Agriculture and Natural Resources 51 (2017) 425–431

Contents lists available at ScienceDirect

Agriculture and Natural Resources

journal homepage: http://www.journals.elsevier.com/agriculture-and-natural-resources/

Short Communication

Breeding ecology of buff-breasted babbler (*Pellorneum tickelli*) at Doi Chiang Dao Wildlife Research Station, Chiang Mai province, Thailand

Patchareeyaporn Panyaarj,[a] Prasit Wangpakapattanawong,[a, b, *] Narit Sitasuwan,[a] Sawat Sanitjan[a]

[a] *Department of Biology, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand*
[b] *Environmental Science Research Center, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand*

ARTICLE INFO

Article history:
Received 9 February 2017
Accepted 3 May 2017
Available online 8 December 2017

Keywords:
Bird nest
Breeding birds
Nestling
Parental care
Riparian

ABSTRACT

The behavior of the buff-breasted babbler (*Pellorneum tickelli*) was recorded from April 2010 to May 2012 along creeks in Doi Chiang Dao Wildlife Research Station, Chiang Mai, Thailand. Fifteen nests of the buff-breasted babbler were found on four creeks: Maeka, Maemard, Ong and Sikrobkrua. The general behavior of birds included foraging, excretion, locomotion, preening and vigilance. The complete breeding cycle of the buff-breasted babbler in this study was almost 1 mth. Egg clutch size was in the range 3–4 and the nestlings hatched almost simultaneously. The eggs were incubated by both the males and the females. After hatching, both parents invested in intensive parental care. As well as providing food, they also protected their nestlings. This information can be used to help with conservation planning in the area and elsewhere.

Introduction

Buff-breasted babblers are found in Bangladesh, Cambodia, China, India, Laos, Malaysia, Myanmar, Thailand and Vietnam where their natural habitats are subtropical or tropical moist lowland forests, and subtropical or tropical moist montane forests (Collar and Robson, 2007). Fledging success is usually two from five in observed nests, representing a 40% rate. Babbler species richness and diversity are positively correlated with humidity (Moradi and Mohamed, 2010). Like many birds in the Pellorneidae family, they are mainly insectivorous with strong feet (Welty, 1962; Lekagul and Round, 2005). They are noisy and gregarious (Lekagul and Round, 2005). A bird nest is the spot, where a bird lays and incubates its eggs and raises its young; however, not all bird species build nests as some species lay their eggs directly on the ground or rocky ledges, while brood parasites lay theirs in the nests of other birds (Welty, 1962). Although nests are primarily used for breeding, they may also be re-used in the non-breeding season for roosting, and some species build special dormitory nests or roost nests (or winter-nests) that are used only for roosting, such as great hornbills (Panyaarj, 2006). Most birds build a new nest each year, though some re-furbish their old nests. For example, the large aeries of some eagles, such as golden eagles, are platform nests that have been used and re-furbished for several years (Wyshynski and Pulfer, 2015). Many species of birds conceal their nests to protect them from predators and some species may choose nest sites that are inaccessible or build the nests so as to deter predators; bird nests can also act as habitats for other inquiline species, which may not affect the bird directly (Welty, 1962; Weatherhead, 1984). Birds have also evolved nest sanitation measures to reduce the effects of parasites and pathogens on nestlings as nests can become home to many other organisms including parasites and pathogens (Welty, 1962; Weatherhead, 1984). The excreta of the fledglings also pose a problem (Welty, 1962). In most passerines, the adults actively dispose of the fecal sacs of the young away from the nesting site or consume them and this is believed to help prevent ground predators from detecting the nests; young birds of prey, however, usually void their excreta beyond the rims of their nests as the presence of feces near a nest may significantly increase the incidence of predation by attracting predators (Petit et al., 1989).

The importance of spatial scale to habitat use by breeding birds in riparian forests was studied along 100 km of the South Fork of the Snake River in southeastern Idaho, USA, from 1991 to 1994. A hierarchical approach was used to examine habitat use at three spatial scales: microhabitat, macrohabitat and landscape. The result showed that the most frequent significant predictor of species

* Corresponding author. Department of Biology, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand.
E-mail address: prasitwang@yahoo.com (P. Wangpakapattanawong).

https://doi.org/10.1016/j.anres.2017.10.004

occurrence was the landscape component—increases in upland natural vegetation with decreases in agriculture (Saab, 1999).

A study of breeding biology of the slaty-backed forktail in the Maeka and Maemard creeks, Chiang Dao district, Chiang Mai province, Thailand by surveying the process for selection of a nest area, breeding season, nest and egg characteristics, raising young and food sources found that the males and the females used moss and mud to build nests attached to a crag, river shore or tree hollow above the creek (Rojanadilok, 1999). In a study of the ecology and breeding biology of the red-wattled lapwing in Bang Phra reservoir in a non-hunting area in Chonburi province, Thailand most nesting areas were in the riparian zone and the food consisted of benthoses, worms, seeds and some small aquatic animals (Sribuarod and Chedsing, 2001).

Studies of breeding birds can lead to conservation of their nesting habitats, to inform factors that lead to their unsuccessful breeding and to determine suitable environments for breeding. Moreover, the studies of breeding birds can be valuable in assessing the status of populations and the factors influencing their populations.

