

**NOTE ON THE SEASONAL USE OF LOWLAND AND HIGHLAND HABITATS BY THE WEST AFRICAN CHIMPANZEE *PAN TROGLODYTES VERUS* (SCHWARZ, 1934) (PRIMATES: HOMINIDAE): IMPLICATIONS FOR ITS CONSERVATION**

Papa Ibnou Ndiaye<sup>1</sup>, Gérard Galat<sup>2</sup>, Anh Galat-Luong<sup>3</sup> & Georges Nizinski<sup>4</sup>

<sup>1</sup>UCAD, Université Cheikh Anta Diop, Département de Biologie animale, B.P 5005, Dakar-Fann, Senegal

<sup>2,3</sup>UCAD - IRD, Université Cheikh Anta Diop - Institut de Recherche pour le Développement, Département Ressources vivantes, and IUCN Species Survival Commission, Route des Pères Maristes, Dakar, Senegal

<sup>4</sup>IRD, Institut de Recherche pour le Développement, UMR 211 Bioemco, 5 rue du Carbone, 45072 Orléans cedex 2, France

<sup>1</sup>ibnou.ndiaye@ucad.edu.sn (corresponding author), <sup>2</sup>gerard.galat@ird.fr,

<sup>3</sup>anh.luong@ird.fr, <sup>4</sup>georges.nizinski@ird.fr

In recent years wild Chimpanzee populations have declined by more than 66% (Butynski 2001). This decrease is of particular concern for the Western Chimpanzee, including the West African subspecies *Pan troglodytes verus* Schwarz, 1934. The IUCN 2011 Red Data Book lists *P. t. verus* as Endangered (A4cd; Humle et al. 2008). It has already disappeared in the wild from Togo, Benin and The Gambia (Campbell & Radley 2006) and is very rare or close to extinction in Burkina Faso, Ghana, Guinea-Bissau and Senegal (Kormos et al. 2003). The survival of the West African Chimpanzee is, therefore, a very high conservation priority. Galat et al. (2000) carried out a large-scale survey (more than 100 villages surveyed) of its distribution area in Senegal, but according to Carter

et al. (2003) a systematic survey of the total area of Senegal inhabited by Chimpanzees has yet to be conducted, which partially explains the difficulties encountered in their conservation. At the time the present study was undertaken, between March 1998 and March 1999, it was generally acknowledged that Chimpanzees were only to be found in Niokolo Koba National Park (PNNK) (Larivière & Dupuy 1978). Available scientific information thus dealt with the PNNK Chimpanzee population, for instance in the studies conducted at Mount Assirik by McGrew et al. (1981), Baldwin et al. (1981, 1982), Tutin et al. (1981); McGrew (1983), Tutin et al. (1983), Bermejo et al. (1989), Galat et al. (1994) and Galat-Luong (1995). During our study we discovered a relatively abundant Chimpanzee population outside of the protected area, living within the transitional area between PNNK in Senegal and Badiar Park in Guinea and the southern part of the national hunting reserve, namely Zone of Cynegetic Interest (Ndiaye 1999; Galat et al. 2000; Galat-Luong et al. 1999–2000; Pruetz 2002; Pruetz et al. 2001, 2002). The most recent data on the population of Chimpanzees living outside the protected area stem from studies focused on diet (Pruetz & Kuntzen 2003; Pruetz 2006; Bogart & Pruetz 2011; Pruetz & Lindshield 2012), use of tools (McGrew et al. 2005; Pruetz & Bertolani 2007; Bogart & Pruetz 2008), behavior in relation to the high temperatures of the savannah habitat (Pruetz 2007), drinking water



ISSN  
Online 0974-7907  
Print 0974-7893

**OPEN ACCESS**

**DOI:** <http://dx.doi.org/10.11609/JoTT.o3229.3697-700> | **ZooBank:** urn:lsid:zoobank.org:pub:2CBC03FE-07F5-4E33-A7F7-5B52B8E1872E

**Editor:** Jill Pruetz, Iowa State University, Ames, USA

**Date of publication:** 26 February 2013 (online & print)

**Manuscript details:** Ms # o3229 | Received 31 May 2012 | Final received 20 October 2012 | Finally accepted 10 February 2013

**Citation:** Ndiaye, P.I., G. Galat, A. Galat-Luong & G. Nizinski (2013). Note on the seasonal use of lowland and highland habitats by the West African Chimpanzee *Pan troglodytes verus* (Schwarz, 1934) (Primates: Hominidae): Implications for its conservation. *Journal of Threatened Taxa* 5(2): 3697–3700; doi:10.11609/JoTT.o3229.3697-700.

