# Birds Species Diversity along Riparian Zones at Doi Chiang Dao Wildlife Research Station, Chiang Mai Province, Thailand
# ความหลากชนิดของนกตามเขตพื้นที่ริมน้ำที่สถานีวิจัยสัตว์ป่าดอยเชียงดาว จังหวัดเชียงใหม่

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## Abstract

A study of bird diversity at Doi Chiang Dao Wildlife Research Station, Chiang Mai, along four (two permanent, which were Maeka and Maemard, and two intermittent, which were Ong and Sikrobkrua) creeks was conducted from April 2011 to May 2013. There were five orders, 23 families, 48 species of birds. Passeriformes was found in the highest number, and the buff-breasted babbler (*Pellorneum tickelli*) was the most abundant species, followed by the puff-throated bulbul and the black-crested bulbul, respectively. Maemard creek's bird community (28 sp.) had the highest diversity index, followed by Maeka's (20 sp.), Sikrobkrua's (17 sp.) and Ong's (10 sp.) with the values of 3.06, 2.89, 2.78 and 1.53, respectively. Similarity coefficiency index showed that birds composition in Maeka was similar to Maemard, and Sikrobkrua was to Ong creek. Abundance of the birds in the studied sites was dependent on physical and biological attributes of the creeks. This information has an important implication, for riparian conservation.

**Keywords:** Buff-breasted babbler, Intermittent creeks, Permanent creeks, Riparian

## บทคัดย่อ

การศึกษาความหลากหลายของนกที่สถานีวิจัยสัตว์ป่าดอยเชียงดาว จังหวัดเชียงใหม่ทั้ง 4 ลำห้วย ซึ่งแบ่งเป็นลำห้วยที่มีน้ำไหลตลอดปี ได้แก่ ห้วยแม่ก๊ะและห้วยแม่มาด และห้วยที่มีน้ำไหลในช่วงฤดูฝน ได้แก่ ห้วยอองและห้วยสี่ครอบครัว ซึ่งทำการเก็บข้อมูลตั้งแต่เดือนเมษายน พ.ศ. 2554 ถึงเดือนพฤษภาคม พ.ศ. 2556 พบนกทั้งหมด 5 อันดับ 23 วงศ์ 48 ชนิด อันดับที่พบจำนวนนกมากที่สุดได้แก่ อันดับนกเกาะคอน (Passeriformes) และนกกินแมลงป่าอกสีน้ำตาลเป็นนกชนิดที่พบมากที่สุด รองลงมาได้แก่ นกปรอดโอ่งเมืองเหนือและนกปรอดเหลืองหัวจุกตามลำดับ ห้วยแม่มาดเป็นลำห้วยที่มีดัชนีความหลากหลายของนกมาก

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ที่สุด (28 ชนิด) รองลงมาคือ ห้วยแม่ก๊ะ (20 ชนิด) ห้วยสี่ครอบครัว (17 ชนิด) และห้วยออง (10 ชนิด) ด้วยค่าดัชนีความหลากหลาย 3.06 2.89 2.78 และ 1.53 ตามลำดับ เมื่อเปรียบเทียบดัชนีค่าสัมประสิทธิ์ความคล้ายคลึงพบว่าความหลากหลายของชนิดนกในห้วยแม่ก๊ะและห้วยแม่มาดมีความคล้ายคลึงกันส่วนห้วยสี่ครอบครัวและห้วยอองก็มีความคล้ายคลึงกัน ความอุดมสมบูรณ์ของชนิดนกในพื้นที่ศึกษาขึ้นอยู่กับปัจจัยทางกายภาพและปัจจัยทางชีวภาพของลำห้วย ซึ่งข้อมูลนี้มีความหมายสำคัญสำหรับการนำไปใช้ประโยชน์ในการอนุรักษ์พื้นที่ริมฝั่ง

