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Author(s)	Charles-Albert Petre; Marie-Claude Huynen; Roseline Beudels-Jamar
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<NOTE>

First Assessment of Chimpanzee (*Pan troglodytes troglodytes*) density and bedding behaviour in the Pongara National Park, Gabon

Charles-Albert Petre[1], *Marie-Claude Huynen*[1], *Roseline Beudels-Jamar*[2]

1.Faculty of Sciences , University of Liège, Belgium
2. Dpt. Conservation Biology, Royal Belgian Institute of Natural Sciences, Belgium

INTRODUCTION

The population size of *Pan troglodytes* in Equatorial Africa is estimated at 105,000 chimpanzees[1]. In 1984, Tutin and Fernandez[2] obtained an estimation of 64,000± 13,000 chimpanzees for the Gabonese population, while in 2000 Walsh *et al.*[3] observed a decline of 56% based on this previous national census. Unfortunately, those estimations are based on few studies and may not reveal the real population status.

The chimpanzee population (*Pan troglodytes troglodytes*) of the Pongara National Park was first documented in 2006[4]. This Park was created in 2002 especially to protect the egg-laying sites of the leatherback turtles (*Dermochelys coriacea*), but contains also a wide variety of mammal species, including chimpanzees. Gorillas seem to be absent, which was confirmed by the villagers inhabiting the park.

METHODS

Study area

Pongara National Park (PNP) in Gabon is at only 15 km from Libreville, on the other bank of the Komo Estuary (Fig. 1). This park of 929 km² is formed by the Atlantic coastal forest of the Pongara peninsula to the west, and by the swamp flooded forest along the south bank of the Komo River. Small savannahs are dispersed into the terra firma forest. The climate is characterized by a dry season from June to September and a rainy season from October to May, with a drier period in January and February. The mean annual rainfall is 3,000 mm and the mean temperature is 26°C. The topography is relatively flat with the highest point culminating at about 40 m above sea level[5].

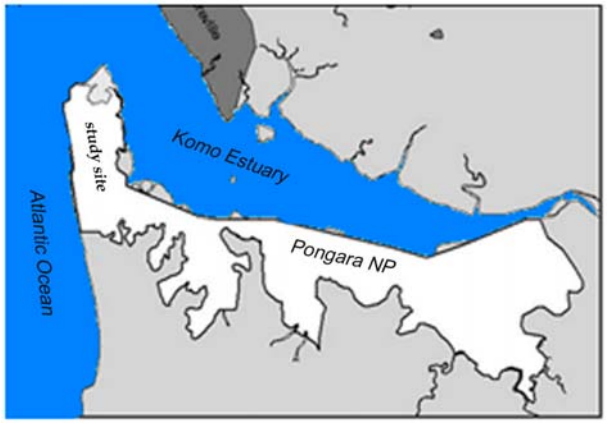

Fig. 1 Pongara National Park map.

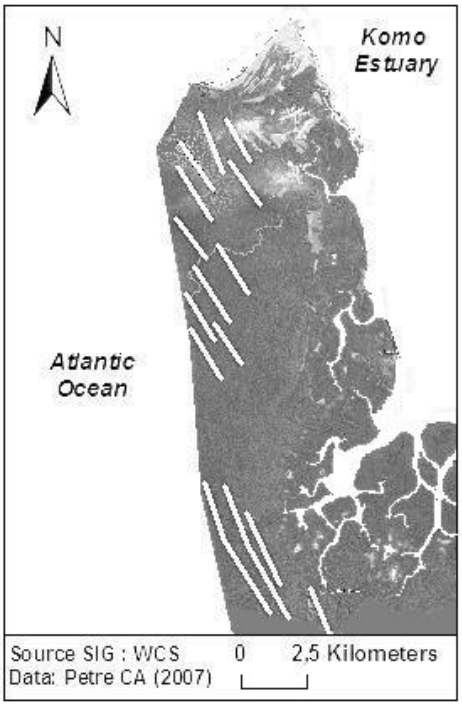

Fig. 2 Sampling design of the terra firma forest.