**Copyright:** © Ndiaye et al. 2013. Creative Commons Attribution 3.0 Unported License. JoTT allows unrestricted use of this article in any medium, reproduction and distribution by providing adequate credit to the authors and the source of publication.

**Funding:** The study was carried out and financially supported by the IRD (Institut de Recherche pour le Développement - the French Institute of Research for Development), IPMO Research Program (Impact des Perturbations Naturelles et anthropiques sur les populations de Mammifères et d'Oiseaux - Impact of Natural and Human Perturbations on Mammals and Birds populations) and the University Cheikh Anta Diop de Dakar (Sénégal).



**Competing Interest:** None.

**Acknowledgements:** The authors thank IRD for logistical facilities, the Senegalese authorities for kind permission to work in the field, local people for their warm welcome and help, and Yeremakhan Keita for help as IRD field assistant. Authors wish to thank also the anonymous reviewers and the Online Access to Research in the Environment (OARE) for facilitating literature.

filtering (Galat-Luong & Galat 2000; Galat-Luong et al. 2009), nesting behavior (Stewart et al. 2007; Pruetz et al. 2008), intestinal parasites (Howells et al. 2011) and seed reingestion (Bertolani & Pruetz 2011). For the present study we assessed the influence of the season and topography on the distribution of *Pan troglodytes* versus Chimpanzees within their habitat outside of the PNNK, which is not previously reported.

**Material and Methods:** Study area: Our study was conducted in the southeastern region of Senegal, in the Kedougou region (12°33'N & 12°11'W) (Fig. 1), outside the protected areas. A Sudano-Guinean type of climate prevails, as defined by Aubreville (1949), sometimes making way for forests with clear understory. Annual rainfall within the 1995–1998 period ranged from 1000mm to 1600 mm, with a mean annual temperature of around 28.6°C ( $t_{\max} = 35.2^{\circ}\text{C}$ ,  $t_{\min} = 21.9^{\circ}\text{C}$ ) (Galat et al. 2009). The dry season is from November to April and the rainy season from June to October. During the rainy season, the gallery forests are flooded. The month of May is a transition point between the dry and the rainy season. Certain forest or gallery forest areas located along the course of Gambia River or at the head of the rivers have typical Guinean species such as *Pterocarpus erinaceus*, *Anogeissus leiocarpus*, *Parkia biglobosa*, and *Syzygium guineense*, among others. These could well be relics from a time when there was greater forest cover, which in turn was reduced by the contemporary climatic drying trend (Mühlenberg et al. 1990). The gallery forest recession may also be attributed to the high number of bushfires lit during the dry season for clearing by farmers and livestock breeders and for

visibility by hunters (hardly any visibility when the grassy vegetation, often over 2m tall, is intact). Throughout the dry season, practically all of the species, except for forest gallery cells that still retain their greenery, lose their leaves (vegetative dormancy). Most of them do not regrow their leaves until right before the first rains.

Method: A basic assumption is that a Chimpanzee builds a nest every evening before spending the night in it (Fruth & Hoffmann 1996). Such nests are generally not reused. The nest density within a site is thus useful for indirect measurement of the population density (Fleury-Brugiere & Brugiere 2010). The nest density, together with other criteria such as their age, can also give other indications on the presence or absence of these Chimpanzees.

In a previous study (Galat-Luong et al. 1999–2000), in a 15,000km survey carried out in a vehicle, we first identified Chimpanzee nesting sites in southeastern Senegal. Then in the present study over 80 days between March 1998 and March 1999 we covered Chimpanzee nesting sites on foot for 380km outside of protected areas and sampled data on the season (dry or rainy), location (highlands with 200–300 m of altitude or valleys with less than 30m of altitude) and age (old or recent, e.g., less than two weeks old, with green leaves that indicate their freshness; Papa Ibnou Ndiaye pers. obs.). Data were analyzed statistically by applying chi squared test.

