Brief Communication:

Spatial Distribution of Wild Bonobo (*Pan paniscus*)
Beds in Sleeping Sites at Iyondji, DR Congo

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INTRODUCTION

Weaned great apes, such as bonobos (*Pan paniscus*), build beds (i.e., nests) for sleeping at night and sometimes use them for resting during the day. Ape beds can provide valuable information about the distribution, population density, and seasonal changes of community size (Mohneke & Fruth 2008), because they are immobile and remain visible after construction (Tutin & Fernandez 1984; Plumptre & Reynolds 1996; Furuichi et al. 2001; Mulavwa et al. 2010; Maloueki et al. 2013). The density of bed groups has been used to estimate population density when it is assumed that a bed group is the product of a single party of bonobos sleeping together for a night (Petre et al. 2007). Most studies use a cut-off distance of 15–30 m from the nearest bed to define a bed group (Baldwin et al. 1981; Furuichi et al. 2001; Mulavwa et al. 2010; Maloueki et al. 2013). The density of bed groups has been used to estimate population density when it is assumed that a bed group is the product of a single party of bonobos sleeping together for a night (Petre et al. 2007). Most studies use a cut-off distance of 15–30 m from the nearest bed to define a bed group (Baldwin et al. 1981; Furuichi et al. 2001; Mulavwa et al. 2010; Maloueki et al. 2013). The density of bed groups has been used to estimate population density when it is assumed that a bed group is the product of a single party of bonobos sleeping together for a night (Petre et al. 2007). Most studies use a cut-off distance of 15–30 m from the nearest bed to define a bed group (Baldwin et al. 1981; Furuichi et al. 2001; Mulavwa et al. 2010; Maloueki et al. 2013).

METHODS

I conducted fieldwork in the Iyondji Community Bonobo Reserve (ICBR) in Tshuapa Province, DR Congo, during three periods: i) April – June 2014, ii) September – November 2014, and iii) March – April 2015. The ICBR covers an area of 1,100 km² and the research camp (00°08'20"N, 22°04'37"E) is located within the range of the main study group. The bonobos of this community (Bembongo, Be) are semi-habituated and have been followed since July 2010, when intensive effort to habituate bonobos was undertaken by Sakamaki et al. (2012, 2016). The study area includes two main types of vegetation: primary or old secondary forest (where in some areas the undergrowth of Marantaceae was open) and swamp forests (where the undergrowth was free of Marantaceae and visibility extended for more than 25 m).

In this study, local research assistants typically confirmed sleeping sites in the evening and returned to the site the next morning to follow the bonobos. For the data documented here, the field assistants and I went to the sleeping site confirmed by the bonobo trackers the previous evening and carried out a thorough search of the beds in the vicinity. We tracked bonobos from morning to evening, or bed to bed, when it was possible.

For this study, I defined a “bed group” (BG) to be a cluster of beds of the same age class built in the same evening and found within 30 m and 50 m distances respectively from the other beds within a single sleeping site. I defined a sleeping site as the entire area occupied by all beds built in a single night. I considered only fresh beds confirmed to be made the previous night and each tree bearing the bed was marked during the visit. Thus, in this study we used two definitions of BGs: 1) where the maximum distance between nearest beds within a bed group was 30 m (Mulavwa et al. 2010) and 2)
where this distance between sites was 50 m. I not only intensively searched beds within 30 m and 50 m, respectively, from a first bed detected, I also searched beyond 30 m and 50 m, respectively (when possible) in a radius of 250 m around each BG within each sleeping site of similarly aged beds. Then, I measured the distance between beds and confirmed the outer border of each BG at the sleeping site, according to the two definitions given here. When there were two or more BGs at a sleeping site, I recorded the gap between the different types of BGs. I repeatedly searched for beds in this way as far as possible up to 250 m until no additional beds were found.