Materials and methods

Buff-breasted babblers were surveyed in riparian zones around Doi Chiang Dao Wildlife Research Station (550–625 m above mean sea level, latitude 19°21.165′ N to 19°22.159′ N and longitude 98°54.856′ E to 98°55.453′ E; Fig. 1). The breeding birds were surveyed for nest site habitat, their selection of nesting areas and nest characteristics (shape and size). Surrounding habitats were described and nest shapes were measured when the nests were vacated, using a ruler to record inside and outside measurements. The following data were recorded: date of laying the first egg, egg characteristics (shape and color, and size—using a vernier caliper), clutch size, brooding time, food for feeding, and size of the completed clutch and fledglings. The behavior of birds was recorded every 5 min, and a video camera was set in front of the nest, while binoculars were used to observe bird behavior on arriving at the nest and for food identification.

Four creeks around Doi Chiang Dao Wildlife Research Station—Maeka, Maemard, Ong and Sikrobkrua—were surveyed for the buff-breasted babbler.

Maeka creek is a large permanent creek. The width of the creek along its route was about 3–7 m and it was 20–70 cm deep. Water flow was rapid. The bottom consisted of sand, gravel and small and large stones. There was sediment accumulation beside the creek. The sides of the wet licks adjacent to the ridge had a slope of about 60° while the other side was adjacent to Maeka creek. There was a shallow swamp in some parts of the wet licks, a small line of creeks ran into Maeka creek, soils were clayey, and the middle part of the licks was an open area of about 15 m^2. The area around the wet lick had many bushes surrounded by large trees (Fig. 2). There were many types of animals living and foraging in the wet licks, including mice and buffaloes that were utilized by local people.

Maemard creek is in front of the research station. The width of the upstream creek was about 1.5–2.5 m. There was a rapid flow of water in some ranges of the creek. There were large stones blocking the stream and many small check dams made from bamboo, stones and sandbags. There were big trees and overgrown shrubs covering the ground; some parts had large clumps of bamboo and bananas within the creek (Fig. 3).

Ong creek flows only in rainy seasons. It was located higher and parallel to Maeka creek with a hill barrier. Ong creek was interspersed with bamboo and bananas. There were a lot of bamboo clumps at the top of the hill. The width of the creek was about 1–2 m with many steep cliffs, ranging in height from 3 m to 8 m. The hill beside of the creek had a 35° slope. The creek bed was largely gravel. There were some medium-sized trees and many ground flora on the lower level (Fig. 4).

Sikrobkrua creek has water only in rainy seasons. The entrance to this creek was narrow—about 1 m wide—with a cliff with a height of about 2–5 m. There were a few small trees and some ground flora. Most plants at ground level were in the ginger family and there were some bananas. The side of the creek had an average slope of 37°. There was a high density of large trees (Fig. 5). About 50 m from the entrance there was a small, human-made basin. Many birds often groomed and bathed at this basin.

The creeks and adjacent hills were traversed to find the buff-breasted babbler. Nesting sites were recorded when bird couples began building nests, until completed. Afterward, bamboo and leaves were used to make a blind on the side of the nest front. The distance between the nest and the blind took into account the advice of Ngoenjun and Sitasuwan (2010) that it should be appropriate, but not too close. Qualitative (frequency) and quantitative behavior (types of behavior: calling, moving, setting, feeding, foraging and incubating behavior) were recorded. The behavior of birds was recorded on the date the last egg was laid until the nestlings left the nests. The data were collected for three breeding seasons (2010–2012), six days per month during the breeding period of the birds, 0800–1700 h in normal weather, with no data collection during periods of inclement weather.

Results

Thirteen nests of buff-breasted babblers were found in the area of the four creeks and two nests were found in front of the office of Doi Chiang Dao Wildlife Research Station (Table 1 and Fig. 6). Only seven nests were successfully used for reproduction. The other nests were destroyed by environmental factors such as heavy rain, erosion and flood, and by some predators such as dogs, lizards, snakes, rats, squirrels and buffaloes.

2010 season

There was one nest of the buff-breasted babbler at Maeka creek (Maeka1). The nest was at the root of a tree with two nestlings inside. The nestlings had all plumage. The nest was empty and torn apart one week later.

2011 season

Seven nests were found in the study area—three nests at Maeka, one nest at Ong, two nests at Sikrobkrua and one nest at Maemard creek. In the area of Maeka creek, two nests were successful in breeding but another one (Maeka4, found 450 m from the beginning of the route, near a hot spring point, slope of substrate was about 45°) failed due to flash heavy rain, resulting in the nest being pulled out from substrate and egg shell was scattered around the nest; there were marks suggesting reptile activity on egg shells and no egg yolk was seen. Behavioral data could not be collected at one successful breeding nest (Maeka2), as the nest was empty on the day it was found, but the sound of parents and nestlings around this nesting habitat and the well-shaped nest indicated it had been used. Another successful breeding nest (Maeka3) where behavior was recorded was found with three eggs inside. The nest was 2 m away from the creek, and the slope of substrate was about 32°. One of the nests in the area of Ong creek (Ong1) was on the creek side whose substrate slope was about 35°. The nest was on the ground at the base of a tree, covered with dried leaves and bamboo leaves. There were three eggs and the parents were incubating their eggs. On the third day, the nest was destroyed by heavy rain and soil erosion. The eggs were absent, and there was no egg shell around the nest.