**Results:** From March 1998 to March 1999 we recorded a total of 1,397 nests, 436 of which were recent. The distribution of recent nests in the valleys and highlands according to the season is given in Table

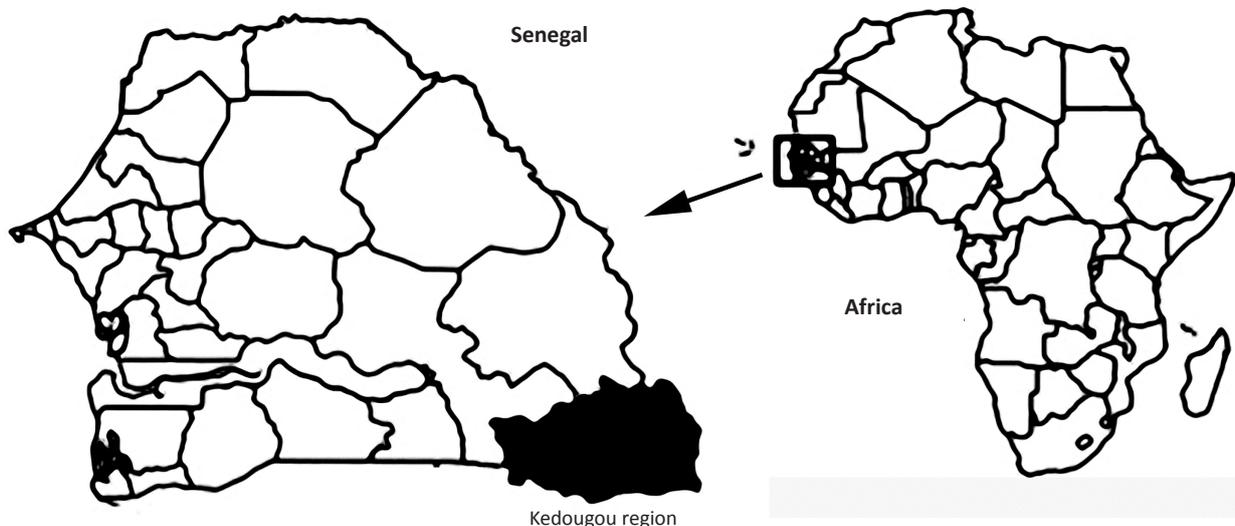


Figure 1. Study area

**Table 1. Distribution of recent nests (with green leaves less than two weeks old) in the highlands and on the valleys according to the season.**

Distribution of recent nests	Wet season	Dry season	Total
Highlands	105	2	107
Valleys	129	200	329
<b>Total</b>	<b>234</b>	<b>202</b>	<b>436</b>

1. The statistical analysis of these findings indicated a significant difference between seasons in the type of habitat used (Chi-square=112.730, df=1, two-tailed  $P < 0.0001$ ).

**Discussion:** The analysis of the results in Table 1 show that the frequency of recent nests was higher in the valleys during the dry season, while in the highlands this frequency was much significantly higher during the rainy season. The proportions of recent nests observed in the valleys and the highlands throughout the different seasons of the year showed that, during the dry season, Chimpanzees were more frequently nesting in the gallery forests, likely due to the availability of drinking water, food and the vegetation density, which created a humid microclimate (Papa Ibnou Ndiaye 1999 unpub. obs.). Conversely, flooding of valleys during the rainy season and the diminution of the availability of suitable nesting trees may have prompted the Chimpanzees to move to higher grounds (hills and gallery forests on plateau edges). According to Balcomb et al. (2000), the density of fruit trees and food sources is a determining factor in the distribution of Chimpanzees living in the wild. In Kibale National Park in Uganda, these authors observed an abundance of Chimpanzee nests in areas in which there were concentrations of trees whose fruits constituted a major component of these primates' diet. For Schoeninger et al. (1999), Savanna Chimpanzees are highly dependent on food from trees, and they feed both in the gallery forest closest to the river and in the dry forest beyond. According to Stanford & O'Malley (2008), 93% of the Chimpanzee nests recorded (N=3414) in Bwindi National Park (Uganda) were in fruit trees, which is also in line with the observations of Basabose & Yamagiwa (2002) in Kahuzi-Biega National Park (Congo) and of Brownlow et al. (2001) in Budongo forest (Uganda). Hernandez-Aguilar (2006, 2009) note that availability of foods and water are determining factors for the distribution of the Chimpanzees in Issa, Ugalla. Our study showed that the elevation and liability to flooding can also have an impact on seasonal Chimpanzee distributions.

