

## PHENOTYPIC CHARACTERIZATION AND OCCURRENCE OF PANGOLIN SPECIES IN BUSH MEAT MARKET AT EMURE-ILE, ONDO STATE, NIGERIA.

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### Abstract

*Update on identification key for existing species is important in the face of constant over exploitation and habitat destruction which may force species to reduce/expand their range and may lead to overlap in habitat of species and consequently hybridization in distinct species or subspecies. Pangolin species occurring in Emure-ile, state, Nigeria were compared for species availability and frequency of occurrence at bush meat market. Popular bush meat market was visited in 2015 to document the species of pangolins traded as well as the occurrence of each species of pangolin. As obtained from the physical observation of the available species, two distinct species (*Phataginus tricuspis* and *Phataginus tetradactyla*) were recorded throughout the study period. These species were differentiated using the color of their scale and under part. Based on morphometric measurements, the two species are not distinguishable by body weight, and head length but differ significantly from each other using their body and tail length. *P. tetradactyla* has longer body length and tail (32.13cm and 26.8cm) respectively compared to *P. tricuspis* (24.91cm and 1975cm) at a significant level of  $P < 0.05$ . Occurrence is higher for *P. tricuspis* throughout the study period. In general, occurrence is low for both species at the study site. Scale, under part coloration, and tail length remain key identification factors in pangolin differentiation.*

**Key Words:** *Characterization, Pangolins, Conservation, Occurrence*

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### Introduction

Characterization in the context of physical features has to do with heritable characteristics that are visible to the eyes and on which differentiation of species, breeds or strains can be based (FAO, 2005). Morphometric analysis including shape analysis is important in various aspect of ecology such as its application to plasticity (Parsons *et al.*, 2011; Hollander *et al.*, 2006; and Gonzalez *et al.*,

2011), evolutionary changes in shape (Monteiro and Nogueira 2009; Drake and Klingenberg 2008; Berner *et al.*, 2008 and Swiderski and Zelditch, 2010) and in evolutionary developmental biology (Frederich *et al.*, 2008; and Zelditch *et al.*, 2003). Scaly anteaters are commonly referred to as Pangolins comprising of African and Asian mammal in the order Pholidota, whose body are covered with scales and positioned like armour

especially when curled up. They are characterized by a long and narrow snout giving their face an appearance of a carnivore, they lack teeth, but possess a long tongue used to capture their primary diet: ants and termites. They have short and powerful limbs and their tails are long (Kingdon, 2015). Pangolins are found in tropical and subtropical regions of Africa and Asia. They are found south of the Sahara in Africa and in southern and south-eastern Asia, including India, Thailand, Myanmar, southern China, the Malay Peninsula, Indonesia, the Philippines, and various other islands. Pangolins inhabit diverse habitats, including rainforest, deciduous forest, grassland, steppes, open country, thick bush, and shrubby slopes, as long as they contain ants and termites (Fahey, 1999). Pangolins include both terrestrial (ground-dwelling) and arboreal (tree-climbing) species. Some arboreal pangolins live in hollow trees, whereas the ground dwelling species dig tunnels underground, up to a depth of 3.5 meters (11 feet). Some species can dwell on both the ground and in trees, although they are classified as either terrestrial or arboreal. Most are good climbers and pangolins are also good swimmers (Atkins, 2004).

Pangolins are nocturnal animals, using their well-developed sense of smell to find insects. The long-tailed pangolin (*Manis tetradactyla*) is also active by day. Pangolins spend most of the daytime sleeping, curled up into a ball. There are currently eight extant species of pangolins located in Sub-Saharan Africa and in Southeast Asia (Gaudin *et al.*, 2009). Four species are endemic to the African continent: (giant ground pangolin, *Smutsia gigantea*; Temminck's ground pangolin, *S. temminckii*; black-bellied pangolin, *Phataginus tetradactyla*; and