Transects

Data were collected from January to April 2007. To assess the chimpanzee density, we opted for the Standing Crop Bed (=Nest) Count Method as the best compromise between the time and means available and the precision required for this study[6,7,8]. A total of 41.16 km in 17 line transects (mean length: 2.4 km; [1.8-3.3]) distant of at least 500 m from each other, were covered in the terra firma of the Pongara peninsula (Fig. 2). They were walked once following fix compass bearing adjusted on S-W 150°. All ape and human signs encountered along transects, as well as vegetation changes were noted and mapped using a

Garmin GPSmap 60 Cx. We considered arbitrarily as a group of beds all the beds of the same age in a circle of 30 m diameter. For each group of beds, we noted the GPS coordinates, the number of beds, their perpendicular distance from the transect, their age, height, diameter, their type of construction, the tree species in which they were built, and the habitat type and characteristics of the site.

Chimpanzee bed

We used four ages classification based on the bed decomposition state [2]:

- "Fresh": the vegetation is green, sometimes with moist dung present and gorilla/chimpanzee odour,
- "Recent": the vegetation is drier but the leaves remain in majority green,
- "Old": the vegetation is dead but the bed shape remains distinguishable,
- "Very old": no more leaves on stems and the bed is deformed and incomplete.

We distinguished two types of bed construction:

- "Tree bed": the bed is constructed in tree, exclusively with woody materials,
- "Liana bed": the bed is constructed in lianas, exclusively with woody materials.

Density assessment

The line transect census was carried out using the method described by Tutin and Fernandez[2]. Assuming that every weaned chimpanzee build a new bed every night, the density of weaned individuals is:

$$D = n \times \text{mean bed group size} \;/\; (2wL \times \text{mean bed life span})$$

Where n = total number of bed group; w = effective strip width; L = total transect length.

The DISTANCE sampling program (5.0 version) uses the perpendicular distances of the first bed seen of the bed groups from the transect line to determine a detection function and the effective strip width (w). The « Half-Normal » model adjusted by the « Cosines » function was used to fit bed group data. In order to obtain a better fitting of the detection function to the bed group, 5% of the data corresponding to the highest perpendicular distances were taken out[9]. We also reduced the density calculated by 20% to take into account the day bedding activity of the chimpanzee[10,11].

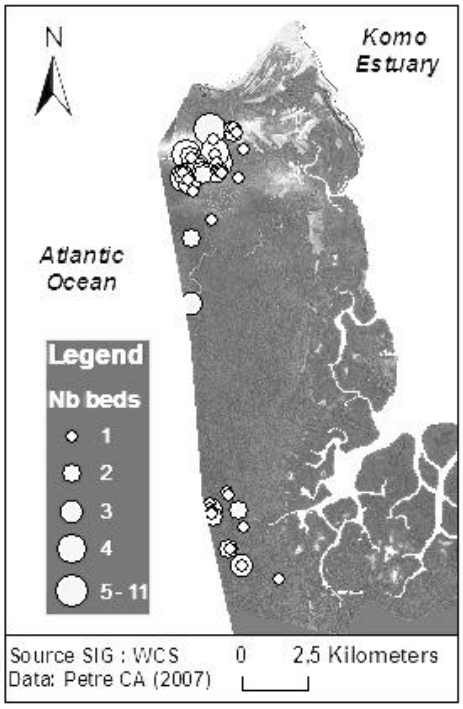

Fig. 3 Repartition of the chimpanzees bedding sites in the study area.

RESULTS

Chimpanzee density and bed distribution

Along the transects, we encountered 51 bed groups, for a total of 101 beds (Fig. 3). After the 5% data truncation, DISTANCE sampling program has calculated a

Table 1 Details of the density assessment by Distance Sampling Program.

Object	n	ESW	MGS	r	CV(r)	IC 95% (r)	D	CV(D)	IC 95% (D)
Site	48	13.49	-	1.17	0.31	0.61-2.22	48.137	0.385	19.873-90.179
Nid	98	-	-	2.38	-	-	95.310	0.398	42.632-201.548
Ind.	-	-	2.04	-	-	-	0.839	0.398	0.386-1.823

n = number of object , ESW = Effective Strip Width, MGS = mean group size; r = encounter rate (object/km), CV = coefficient of variation, IC = confidence interval, D = density (object/km²).

density of 0.839 weaned chimpanzees/km², which becomes 0.671 weaned chimpanzees/km² after the reduction of 20% (Table1).

