MOVEMENT OF LYLE'S FLYING FOX(*Pteropus lylei*) IN CENTRAL THAILAND

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ABSTRACT

Via satellite telemetry (Argos satellite system), we recorded the movements of a Lyle's flying fox in Singburi Province, Central Thailand. The apparatus was attached to a mature male bat at Wat Kaochang, one of the biggest roosting sites of Lyle's fruit bat in the province. Movement of Lyle's fruits bat was examined from March 12 through April 1, 2009. The bat seemed to change its roost from Wat Kaochan to some roosts in Chainat Province by the captive stress. There was no report of the roosts of Lyle's flying fox in the province, so further investigation about its habitat in central Thailand is required. On the other hand, the bat sometimes fly over provinces, but this trip was usually occurred within a day, and the bat went back to Chainat Province again. This study showed wide range of movement of Lyle's flying fox in central Thailand.

Key word: *daily movement, fruit bat, satellite telemetry, roosting site*

INTRODUCTION

The Lyle's flying fox (*Pteropus lylei*) was firstly described in 1861 as *Pteropus edwardsi* in Cambodia (Gray, 1861), and received its current name in 1908 (Andersen, 1908). In adults, body weight ranges from 390 g to 480 g, and forearm length (FA), measured from the outside of the elbow to the outside of the wrist in the bent wind, ranges from 145 mm to 160 mm (Francis, 2008). Total length of skull (LS) is 61 mm to 66 mm. It resembles the Indian flying fox (*Pteropus giganteus*) (FA; 164-177, LS; 71-76), but is much smaller. Lyle's flying fox has a dark brown

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or black back and wings. Head and mantle are yellow- or light-brown, contrasting with the color on the back. The muzzle is dark. The color on the lower body varies between individuals from yellow-brown to deeply dark brown. Its breast and belly color are blackish or seal-brown as in the Large flying fox (*Pteropus vampyrus*), but occasionally bright-colored as in *Pteropus giganteus*. All known flying foxes are frugivorous and/or herbivorous. In Lyle's flying foxes the average amount of food ingested per day is 217.5 g, while the amount of feces produced is only 18.4 g (Boonneung , 1977).

In South-East Asia, the Lyle's flying fox is found in Thailand, Cambodia, Vietnam, and Malaysia (Olival *et al*, 2007; Francis, 2008). Among where, distribution of it in Thailand has been well-documented (Boonkird & Wanghongsa, 2004; Hillman, 2005). Lyle's flying foxes usually roost in temples, in the middle of towns and cities. In each roost, bats between 389 and 11,010 have been counted from 2001 to 2003 around Bangkok. According to the monks living in these temples, the bats leave in the evening (only few bats stay in the temple during the night) and return in the early morning. This behavior is known for over 30 years in most temples. Bats depart in small groups of some dozens up to several hundreds to look for food. If they could not find foods in a place, they never come back again. In areas with a lot of food, the bats may aggregate in large numbers. Sometimes, bats go out to look for food over provinces of Thailand.

These long-term observations by monks provide useful information, even though they have yet to be confirmed, scientifically. In this study, the movements of a Lyle's flying fox were tracked in Singburi province in Thailand using Argos satellite telemetry system, to reveal details of its behavior.

MATERIALS AND METHODS

Capture and release of Lyle's flying fox

A Lyle's flying fox from Wat Kaochang (14°45'55.08"N; 100°26'51.18"E), about 130 km north of Bangkok, was used in this study. A trap-net was set on the path (14°45'35.94"N; 100°26'21.98"E) where Lyle's flying fox pass regularly. The trap-net was triangle-shaped, with one corner fixed in a tree top above the path (about 10 m above the ground), and the other two corners tied on two tree trunks located on either side of the path (Fig. 1). The net was checked every morning (around 4 AM), and a captured bat was used in this study. The sexually mature male bat, which was the biggest among more than 20 bats captured in a day, was chosen for the study. After attaching the telemetry system, the bat was released at the same place as its capture.

Telemetry equipment

An Argos signal sender (Fig. 2) was purchased from North Star Sciences & Technology Co. (Model 12 Gram Solar PTT) (King George, VA, USA). Specifics of this sender are as follows; Power 225 mW, Frequency 401.664 MHz, Spurious emission level in out-of-band domain (Maximum level; <-50 dBc, Frequency; all over the domain), and unwanted emission level in spurious domain (Maximum level; <-44.57 dBc, Frequency; 802 MHz). The small tracking apparatus (total weight 12 g) was tightly attached to the neck of the Lyle's flying fox using a synthetic leather backpack with plastic cable tie (cargo/apparel bundle tie) (Fig. 3 and 4).