RESULTS & DISCUSSION

I obtained data from 78 sleeping sites (36, 27 and 15 in the first, second, and third periods, respectively), and 145 and 102 BGs according to the 30 m and 50 m definitions, respectively. One sleeping site was found in the swamp forest and the other 77 were found in the primary/old secondary forest. There were no differences in the number of beds at a sleeping site between open area with Marantaceae undergrowth and dense area from primary/old secondary forest (Mann-Whitney test, $N_{dense\ forest}=50$, $N_{Marantaceae\ area}=28$, $U=755$, $P>0.05$), suggesting that vegetation type did not affect the rate that beds were found in this study. When I found two or more bed groups according to the 30 m and 50 m definitions, I calculated bed group mean size at the sleeping site (Figure 1). The number of beds in a bed group according to the 30 m definition is slightly lower than that of a bed group according to the 50 m definition (see Table 1 for more details: Kruskal–Wallis test, $H=15.9$, $df=2$, $P<0.001$). Many night beds were sometimes clumped in one place within a relatively small range of 30 to 55 m from other beds at the sleeping site (Figure 2). Although I have not identified all individual bonobos in the Be community, the maximum number of 40 beds found in one day appears to be larger than the number of independent individuals in the community, as determined by my direct observations during daily tracking. Bonobos from a neighboring community may have made beds at the same site on the same day; bonobos from different communities occasionally range together at feeding sites during peaks of food availability (Sakamaki et al. 2018). Moreover, some of the beds may have been built for day use and not used during the night.

Two or more bed groups according to the 30 m definition were found in 46% of all sleeping sites, and

![Figure 1](image1.png)

**Figure 1.** The number of beds in a bed group according to the 30 m definition, those according to the 50 m definition, and the total number at a sleeping site. The bottom and top of the box show the lower and upper quartile and the band in the box the median. The end of the whiskers and/or circles show data minimum and maximum. There were significant differences in the number of beds between in a bed group according to the 30 m definition and those according to the 50 m definition and between in a bed group according to the 30 m definition and those according to the 50 m definition at a sleeping site (Kruskal–Wallis test, $P<0.001$).

**Table 1. Information on bed groups and beds in sleeping sites sampled (N = 78).**

<table>
<thead>
<tr>
<th></th>
<th>Number of Bed Groups</th>
<th>Number of Beds in a Bed Group*</th>
<th>No. Beds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 m definition</td>
<td>50 m definition</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>1.79</td>
<td>1.26</td>
<td>30 m</td>
</tr>
<tr>
<td>SD</td>
<td>1.09</td>
<td>0.52</td>
<td>50 m</td>
</tr>
<tr>
<td>Max</td>
<td>5</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Min</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>145</td>
<td>102</td>
<td></td>
</tr>
</tbody>
</table>

*Kruskal–Wallis test, $H=15.9$, $df=2$, $P<0.001$ was significant highly in comparison according to the 30 m and 50 m definitions; SD: Standard deviation.
those according to the 50 m definition were found in 23% of all sites (Table 2). The ratio of detected beds out of all beds at a sleeping site was 72% ± 31% (mean ± SD) in the 30 m definition and 88% ± 23% in the 50 m definition.

The median of the gaps recorded was 40.1 m and the largest gap was 429.4 m. Most gaps were within 60 m, whereas gaps of more than 100 m were also observed at four sleeping sites. Bonobos sometimes made beds even beyond 60 m from the nearest bed, but this was rare. The distance of 100-200 m is an audible range of bonobo loud calls. Hohmann & Fruth (1994) measured the long-distance high hoots (the bonobo distance call) as being audible for at least 700 m in the forest between bonobo communities.

Although it is difficult to estimate the number of bonobos on the basis of their vocalizations, observations during this study suggest that most bonobos tend to gather within 30-60 m distance of each other at a sleeping site. It was also evident that a few individuals occasionally slept apart from the others within earshot. Indeed, they sometimes sleep at night in a relatively short distance from each other. The minimum number of beds at sleeping sites was four. In one case, an adult male ranged alone, apart from other community members, for more than four months (Sakamaki 2013). Thus, bonobos may range alone for many days, but they typically gather within relative a relatively short distance at sleeping sites (Mulavwa et al. 2010) and separate parties typically range within earshot.

The nature of bonobos' cohesive gathering is an old-yet-new question. This cohesion could be due to the many socioecological factors such as food production, intersexual rank of group members, or group size (Stanford 1998; Hemelrijk 2002; Furuichi 2009). Studies comparing different study sites, assessing risks of predators, effect of estrous females, seasonal changes of foods, social-bonding mechanisms, and intercommunity relationships will be important to further explain their cohesive gathering. For the evaluation of a cluster of night beds on the same day, I recommend extending the search for beds within a distance of 60 m from each bed of a bed group.

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