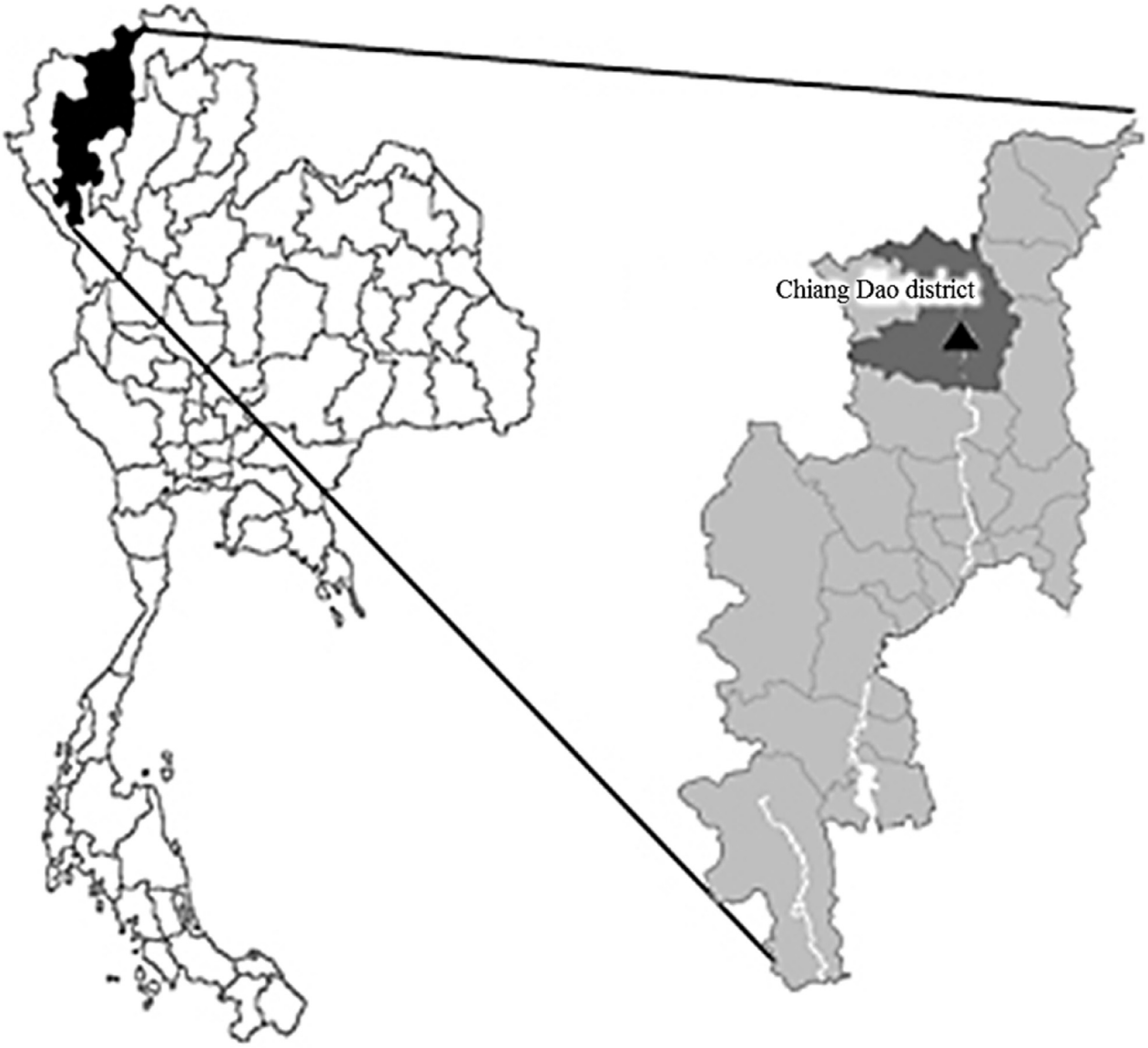

Fig. 1. Map of study area Chiang Dao district, Chiang Mai province, Thailand.

The two nests in the area of Sikrobkrua creek were both unsuccessful. The first nest (Sikrobkrua1) was empty, and there was neither nestling nor parents around the area of the nest. The second nest (Sikrobkrua2) was found at the top of the hill. The nestlings were lost to predators and the nest was wide-open the day after.

Only one nest was found in the area of Maemard creek; it was on the ground and had been destroyed by resident buffaloes. The nest was split open and the exact size was not measurable.

2012 season

Seven nests were found in the study area at Maeka (2), Ong (1), Sikrobkrua (2) and in front of the office (2). The two nests around Maeka creek (Maeka5 and Maeka6) were successful in breeding. The nests were well-shaped, but only sounds were heard around the nesting area and the birds were not seen.

The nest at Ong creek (Ong2) was found up on the hill. The surrounding area was filled with bamboo. The two nestlings and their parents moved around their territory and made calls.

Two nests were found around Sikrobkrua creek; one of them (Sikrobkrua3) was empty, and there was no evidence of either nestlings or their parents around the nesting area. Another nest was found on the last day of nest building (Sikrobkrua4) and bird behavior there was recorded.

