Short Communication

New population estimates for the endemic Kloss's gibbon *Hylobates klossii* on the Mentawai Islands, Indonesia

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Abstract The Vulnerable endemic Kloss's gibbon was surveyed throughout the Mentawai Islands, Sumatra, Indonesia, using a call-based method. Populations were estimated by extrapolating from local densities using recent assessments of remaining forest cover. About 20,000–25,000 Kloss's gibbons remain in nearly 3,000 km^2 of forest (about 40% of the islands' total area). This number is markedly lower than a 1980 estimate of 36,000 on the northernmost island of Siberut. Conservation action to preserve the remaining populations should focus on strengthening the enforcement of regulations in Siberut National Park, formally protecting the Peleonan forest in north Siberut, and cooperating with a logging company in North and South Pagai to protect the populations in the company's self-established conservation and buffer areas.

Kloss's gibbon *Hylobates klossii* is endemic to the Mentawai Islands off the west coast of Sumatra, Indonesia. Because of long isolation from mainland Sundaland, this archipelago exhibits a high level of endemism, including four primate species (*H. klossii*, *Simias concolor*, *Presbytis potenziani* and *Macaca pagensis*; Whitten *et al.*, 2000). The only protected area in the Mentawai Islands is Siberut National Park, which at 1,926 km^2 includes nearly half of Siberut, the largest island (Fig. 1). Gazetting of additional reserves has been advocated for South Pagai (Tenaza, 1988), North Pagai (Fuentes, 1996/1997) and in the Peleonan forest of north Siberut (Kobold *et al.*, 2003).

Kloss's gibbon is currently categorized as Vulnerable on the IUCN Red List (IUCN, 2004), but populations have not been surveyed since 1980, when extrapolation from a single study site suggested the Siberut population comprised 36,000 individuals (WWF, 1980). Because of logging, hunting and the pet trade, population numbers have probably decreased. Thus, in the course of a study to assess the extent of genetic variation in *H. klossii*, I made efforts to evaluate the current status of the species on all four islands.

Surveys were conducted throughout the Mentawai Islands at sites encompassing a range of forest types and disturbance (numbers correspond to sites in Fig. 1): (1) Peleonan forest, North Siberut; research area logged

c. 20 years ago with low hunting levels. (2) Simabuggai Biodiversity Research Station, Siberut National Park; protected area subject to moderate hunting pressure by local people. (3) Taileleu, South Siberut; located near a logging concession, subject to heavy traditional use including hunting, extraction of forest products, and clearance for agriculture. (4) Saureinu, Sipora; subject to moderate levels of traditional use, but not logged because of local opposition. (5) Betumonga Research Station, North Pagai; visited during pilot study in 2001, but not surveyed; according to local reports the area has since been logged. (6) PT Minas Pagai Lumber concession, South Pagai; 20-year selectively logged plots with some traditional use and high hunting pressure.

Because gibbon groups are difficult to detect by sight in tropical rain forests, survey methods using line transects tend to underestimate gibbon densities; methods based on gibbon loud calls have been advocated as an alternative (Brockelman & Ali, 1987; Brockelman & Srikosamatara, 1993). I used loud-call monitoring to census Kloss's gibbon populations. I sat from 06.00–10.00 at a listening post on an elevated terrain feature, and for each loud call heard I noted the time of commencement, and the direction and estimated distance of the calling animal. The calls were mapped, and songs from gibbons that mapped more than 500 m apart were considered to be from separate groups. I conducted surveys at 1–5 listening posts on 4–16 mornings at each site (Table 1).

When the listener is at the top of a hill and there are no large geographic barriers, Kloss's gibbon calls can be heard at distances of up to *c.* 1 km (L. Paciulli, pers. comm.) but, without a detailed survey of each site, I