**คำสำคัญ :** นกกินแมลง ลำห้วย พื้นที่ริมฝั่ง

## Introduction

Riparian area (or riparian zone) is the interface between land and a river or a stream. Riparian zones are significant in ecology, environmental management, and civil engineering because of their role in soil conservation, habitats, biodiversity, connectivity corridors within river networks, and the influence they may have on fauna and aquatic ecosystems, including grassland, woodland, wetland or even non-vegetative areas (Orr et al., 2009; Owen et al., 2011). The riparian zones provide wildlife habitat and foraging area for wildlife. Riparian zone are attractive to some birds to forage, nest, use as a refuge or ambush preys. Some habitats are used by birds for roosting or as refuge sites. The birds may leave the forests and fly to adjacent areas to find food (Mansor et al., 2011). Doi Chiang Dao Wildlife Research Station is located at the foot of Doi Chiang Dao mountain, Chiang Mai, at Maeka creek at an altitude about 490 meters above sea level, and is covered with hill-evergreen and mixed-deciduous forests (Ngoenjun, 2010). Doi Chiang Dao is the origin of several streams, with, therefore, many riparian areas. Permanent creeks (or perennial stream) are streams that have continuous flow in parts of the stream bed all year round during years of normal rainfall. Permanent streams are contrasted with intermittent streams, which normally cease flowing for weeks or months each year, and with ephemeral channels that flow only for hours or days following rainfall (Levick et al., 2008). During unusual dry years, a normal permanent stream may cease flowing, becoming intermittent for days, weeks, or months depending on severity of the drought.

The riparian zones provide wildlife corridors enabling aquatic and riparian organisms to move along river systems avoiding isolated communities. A study of the use of riparian buffer strips as movement corridors by forest birds showed that capture rates of juvenile birds increased significantly from pre- to post-harvest of boreal mixed wood forest of Alberta, Canada (Machtans et al., 1996). Movement rates of the forest species in clear-cuts were significantly lower than the capture rates in the forests. This result indicated that buffer strips enhanced movements of the juveniles (i.e., acted as corridors) and maintained movement rates of the adults, and adult birds may be less reluctant to fly across openings, making corridor use less

important (Machtans et al., 1996). Furthermore, riparian zones provide native landscape irrigation by extending seasonal or perennial flows of water. Nutrients from terrestrial vegetation (e.g. plant litter) are transferred to aquatic food webs. The vegetation surrounding the stream helps to shade the water mitigating water temperature changes. Although riparian zones are a small component of the landscape, they provide essential habitats for many species of birds (Luther et al., 2008; Cooke and Zack, 2009). Riparian zone in many areas of the western United States comprised less than 1 per cent of the total land area, yet these areas are used by more species of breeding birds than any other habitats in North America (Fisher, 2000). The riparian zone had potential benefits by maintaining pollinators for figs and riparian species, whose dispersal were mainly by water, rather than animals (Pothasin et al., 2016). Several bird species also nested at or near the surface of the water, and are thus vulnerable to nest flooding or standing (des Granges et al., 2006). Furthermore, water level can affect aquatic insects. Stream insects are an important food resource for insectivorous birds in riparian habitats of the tallgrass prairies (Gray, 1993). Birds and bats predation on arthropod herbivores significantly reduced leaf damage and biomass loss of the canopy in oak trees of the temperate zone. The top-down control of leaf damage strongly depended on predator diversity (Bohm, 2011).

A study of the importance of different regimes together with their associated vegetation on bird species richness in north-western New South Wales, Australia, investigated that bird species richness under three water regimes, which were artificial lake, natural waterholes, and desert location. It was found that increased habitat complexity and the influence of the neighbouring habitat matrix have been identified as important factors responsible for high bird diversity in riparian habitats. Species numbers decreased with the distance to water both in the riparian and the desert habitat types, especially during drought, bird species concentrated in riparian zones and used riparian vegetation more often (Schneider and Griesser, 2009).

Other research works at Doi Chiang Dao have been focused on species diversity, status, distribution, and ecology of plants, microorganisms and wildlife. For example, a study of 17 orders of insects, most are herbivores (Leksawad, 1998) was done in Doi Chiang Dao Wildlife Sanctuary. A survey of birds at Doi Chiang Dao Wildlife Sanctuary was determined by line transect. There were 61 species of birds, which could be classified as 55 residents and 6 migratory species. Distribution of the birds was related to foraging behaviour (Boonquarmdee, 2003). In addition, a study of diversity of four groups of vertebrate in Doi Chiang Dao Wildlife Sanctuary, i.e. mammals, birds, reptiles, and amphibians, were conducted. The methods used were manual collecting, visual encounter survey, and trapping. This study had recorded 50 mammal species, 165 bird species, 34 reptile species, and 33 amphibian species (Niyomwan, 2005). Four groups of the wildlife (mammals, birds, reptiles and amphibians) were studied for nearly 4 years at Doi Chiang Dao. The study was conducted by manual collecting, visual

encounter survey and trapping methods. The result showed that at least 357 species of wildlife, consisting of 59 mammal species, 213 bird species, 51 reptile species, and 34 amphibian species (Boonkird et al., 2007).