Two nests were found on the hill in front of the Doi Chiang Dao Wildlife Research Station office. One of them was empty (Front1), no birds were found around the nesting area, and the second one (Front2) was successful in breeding, and the parents were sighted moving around their territory.

Behavior of the breeding birds

During the first day of incubation, the buff-breasted babblers incubated their eggs for a few minutes and then switched to flying away to forage (Day 1). During the first two weeks, the frequency of incubation increased when the eggs were nearly hatched (Fig. 7). The frequency of the incubating and foraging behaviors were contrasted. The greatest duration of incubation was 105 min. After

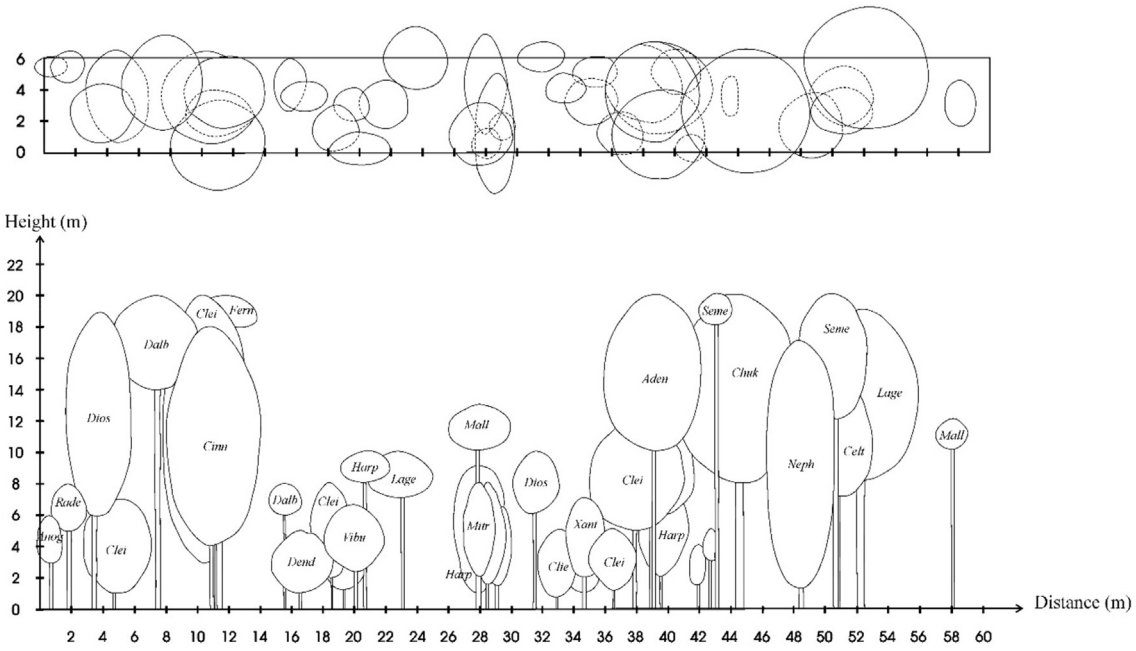

Fig. 2. Top and side-view forest profiles of Maeka creek study site (species names provided in Table 2).

hatching (Day 9), the feeding behavior duration increased and the incubating behavior gradually decreased as the nestlings got older (Day 18). Calling and setting behaviors were inconsistent depending on the surrounding situation. Alarm calls were made when something unusual approached the nests. The parents perched around the nest area to take care of their nestlings or to feed them.

Discussion

The seven successful nests consisted of the fur nests found at Maeka creek, one at Ong creek, one at Sikrobkrua creek, and the last one in front of the office of Doi Chiang Dao Wildlife Research Station. Moreover, for five successful nests (Maeka2, Maeka5, Maeka6, Ong2 and Front2), bird sounds were heard, and the birds were still living in their nest territories, and many nestlings moved around their territories. The eight unsuccessful nests were the result of predation and natural calamity.

Both parents fed the nestlings with many types of insects including larvae and the imagines of dragon-flies (Odonata), orthopterans (Orthoptera), larvae and imagines of butterflies and moths (Lepidoptera), larvae and imagines of flies (Diptera), bugs (Hemiptera), ants (Hymenoptera) larvae and imagines of spiders (Arachnida), and other unidentified insects. According to Welty (1962), the amount of food eaten by birds depends on the

