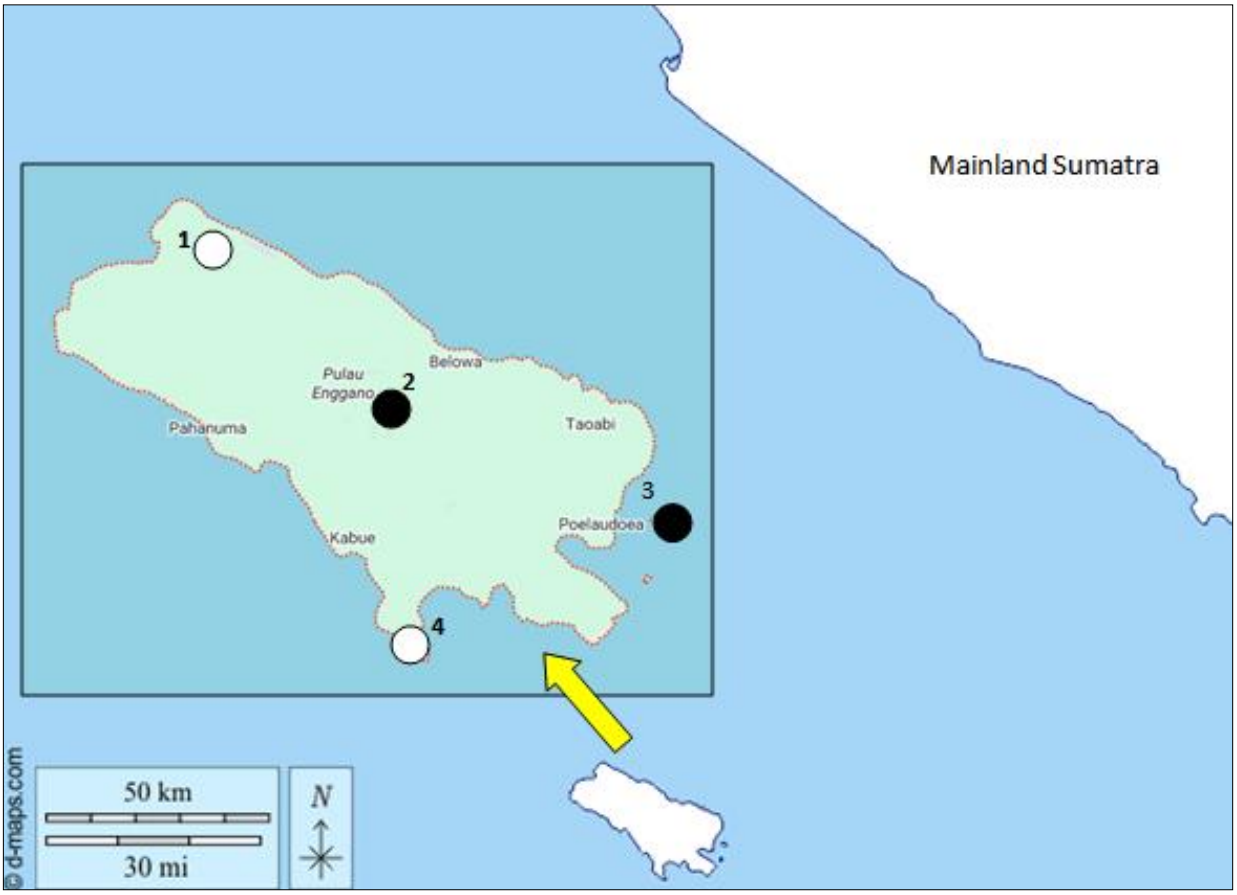

Figure 1. Map of Enggano Island and available information records of *Paradoxurus hermaphroditus enganus*. Numbers showing location presented in table 1. Solid circles are historical records and open circles are our observations in the field.

Figure 2. *Paradoxurus hermaphroditus enganus* documented on 26 February 2011 in Kaana, Enggano Island, Bengkulu Province, Sumatra (Photograph: Rendra Regen Rais).

Figure 3. *Paradoxurus hermaphroditus enganus* documented on 29 February 2020 in Banjarsari, Enggano Island, Bengkulu Province, Sumatra (Photograph: Muhammad Iqbal).

Figure 4. Typical habitat of *Paradoxurus hermaphroditus enganus* documented in Banjarsari, Enggano Island, Bengkulu Province, Sumatra (Photograph: Muhammad Iqbal).

There are two main reasons why information of *P. hermaphroditus enganus* are very little known. First, as an isolated island with the distance c. 100 km, the transportations from Enggano Island to mainland Sumatra is very limited. It caused only few researchers can visit the island. Second, *P. hermaphroditus enganus* is nocturnal mammals and possibly overlooked in the field. The research of nocturnal mammals in Sumatra relatively still in little number compare to diurnal mammals.

According to Duckworth *et al.* (2016), Common Palm Civet *Paradoxurus* hermaphroditus has been assessed for The IUCN Red List of Threatened Species as Least Concern because it has a broad range, good number populations, uses a wide type of habitats and is tolerant of extensive change habitat and degradation, warrants review when better data on the effects of this off-take become available. In Enggano Island, Miller (1916) reported that "Musangs" (local name for *P. hermaphroditus enganus*) were common, and their droppings could be seen everywhere in the paths, and there were a few on Pulo Dua (Pulau Dua, a sattelite island of Enggano Island). Our observations of *P. hermaphroditus enganus* found this taxa in remaining small forest near urban areas (Fig. 4). This could be indicate that this mammal is tolerant with habitat degradation.

Due to the its adaptability to modified habitats (including villages and towns) and resilience in the face of heavy general hunting means that at present no conservation interventions are needed for Common Palm Civet *P. hermaphroditus* (Duckworth *et al.* 2016). However, as reported by Nijman *et al*. (2014) that the pet trade in parts of its range (notably Indonesia) are unknown; surveillance of trade levels and investigation of effects on wild populations are warranted. Further surveys of *P. hermaphroditus enganus* in Enggano Island are required, especially for possible threats and population monitoring with presence only on small islands in fragmentary landscapes vulnerable to environmental changes due to global climate change suggests a higher local extinction risk than currently recognized.

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