Because the creek around the research station has different conditions, such as the width of the creeks, density of trees and forest floor, side area of creeks, altitudes and flow of water through the creeks, but all of creeks were adjoin to each other. This study investigated bird diversity along these four creeks, we investigated the diversity of birds in intermittent and permanent riparian areas. Diversity of birds in those areas can be assessed to important factors for birds' habitat-use and most importantly can be used to help protect these animals and their habitats from population decline or extinction.

**Materials and Methods**

Maeka creek is a permanent creek running through Doi Chiang Dao Wildlife Research Station and flows into marsh areas in Chiang Dao district. Maemard creek is also a permanent creek and flows into a reservoir, which is used as water supply for a village. Ong creek and Sikrobkrua creek are intermittent creeks, but there are a few small pools around rocks. Diversity of birds was surveyed for two year from April 2011 to May 2013. Along each of the creeks, a line transect (Goldsmith, 1991) of 500 meters was laid. Bird species were recorded using the line transect method with a binocular and record the birds that found along the creeks and on the side area along the surveyed route. The surveys were done with random time and distributing period during 8am to 5pm at each of the creeks. There were two permanent creeks, which were Maeka creek and Maemard creek, and two intermittent creeks, which were Ong creek and Sikrobkrua creek at Doi Chiang Dao Wildlife Research Station (Figure 1).

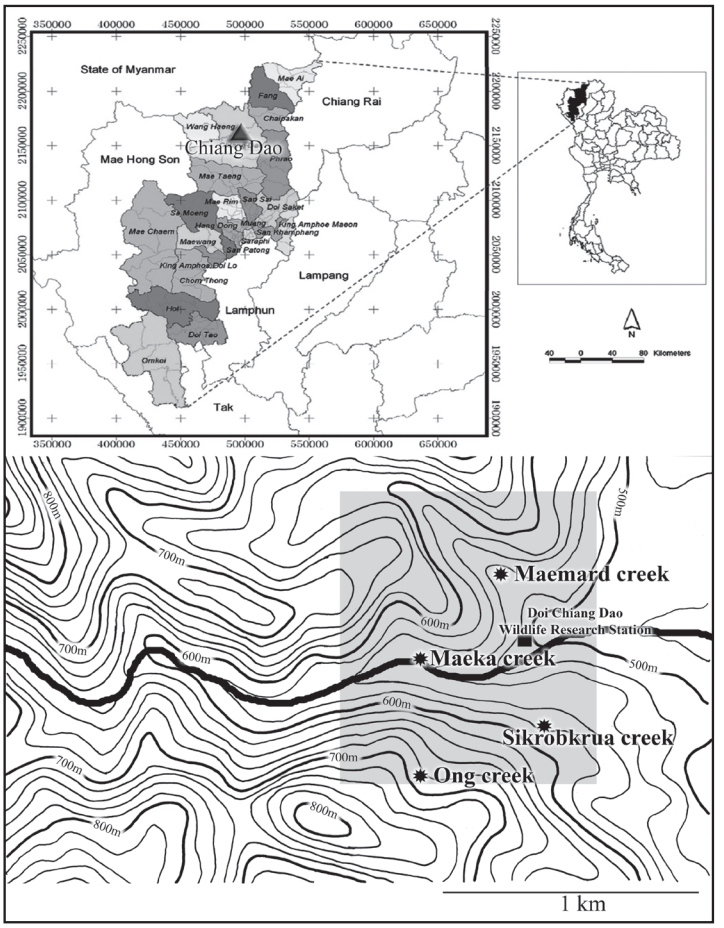


**Figure 1** Map of study areas at Doi Chiang Dao Wildlife Research Station, Chiang Mai

Bird species and their numbers were recorded. The species were classified according to the reference books, "A Guide to the Birds of Thailand" (Lekagul and Round, 2005) and "A Field Guide to the Birds of Thailand and South-East Asia" (Robson, 2000). The survey of birds was not conducted during periods of inclement weather, i.e. strong winds or precipitation (Smith and Wachob, 2006). Finally, the data obtained throughout the survey were calculated for species diversity index (Shannon's index) of birds and similarities (Sorensen's index) between the creeks.