The clumped distribution of the bed groups shows at least two groups of chimpanzees, each bedding in a different habitat type. The northern chimpanzee's group of the peninsula, which is the largest, beds in what we can described as an old secondary forest, while the southern group beds in a dense undisturbed forest. Right down the old secondary forest is a stand of open forest with *Podococcus* where no bed was found.

Bedding behaviour

During the sampling of the terra firma forest ten additional beds were found while walking between transects and were included to determine the bedding behaviour. Among the 111 beds encountered, 4 were built in lianas and 107 in trees, all found at a mean height of 13.4 m [4-34 m]. Their mean diameter was of 50.3± 17.1 cm [20-130 cm], all the bed ages confounded, and 68.9±11.7 cm (n=9, [55-130 cm]) when only fresh and recent beds are taking into account. Their physical characteristics confirmed that all the beds were built by chimpanzees, except a 130 cm wide bed which could meet the gorilla bed criteria.

Table 2 List of trees used for bed construction and comparison between their frequency of utilization for bedding and their abundance in the Park.

Species	N	Utilization for bedding (%)	Abundance (%)
Anisophyllea purpurascens	6	6.5	3.5
Anthonota macrophylla	2	2.2	7.1
Antidesma vogelianum	1	1.1	1.7
Cola nitida	14	15.2	2.7
Coula edulis	21	22.8	3.1
Dacryodes cfr klaineana	1	1.1	3.9
Diospyros iturensis	1	1.1	2.3
Gambeya boukoukouensis	3	3.3	1.4
Irvingia gabonensis	15	16.3	3.3
Maesobotrya klaineana	1	1.1	3.7
Maranthes gabunensis	7	7.3	0.4
Maranthes glabra	3	3.3	1.6
Maranthes sp.	2	2.2	0.2
Oncoba glauca	1	1.1	0.8
Pentaclethra macrophylla	3	3.3	1.7
Phyllocosmus calothyrsus	1	1.1	2.3
Plagiostyles africana	2	2.2	0.4
Rhabdophyllum arnoldianum	1	1.1	0.0
Scottellia sp.	3	3.3	2.7
Scyphocephalium mannii	2	2.2	1.4
Staudtia gabonensis	2	2.2	1.9

For the 107 arboreal beds, 92 tree identifications could be done, counting for 21 species. The utilization frequency for bedding varies between the tree species and is not related to the abundance of those trees in the park ($0.1<P<0.2$, R=0.293, N=21, Rho of Spearman) suggesting that tree species is specifically selected by chimpanzees for bedding (Table 2).

Human activity

We found a guild of human indices in the area sampled (Table 3). Most of them can be attributed to poaching and show a dichotomized clumped repartition at the surrounding of the arm of the Komo River and of the road crossing the forest from the North-East to the middle-West (Fig. 4).

Table 3 Human indices met in the Park.

Human indices	N
Traps	21
Fireshots	4
Cases of cartridge	5
Camp of Poachers	1
Machete cuts	22
Carcass of elephant	1
Chain saw noises	4
Firecamp	1

DISCUSSION

The chimpanzee population of the Pongara National Park lives in density comparable with other Gabonese and Central African parks more isolated from towns (Table 4). We have to note, however, that certain factors may bias the density calculated. Chimpanzees are known to re-use beds[8] which reduces the density calculated, and the bed life span used was calculated in a forest with different environmental conditions than in the Atlantic coastal forest. The higher humidity level and rainfall of the Atlantic coastal forest make the organic matter disappear faster, then the mean bed life span might be smaller and the density calculated higher.

The stand of open forest with *Podococcus* does not seem to be favourable for bedding, which could be related in part to the physical characteristics of this type of forest. The trees are very tall with their first branches standing high, the undergrowth is very open and the tree diversity could be not appropriate for chimpanzees that seem to select trees for bed construction. This selection was documented in other studies[12,13] and is believed to be based on tree's physical factors as the foliage density[13] and the tree architecture. In our case, another factor seems to act in this tree selection: 11 of the 21 bedding tree species identified are known to be part of the chimpanzee diet, e.g., *Coula edulis*, *Irvingia gabonensis* and *Cola nitida*. If we admit that these items are really eaten by chimpanzees of the Pongara NP, the proportion of beds observed in trees identified in other sites as "food trees" rises to 71.9%, which is statistically more than the proportion expected by chance (χ^2=9.391, df=1, P<0.05). The tree selection could be then related as well to feeding. The predominant factors that influence the bedding-site selection in the dense evergreen forest of Pongara could be the vegetation type and the edible food availability as described in the Kalinzu Forest Reserve[14].

