

# Group structure and physical characteristics of Simakobu monkeys (*Simias concolor*) on the Mentawai island of Siberut, Indonesia

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## Abstract

We present data on group structure and physical characteristics from free ranging *Simias concolor*. Mean group size (n=3) was  $8.7 \pm 1.1$  individuals with an average adult male-female sex ratio of 1:3. All individuals were sexed and allocated into three categories (infants, juveniles & subadults and adults) on the basis of their physical development. Within age category head-body lengths ranged from 19.6-25cm, 34-44cm and 42-53cm. Corresponding body weights ranged from 0.5-0.9kg, 2.35-4.4kg and 5.2-7.85kg, respectively; on average adult males were 13% larger and 23% heavier than adult females. Results indicate that for *Simias concolor* living in undisturbed habitat i) group sizes are larger than previously reported ii) polygyny is the most likely mating system. Both results support an earlier proposal that group size and social organization in Simakobu monkey are related to degree of habitat disturbance.

## Introduction

Having been separated from the mainland Sunda for more than 500 000 years, the four main islands comprising the Mentawai archipelago (Siberut, Sipora, N and S Pagai) (Verstappen, 1975, 1980) possess an unusual degree of biological diversity and species endemism. Of 16 mammal species found nowhere else, five are primates, all of which are officially listed as threatened [vulnerable, endangered or critically endangered (Eudey et al. 2000)]. One of these, the Pig-tailed langur (*Simias concolor*), locally known as Simakobu, has been listed as one of the world's 25 most endangered primates (Mittermeier et al. 2007). Like most other areas in Sundaland, loss of suitable forest habitat, through commercial logging and other non-sustainable land use practices, is the main factor threatening populations of all the Mentawai primates, including Simakobu.

Despite the urgent need for scientifically based conservation measures for this species, basic information on the biology of the Pig-tailed langur is very limited. Even data on group size and composition, as reported in studies conducted in the 1970's and '80 (Tilson, 1977; Watanabe, 1981; Kawamura & Megantara, 1986) are contradictory and there is still no consensus on adult sex ratio and mating system of this species. For example, the monogamous mating system proposed for *S. concolor* by Tilson (1977) does not accord with the significant morphological differences between the sexes reported from field observations by Tenaza and Fuentes (1995). Furthermore, the only data on physical characteristics of the species derive from studies on relatively few specimens kept in museum collections (Napier, 1985) and direct measurements of animals living in the wild have never been recorded. Concerning pelage, *Simias* is asexually dichromatic (Chasen & Kloss, 1927), with the majority of animals having a greyish-black fur colour and less than one-third of individuals being creamy-buff with brown (Tilson, 1977).

Despite widespread habitat destruction throughout most of the Mentawai Islands, Northern Siberut still possesses areas of relatively undisturbed rainforest cover and recent census data for the Peleonan forest (Waltert et al, 2008) indicate that *S. concolor* occurs in densities of up to 53.1 individuals/km<sup>2</sup>, considerably higher than estimates reported for other locations. Although hunting pressure in N Siberut is thought to be relatively low, and local inhabitants have traditionally shown considerable respect for their natural habitat and its resources, primates are still killed as an occasional source of animal protein. As part of our field research and conservation programme in Northern Siberut (SCP; [www.siberut-island.org](http://www.siberut-island.org)), which relies heavily on the support of and close interaction with local inhabitants, the opportunity arose for one of our team to passively attend a rare ceremonial hunt of *S. concolor*. In the course of this, three groups were hunted down and the majority of individuals were killed. Here we present data on size and composition of these groups as well as physical characteristics of most of the individuals killed by the local hunters.

## Materials & Methods

The data presented here were collected in the Loh Bajou bay region of NE Siberut (0°55'46.41"S and 98°53'17.98"E), which forms part of a largely undisturbed forested area stretching between the village of Politcioman, next to the Sigep river in the West, and the village of Loh Bajou in the East (Fig.2). The habitat can be described as an undisturbed peat swamp forest, dominated by the tree species *Terminalia phellocarpa*, *Elaeocarpus* sp and *Alstonia angustiloba* Miq. All local traffic between the villages is restricted to boats going along the NE-cost or a 12 km track along the beach.