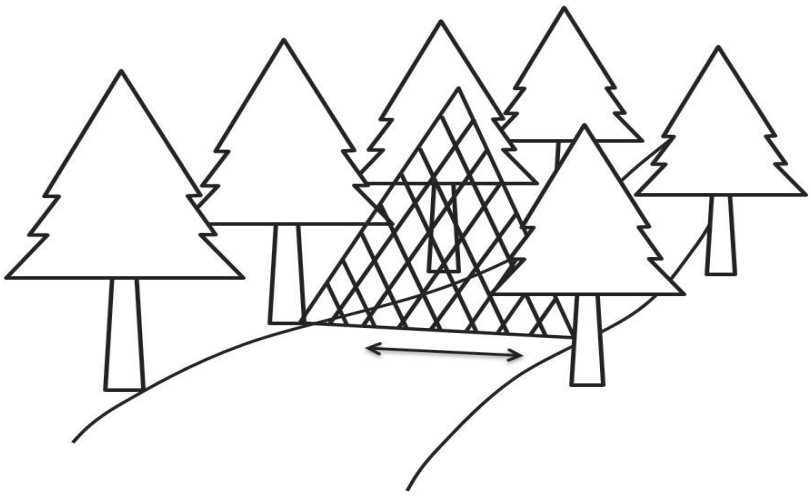

Fig. 1 The net is only pitched during nighttime. The triangle-shaped net is put away by moving one bottom corner to the opposite side as the arrow indicates.

Fig. 2 The Argos signal sender. Main body includes solar battery on the back with long antenna.

Fig. 3 Argos signal sender with the backpack for the bat. It was attachedto the backpack using three plastic bundles. The back pack was tied aroundthe neck of the bat using one bundle.

Fig. 4 The telemetry system is attached to the male Lyle's flying fox.

RESULTS AND DISCUSSION

Every second, the tracking apparatus send a signal, powered by its solar battery. Whenever Argos satellites happened to be located in the air space above Thailand, they would receive the signal and send it to the Argos server located in France. The server automatically determines the location of the tracking apparatus including accuracy (Vincent *et al*, 2002). These locational data can then be downloaded from the website (http://www.argos-system.org/).

The location of the bat is summarized in Fig. 5 and the precise location, date and time are given in Table 1. Black dots in Fig. 5 show the location of the bat including error distances, which means that the bat was at least within the dots. All data were obtained during 2 weeks after release of the bat. Thereafter, the signal stopped because 1. The bat was killed by a hunter, who routinely gets bats for sale, or attached by a predator, 2. The tracking apparatus was broken, or 3. The solar battery failed.

No signal was ever received from the vicinity of Wat Kaochang. Most signals were located in the neighboring province, Chainat Province. Some daytime signals came from Chainat Province, indicating that the main roosting site had changed. Surprisingly, daytime signals were received also from four different locations outside of Chainat Province (March 15, 17, 27 and 28 in Fig.1). It is, therefore, possible that the Lyle's flying fox changes the roost several times. The camps of Lyle's flying fox in central Thailand were previously described by Hillman (2005) and Boonkird & Wanghongsa (2004). They do not report camps in Chainat Province. This was, however, confirmed by our present study which furthermore suggests that there are some more roosts in central Thailand. It seems that Lyle's fruit bat can move among camp in a very short period of time (within days or weeks), and individual bats do not have fixed roost. This hypothesis is supported by reports, in which movement of other fruit bats were traced using the satellite tracking systems (Tiderman & Nelson, 2004; Richter & Cumming , 2008; Bread *et al*, 2010)

The longest travel distance was observed on March 28 (Fig. 5). If the bat flew continuously and in a straight line from one point to another on March 28, the flying speed would have been 49.83 km/h. Grey-headed Flying foxes (*Pteropus poliocephalus*) fly about 25-30 km per hour. In the wind tunnel test, this flying fox maintained a speed of 26 km/h for 4 hours (Carpenter, 1985) On the other hand, Tidemann & Nelson (2004) documented a speed of 49, 52, and 63 km/h with assistance of wind currents.

The grey-headed flying fox is highly mobile (Tidemann, 1998) and the population in a country is fluid, moving up and down the east coast of Australia to look for food. For example, two individual bats attached with satellite tracking devices made round trips of more than 2,000 km in a nine-months period (Tidemann & Nelson, 2004; van der Ree *et al*, 2006). It is suggested that no separate or distinct populations of Grey-headed Flying foxes exist, because of constant genetic exchange and movement between camps over the entire geographic range of the species. This indicates that there is one single interbreeding population (Webb & Tidemann, 1995). The roost of the Lyle's flying fox appears to be separated by those of two flying fox species (*Pteropus giganteus* and *vampyrus*) living in Thailand, because all reported roosts of the Lyle's flying fox are restricted to the temple, and there is no other species of the flying fox there. This study showed the possibility of routine migration (change of the roost) of the Lyle's flying fox. It is noteworthy that anthropogenic pressures (not only development of lands and/or forests, but also the hunting, and so on) (Wiles & Glass, 1990; Epstein, 2009) could initiate large scale migration of Lyle's flying fox. So, it is quite intriguing that the genetic exchange among three species of the flying fox living in Thailand would be investigated, to know Thai flying fox, leading to understand the Thai-Malayan Fauna, which would be influenced by environments partly with human activities.

