

STUDY REPORT

1. Title: Behavior and Ecology of Gibbons on Kled Kaeo Island

Principal Investigator: Warren Y. Brockelman, CPT, MSC

Associate Investigators: Verachart Chaicumpa, D.V.M.
Dennis O. Johnsen, Maj, VC
Joe T. Marshall, Ph.D.
Somsak Pantuwatana, M.Sc.
Chamlong Pengklai*, BSC
Somchit Pongpangan*
James D. Pulliam, Maj, VC
Paul C. Smith, Maj, VC

Assistant Investigators: Bruce A. Ross, SSG, E-6
James P. Slowey, SFC, E-7

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OBJECTIVE

The gibbon (Hylobates lar) is being increasingly used as a model for the study of parasitic and other infectious diseases. The studies on Koh Kled Kaeo, now in their third year, are an attempt to establish a free-ranging, reproducing colony of gibbons

DESCRIPTION

Field observations are made periodically on the social behavior and ecology of the free-ranging gibbons, with special attention paid to factors that may influence reproductive success.

PROGRESS

General Status of Gibbons on the Island

As of August 1968, 11 adult gibbons were present on the island. An additional one (#12, Lab. #B52) had been released in June 1968, but has been missing since that time. It was quite friendly toward humans, and we suspect that it may have been stolen for a pet by an unauthorized visitor.

During 9-13 September 1968, we attempted to capture all the gibbons for clinical examination. Gibbons #1, 2, 5, 11, 14 and 15 were captured by hand. Gibbon #5 had been fed a banana drugged with Sernylan (Parke-Davis). Gibbons #6 and 19 were caught in a large wire cage trap baited with bananas, and #8, 17 and 18 were too feral and could not be caught. The following procedures were performed on the captured gibbons, while drugged with Sernylan:

- 1) General physical examination
- 2) Complete blood counts and check for malaria
- 3) Stool examination for parasites
- 4) Tuberculosis testing
- 5) Uterine biopsies and pap smears (females)
- 6) Semen evaluation (males)

* Applied Scientific Research Corporation of Thailand.

The eight gibbons were negative for endoparasites, and had normal blood counts. The male sperm samples showed motility and sperm counts which were normal and ranged from $3.5-10 \times 10^5$ sperm/mm³. Endometrial biopsies and pap smears revealed that the uterine mucosa of females 2, 6 & 14, was in the proliferative stage, and that 14 was in the late proliferative stage. Gibbons #6 and 14 seemed to be having menstruating. Female #2 was believed to be pregnant, but may have miscarried as it was not pregnant when it was examined two months later. All gibbons are sexually mature and ranged in weight from 4.5-7.0 kg.

On 7 February 1969, we discovered that the feral #8 had given birth to a buff colored infant. Female #8 had always been difficult to observe closely, and we had not known that it was pregnant. However, on the previous trip to the island we noted that it seemed less active and vocal than usual, and had an enlarged belly. Its vulva had not been seen clearly during pregnancy, and this may have been because it was not everted. The vulvas as #6, 14 and 18 have been everted all year, as was #2's during its suspected pregnancy. The mother has been caring for its infant satisfactorily in the manner reported for wild gibbons. Its locomotion through the trees does not seem appreciably hindered by the infant, which clings tightly around the mother's waist, and is supported partially by the mother's thighs. On 7 March the baby was heard uttering highpitched squeals as it actively shifted about the mother's chest, abdomen and thighs and pawed the air with its arms. Its sex is still undetermined.

On 8 November 1968, female #2 was caught and returned to Bangkok because it was wandering about the island and had broken the #5-14 pair bond.

Social Behavior and Territoriality

Observational methods. Most behavioral observations are now made from seven platforms built in tall trees on different parts of the island, that together permit observation of more than three-fourths of the island's area. This has permitted observation from greater distances with less disturbance of the animals, and does not produce the range location bias caused by making most observations on foot from the main trails.

Data are recorded on the following aspects of gibbon behavior:

- 1) Location of animals
- 2) Social interactions, both within and between groups
- 3) Behavior toward humans
- 4) Vocal behavior, particularly the time and frequency of morning calls.
- 5) Feeding behavior

Behavior toward humans. The gibbons vary in their reactions to humans, in ways which are correlated with other social behavior patterns (Studies of Gibbons at Koh Kled Kaeo", SMRL Annual Report, 1968). Changes in behavior toward humans often correlate with changes in gibbon social interactions. Close familiarity with the individual gibbons is necessary in order to study them safely and with the least amount of disturbance of interactions among gibbons. A summary of behavior toward humans follows: (Laboratory numbers are given after field numbers)

#1 (B2): Very friendly toward humans. Follows people around the trails, leaving its own mate behind.