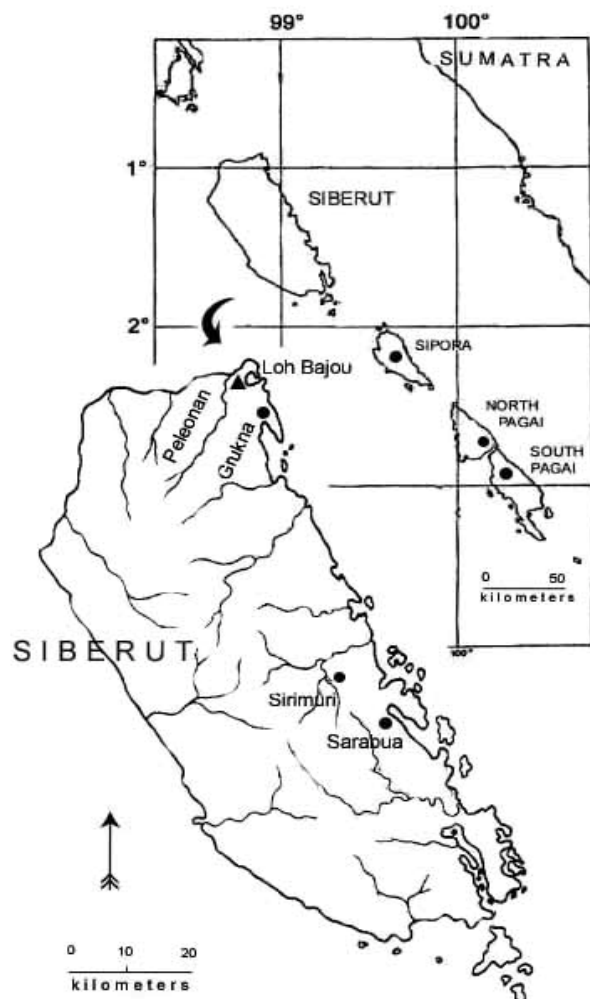
The ceremonial hunt took place in the 3<sup>rd</sup> week of December 2006, during which three Simakobu groups were encountered. For two of these groups, comprising eight and ten individuals respectively, all but one member were killed. Data on sex, age class and measurements of body weight

and crown rump length were collected within an hour by the first author. A third group was followed and its size determined but culling was called off after the sighting of an individual with white (creamy buff) fur, the hunting of which is prohibited by a religious taboo. Data on sex, age class and reproductive status were collected, but were incomplete (see Table 1), whereas here, physical measurements of culled individuals were not possible at all.

After sexing of individuals in the first two groups (18 in total), animals were allocated to three age categories: infant, juvenile & sub adult and adult, according to their physical development (body size, reproductive status, parity, dental development). Additionally, measures of the head-body length (using hand-held tape measure) and body weight (using a portable digital balance) of these individuals were taken and the species specific relationship between these parameters was analysed using linear regression. Differences in physical characteristics between adult males and adult females were analysed using the Student t Test. The results were compared to data obtained from the only other comparable study by Tenaza and Fuentes (1995), which is based on measurements of museum specimens.