## Results and Discussion

The study on the diversity of birds along the creeks in the area of Doi Chiang Dao Wildlife Research Station (consisted of four creeks: Maeka, Maemard, Ong, and Sikrobkrua creeks) recorded 5 Orders, 23 families, 48 species of the birds. The most common was members of Order Passeriformes (It has the highest number of species), followed by Orders Galliformes, Strigiformes, Columbiformes, and Gruiformes, respectively (Table1).

**Table 1** Bird diversity of Maeka, Maemard, Ong and Sikrobkrua creeks, Doi Chiang Dao Wildlife Research Station, Chiang Mai Province

| Item | Common Name | Species name | Family name | Order | Status |
|---|---|---|---|---|---|
| 1 | Scaly-breasted Partridge | *Arborophila chloropus* | Phasianidae | Galliformes | R |
| 2 | Bar-backed Partridge | *Arborophila brunneopectus* | Phasianidae | Galliformes | R |
| 3 | Emeral Dove | *Chalcophaps indica* | Columbidae | Columbiformes | R |
| 4 | Oriental Scops-Owl | *Otus sunia* | Strigidae | Strigiformes | R |
| 5 | Bay Owl | *Phodilus badius* | Tytonidae | Strigiformes | R |
| 6 | White-breasted Waterhen | *Amauronis phoenicurus* | Rallidae | Gruiformes | R |
| 7 | Great Iora | *Aegithinala fresnayei* | Chloropseidae | Passeriformes | R |
| 8 | Golden-fronted Leafbird | *Chloropsis aurifrons* | Chloropseidae | Passeriformes | R |
| 9 | Yellow-vented Flowerpecker | *Dicaeumchry sorrheum* | Dicaeidae | Passeriformes | R |
| 10 | White-rumped Munia | *Lonchura striata* | Estrildidae | Passeriformes | R |
| 11 | Pin-tailed Parrotfinch | *Erythrura prasina* | Estrildidae | Passeriformes | R |
| 12 | Silver-breasted Broadbill | *Serilophus lunatus* | Eurylaimidae | Passeriformes | R |
| 13 | Asian Fairy-bluebird | *Irena puella* | Irenidae | Passeriformes | R |
| 14 | White-crested Laughingthrush | *Garrulax leucolophus* | Leiothrichidae | Passeriformes | R |
| 15 | Lesser Necklaced Laughingthrush | *Garrulax monileger* | Leiothrichidae | Passeriformes | R |
| 16 | Asian Paradise Flycatcher | *Terpsiphone paradisi* | Monarchidae | Passeriformes | R |
| 17 | Black-naped Monarch | *Hypothymis azurea* | Monarchidae | Passeriformes | R |
| 18 | Grey Wagtail | *Motacilla cinerea* | Motacillidae | Passeriformes | M |
| 19 | White Wagtail | *Motacilla alba* | Motacillidae | Passeriformes | M |
| 20 | Grey-headed Flycatcher | *Culicicapacey lonensis* | Muscicapidae | Passeriformes | R |
| 21 | Hill Blue Flycatcher | *Cyornis banyumas* | Muscicapidae | Passeriformes | R |
| 22 | Little-Spiderhunter | *Arachnothera longirostra* | Nectariniidae | Passeriformes | R |
| 23 | Purple-naped Sunbird | *Hypogramma hypogrammicum* | Nectariniidae | Passeriformes | R |
| 24 | Ruby-cheeked Sunbird | *Anthreptes singgalensis* | Nectariniidae | Passeriformes | R |
| 25 | Streaked Spiderhunter | *Arachnothera magna* | Nectariniidae | Passeriformes | R |
| 26 | Yellow-browed Tit | *Sylviparus modestus* | Paridae | Passeriformes | R |
| 27 | Black-crested Bulbul | *Pycnonotusme lanicterus* | Pycnonotidae | Passeriformes | R |
| 28 | Puff-throated Bulbul | *Criniger pallidus* | Pycnonotidae | Passeriformes | R |