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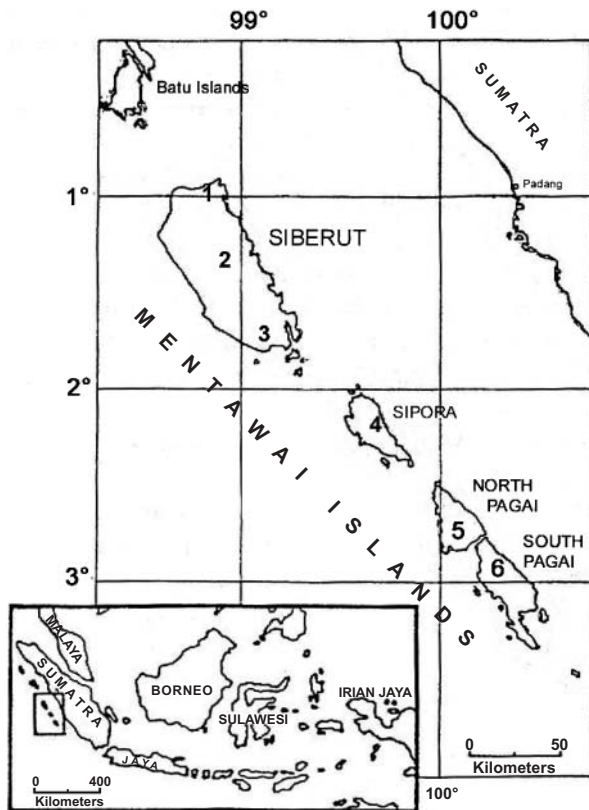
Fig. 1 Map of the Mentawi Islands, showing locations of study sites. The inset indicates the position of the main map in Indonesia.

could not know whether the surrounding area was unobstructed by barriers in all directions. I was able to confirm the reliability of distance estimates of up to 600 m by going to the calling gibbon group and measuring the distance from the listening post using a Global Positioning System. Thus, only calls within a 600 m radius are included in the analysis, resulting in a sampling area of 1.13 km^2 at each site.

I calculated population densities using $D = n/p(m)A$, where D = estimated density, n = number of groups heard, $p(m)$ = proportion of groups expected to sing during sample period m, and A = size of the listening area. For this project, n is equal to the highest number of groups heard on any one day (Brockelman & Ali, 1987). Because of time constraints it was not possible to empirically estimate $p(m)$ for Kloss's gibbon. For a minimum population estimate $p(m) = 1.0$, which assumes that 100% of gibbon groups in the listening area call on any one day within the sample period. This estimate is conservative, but singing in Kloss's gibbons has been described as contagious, stimulating neighbouring groups to sing (Tenaza, 1976), and thus on a day with favorable weather all gibbon groups may be heard. For related gibbon species (*Hylobates lar* and *Hylobates pileatus*) $p(m)$ has been estimated as *c*. 0.85–0.90 over a sample period of 3 days (Brockelman & Ali, 1987; Brockelman & Srikosamatara, 1993). For a maximum population estimate in the present study $p(m) = 0.85$. Sample periods ranged from 4–16 days.

Kloss's gibbon pairs do not duet, a characteristic unusual among gibbon species (shared only by *Hylobates moloch*). Most male songs occur in the hour before dawn, whereas females sing only after dawn, usually 08.00–09.00 (Whitten, 1982). Unmated 'floating' male Kloss's gibbons sing, perhaps even more frequently than mated males, indicating that male gibbon song may function for mate attraction (Tenaza, 1976). Female gibbons may sing to defend a territory (Cowlishaw, 1992), and thus may be more likely to indicate the presence of a gibbon group. I observed solitary males at several sites, but never a solitary female. Only results based on female calls are presented here, which give a more conservative population estimate than those based on males (Whittaker, 2005).

Table 1 Summary of survey effort, total and forested areas, and gibbon group and population densities in remaining forest areas in the Mentawai Islands (Fig. 1).

Location	LP[1]	Total days[2]	Total area (km^2)	Forested area (km^2)	Group density km^{-2} (range)	Observed average group size (n)	Individual density km^{-2} (range)	Total population (range)
Peleonan, N Siberut	5	16	40	40	2.65–3.13	10 (8)	26.5–31.3	1,060–1,252
Siberut National Park	1	4	1,926	1,482[3]	1.77–2.08	5 (4)	8.9–10.4	13,190–15,413
Siberut, outside park	2	10	2,064	900[4]	0.88–1.04	5 (2)	4.4–5.2	3,960–4,680
Sipora	1	6	845	106[5]	1.77–2.08	4 (2)	7.1–8.3	753–880
North & South Pagai	2	8	1,675	210[6]	1.77–2.08	4.5 (13)	8.0–9.4	1,680–1,974
Total	11	44	6,550	2,738	mean 1.77–2.08	mean 5.7	mean 11.0–13.0	20,643–24,199