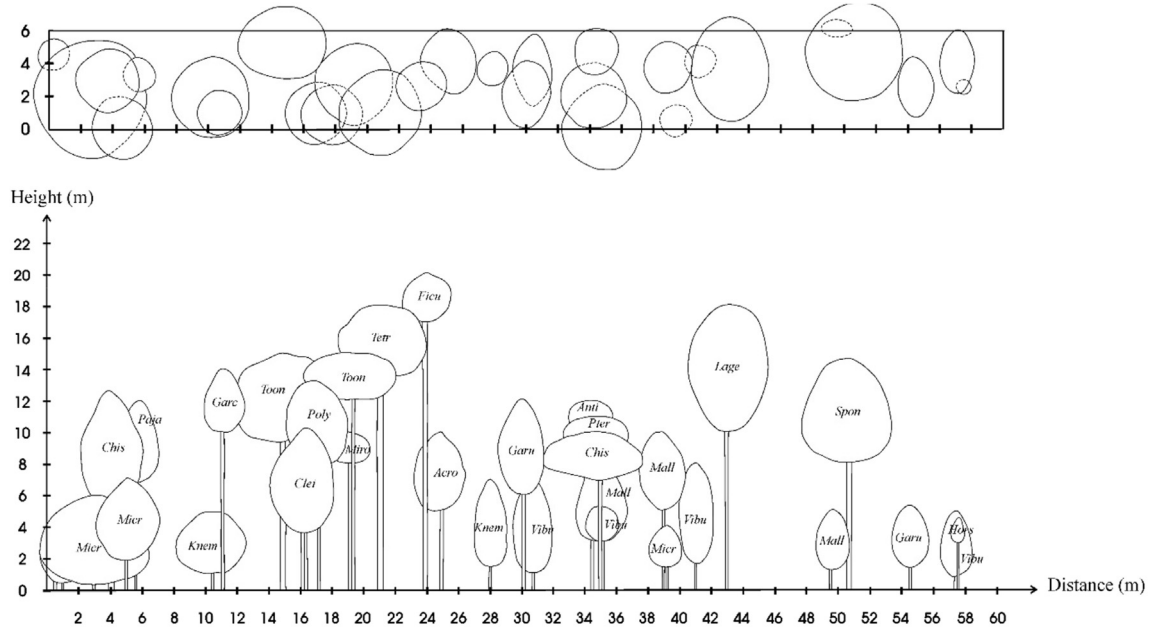

Fig. 3. Top and side-view forest profiles of Maemard creek study site (species names provided in Table 2).

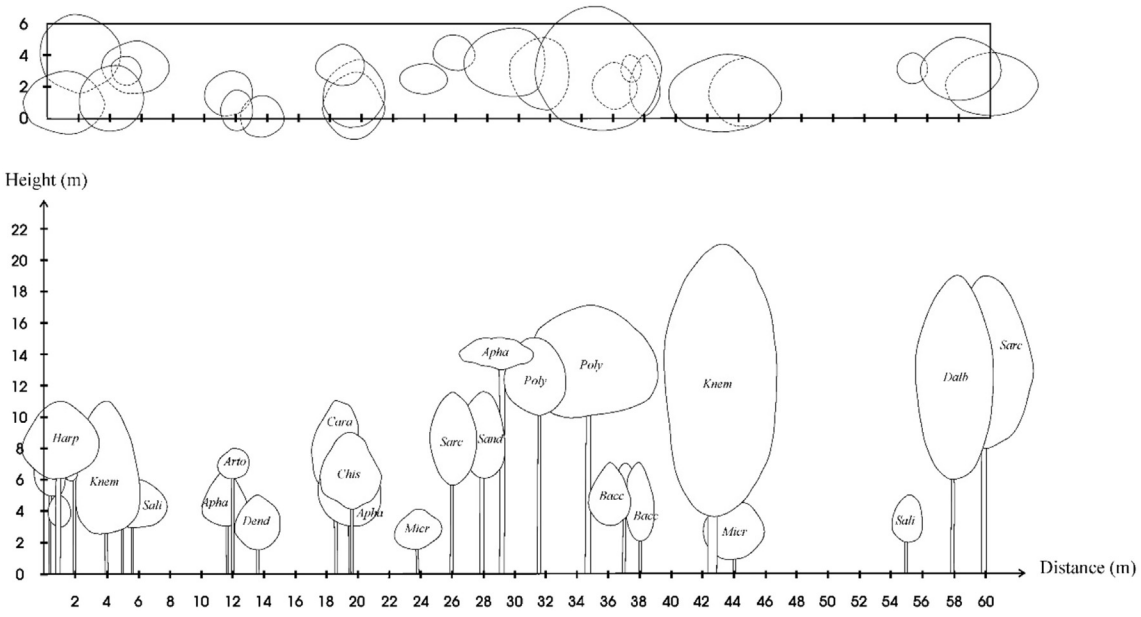

Fig. 4. Top and side-view forest profiles of Ong creek study site (species names provided in Table 2).

species, health, age and sex of bird, on the season, time of day, food availability, and other factors. Periods of increased demands for energy or for body-building materials generally result in increased food intake. The increased metabolism involved in the digestion of food eaten requires increased respiration, and hence increased water loss. A female bird increases its food consumption and also draws on fat reserves in the body during the egg-laying period.

The parents carried and fed the prey to one nestling for each feeding visit. The nestling raised its beak up and stretched its neck out trying to reach the parent's beak. The parents put some food deep into the nestling's throat for feeding. After that, the nestlings would lay down at the bottom of nest, turning their tails, lifting the bottom up using the outrigger to excrete a fecal sac. The parents would reach into the nests, and gather up the passed fecal sac and then swallow it. The nestlings would then lay down in the nest, and fold their necks down as they slept. If the nestlings could not swallow the food, they opened their mouths wide, and the parents used the beak to place food in order to make it easy to swallow.

One feeding visit always fed one nestling with ants, but large larvae could feed two nestlings at one time, such as a spider. The parents were able to recognize their nestling's location in the nest, so when they returned with some food again, they would feed another nestling. If the nestlings did not excrete a fecal sac, the parents waited for a while and watched over the nestlings before flying out.