**Table 1** (Continue)

| Item | Common Name | Species name | Family name | Order | Status |
|---|---|---|---|---|---|
| 29 | Grey-eyed Bulbul | *Hypsipetes propinquus* | Pycnonotidae | Passeriformes | R |
| 30 | Stripe-throated Bulbul | *Pycnonotus finlaysoni* | Pycnonotidae | Passeriformes | R |
| 31 | White-browed Fantail | *Rhipidura aureola* | Rhipiduridae | Passeriformes | R |
| 32 | Velvet-fronted Nuthatch | *Sitta frontalis* | Sittidae | Passeriformes | R |
| 33 | Yellow-billied Warbler | *Abroscopus superciliaris* | Sylviidae | Passeriformes | R |
| 34 | Stub-tailed Bush-Warbler | *Cettia squameiceps* | Sylviidae | Passeriformes | M |
| 35 | Inornate Warbler | *Phylloscopus inortatus* | Sylviidae | Passeriformes | M |
| 36 | Common Tailorbird | *Orthotomus sutorius* | Sylviidae | Passeriformes | R |
| 37 | Hill Prinia | *Priniaatrogularis* | Sylviidae | Passeriformes | R |
| 38 | Thick-billed Warbler | *Acrocephal usaedon* | Sylviidae | Passeriformes | M |
| 39 | Lemon-rumped Warbler | *Phylloscopus proregulus* | Sylviidae | Passeriformes | M |
| 40 | Buff-breasted Babbler | *Pellorneum tickelli* | Timaliidae | Passeriformes | R |
| 41 | Puff-throated Babbler | *Pellorneum ruficeps* | Timaliidae | Passeriformes | R |
| 42 | Stripe Tit-Babbler | *Macronous gularis* | Timaliidae | Passeriformes | R |
| 43 | White-crowned Forktail | *Enicurusles chenaulti* | Turdidae | Passeriformes | R |
| 44 | Slaty-backed Forktail | *Enicuruss chistaceus* | Turdidae | Passeriformes | R |
| 45 | Black-backed Forktail | *Enicurusim maculatus* | Turdidae | Passeriformes | R |
| 46 | White-rumped Shama | *Copsychus malabaricus* | Turdidae | Passeriformes | R |
| 47 | Siberian Blue Robin | *Luscinia cyane* | Turdidae | Passeriformes | M |
| 48 | Japanese White-eye | *Zosterops japonicus* | Zosteropidae | Passeriformes | M |

R = resident species

M = migratory species

Twenty bird species were found in Maeka creek area, 16 species were resident birds and 4 species were migratory birds. Most of the birds were in Order Passeriformes (Table 2). The most abundant birds that found at Maeka creek were buff-breasted babbler (*Pellorneum tickelli*) and white-crowned forktail (*Enicurus leschenaultia*), followed by black-crested bulbul (*Pycnonotus melanicterus*), puff-throated bulbul (*Criniger pallidus*), and grey-headed flycatcher (*Culicicapa ceylonensis*), respectively.

**Table 2** Numbers and status of birds species recorded at Maeka creek, Doi Chiang Dao Wildlife Research Station, Chiang Mai Province

| Item | Common Name | Scientific Name | Number | Status |
|---|---|---|---|---|
| 1 | Buff-breasted Babbler | *Pellorneum tickelli* | 8 | R |
| 2 | Puff-throated Babbler | *Pellorneum ruficeps* | 2 | R |
| 3 | Stripe Tit-Babbler | *Macronous gularis* | 4 | R |
| 4 | Black-crested Bulbul | *Pycnonotusme lanicterus* | 6 | R |
| 5 | Puff-throated Bulbul | *Criniger pallidus* | 2 | R |
| 6 | White-crowned Forktail | *Enicurusles chenaulti* | 8 | R |
| 7 | Slaty-backed Forktail | *Enicuruss chistaceus* | 2 | R |
| 8 | Grey-headed Flycatcher | *Culicicapa ceylonensis* | 5 | R |
| 9 | Hill Blue Flycatcher | *Cyornis banyumas* | 1 | R |
| 10 | Black-naped Monarch | *Hypothymis azurea* | 1 | R |
| 11 | Inornate Warbler | *Phylloscopusi nortatus* | 1 | M |
| 12 | Grey Wagtail | *Motacilla cinerea* | 2 | M |
| 13 | White-rumped Shama | *Copsychusma labaricus* | 1 | R |
| 14 | Yellow-browed Tit | *Sylviparus modestus* | 1 | R |
| 15 | Ruby-cheeked Sunbird | *Anthreptessing galensis* | 1 | R |
| 16 | Hill Prinia | *Priniaatro gularis* | 1 | R |
| 17 | Great Iora | *Aegithinala fresnayei* | 3 | R |
| 18 | Thick-billed Warbler | *Acrocephalus aedon* | 1 | M |
| 19 | Lemon-rumped Warbler | *Phylloscopus proregulus* | 2 | M |
| 20 | Streaked Spiderhunter | *Arachnothera magna* | 1 | R |
| | | | Total = 53 | |