## Results

Sizes and composition of the three groups are shown in Table 1. Individual group sizes were 8, 10 (without foetus) and 8 (mean group size was  $8.7 \pm 1.1$  individuals). The adult male: female sex ratio was on average 0.3 and similar in all groups (either 3 or 4 females per adult male). In each group only one adult male was present (Table 1 and 3). Of the nine adult females killed, three were pregnant and four were accompanied by infants less than one month old. Within the three age categories infant, juvenile & sub-adult and adult (sexes combined), head-body lengths ranged from 19.6-25cm, 34-44cm and 42-53cm respectively. Corresponding body weight ranges were 0.5-0.9kg, 2.35-4.4kg and 5.2-7.85kg (Tab. 1 and Fig. 2). Head-body lengths and body weights showed significant differences between adult males and adult females. As shown in Table 2, adult males were 13% ( $p < 0,05$ ) larger and 23% ( $p < 0,05$ ) heavier than adult females. Our data for wild animals compare well with those for museum specimens as published by Tenaza and Fuentes (1995). Based on measurements of 3 infants less than two weeks of age, we propose a neonatal body weight of 450-500g and a head body length of about 20cm (Table 1). According to our physical measurements the relationship between head body



**Fig. 1.** Map of Mentawai islands/Siberut, depicting the site of the present study at Loh Bajou (triangle) on Siberut and the sites of previous studies by Tenaza and Fuentes [1995] in North + South Pagai; Kawamura and Megantara [1986] on Sipora; Watanabe [1981] in Sarabua and Grukna Tilson [1977] at Sirimuri (circles on Siberut island).

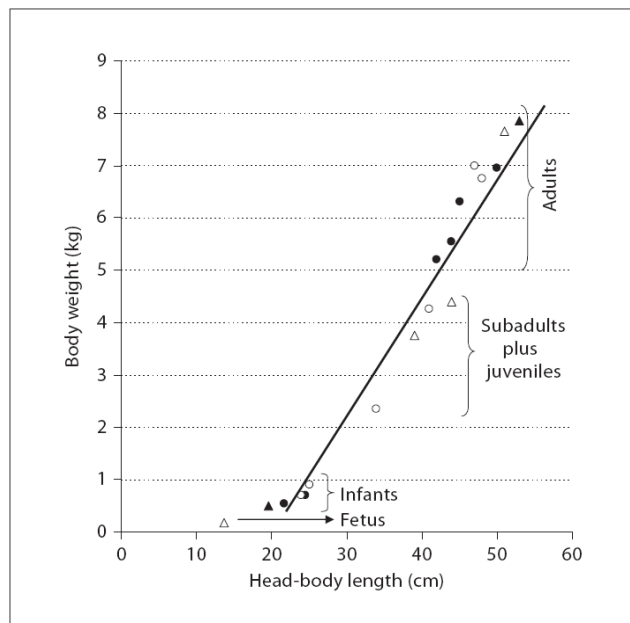
length and body weight for this species (Fig. 1; sexes combined, n=17) follows the equation  $Y = 0,24X - 4.91$ .

**Table 1.** Group composition and individual measurements of head-body length and body weight in *S. concolor*

Group	Sex (age category)	Length (cm)	Weight (kg)	Remarks
I	1 Male (adult)	53	7.85	
	2 Male (infant < 1 week)	19.6	0.5	
	3 Female (adult)	50	6.95	
	4 Female (adult)	45	6.3	
	5 Female (infant 1-2 weeks)	21.7	0.55	
	6 Female (adult)	44	5.55	
	7 Female (infant 2 weeks)	24.5	0.7	
	8 Female (adult)	42	5.2	
II	1 Male (adult)	51	7.65	
	2 Male (juvenile)	39	3.75	
	3 Male (sub adult)	44	4.4	
	4 Male (foetus II/4)	13.6	0.18	
	5 Female (adult-pregnant)	47	7.0	with foetus-placenta 7.3kg
	6 Female (sub adult)	41	4.25	
	7 Female (juvenile)	34	2.35	
	8 Female (adult)	48	6.75	
	9 Female (infant < 1 month)	25	0.9	
	10 Female (infant < 1 month)	24	0.7	
	11 Female (adult)	-	-	survived
III	1 Male (adult)	-	-	
	2 Male (sub adult)	-	-	
	3 Male (juvenile)	-	-	
	4 Female (adult- pregnant)	-	-	foetus 60% smaller than the one listed as II/4
	5 Female (adult-pregnant)	-	-	foetus 20% smaller than the one listed as II/4
	6 Female (adult)	-	-	
	7 Sex? (infant)	-	-	survived
	8 Sex? (sub adult - white fur)	-	-	survived

**Fig. 2.** Relationship of physical characteristics (head-body length in cm and body weight in kg) across age categories of Simakobu monkeys.