**Conclusion:** The results of our study showed that

*Pan troglodytes verus* Chimpanzees migrate within their habitat. These migrations seem to be determined by the seasons. The habitats where they nested were gallery forests in valleys in the dry season and highlands (hills and plateau edge galleries) in the rainy season. It is therefore essential to preserve these habitats in order to ensure the survival of these Chimpanzees in Senegal - this must be a biodiversity conservation priority. When creating or managing a protected area (e.g. a "Community Heritage Area" by local people) for the purpose of preserving Chimpanzees on the basis of their presence in a gallery forest or on a hillside, it would thus be necessary to preserve both habitats, i.e., lowland forest galleries and the surrounding highlands, along with a migration area to allow them transit between these two habitats. The present results will provide conservation managers with information on how to protect the species and help them to make appropriate management decisions.

## REFERENCES

- Aubreville, A. (1949). *Climats, forêts et désertification de l'Afrique Tropicale*. Société d'Éditions Géographiques, Maritimes et Coloniales, Paris, 99pp.
- Balcomb, S.R., C.A. Chapman & R.W. Wrangham (2000). Relationship between Chimpanzee (*Pan troglodytes*) Density and Large, Fleshy-Fruit Tree Density: Conservation Implications. *American Journal of Primatology* 51: 197–203.
- Baldensperger, J. (1965). *Etude pédologique d'un bassin versant de la région de Kédougou (Sénégal Oriental)*. ORSTOM. Dakar, 68pp.
- Baldwin, P.J., J. Sabater-Pi, W.C. McGrew & C.E.G. Tutin (1981). Comparisons of nests made by different populations of Chimpanzees (*Pan troglodytes*). *Primates* 22: 474–486.
- Baldwin, P.J., W.C. McGrew & C.E.G. Tutin (1982). Wide ranging Chimpanzees at Mt. Assirik, Senegal. *International Journal of Primatology* 3: 367–385.
- Basabose, A.K. & J. Yamagiwa (2002). Factor affecting nesting site choice in Chimpanzees at Tshibati, Kahuzi-Biega National Park: Influence of sympatric Gorillas. *International Journal of Primatology* 23(2): 263–282.
- Bermejo, M., G. Illera & J. Sabater-Pi (1989). New observations on the tool-behavior of Chimpanzees from Mt Assirik (Senegal, West Africa). *Primates* 30(1): 65–73.
- Bertolani, P. & J.D. Pruetz (2011). Seed reingestion in Savannah Chimpanzees (*Pan troglodytes verus*) at Fongoli, Senegal. *International Journal of Primatology* 32: 1123–1132.
- Bogart S.L. & J.D. Pruetz (2008). Ecological context of Savannah Chimpanzees (*Pan troglodytes verus*) termite fishing at Fongoli, Senegal. *American Journal of Primatology* 70: 605–612.
- Bogart S.L. & J.D. Pruetz (2011). Insectivory of Savannah Chimpanzees (*Pan troglodytes verus*) at Fongoli, Senegal. *American Journal of Physical Anthropology*, 145: 11–20.
- Brownlow, A.R., A.J. Plumptre, V. Reynolds & R. Ward (2001). Sources of variation in the nesting behavior of Chimpanzees (*Pan troglodytes schweinfurthii*) in the Budongo forest, Uganda. *American Journal of Primatology* 55: 49–55.
- Butynski, T.M. (2001). Africa's Great Apes, pp. 3–56. In: Beck, B., T.S. Stoinski, M. Hutchins, T.L. Maple, B. Norton, A. Rowan, E.F. Stevens & A. Arluke (eds). *Great Apes and Humans: The Ethics of Coexistence*. Smithsonian Institution Press, Washington, D.C., USA.
- Campbell, G. & P.M. Radley (2006). Primate and bird diversity