R = resident species

M = migratory species

In front of the research station, there was a field that had small swamp and clay soil. Villagers often took their buffalos there. These free ranging buffalos fed in natural trail through Maemard creek. There were also footprints of other wildlife species, such as barking deer and wild boar.

Twenty-eight bird species were found at Maemard creek, 25 species were resident birds and 3 species were migratory birds (Table 3), most of the birds were in Order Passeriformes (Table 3). Most of the birds that took advantage of the creek moved on tree branches, and fed on ground flora. It was found that the buff-breasted babbler used the habitat most frequently, followed by black-crested bulbul that feed on fruits of lower bushes, and also found puff-

throated bulbul (*Criniger pallidus*) , white-crowned forktail (*Enicurus leschenaultia*), grey-headed flycatcher (*Culicicapa ceylonensis*), inornate warbler (*Phylloscopus inortatus*) and lesser necklaced laughing thrush (*Garrulax monileger*) followed in similar numbers.

**Table 3** Numbers and status of birds species recorded at Maemard creek, Doi Chiang Dao Wildlife Research Station, Chiang Mai Province

| Item | Name | Scientific Name | Number | Status |
|---|---|---|---|---|
| 1 | Buff-breasted Babbler | *Pellorneum tickelli* | 11 | R |
| 2 | Puff-throated Babbler | *Pellorneum ruficeps* | 3 | R |
| 3 | Stripe Tit-Babbler | *Macronous gularis* | 1 | R |
| 4 | Black-crested Bulbul | *Pycnonotusmela nicterus* | 7 | R |
| 5 | Puff-throated Bulbul | *Criniger pallidus* | 6 | R |
| 6 | Stripe-throated Bulbul | *Pycnonotus finlaysoni* | 1 | R |
| 7 | White-crowned Forktail | *Enicurusles chenaulti* | 6 | R |
| 8 | Slaty-backed Forktail | *Enicuruss chistaceus* | 2 | R |
| 9 | Black-backed Forktail | *Enicurusimma culatus* | 2 | R |
| 10 | Asian Paradise Flycatcher | *Terpsiphone paradisi* | 1 | R |
| 11 | Grey-headed Flycatcher | *Culicicapa ceylonensis* | 6 | R |
| 12 | Hill Blue Flycatcher | *Cyornis banyumas* | 1 | R |
| 13 | Black-naped Monarch | *Hypothymis azurea* | 3 | R |
| 14 | Yellow-billied Warbler | *Abroscopus superciliaris* | 1 | R |
| 15 | Inornate Warbler | *Phylloscopusi nortatus* | 6 | M |
| 16 | Grey Wagtail | *Motacilla cinerea* | 2 | M |
| 17 | White Wagtail | *Motacilla alba* | 2 | M |
| 18 | White-rumped Shama | *Copsychus malabaricus* | 2 | R |
| 19 | White-rumped Munia | *Lonchura striata* | 3 | R |
| 20 | Emeral Dove | *Chalcophaps indica* | 1 | R |
| 21 | Little-Spiderhunter | *Arachnothera longirostra* | 4 | R |
| 22 | Pin-tailed Parrotfinch | *Erythrura prasina* | 1 | R |
| 23 | Common Tailorbird | *Orthotomus sutorius* | 1 | R |
| 24 | Lesser Necklaced Laughingthrush | *Garrulaxmo nileger* | 6 | R |
| 25 | White-breasted Waterhen | *Amauronis phoenicurus* | 1 | R |
| 26 | Golden-fronted Leafbird | *Chloropsis aurifrons* | 2 | R |