- ▲ male group I
- female group I
- △ male group I
- female group I



## Discussion

The present study provides an important contribution to the limited dataset for *Simias concolor*, one of the 25 most endangered primates worldwide (Mittermeier et al. 2007). The data, collected in an undisturbed swamp forest of N Siberut, indicate a mean group size (8.7) higher than that reported previously from various locations throughout the Mentawai archipelago (Table 3). Interestingly the present figure for group size is most similar to that reported by Watanabe (1981), based on a total of 23 groups encountered (mean group size 7.1). In his publication, Watanabe notes that large groups of Simakobu can only be found in the North of Siberut island and that local people often see relatively large groups of this langur species in inaccessible swamp forest areas. The present study confirms these earlier observations on group size and, since our own study was carried out in a peat swamp forest region, it also provides further support that peat swamp forest represents an important habitat for *Simias concolor* (see also: Quinten, 2008). These findings, together with the high abundance of *Simias concolor* in the adjacent (mixed) primary rainforest of North Siberut (53.1 Indiv/km<sup>2</sup>) shown by Waltert et al. (2008), indicate a relatively high carrying capacity of both habitats, situated in the northern periphery of the distribution range of *S. concolor*. The comparatively low level of forest degradation in this region combined with the relatively low hunting pressure exerted on *S. concolor* by the locals living in this area most likely explain the abundance of these primates in the Peleonan forest and emphasise the conservation significance of this region for this critically endangered species.

**Table 2.** Comparison of head-body length and body weight measurements in adult male and female Simakobu monkeys

Measure- ment	Male		Female		Statistics <sup>a</sup>		Sources
	mean	range	mean	range	t	p	
Head-body length [cm]	52 ± 0.14 (n=2)	51.0-53.0	46.0 ± 2.9 (n=6)	42.0-50.0	3.38	< .05	this study
	53.11 ± 2.61 (n=8)	48.0-57.1	47.61 ± 1.38 (n=12)	46.0-50.0	5.82	< .001	Tenaza and Fuentes [1995]
Body weight [kg]	7.75 ± 0.14 (n=2)	7.65-7.85	6.29 ± 0.76 (n=6)	5.2-7.0	3.20	< .05	this study
	8.8 ± 0.2 (n=2)	8.6-8.9	6.8 ± 0.5 (n=3)	6.2-7.1	4.18	< .05	Tenaza and Fuentes [1995]

<sup>a</sup> Students t-test (two-tailed)

Consideration of our data, together with those from earlier studies also allows us to comment on group composition and mating system in this species. One of the first scientific publications on *S. concolor* describes the mating system as monogamous and therefore unique among Asian colobines (Tilson, 1977). These initial observations however were made on non-habituated groups, living in a disturbed secondary forest near Sirimuri, where hunting pressure was relatively high. Based on counts during relatively short sightings, group sizes reported ranged from 2-5 individuals. Some years later, Watanabe (1981) studied *S. concolor* at two different sites on Siberut, at one of which he observed much larger single male – multi female groups near Grukna, in a relatively undisturbed area. Subsequently, Tenaza and Fuentes (1995) proposed the revised term “monandrous” (i.e. one adult male and one or more adult females) to describe the mating system of *S. concolor*, and since then the species has been considered to be organized into both monogamously and polygynously breeding groups. However, Watanabe (1981) was the first to propose that in the absence of large predators on the Mentawai Islands, group size and composition in Simakobu monkeys is strongly influenced by human hunting pressure. In contrast to the earlier studies conducted in disturbed or secondary forests, where relatively high hunting pressure existed (Tilson, 1977; Kawamura and Megantara, 1986; Tenaza

and Fuentes, 1995), our study in an undisturbed swamp forest found only one male – multi female groups of Simakobu monkeys.