#5 (B64): Fairly tame toward humans.

#6 (B59): Has usually been shy and elusive, but has become increasingly more threatening toward humans since pairing with #1, with jaw-snapping and aggressive movements. It has bitten one unauthorized visitor (boy) to the island. It has unclipped canine teeth, and is regarded as the most dangerous animal on the island.

#8 (B60): Still very wary and unapproachable.

#11 (B39): Usually friendly toward familiar people, often stealing food. Enjoys being scratched. However, it attacks people, especially newcomers, when it gets excited.

#14 (B6): Until February 1969, had been extremely friendly toward humans, greeting them with a "squeal-grimace" and warm embrace. Now it has become rather aggressive and has twice attacked human intruders into its territory.

#15 (B81): Usually tame toward people, putting its arm around them and following them around. However, it has a quick temper and often bites when provoked or teased. It has been conditioned to attack people not wearing long trousers on sight, because bathers have frequently tossed objects at it and teased it on the beach. It seeks the protection of humans when threatened by the more wary #17.

#17 (B73): Shy and wary, but may approach to within 5 meters to threaten away #15 in its territory.

#18 (B79): Shy and wary. Has approached to within 10 meters of observers on tree platforms when its mate #11 has visited.

#19 (B62): Belligerent and sometimes attacks humans when they are not looking. It frequently attacks observers in the tree platforms when #11 is around, which excites #11 so that it attacks also.

All gibbons have been taught to fear slingshots, and aiming one at them is usually sufficient to cause an attacking animal to flee.

Grouping patterns. Individual grouping patterns have changed somewhat during the past year. The gibbons have comprised four groups that have occupied generally exclusive portions of the 25-hectare island. In early September before capture, the groups were as follows (even numbers are females, odd numbers males):

8-11-19: Female #8 is the most aggressive female and defends about 6 hectares of area on the west half of the island. Males #11 and 19 are friendly toward each other and both shared the same mate and territory, although #11 was usually more closely associated with #8 than was #19.

18-17: This feral pair occupied about 4.2 hectares on the north central slope. They seemed to defend the SW boundary against the 8-11-19 group.

5-14: Male 5 was originally paired with #6, but now has usually been with #14 on the west end of the island. This pair is continually harassed and chased by the 8-11-19 group and occupied only 1-2 ha.

2-1: This pair ranged over 3-4 ha. on the east end of the island, aggressively chasing out intruding individuals.

Numbers 6 and 15 both lived alone during September on restricted parts of the island, not socializing significantly with other gibbons. Male #15 remains alone, usually near the camping area at the south beach landing area where it occasionally receives handouts from humans.

Some permanent changes in the grouping patterns occurred during September and October. On the first visit to the island after the trapping operations on 23-25 September, female #2 had a wound on its knee, which the caretakers said was inflicted by #6. Female #6 had become associated with #1 at the east end of the island. Then #2 began to wander about and was seen only infrequently for a few weeks, it was finally found with #5 on the western end early in November. The day before, #14 had been seen alone in the central portion of the island. We then removed #2 from the island, to allow #14 and 5 to pair again (they did).

In late September, #11 had a wound over one eye, which the caretakers said occurred in a fight with #17. One month later, we found that males #11 and 17 had mysteriously exchanged mates and territories. Male 19 was slower to make the shift, but it also became associated with #18 and with the tolerant #11. This new arrangement also has persisted, and may have been induced partly by a preference by #17 for female #8 after #8's two mates were trapped.

Aggression. The two main episodes related above illustrate in a dynamic way the conflict-nature of gibbon social organization, expressed in aggression between adult members of the same sex. In spite of the relative stability of territorial groups in the wild, the maintenance of pair bonds probably depends upon continual attention and aggression by both members of the pair toward outsiders. The tamer gibbons raised by humans also show this aggressive behavior, but seem to be less successful in maintaining pair bonds and defending large territories than the three or four most feral animals.