**Table 3** (Continue)

| Item | Name | Scientific Name | Number | Status |
|---|---|---|---|---|
| 27 | Yellow-vented Flowerpecker | *Dicaeumchry sorrheum* | 1 | R |
| 28 | Velvet-fronted Nuthatch | *Sitta frontalis* | 1 | R |
| | | | Total = 84 | |

R = resident species

M = migratory species

Ten species of birds were found along Ong creek. There were 8 species of resident birds and 2 species of migratory birds (Table 4), most of the birds were in Order Passeriformes. They were only partially there, such as little-spider hunter that fed on nectar from banana flowers, and some scaly-breasted partridge ferreted foods on the ground. This was home use for some birds, such as silver-breasted broadbill (*Serilophus lunatus*), which nested on the top part of tree branches at the bottom of the creek, and buff-breasted babbler (*Pellorneum tickelli*) that nested on the ground.

**Table 4** Numbers and status of birds species recorded at Ong creek, Doi Chiang Dao Wildlife Research Station, Chiang Mai Province

| Item | Name | Scientific Name | Number | Status |
|---|---|---|---|---|
| 1 | Buff-breasted Babbler | *Pellorneum tickelli* | 4 | R |
| 2 | Puff-throated Bulbul | *Criniger pallidus* | 3 | R |
| 3 | Grey-eyed Bulbul | *Hypsipetesprop inquus* | 2 | R |
| 4 | Scaly-breasted Partridge | *Arborophila chloropus* | 4 | R |
| 5 | Little-Spiderhunter | *Arachnothera longirostra* | 2 | R |
| 6 | Oriental Scops-Owl | *Otus sunia* | 1 | R |
| 7 | White-browed Fantail | *Rhipidura aureola* | 1 | R |
| 8 | Siberian Blue Robin | *Luscinia cyane* | 1 | M |
| 9 | Silver-breasted Broadbill | *Serilophus lunatus* | 4 | R |
| 10 | Japanese White-eye | *Zosterops japonicus* | 2 | M |
| | | | Total = 24 | |

R = resident species

M = migratory species

The birds found at Sikrobkrua creek consist of 17 species, 15 species were resident and 2 species were migratory birds (Table 5), most of the birds were in Order Passeriformes. The birds took advantage of Sikrobkrua creek and accessed to the creek for living on the

ground and on tree branches. The forest floor of Sikrobkrua creek had a variety of material types. There was a sparse forest, and the ground was covered with dried leaves. The sides of the creek had not much rock compared to the other three creeks. It was suitable for ferreting food on the ground. The birds that were abundantly ferreted foods on the ground were white-crested laughing thrush (*Garrulax leucolophus*), buff-breasted babbler (*Pellorneum tickelli*), and Siberian blue robin (*Luscinia cyane*).

**Table 5** Numbers and status of birds species recorded at Sikrobkrua creek, Doi Chiang Dao Wildlife Research Station, Chiang Mai Province

| Item | Name | Scientific Name | Number | Status |
|---|---|---|---|---|
| 1 | Buff-breasted Babbler | *Pellorneum tickelli* | 11 | R |
| 2 | Black-crested Bulbul | *Pycnonotusme lanicterus* | 6 | R |
| 3 | Puff-throated Bulbul | *Criniger pallidus* | 6 | R |
| 4 | Grey-eyed Bulbul | *Hypsipetes propinquus* | 2 | R |
| 5 | Grey-headed Flycatcher | *Culicicapacey lonensis* | 4 | R |
| 6 | Hill Blue Flycatcher | *Cyornis banyumas* | 1 | R |
| 7 | Scaly-breasted Partridge | *Arborophila chloropus* | 1 | R |
| 8 | Bar-backed Partridge | *Arborophila brunneopectus* | 1 | R |
| 9 | Stub-tailed Bush-Warbler | *Cettiasqua meiceps* | 1 | M |
| 10 | Emeral Dove | *Chalcophaps indica* | 1 | R |
| 11 | Little-Spiderhunter | *Arachnothera longirostra* | 3 | R |
| 12 | Bay Owl | *Phodilus badius* | 1 | R |
| 13 | Siberian Blue Robin | *Luscinia cyane* | 5 | M |
| 14 | Purple-naped Sunbird | *Hypogrammahypo grammicum* | 1 | R |
| 15 | Silver-breasted Broadbill | *Serilophus lunatus* | 2 | R |
| 16 | White-crested Laughingthrush | *Garrulax leucolophus* | 12 | R |
| 17 | Asian Fairy-bluebird | *Irena puella* | 2 | R |
| | | | Total = 60 | |