Despite the postulate stating that ape populations decline with the proximity from big towns such as Libreville[2,3] and despite the encounter rate of poaching signs, the density we found shows that this chimpanzee population has well resisted the human pressure (as well as stochastic events since this peninsular population of chimpanzee is quite geographically isolated). This emphasizes the urgent need to develop a management plan for the Park, including a specific chimpanzee protection

Table 4 Density of weaned chimpanzees in ***terra firma* forest** in different sites of Central Africa.

Site	r (bed/km)	D (ind./km²)
CAR		
Ngotto[15]	1.55	0.44 (NA)
CAMEROON		
Dja Reserve[17]	2.10	0.79 (0.60-1.04)[a]
Campo Forest[18]	NA	(0.63-0.78)[b]
Ma'an Forest[18]	NA	(0.8-1.0)[b]
CONGO		
Odzala NP[19]	13.26	2.2 (1.5-3.0)[b]
Lac Télé Community Reserve[16]	0.65	0.1 (0.0-0.1)[b]
GABON		
Lopé NP[20]	NA	NA (0.32-0.70)[b]
Petit Loango[21]	NA	0.78 (0.65-0.94)[b]
Pongara NP (this study)	2.38	0.67 (NA)
Gabonese territory[2]	2.05	0.49 (0-1.78)[b]

Values for Gabonese territory include all types of habitats.
NA: not available.
a: 95% confidence interval.
b: mean density (minimum and maximum mean density for different habitats).

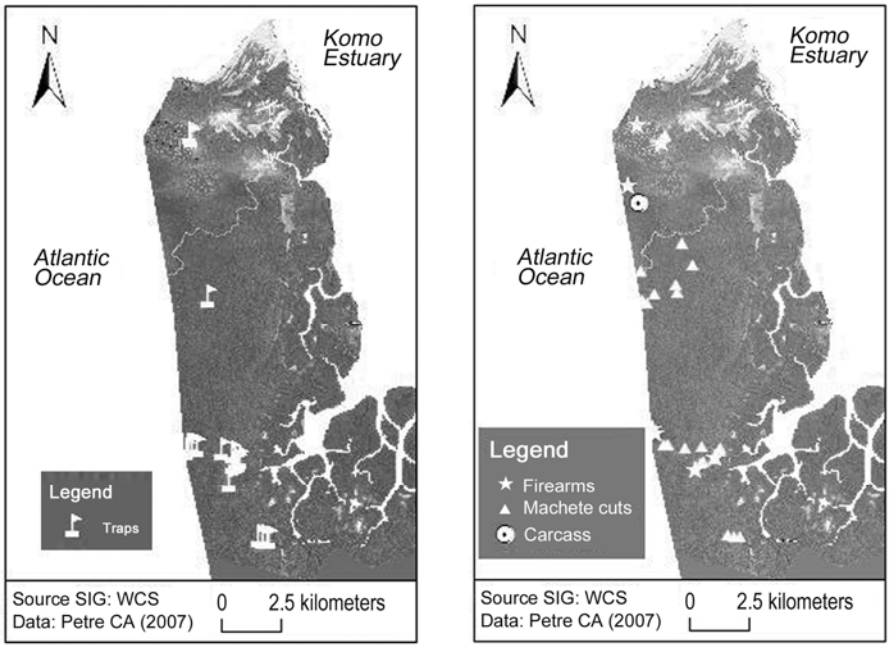

Fig. 4 Repartition of the Human indices in the study area.

program and a law enforcement plan that would aim at penalising illegal activities in the Park. We propose that this preliminary study serve as the basis for a chimpanzee monitoring program in Pongara NP and to extend the sampling area to the swamp forest which could shelter other groups of chimpanzees or even gorillas [15,16,17].

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