[1]Number of listening posts at each location
[2]Total days spent surveying each location
[3]Excludes Park Village Zones of the National Park, which are subject to heavy use by inhabitants
[4]Area still unlogged due to disputed documents and land rights
[5]Estimated 10–15% of area still forested (Fuentes, 1996/1997)
[6]Includes Conservation Area, Buffer Zone, and Limited Production Forest areas set aside by PT Minas Pagai Lumber

Average group size was estimated during faecal sample collection for a genetic study (Whittaker *et al.*, 2004; Whittaker, 2005). When wild groups were encountered, my field assistants and I attempted to count the individuals and categorize them as adult, juvenile, or infant. Group sizes reported here reflect individuals of all age classes. Males and females could not be distinguished.

Information on the status of Mentawai forests was compiled from existing estimates of forest cover (Fuentes, 1996/1997), satellite imagery (Stibig *et al.*, 2002), and interviews with representatives of PT Minas Pagai Lumber Corporation, Siberut National Park, and UNESCO. Nearly 3,000 km^2 of adequate gibbon habitat remains. While the level of disturbance throughout these areas is uneven, Kloss's gibbons maintain similar population densities in unlogged forest, forests logged 10 years ago, and forests logged 20 years ago (Paciulli, 2004). Table 1 shows total population sizes based on estimates of population density and forest cover, indicating that there are 20,000–25,000 Kloss's gibbons remaining in the Mentawai Islands, most (13,000–15,500) located in Siberut National Park. This estimate is a substantial decrease from the estimated 36,000 gibbons in Siberut (WWF, 1980) or 84,000 gibbons throughout the Mentawai Islands (Chivers, 1977). Suggestion of a decrease based on these earlier estimates must be viewed with caution, however, as these numbers were based on home range sizes of gibbon groups at a single study site. The 1977 estimate is based on groups with unusually small home ranges, probably resulting in an overestimate of population size.

Siberut National Park has by far the largest remaining *H. klossii* population, but suffers from poor law enforcement, resulting in much hunting and forest product extraction within park boundaries. According to local reports, the areas suggested for conservation in the southern islands (Betumonga, North Pagai; Sinakak, South Pagai) may have already been logged. However, about half of the total area of the Pagai Islands has been managed since 1971 by PT Minas Pagai Lumber Corporation, which has established conservation areas within its concession and practices selective logging and reforestation. This concession has been granted until 2012, and may be extended.

The Peleonan forest of north Siberut is important, because of its high density of all four Mentawai primate species (Kobold *et al.*, 2003) as well as its accessibility for research and tourism. This area has the highest density of Kloss's gibbons, due in part to unusually large group sizes. I observed eight groups with an average size of 10 (range 4–15). Even if overestimation has been caused by preferential detection of large groups, or if two associating groups were observed, this area had the highest group density and such an error would only overestimate the total population by 500–600 animals. However, higher food availability in the Peleonan forest, because of a higher proportion of fleshy fruit-bearing trees compared to the typical Asian monodominant Dipterocarp forests, combined with increased omnivory in the Kloss's gibbon diet, may allow these gibbons to live in larger groups than observed in any other species (Whitten, 1984; Whitten *et al.*, 2000). Large groups have been observed throughout the Mentawai Islands (A. Fuentes, pers. comm.; Whittaker, 2005), suggesting greater flexibility in gibbon social organization in relationship to resource availability than previously observed.

The data indicate that there may have been a *c.* 50% decrease in the population of *Hylobates klossii* over the last 25 years, which is *c.* three generations in gibbons. I therefore suggest that the present Vulnerable Red List categorization (IUCN, 2004) should be changed to Endangered on the basis of criteria A2cd (IUCN, 2001), i.e. an estimated, population reduction of 50% over the last three generations, where the reduction or its causes may not have ceased (A), based on a decline in area of occupancy, extent of occurrence and/or quality of habitat (c), and levels of exploitation (d). Conservation action to preserve the remaining populations should focus on strengthening the enforcement of regulations in Siberut National Park, formally protecting the Peleonan forest in north Siberut, and cooperating with the logging company in North and South Pagai to protect the populations in the company's self-established conservation and buffer areas.

Acknowledgements

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Biographical sketch

Danielle Whittaker's current research focuses on the evolutionary genetics and conservation biology of Kloss's gibbon and other gibbon species. More broadly, she is interested in the mating systems and genetic population structure of gibbons and other pair-living primates.