white-bellied pangolin, *P. tricuspis*) and the remaining four species are found in the Indomalayan regions of Asia: (Indian pangolin, *Manis crassicaudata*; Philippine pangolin, *M. culionensis*; Sunda pangolin, *M. javanica*; and Chinese pangolin, *M. pentadactyla*). The eight species of pangolin are all considered to be at risk of extinction by the International Union for Conservation of Nature Red List (IUCN, 2015). The four Asian species are either endangered and critically endangered (Baillie *et al.* 2014; Lagrada *et al.*, 2014 and Challender *et al.*, 2014, 2015) while the four African species are considered vulnerable (Pietersen *et al.*, 2014b; Waterman *et al.*, 2014a, 2014b). On account of the continuous threat to survival of pangolin species, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) scaled up protection accruing to all species by moving them up from Appendix II to Appendix I at its 17th meeting of the Conference of the Parties, effectively banning on all forms of international trade and increasing local protection for pangolins in Asia (Dixon and Weiskotten, 2016). In the face of current over exploitation of pangolin species, there are possibilities of range and habitat shift, reduction or expansion of geographical range resulting from habitat destruction. Phenotypic characterization therefore becomes necessary in the update of pangolin populations to assist in putting up specific management measure targeted at individual species.

This study therefore was designed to provide recent confirmation on, or support the identity and presence of initially defined species of pangolins present and utilized as bush meats in Ondo state, and to determine hunter's accessibility to these species by recording pangolins occurrence

in the market. The knowledge of these can help understand demand for pangolins and to what extent they are being supplied, and subsequently inform specific conservation effort of individual species.

## Materials and Methods

### Study Area

Ondo state lies between latitudes 5° 45' and 7° 52'N and longitudes 4°20' and 6° 05'E. Its land area is about 15,500 square kilometers. Ondo State is bounded on the east by Edo and Delta states, on the west by Ogun and Osun States, on the north by Ekiti and Kogi States and to the south by the Bight of Benin and the Atlantic Ocean (UNAAB-IFSERAR, 2010). Agriculture (including fishing) constitutes the main occupation of the people of the state.

The State is composed of lowlands and rugged hills with granitic outcrops in several places. In general, the land rises from the coastal part of Ilaje/Ese-Odo (less than fifteen meters above sea level) in the south, to the rugged hills of the north-eastern portion in Akoko area. Some of the more prominent hills found at Idanre and Akoko rise above 250 meters above sea level. The climate of Ondo State is of the Lowland Tropical Rain Forest type, with distinct wet and dry seasons. In the south, the mean monthly temperature is 27°C, while mean relative humidity is over seventy five percent (75%). The mean annual total rainfall exceeds 2000 millimeters. However, in the north, there is marked dry season from November to March when little or no rain falls. The total annual rainfall in the north, therefore, drops considerably to about 1800 millimeters.

### Data Collection

The bush meat market at Emure-Ile in Ondo state where Pangolins are more

frequently displayed for sale was visited for this study for a period of 3 months in 2015. Species of pangolin encountered at this market were carefully assessed for distinguishing characteristics. Scales were observed for variation in color, the under part was also observed for color variation, and body measurement such as total body weight, body length, tail length and scale diameter were taken and considered in species identification following the identification keys for African pangolins described by Kingdon (1997; 2015). Pangolin species were counted on each visit to the market usually on the market days throughout the study period, and the number of each species was recorded for determining frequency of occurrence.

### Data Analysis

Descriptive analysis was used to represent some of the results obtained from the phenotypic characterisation of the species of pangolin encountered. Body measurements and frequency of occurrence were statistically compared between the two species using two samples T-test in R-studio version 0.99b, on R version 3.3.1 (2016).

## Results

Table 1 presents the data recorded from the phenotypic characteristics of the Pangolin species that were identified at Emure-Ile bushmeat market, Ondo State. The data were collected for three (3) months of the research works which was carried out from (March, 2015 – May, 2015). Two different Pangolin species were identified at the bushmeat market during the total period of the research work, the White belied Pangolin (*Manis tricuspis*) and Black bellied Pangolin (*Manis tetradactyla*).