Since the birth of the baby to #8, territorial sizes have been changed slightly. The range of the 18-11-19 group has encroached upon the territory of #8 and 17 by 40-50 m, and these three gibbons are now frequently seen in border areas that were until recently the exclusive domain of #8 and 17. Gibbons #11 and 19 readily came into #17's territory once while #17 was away chasing #15. Ordinarily the presence of #17 giving threatening stares is enough to prevent territorial intrusion.

It is difficult to tell if the appearance of the baby has prompted this intrusion by the 18-11-19 group, or whether #8 and 17 are too preoccupied with family matters to defend as aggressively. The appearance of the baby has also coincided with an increase in aggressiveness and vocalization by #14 on the west end of the island.

These observations on territorial aggression and its changes imply that the density of gibbons on the island is not far from the upper limit that would allow effective reproduction and rearing. The sizes of the territories are somewhat below those observed in natural forests. In four groups closely studied by Ellefson (1967) in Malaysia, the actually defended areas were 10, 32, 32, and 42 hectares. Perhaps two more groups could become established on the eastern portion of the island. The #6-1 group presently there does not seem to occupy all the available area, and does not have to defend its territory against any adjacent groups.

Vocal behavior The loud morning vocalizations of gibbon pairs have been classified into "great-calls" given only by the females and the "hoot-series" of males by Ellefson. He reports that these calls are given by groups on 85% of all mornings. They are believed to function in advertising the presence of territorial groups, comprising one adult pair with 0-4 offspring, to other nearby groups. 36% of all intergroup conflicts were preceded by morning calls by less than 1 hour. However, it is not known precisely what effects morning calls of one group have on adjacent groups.

Actual conflicts between groups are difficult to observe in the thick, low vegetation on the island, and those among the most feral animals have probably mostly gone unnoticed. However, morning calling sessions are easily observed from the platforms, as the gibbons display themselves high in the trees during the great-calls which are usually accompanied by acrobatic movements. The frequency and intensity of morning calling sessions seems to be correlated with the necessity of territorial defense. Baseline data are being collected on morning calls to permit comparisons with the quantitative data of Ellefson (Fig. 1) and for an experimental analysis of possible functional relationships between vocal behavior and territorial defense. We are attempting to try to identify any variations in vocalization caused by shifting gibbon ranges on the island and the introduction of additional pairs.

Gibbons #8 and 18 have been the most vocal females, as well as the most feral and territorial. Female #6, which rarely needs to defend its range against intruding females, usually gives single isolated great-calls at irregular intervals. They are often not answered by hoots from #1. The arrival of the caretakers on the east end of the island in the morning usually stimulates a single great-call by #6. The data on female #14 includes observations collected since early February when it became more aggressive and vocal. Before this time #14 gave rare and sporadic calls. The calling sessions of females #18 and 8 may be longer than those reported by Ellefson because of the smaller territorial sizes on the island.

Food and vegetation. Large numbers of food pellets are being removed from the 50 feeders on the island daily. We cannot tell exactly how many of these the gibbons are consuming, because macaques native to the island sometimes rob the feeders and the gibbons discard some of the pellets on the ground. The gibbons, especially the feral ones, do much foraging in the natural vegetation during the morning. During the fruiting seasons of some of the trees, the natural vegetation probably provides most of the nourishment.

A survey of the vegetation was made during 4-9 February by Royal Thai Forestry Department personnel. It consisted of two profiles across the island (north-south), and a count of all trees greater than 5 cm. in diameter in a 10-m. wide east-west transect along the ridge of the island. The percentage of the total number of trees in the transect-sample represented by each species (plus some not found in the transect that occur on the island) is shown in Table 2 with the fruiting season, when known. The mean density of trees over 5 cm. in diameter is 15 per acre (100 m²). Bridelia and Dialium fruits provided much food for the gibbons during summer and autumn.

Table 1. Female gibbon morning vocalization patterns, Koh Klet Kaeo. Sample sizes on which estimates are based are shown in parentheses.