Table 1 Location of the bat in central Thailand*

Date	Time (GMT)	north latitude	east longitude
2009/03/12	19:14:05	15° 10'33.60	100° 24'54.00
2009/03/13	22:18:51	15° 23'09.60	99° 27'03.60
	23:34:55	15° 06'32.40	100° 01'30.00
2009/03/14	2:40:33	15° 09'14.40	99° 55'55.20
	4:20:38	15° 06'07.20	100° 02'06.00
	4:34:39	15° 05'31.20	100° 03'14.40
2009/03/15	7:43:54	15° 00'46.80	100° 01'12.00
	8:54:28	15° 06'00.00	99° 58'58.80
2009/03/16	14:36:21	15° 15'28.80	99° 59'56.40
2009/03/17	20:01:13	15° 16'37.20	99° 58'51.60
	22:22:20	15° 31'12.00	98° 54'57.60
2009/03/19	2:49:39	15° 06'18.00	100° 01'08.40
2009/03/20	10:15:37	15° 06'25.20	100° 01'26.40
2009/03/25	15:08:57	15° 15'28.80	100° 00'14.40
	16:07:59	15° 15'03.60	99° 59'38.40
2009/03/26	22:04:23	15° 14'49.20	100° 00'14.40
2009/03/27	2:37:36	15° 02'13.20	100° 30'25.20
	3:24:08	15° 05'52.80	100° 01'26.40
2009/03/28	7:02:26	15° 31'48.00	100° 25'26.40
	10:20:35	14° 59'45.60	99° 56'42.00
2009/03/29	15:28:56	15° 15'14.40	99° 59'45.60
	16:15:29	15° 15'36.00	99° 59'52.80
2009/03/30	19:25:45	15° 16'33.60	99° 58'37.20
	22:10:22	15° 10'48.00	99° 55'08.40
2009/04/01	4:00:16	15° 08'16.80	99° 57'03.60

*The error of location is not shown.

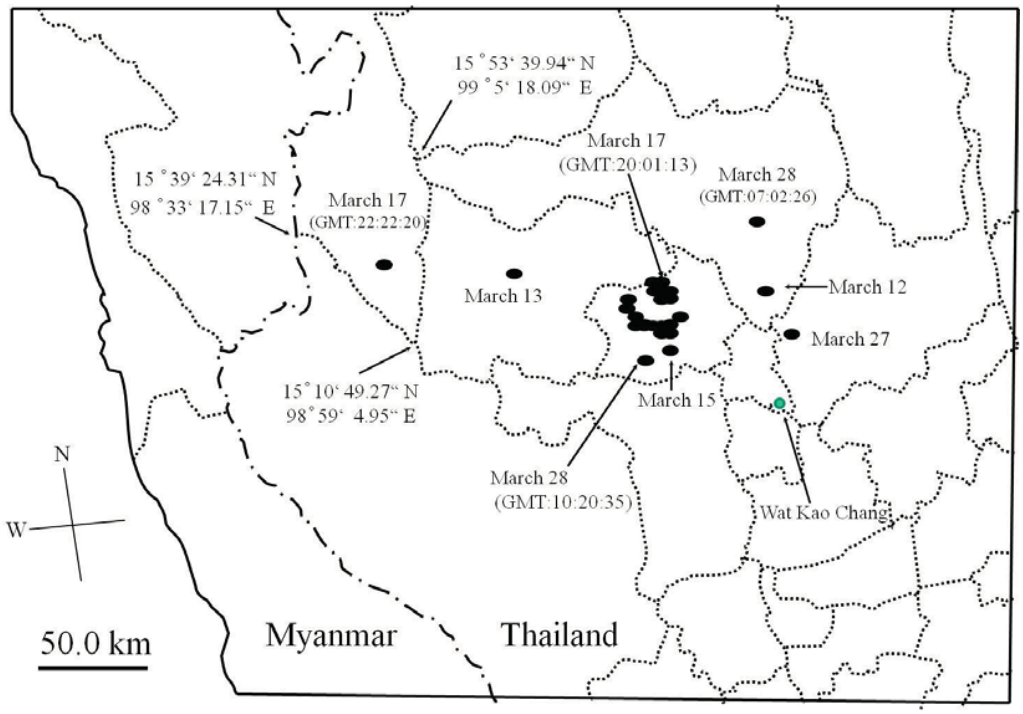

Fig. 5 The tracking data is summarized here. After having been release, the bat never returned to Wat Kaochang, Singburi Province.

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