This result is not only in line with the findings of Watanabe (1981), but are also supported by our own long term observation of an all-male band of *S. concolor* near our field station in northern Siberut - a phenomenon, not yet described for *S. concolor*, but to be expected as a consequence of a heavily biased sex ratio in polygynous groups (see also Watanabe, 1981 and Kawamura and Megantara, 1986). An additional indication contradicting a monogamous mating system in this species is the significant sexual dimorphism found in this species on the basis of museum specimens (Tenaza and Fuentes, 1995) and direct measurements from the present study (Table. 2). Thus, combining all available evidence, we would propose that the mating system of Simakobu monkeys be reassigned as polygynous. Furthermore, we consider the local occurrence of one adult male / one adult female units as an unusual social organization caused by increased human hunting pressure in combination with the degradation of the natural habitat of these langurs due to commercial logging and the conversion of primary forest into agricultural fields.

Although our data are limited, certain inferences on post natal development and reproductive seasonality can also be made. Based on its size and the presence of visible remains of the umbilical cord (1.5 cm in length with dry blood on the tip), the youngest infant of group I can be assumed to have been born a few (2-3) days prior to the hunting event. Its body weight and head-body length are therefore likely to fit closely to those of new born Simakobu monkeys. The other infants of the same group were estimated to be 1-2 and about 2 weeks of age, being 50g and 200g heavier than the new-born. As referred from their physical measurements (see Table 1), and information from the local hunters, both infants found in group II were no older than about one month. These data suggest a growth rate for new born Simakobu infants of ca. 1.5cm and 0.15 kg per week and provide the first information of this nature for the species.

Based on their estimated age, infants were most probably born in the first and second week of December and the third or fourth week of November 2006. The mature fetus found in group II would most probably have been born in the second half of January 2007 and the two other fetuses (found in group III) from which exact measurements could not be collected, were estimated to have reached 80% and 40% of the size of the mature embryo (13.6cm / 0.18kg), giving a prospected time of birth around late February – April (Kirkwood 1885, Tarantal & Hendrickx 1988; Martin & MacLarnon, 1988, 1990; Ross 1991). Since Tilson (1977) reported births in June/July, collectively the data indicate the period during which births occur extends from at least November to July. Thus, in contrast to earlier suggestion of a restricted birth season for Simakobu monkeys (Tilson, 1977), we propose that only a weakly seasonal, if not an aseasonal pattern of reproduction can be expected for this species.

**Table 3.** Comparison of present data on mean group size, group size ranges and observed sex ratios with previous studies.

Parameter	N. Siberut L. Bajou <sup>a</sup> (n = 3)	S. Siberut Sirimuri <sup>b</sup> (n = :15)	S. Siberut Sarabua <sup>c</sup> (n = 7)	N. Siberut Grukna <sup>c</sup> (n = 23)	Sipora <sup>d</sup> (n = 2)	Pagai <sup>e</sup> (n = 20)
Group size	8.7 ± 1.1	3.5 ± 1.1	3.0 ± 1.0	7.1 ± 6.4	3.0 ± 0.0	4.1 ± 2.1
Range	8 - 11	2 - 5	2 - 5	2 - 20	3	2 - 7
Adult M:F ratio	1 : 3	1 : 1	1 : 1	1 : 2	1 : 2	1 : 1.8
Proportion of groups observed with:						
1 adult M : 1 adult F	-	100%	100%	39%	-	45%
1 adult M : > 1 adult F	100%	-	-	61%	100%	55%

Sources: <sup>a</sup>This study (2006); <sup>b</sup>Tilson (1977); <sup>c</sup>Watanabe (1981); <sup>d</sup>Kawamura & Megantara (1986); <sup>e</sup>Tenaza & Fuentes (1995)

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