Gibbon Number	18	8	14	6	(Ellefson, Malaysia)
Median time of beginning of morning calls—	0730 (19)	0730 (15)	0730 (6)	0730 (9)	—
Mean length (min.) of morning calling sessions—	20.9 (26)	22.5 (22)	10.1 (12)	11.0 (3)	13
Mean time interval between great-calls within sessions (min.)—	1.98 (24)	2.40 (22)	1.47 (11)	2.4 (3)	2
Mean number of great-calls per morning—	15.1 (14)	13.6 (12)	10.5 (6)	3.0 (6)	—

SUMMARY

One disappearance, one removal and one birth during 1968 leaves the number of gibbons on the island at 11. There are four social groups and one lone individual. Aggressiveness, intensity of morning vocalizations and ferality seem to be correlated with the ability to defend a territory and hold a mate effectively. The island should be able to hold about two more pairs without straining normal territorial behavior too much.

Considerable amounts of natural fruits are being consumed along with artificially supplied pellets.

REFERENCE

Ellefson, J.O. 1967. A natural history of gibbons in the Malay Peninsula, Ph.D. Thesis, University of California, Berkeley.

Table 2. Woody plants on Koh Klet Kao

<u>Family</u>	<u>Name</u>	<u>Relative abundance (%) for 39 most common species</u>	<u>Fruiting season, where known</u>
Annonaceae	Polyartia sp.		
Bombacaceae	Boxbax insigne		
Capparidaceae	Capparis sp.		
"	Niebuhrria siamensis	4.4	
Celastaceae	Canthium sp. (two species)	6.4	Mar—Apr
"	Microtopis sp.	2.0	
Combretaceae	Combretum quardrangulare	0.3	
"	Terminalia obliqua	0.1	Jan—Feb
Connaraceae	Connarus sp.		
Ebenaceae	Diospyros buxifolia	3.4	Jul—Sept
"	*Diospyros castanea	3.7	Jun—Jul
"	Diospyros ferrea	0.3	Jun—Jul
"	Diospyros filipendula	0.7	Feb—Apr
"	*Diospyros malabarica	0.1	
"	Diospyros oblongata	0.2	
"	Dioepiros sp.	0.1	
Euphorbiaceae	*Bridelia siamensis	1.3	Dec—Mar
"	Cleistanthus sp.		
"	Croton sp.	9.3	Apr—Jun
"	Gelonium multiflorum		
"	Rhodomua siamensis	0.5	
Flacoutiaceae	Hydnocarpus ilicifolius	2.9	
Gramineae	Bambusa arundinacea	0.05	
Leguminosae	Acacia sp.		
	Albizzia sp.		
	Bauhinia sp.		
	*Dialium cochinchinense	8.4	Oct—Feb
	Sindora siamensis	0.1	Oct—Nov
	Tamarindus indica		
Loganiaceae	*Strychnos chloropetala	8.4	Oct—Feb
Lythraceae	Lagerstroemia floribunda		
Malvaceae	Thespesia populina		
Melastomaceae	Melastoma sp.	0.5	
"	*Memecylon ovatum	27.5	Mar—May
Meliaceae	Aglaia sp.	0.6	Mar—Jun
Moraceae	Ficus sp.	0.5	
Myrtaceae	Drypetes sp.	0.7	
	*Rhodamnia siamensis		
Ochnaceae	Ochna wallichii	1.6	
Opiliaceae	Opilla amentaceae		
Olacacea	Olax imbricatus		
Oleaceae	Olea maritima		

Table 2. (Continued)

<u>Family</u>	<u>Name</u>	<u>Relative abundance (%) for 39 most common species</u>	<u>Fruiting season, where known</u>
Rubiaceae	Canthium sp.		Mar—Apr
"	Gardenia collinsae	0.4	Nov—Jun
"	Guettada speciosa		Jan—Feb
"	Ixora sp.		
"	Morinda sp.		Jun—Aug
"	Randia sp.	0.4	Mar—Apr
"	Tarenna sp.	3.0	Feb—Apr
Rutaceae	Atalantia monophylla	9.4	
"	Atalantia scandens		
Sapindaceae	Harpullia sp.		
	Lepisanthes sp.	0.3	
Sapotaceae	Manilkara hexandra	1.8	Mar—Apr
"	Xantoris sp.	0.8	
Sterculiaceae	Pterospermum diversifolium	3.3	Mar—Jun
"	Sterculia foetida		
Tiliaceae	*Grewia paniculata	1.5	
Ulmaceae	Celtis sp.	0.1	
"	Ulmus sp.	0.7	
Verbenaceae	Vitex pinnata		Apr—Jun
Unidentified	— —	0.2	

* Species known to be eaten by gibbons.