Table 1: Distinguishing features of *Phataginus* species at the study site.

Body part	<i>Phataginus tricuspis</i>	<i>Phataginus tetradactyla</i>
Scale	the scale is generally light, with light-yellow coloration	the scale is generally dark, with brown/black coloration
Under part	lighter, light-yellowish	Darker, brown/black



Plate 1: *Phataginus* species at the study site showing variation in scale color.

Body measurements of *Phataginus* spp. taken at the study site for the purpose of identification and comparison between the two species presented in figures 1 and 2 show that *P. tetradactylais* bigger in

weight though not significantly. For other body measurements, *P. tricuspis* is significantly higher in Body length and tail length, but not in head length

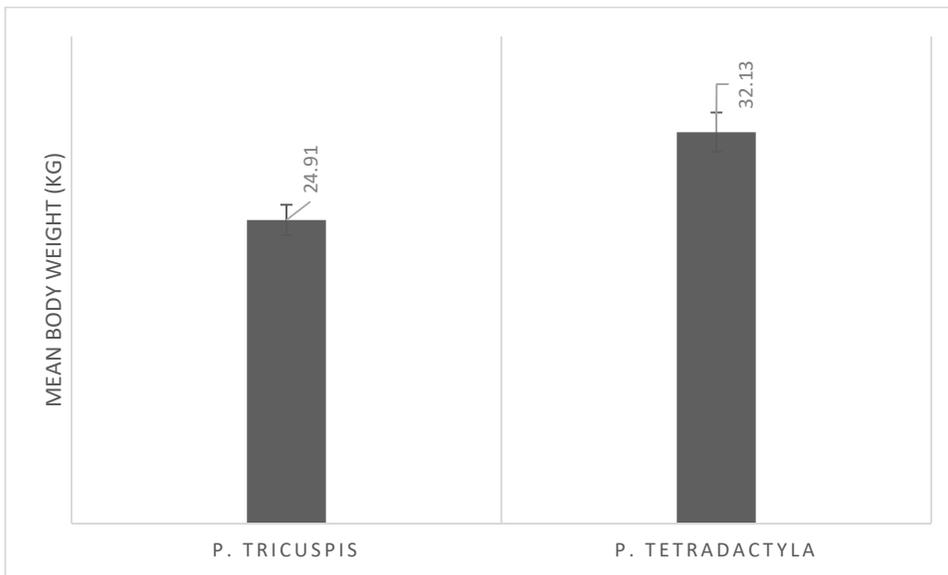


Fig. 1: Average body weight of *Phataginus spp* at Emure-ile study site. The two species are not significantly different (T-test = -1.25, p (0.22)).