Both the males and the females spent time at the nests for feeding and brooding the nestlings. Sometimes, the parents arrived at the nest for feeding and perched at the nest without brooding the nestlings. When the nestlings got older they always kept their faces

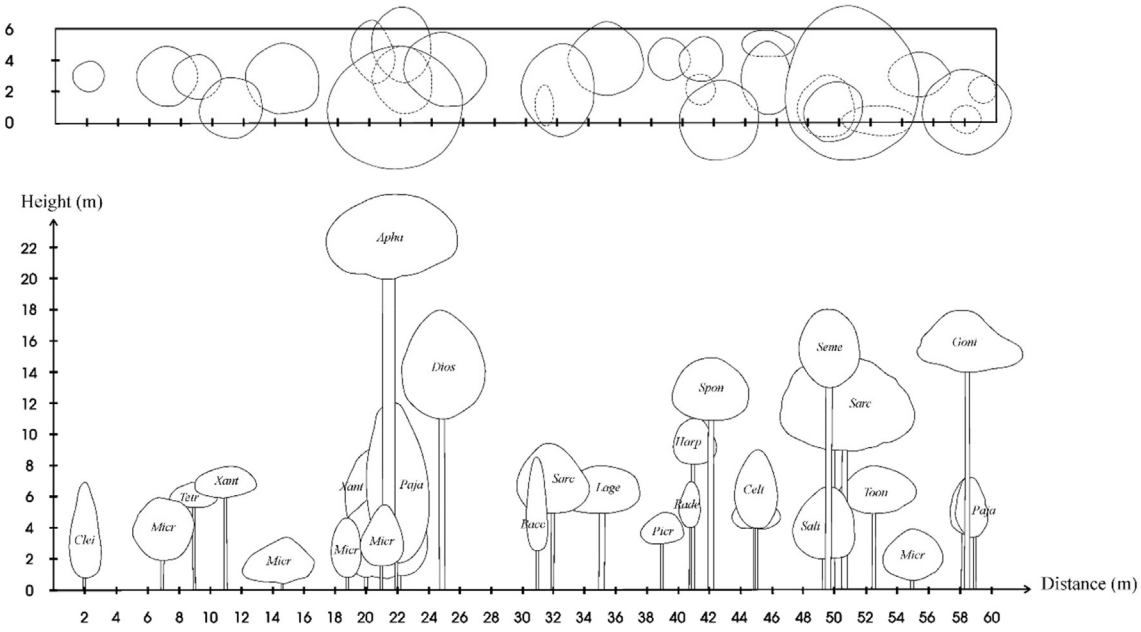

Fig. 5. Top and side-view forest profiles of Sikrobkrua creek study site (species names provided in Table 2).

Table 1
Nest data from the study.

Creek	Nest name	Year	Status of nest when first found	Behavior study	Cause of nest loss	Distance from creek (m)
Maeka	Maeka1	2010	Nestlings	×	n/a	2
	Maeka2	2011	Success	×	–	4
	Maeka3	2011	Egg	✓	–	2
	Maeka4	2011	Egg	✓	Heavy rain, lizard	5
	Maeka5	2012	Success	×	–	4
	Maeka6	2012	Success	×	–	4
Ong	Ong1	2011	Egg	✓	Heavy rain, erosion	2
	Ong2	2012	Success	×	–	20
Sikrobkrua	Sikrobkrua1	2011	Empty nest	×	n/a	3
	Sikrobkrua2	2011	Nestlings	✓	dogs	3
	Sikrobkrua3	2012	Empty nest	×	n/a	1
	Sikrobkrua4	2012	Egg	✓	–	5
Maemard	Maemard1	2011	Empty nest	×	Buffaloes	0
In front of office	Front1	2012	Empty nest	×	n/a	14
	Front2	2012	Success	×	–	15

*n/a = not available; – = no loss factors.

Table 2
Tree names in the study area.