R = resident species

M = migratory species

A comparison of the bird diversity along the four creeks found that highest diversity index of birds was at Maemard creek, followed by Sikrobkrua, Maeka, and Ong creeks, whose diversity index were 3.06, and 2.89, 2.78 and 1.53, respectively. Evenness index of the birds was highest at Sikrobkrua creek, followed by at the Maeka, Maemard, and Ong creeks, which

were 0.98, 0.97, 0.92 and 0.66, respectively. By the way, the results of the study showed the mean difference of bird species and family of those birds were not significant for all creeks at the 0.05 level. But for similarity of the birds at the four creeks, it was found that Maeka creek was similar to Maemard creek at 0.74, and Ong creek was similar to Sikrobkrua creek, with the same value of 0.74 (Table 6).

**Table 6** Similarity coefficiencies (Sorensen's index) of the birds at Maeka, Maemard, Ong and Sikrobkrua creeks, Doi Chiang Dao Wildlife Research Station, Chiang Mai Province

| Creek | Sorensen's index | | | |
|---|---|---|---|---|
| | **Maeka** | **Maemard** | **Ong** | **Sikrobkrua** |
| Maeka | - | 0.74 | 0.14 | 0.32 |
| Maemard | | - | 0.17 | 0.38 |
| Ong | | | - | 0.74 |
| Sikrobkrua | | | | - |

The permanent creeks had more bird species than the intermittent creeks because of its complexity of habitat for many birds. Maemard creek had a large amount of bush-covered ground, so it was suitable for the babbler birds, especially buff-breasted babbler (*Pellorneum tickelli*), to forage in this area, and fed on insects on the forest floor. This was similar to the situation at the Sikrobkrua creek. In addition, root systems of the riparian vegetation were suitable for the nesting of forktail birds, which was similarly to Maeka creek. They lived along small creeks on mountains, permanent creeks with rock substrate. All of the forktail birds nest adjacent to rock walls, hollow banks or tree holes along the creeks (Rojanadilok, 1999). There were shallow swamps in some parts of the wet lick at Maeka creek, the birds tended to use these areas. Most of the birds in the study areas were insectivorous birds. Riparian area of permanent creeks were complexity and suitable for many species of birds.

## Conclusion

The same type of creek was similar in species composition of the birds. However, the abundance of the birds depended on physical (e.g. riparian substrate and slope) and biological (e.g. ground flora and trees) factors of those creeks. Maemard creek had the highest diversity index of the birds, followed by Sikrobkrua, Maeka, and Ong creeks, respectively. Most birds acquire fruits, took a bath, and sun bathing in the wet lick areas. Foods of these birds were small insects and seeds along the riparian areas. Bird species richness responded positively to structural complexity, which was greater in riparian location. There were many species of birds that build nests in riparian areas because of the habitats were associated with food and nesting, buff-breasted babbler (*Pellorneum tickelli*), scaly-breasted partridge (*Arborophila chloropus*) and silver-breasted broadbill (*Serilophus lunatus*) were found there.

Important factors affecting the birds that come to the riparian area were food sources, safety habitat and behavior of each bird species. The tree with large spreading branches is a good habitat for birds. Dried leaves that fall on the floor were also hiding place for insects, these were the food source for the birds. Different forests ground affect the use of birds and also depends on the type of food and the behavior of the birds, such as movement, foraging and building a nest. Some avian species respond to areas of abundant fruit supply rather than foliage profile in selecting habitats (Stamp, 1978). Plants in general can provide habitats for many species of birds (Munro et al., 2011). The permanent creeks had more bird species than the intermittent creeks because of its complexity of food and habitat for many birds, for riparian conservation. Some of bird species were sensitive to human activity, bird watching activity in some habitats should be avoid during breeding season, it may cause of abandoned nest. Human activities of hunting, picking mushrooms and other edible species have had a small effect in this area (Kamtaeja et al., 2010). Also some of bird species such as buff-breasted babbler, puff-throated babbler and scaly-breasted partridge were build a nest on ground or under fallen dried leaves, nest destroying may happened accidentally. In addition, fence should be made to keep out of free ranging buffalos fed in natural trail to save the bird nests.

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