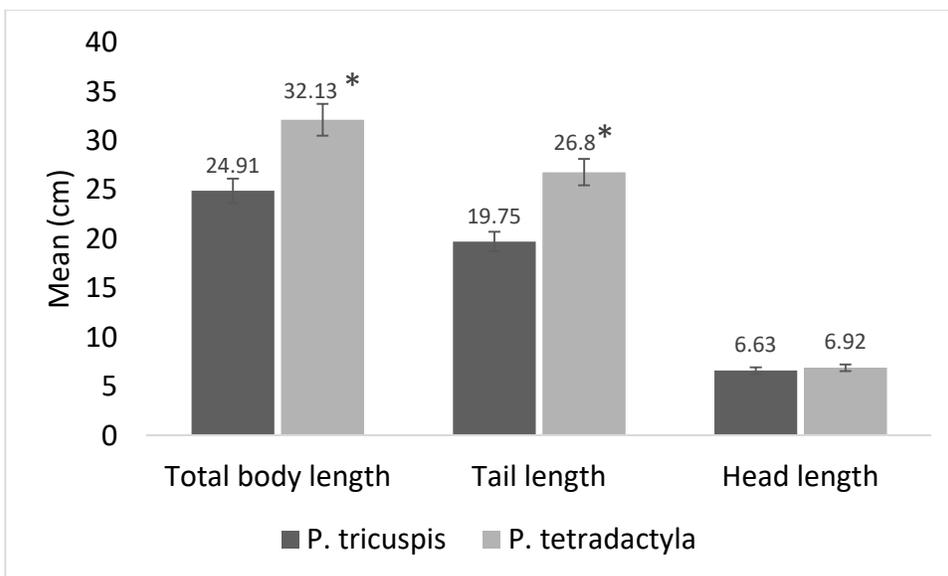


Fig. 2: Body measurements of *Phataginus spp*s at Emure-ile study site. *P. tricuspis* had significantly higher body length (T-test = -4.69, P (0.0001)) and tail (T-test = -0.4, p (8.514E-05)).

As presented in figure 2, only two different Pangolin species were identified at the market (*Phataginus tricuspis* and *Phataginus tetradactyla*). *Phataginus tricuspis* are observed to occur more frequently in each month all through the

study which is statistically significant from *P. tetradactyla* (figure 3). A total of twenty-four Pangolin species (sixteen *P. tricuspis* and eight *P. tetradactyla*) were identified throughout the period of the research.

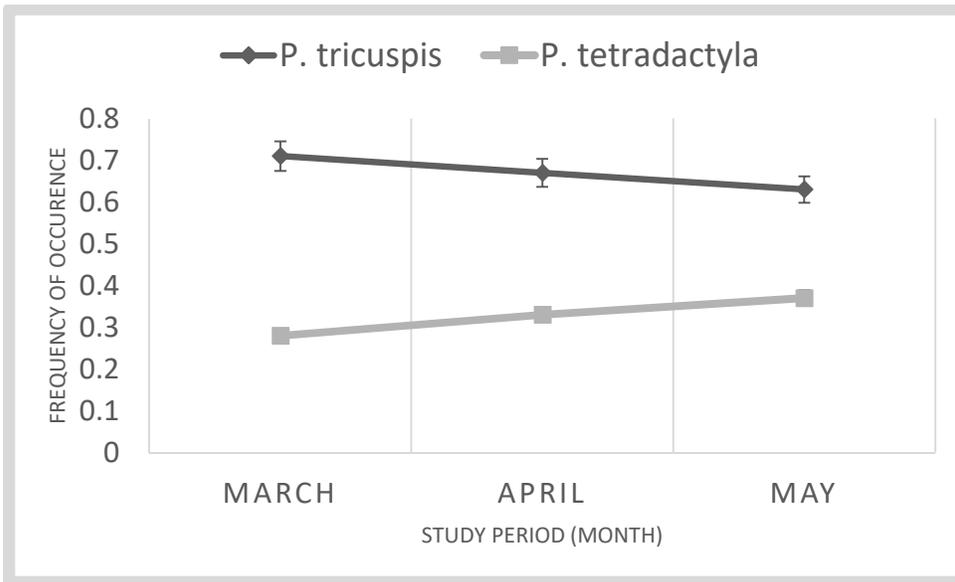


Fig. 3: frequency of occurrence of *Phataginus spp.* during the study period at Emure-ile, Ondo state. *Phataginus tricuspis* had higher frequency of occurrence at a significant level of  $p < 0.05$  (T-test = 9.8,  $p$  (0.00005)).

**Discussion**

Two species of Pangolins: *Phataginus tricuspis* also known as: tree pangolin; white-bellied pangolin and *Phataginus tetradactyla* also known as long-tailed and black-bellied pangolin were the only Pangolin species encountered at Emure-ile in Ondo State following the physical description of several authors for pangolin species and their occurrence in moist lowland forest regions (Kingdon, 2015; Gaubert, 2011). This further supports previous distribution of pangolin species in Africa with total exclusion of giant pangolin and Temminck’s pangolin from Nigeria, and the forest habitat preference of the *Phataginus spp.* The general appearance of *P. tricuspis* available at this site showed that their body is covered with scale that is dark-yellowish in color, and their under part is light-yellow and hence their name: white-bellied pangolin. Their scale shape is not different from what has been previously noted with three small projecting points and hence their name

“tricuspis” (APWG, 2015). Inversely, *P. tetradactyla* has a general appearance ranging from dark brown to black, their under part is also of this coloration. Both species present here are not distinguishable based on live body weight and head length. Their weight falls within the same range of 2.0 to 5.3kg with the average being 3.14kg and 3.66kg. This is in agreement with the observation of authors (Nowak, 1991; Angelici *et al.*, 2001; Hutchins *et al.*, 2003; Kingdon, 2015) that *Phataginus spp.* have weight range of 2.0kg to 14kg.