Order	Species code	Species (Samitinand, 2001)	Family	Creek			
				Maeka	Maemard	Ong	Sikrobkrua
1	Aden	*Adenanthera pavonian*	Leguminosae-Mimosoideae	✓			
2	Adin	*Adinandra integerrima*	Theaceae				✓
3	Anog	*Anogeissus acuminate*	Combretaceae	✓			
4	Anti	*Antiaris toxicaria* Lesch	Moraceae		✓	✓	
5	Apha	*Aphananthe cuspidate*	Ulmanceae			✓	✓
6	Appo	*Aphanamixis polystachya*	Meliaceae			✓	
7	Arto	*Artocarpus gomezianus*	Moraceae			✓	
8	Bacc	*Baccaurea ramiflora*	Euphorbiaceae	✓		✓	✓
9	Cara	*Carallia brachiate*	Rhizophoraceae			✓	
10	Celt	*Celtis timorensis*	Ulmaceae	✓			✓
11	Chis	*Chisocheton cumingianus*	Meliaceae		✓	✓	
12	Chuk	*Chukrasia tabularis*	Meliaceae	✓			
13	Cinn	*Cinnamomum iners*	Lauraceae	✓			
14	Clei	*Cleidion spiciflorum*	Euphorbiaceae	✓	✓		✓
15	Dalb	*Dalbergia cana*	Leguminosae-Papilionoideae	✓		✓	
16	Dend	*Dendermachera ignea*	Bignoniaceae	✓		✓	
17	Dimo	*Dimocarpus longan*	Sapindaceae	✓			
18	Dios	*Diospyros rubra*	Ebenaceae	✓	✓		✓
19	Fern	*Fernandoa adenophylla*	Bignoniaceae	✓			✓
20	Ficu	*Ficus callosa*	Moraceae		✓		
21	Garc	*Garcinia cowa*	Guttiferae		✓	✓	
22	Garu	*Garuga pinnata*	Burseraceae		✓		
23	Goni	*Goniothalamus griffithii*	Annonaceae			✓	✓
24	Harp	*Harpullia arborea*	Sapindaceae	✓		✓	✓
25	Hors	*Horsfieldia glabra*	Myristicaceae		✓		
26	Knem	*Knema erratica* Sinclair	Myristicaceae		✓	✓	
27	Lage	*Lagerstroemia venusta*	Lythraceae	✓	✓		✓
28	Mall	*Mallotus barbatus*	Euphorbiaceae	✓	✓		
29	Micr	*Microcos tomentosa*	Tiliaceae		✓	✓	✓
30	Miro	*Mitragyna rotundifolia*	Rubiaceae		✓		
31	Mitr	*Mitrephora vandaeflora*	Annonaceae	✓			
32	Neph	*Nephelium hypoleucum*	Sapindaceae	✓			
33	Paja	*Pajanelia obovatum*	Sapotaceae		✓		✓
34	Picr	*Picrasma javanica*	Simaroubaceae				✓
35	Poly	*Polyalthia viridis*	Annonaceae		✓	✓	
36	Pter	*Pterospermum cinnamomeum*	Sterculiaceae		✓		
37	Rade	*Radermachera ignea*	Bignoniaceae	✓			✓
38	Sali	*Salix tetrasperma*	Salicaceae			✓	✓
39	Sand	*Sandoricum koetjape*	Meliaceae			✓	
40	Sarc	*Sarcosperma arboretum*	Sapotaceae			✓	✓
41	Seme	*Semecarpus albescens*	Anacardiaceae	✓			✓
42	Spon	*Spondias lakonensis*	Anacardiaceae		✓		✓
43	Tetr	*Tetrameles nudiflora*	Datiscaceae		✓		✓
44	Toon	*Toona ciliate*	Meliaceae		✓		✓
45	Vibu	*Viburnum odoratissimum*	Caprifoliaceae	✓	✓		
46	Xant	*Xanthophyllum virens*	Xantophyllaceae	✓			✓

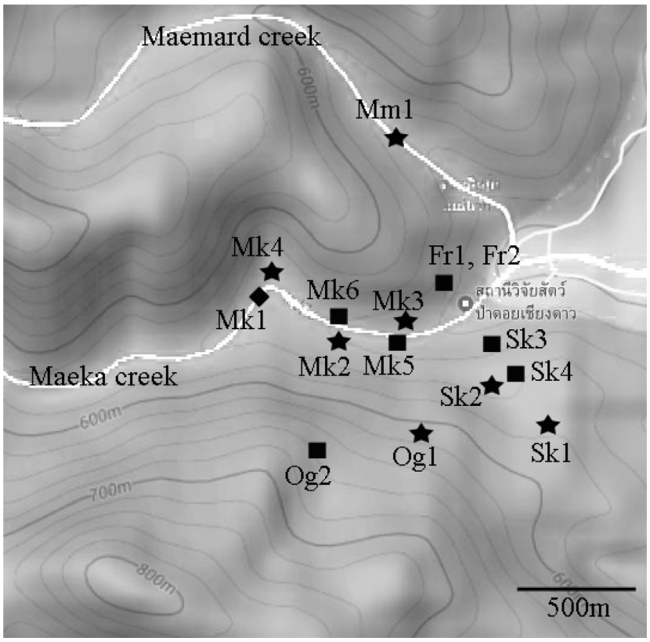

Fig. 6. Map of nest sites (Mk = Maeka; Mm = Maemard; Og = Ong; Sk = Sikrobkrua).

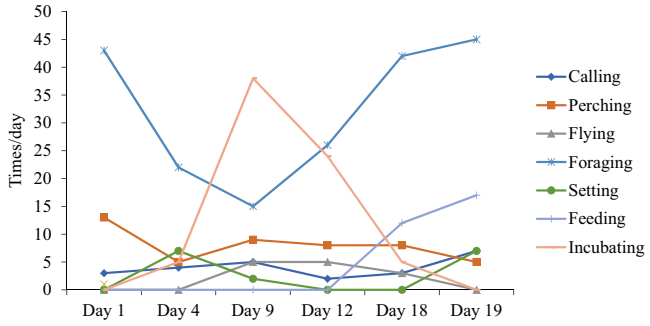

Fig. 7. Behavior of the buff-breasted babbler during the nesting (Maeka3) during April–May 2011.

in the direction of the nest mouth, sometimes asleep with their mouths open. In addition, they stretched themselves, expanded their wings, preened and made soft noises.