- in the Fazaou-Malfakassa National Park, Togo. Technical report. Conservation International, Washington, D.C.
- Carter, J., S. Ndiaye, J. Pruettz & W.C. McGrew (2003).** Senegal, pp. 5–12. In: Kormos, R., C. Boesch, M.I. Bakarr & T.M. Butynski (eds). *Status Survey and Conservation Action Plan: West African Chimpanzees*. IUCN, Gland, Switzerland and Cambridge, UK.
- Fleury-Brugiere, M.-C. & D. Brugiere (2010).** High Population Density of *Pan troglodytes verus* in the Haut Niger National Park, Republic of Guinea: Implication for local and regional conservation. *International Journal of Primatology* 31: 383–392.
- Fruth, B. & G. Hohmann (1996).** Nest building behavior in the great apes : the great leap forward? pp. 225–240. In: McGrew, W.C., L.F. Marchant, T. Nishida (eds.). *Great Ape Societies*. Cambridge University Press, Cambridge.
- Galat, G., A. Galat-Luong, M. Benoit, H. Chevillotte, A. Diop, J.M. Duplantier & G. Pichon (1994).** Primate density in the Niokolo Koba National Park, Senegal. *Folia Primatologica* 62: 197.
- Galat, G., A. Galat-Luong, P.I. Ndiaye & Y. Keita (2000).** Geographical distribution of Chimpanzees and baboons in Senegal. *Folia Primatologica* 71: 249–267.
- Galat, G., A. Galat-Luong & G. Nizinski (2009).** L'impact du changement climatique sur les variations des populations de grands vertébrés à leur extrême limite de répartition est-il fonction de leurs régimes alimentaires? *Geographia Technica* Numéro spécial 205–210pp.
- Galat-Luong (1995).** Du statut et de l'avenir des primates au Sénégal. *African Primates* 1(1): 12–13.
- Galat-Luong A. & G. Galat (2000).** Chimpanzees and baboons drink filtered water. *Folia Primatologica* 71: 258.
- Galat-Luong, A., G. Galat, I. Ndiaye & Y. Keita (2000).** Fragmentation de la distribution et statut actuel du Chimpanzé, *Pan troglodytes verus*, en limite d'aire de répartition au Sénégal. *African Primates* 4(1&2): 71–72.
- Galat-Luong A., G. Galat & G. Nizinski (2009).** Une conséquence du réchauffement climatique: les chimpanzés filtrent leur eau de boisson. *Geographia Technica* Numéro spécial, 199–204pp.
- Hernandez-Aguilar, R.A. (2006).** Ecology and nesting patterns of Chimpanzees (*Pan troglodytes*) in Issa, Ugalla, Western Tanzania. PhD Thesis. University of Southern California, Los Angeles.
- Hernandez-Aguilar, R.A. (2009).** Chimpanzee nest distribution and site reuse in a dry habitat: implications for early hominin ranging. *Journal of Human Evolution* 57: 350–364.
- Howells, M.E., J. Pruettz & T.R. Gillespie (2011).** Patterns of gastrointestinal parasites and commensals as an index of population and ecosystem health: the case of sympatric Western Chimpanzees (*Pan troglodytes verus*) and Guinea Baboons (*Papio hamadryas papio*) at Fongoli, Senegal. *American Journal of Primatology* 73: 173–179.
- Humle, T., C. Boesch, C. Duvall, C.M. Ellis, K.H. Farmer, I. Herbinger, A. Blom & J.F. Oates (2008).** *Pan troglodytes* ssp. *verus*. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. Downloaded on 21 February 2013.
- Kormos, R., C. Boesch, M.I. Bakarr & T.M. Butynski (2003).** *West African Chimpanzees: Status Survey and Conservation Action Plan*. Gland, Switzerland, IUCN/SSC Primate Specialist Group, 219pp.
- Larivière, J. & A.R. Dupuy (1978).** *Sénégal, Ses parcs, Ses animaux*. Fernand Nathan, 144pp.
- McGrew, W.C. (1983).** Animal food in the diets of wild Chimpanzees: Why cross-cultural variation? *Journal of Ethology* 1: 46–61.