The body and tail length are another characteristics which can be used to distinguish *P. tricuspis* from *P. tetradactyla* apart from the conspicuous scale shape and color, and under part color. The body length of *P. tricuspis* at this site ranged from 19.0 cm to 32 cm, while that of *P. tetradactyla* ranged from 27 cm to 36 cm. Both *P. tricuspis* and *tetradactyla* have mean body length of 24.91 cm and 32.13 cm respectively. *P.*

*tetradactyla* have higher tail length with an average of 26.8 cm compared to *P. tricuspis* (19.75 cm). However, body length and tail appear to be one of those phenotypic characteristics unaffected by resource availability and hunting pressure and this is possibly a good distinguishing characteristic. Tree pangolins (*P. tricuspis*) occur more frequently than *P. tetradactyla* in spite of range overlap. These two species share the same habitat and almost every other ecological considerations such as having the same diet, reproductive behavior, mating etc. (Akpona *et al.*, 2008; Kingdon, 2015. APWG, (2015) reported that *P. tricuspis* are the most frequently encountered in Nigeria. It is regarded the most common of the three pangolin species found in Nigeria (Angelici *et al.*, 1999; Soewu and Ayodele 2009). *Phataginus spp*s are reportedly well suited to habitats other than intact primary forest, they appear to do well in farm lands, secondary forest and disturbed areas (Sodeinde and Adedipe, 1994; Angelici *et al.*, 1999). Suitability of habitat is a factor in animal development and survival as Kingdon and Hoffman (2013) likewise reported that this species is the most common of the three pangolin species found in Nigeria often with high densities in suitable habitat. The more frequent occurrence of *P. tricuspis* in the bush meat market is not associated with any preferential utilization of the species as traders often do not distinguish between these two species when it comes to utilization as meat or for traditional medicine. Therefore, successful adaptation of *P. tricuspis* to its habitat both intact and disturbed habitats could be the explanation for its abundance and consequently its frequent sighting in the bush market. The more frequent sighting of *P. tricuspis* could also be as a

result of habitat preference, *P. tetradactyla* prefer swamp forest (Kingdon, 1997; Angelici *et al.*, 2001), and this is the habitat type present in some part of Cross-river, Akwa-ibom and River states in Nigeria. With the present rate of exploitation, hunting pressure and habitat destruction, it is expected that pangolin species alongside other species will be affected by indiscriminate hunting as observed in different sizes (small and big) of individuals at this site.

Generally, encounter rate of these two species are low over the period of months this study was undertaken. There is no doubt that demand for these species continue to be high due to the belief of the locals in the potency of these species in curing various kinds of ailments as observed in previous studies (Akpona *et al.*, 2008; Soewu and Ayodele, 2009; Soewu and Adekanola, 2011). Apart from these species serving as source of food and protein source, traders in them make a good living for themselves as these species are sold to not just the local customers, but also to international black market (Boakye *et al.*, 2015; Challender *et al.*, 2015).

## Conclusion

The two species of *Phataginus* (*P. tricuspis* and *P. tetradactyla*) earlier known to occur in forest region of Nigeria still remain in the western Nigeria where the study was carried out further supporting the preference of this species for forest habitat. The scale and under part coloration is an important distinguishing feature together with body and tail length. *Phataginus tricuspis* occurred more frequently in bush meat market over the study period even though traders seemed not to take into consideration the different species and no utilization preference is

given to any of these species. Generally, overall occurrence is low for both species of *Phataginus* at the study site.

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