The general behavior of the birds included foraging, excretion, locomotion, preening and vigilance. The complete breeding cycle of the buff-breasted babbler in this study was almost 1 mth. The clutch size was 3–4 eggs, and the nestlings hatched almost simultaneously. After hatching, both parents invested in intensive parental care. As well as providing food, they also protected their nestlings. The parents ate the fecal sac to help improve nest sanitation, which in turn helped to increase the likelihood that the nestlings would remain healthy. Keeping the nest clean of the feces also helped keep it warm, dry and free of insect infestation, while transporting the feces away from the nest reduced the likelihood that predators could use them as a clue in finding the nests, and odor of the birds might be expected to affect nest predation because mammalian predators use a well-developed sense of smell to locate prey items (Weatherhead, 1984; Stanbury, 2010). Parents tended to eat the fecal sacs when staying at the nest, and this behavior may facilitate other aspects of parental care such as brooding (Hurd et al., 1991). The frequency of feeding in the nest increased as the nestlings grew older, and the nutritional content of fruits and the availability of insects may be involved in nesting and nesting success (Stauffer and Smith, 2004). It was found that the buff-breasted babbler nestlings usually responded when their nests were shaken no matter whether the parents were present or not by gaping their beaks widely and stretching their necks. The buff-breasted babbler took 27–29 d for breeding consisting of egg laying (3–4 d), incubating (14–15 d) and the nestling period (10 d).

As the loss and destruction of habitat can be considered as the most serious threats facing many bird species, natural habitat protection is essential. This can be achieved by setting aside the areas as protected areas, or non-hunting areas, and passing legislation protecting the habitats. The goal of habitat protection for birds and other threatened animals and plants often conflicts with other stakeholders, such as villagers, who can face damaging restrictions on their activities. Making firebreaks away from nesting areas can help to protect the birds from other pests and predators. However, fallen leaves are important for birds that nest on the ground, especially the buff-breasted babbler. Their nests are covered with these dried leaves to hide them from some predators. Fences may be necessary to exclude domestic and wild grazing animals for the conservation of the birds during the breeding season. Studies of the breeding behavior of the birds should not involve being intrusively close to the nests, and blinds made from natural materials were the most suitable for behavioral observation of the breeding birds.

Conflict of interest

The authors declare there is no conflict of interest.

Acknowledgements

The authors are very grateful to the Head of the Chiang Dao Wildlife Sanctuary and the staff of the Doi Chiang Dao Wildlife Research Station who took care of security during surveying.

References

Collar, N.J., Robson, C., 2007. Family Timaliidae (Babblers). Handbook of the Birds of the World, Vol. 12. Picathartes to Tits and Chickadees. Lynx Edicions, Barcelona, Spain.
Hurd, P.L., Weatherhead, P.J., McRae, S.B., 1991. Parental consumption of nestling feces: good food or sound economics? Behav. Ecol. 2, 69–76.
Lekagul, B., Round, P.D., 2005. A Guide to the Birds of Thailand, third ed. Saha Karn Bhaet, Bangkok, Thailand.
Moradi, H.V., Mohamed, Z., 2010. Response of babblers (Timaliidae) to the forest edge-interior gradient in an isolated tropical rainforest in Peninsular Malaysia. J. Trop. For. Sci. 22, 36–48.
Ngoenjun, P., Sitasuwan, N., 2010. Use of a blind to observe the breeding behavior of the Asian paradise flycatcher (*Terpsiphone paradisi* L.). Asian J. Biol. Edu. 4, 2–7.
Panyaarj, P., 2006. Behavior of Great Hornbill (*Buceros bicornis*) in Captivity at Chiang Mai Zoo (M.Sc. thesis). Faculty of Science, Chiang Mai University, Chiang Mai, Thailand.
Petit, K.E., Petit, L.J., Petit, D.R., 1989. Fecal sac removal: do the pattern and distance of dispersal affect the chance of nest predation. Condor 91, 479–482.
Rojanadilok, P., 1999. Breeding biology of slaty-backed forktail. J. Wildl. Thail. 7, 46–55.
Saab, V., 1999. Importance of spatial scale to habitat use by breeding birds in riparian forests. Ecol. Appl. 9, 135–151.
Samitinand, T., 2001. Thai Plant Names (revised edition). The Forest Herbarium, Royal Forest Department, 810 p.
Sribuarod, K., Chedsing, B., 2001. Ecology and Breeding Biology of the Red-Wattled Lapwing (*Vanellus indicus*). Wildlife Yearbook. Wildlife Research Division, Bangkok, Thailand.
Stanbury, M., 2010. A Study of the Role Odor Plays in Risk of Nest Predation in Birds. University of Canterbury, Canterbury, New Zealand.
Stauffer, D.J., Smith, T.B., 2004. Breeding and nest site characteristics of the black-casqued hornbill (*Ceratogymna atrata*) and white-thighed hornbill (*Ceratogymna cylindricus*) in South-Central Cameroon. Ostrich 75, 79–88.
Weatherhead, P.J., 1984. Fecal sac removal by tree swallows: the cost of cleanliness. Condor 86, 187–191.
Welty, J.C., 1962. The Life of Birds. W.B. Saunders Company, Philadelphia, PA, USA.
Wyshynski, S., Pulfer, T., 2015. Recovery Strategy for the Golden Eagle (*Aquila chrysaetos*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources and Forestry, Peterborough, Ontario, Canada.