- McGrew, W.C., P.J. Baldwin & C.E.G. Tutin (1981).** Chimpanzees in a hot, dry and open habitat: Mt. Assirik, Senegal, West Africa. *Journal of Human Evolution* 10: 227–244.
- McGrew, W.C., J.D. Pruettz & S.J. Fulton (2005).** Chimpanzees use tools to harvest social insects at Fongoli, Senegal. *Folia Primatologica* 76: 222–226.
- Mühlenberg, M., A. Galat-Luong, P. Poilecot, B. Steinhauer-Burkart & I. Kühn (1990).** L'importance des îlots forestiers de savane humide pour la conservation de la faune de forêt dense. *La Terre et la Vie* 45: 40–57.
- Ndiaye, P.I. (1999).** Biogéographie et Éléments d'écologie du Chimpanzé (*Pan troglodytes verus*) au Sénégal. *Mémoire de DEA de Biologie Animale*, Université Cheikh Anta Diop de Dakar.
- Pruettz, J.D. (2002).** Competition between humans and Savanna Chimpanzees in southeastern Senegal. *American Journal of Physical Anthropology, Supplement* 34: 128.
- Pruettz, J.D. (2006).** Feeding ecology of Savanna Chimpanzees (*Pan troglodytes verus*) in Fongoli, Senegal, pp. 161–182. In: Boesch, C., G. Hohmann & M. Robbins (eds). *The Feeding Ecology of Great Apes and other Primates*. Cambridge University Press, Cambridge.
- Pruettz, J.D. (2007).** Evidence of cave use by Savanna Chimpanzees (*Pan troglodytes verus*) at Fongoli, Senegal: Implication for behavioral thermoregulation. *Primates* 48(4): 316–319.
- Pruettz, J.D. & P. Bertolani (2007).** Savanna Chimpanzees, *Pan troglodytes verus*, Hunt with tools. *Current Biology* 17: 412–417.
- Pruettz, J.D., S.J. Fulton, L.F. Marchant, W.C. McGrew, M. Schiel & M. Waller (2008).** Arboreal nesting as anti-predator adaptation by Savanna Chimpanzees (*Pan troglodytes verus*) in southeastern Senegal. *American Journal of Primatology* 70(4): 393–401.
- Pruettz, J.D. & P. Knutsen (2003).** Scrambling for a common resource: Chimpanzees, humans, and *Saba senegalensis*, in southeastern Senegal. *American Journal of Physical Anthropology (supplement)* 120–172.
- Pruettz, J.D. & S. Lindshield (2012).** Plant-food and tool transfer among Savanna Chimpanzees at Fongoli, Senegal. *Primates* 53: 133–145.
- Pruettz, J.D., L.F. Marchant, J. Arno & W.C. McGrew (2002).** Survey of Savanna Chimpanzee (*Pan troglodytes verus*) in southeastern Sénégal. *American Journal of Primatology* 58: 35–43. doi: 10.1002/ajp.10035
- Pruettz, J.D., W.C. McGrew, L.F. Marchant & J. Arno (2001).** Status of the Savanna Chimpanzees (*Pan troglodytes verus*) at Mont Assirik in Parc National du Niokolo Koba and in adjacent areas in southeastern Sénégal [abstract]. *American Journal of Physical Anthropology* 32: 121.
- Schoeninger, M.J., J. Moore & J.M. Sept (1999).** Subsistence Strategies of two Savanna Chimpanzees populations: the stable isotope evidence. *American Journal of Primatology* 49: 297–314.
- Stanford, C.B. & R.C. O'Malley (2008).** Sleeping tree choice by Bwindi Chimpanzees. *American Journal of Primatology* 70: 642–649.
- Stewart, F.A., J.D. Pruettz & M.H. Hansell (2007).** Do Chimpanzees build comfortable nests? *American Journal of Primatology* 69: 930–939.
- Tutin, C.E.G., W.C. McGrew & P.J. Baldwin (1981).** Responses of wild Chimpanzees to potential predators, pp. 136–141. In: Chiarelli, A.B. & R.S. Corruccini (eds.). *Primate behavior and sociobiology*. Springer, Heidelberg, Germany.
- Tutin, C.E.G., W.C. McGrew & P.J. Baldwin (1983).** Social organization of Savanna-dwelling Chimpanzees, *Pan troglodytes verus*, at Mt. Assirik, Senegal. *Primates* 24(2): 154–173.

