Bird diversity in northern Myanmar and conservation implications

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ABSTRACT

We conducted four bird biodiversity surveys in the Putao area of northern Myanmar from 2015 to 2017. Combined with anecdotal information collected between 2012 and 2015, we recorded 319 bird species, including two species (Arborophila mandellii and Lanius sphenocercus) previously unrecorded in Myanmar. Bulbuls (Pycnonotidae), babblers (Timaliidae), pigeons and doves (Columbidae), and pheasants and partridges (Phasianidae) were the most abundant groups of birds recorded. Species richness below 1 500 m a.s.l. was higher than species richness at higher elevations. Our results suggest that the current protected areas in this region should be expanded to lower elevations to cover critical conservation gaps.

Keywords: Birds; Hponkan Razi; Hkakabo Razi; Surveys; Conservation; Myanmar

INTRODUCTION

The northern part of Myanmar’s Kachin State borders both China and India and lies in the Indo-Burma conservation hotspot (Myers et al., 2000). Although this area harbors rich biodiversity, conservation-related research in this region is lacking due to its steep topology, difficult transportation, and variable climate (Rao et al, 2010; Rappole et al., 2011). Since 1990, one new species of mammal (Muntiacus putaoensis) (Rabinowitz et al., 1999) and several new subspecies of birds, such as Tesia olivia chiangmaiensis (Renner et al., 2008), have been described in this region. This indicates that there are still opportunities for new discovery and exploration and that more information is needed for future conservation plans.

Since the 1990s, several bird surveys had been carried out in the Putao area (Rappole et al, 2011). Under the leadership of the Nature and Wildlife Conservation Division (NWCD) of the Myanmar Forestry Ministry, two expeditions were launched in 1997–1998 (Aung & Oo, 1999) and 2001–2009 (Rappole et al., 2011), providing the most detailed inventory of local avian diversity thus far.

Between December 2015 and May 2017, the Southeast Asia Biodiversity Research Institute, Chinese Academy of Sciences (CAS-SEABRI), Forest Research Institute (FRI) of Myanmar, Hponkan Razi Wildlife Sanctuary (HPWS), and Hkakabo Razi National Park (HKNP) jointly conducted four general biodiversity surveys in the Putao area of the northwest part of Kachin State, Myanmar. The survey region covered part of HPWS and the surrounding areas south and northeast of Putao (Figure 1). These surveys were conducted to acquire basic biodiversity distribution data for future conservation policy making.

In this paper, we summarize the results of our four surveys as well as episodic observations of a local officer (Myint Kyaw, M.K.). The present research aimed to: (1) update the avian inventory of the study area; and (2) identify survey and conservation gaps in this region.

MATERIALS AND METHODS

Study area

The survey area included the southern part of HPWS, one village south of Putao town, and areas northeast of Putao.
surrounding HKNP (Figure 1). The total survey area was around 5 000 km². Elevation in the area varies from 400 m a.s.l. at Putao to 5 881 m a.s.l. at the Hkakabo Razi Snow Mountain peak (Renner et al., 2007). Vegetation includes lowland tropical rainforest dominated by Dipterocarpaceae between 400 m a.s.l. and 600 m a.s.l., tropical seasonal rainforest dominated by *Terminalia myriocarpa* and *Dysoxylum* sp. from 600 m a.s.l. to 1 200 m a.s.l., mountain tropical rainforest between 1 200 m a.s.l. and 2 000 m a.s.l., subtropical evergreen broad-leaved forest dominated by Lauraceae and Fagaceae between 2 000 m a.s.l. and 2 600 m a.s.l., and bamboo-rhododendron habitats above 3 000 m a.s.l. (Renner et al., 2007; Yun-Hong Tan, personal communication). The temperature varies from 2 °C to 36 °C. Annual precipitation ranges from 3 800–5 100 mm, with a cooler dry season from October to February and a rainy season from March to September (Robinowitz et al., 1999).

GIS and satellite image data were downloaded from http://glcf.umiacs.umd.edu/data/, http://www.diva-gis.org/, and http://ngcc.sbsm.gov.cn/.

**Bird survey**

The surveyed habitats include cropland, small areas of riparian wetland (less than 10 count points), and the forest vegetation types mentioned above. Survey locations ranged from 400 m a.s.l. to 3 200 m a.s.l.. We conducted field surveys from 29 November 2015 to 4 January 2016; 23 April to 21 May 2016; 26 November 2016 to 5 January 2017; and 28 April to 26 May 2017.

Point counts and camera traps were combined to obtain bird diversity information. Points were situated along trails from 400 m a.s.l. to 3 200 m a.s.l.; each point was located at least 300 m from other points to ensure quasi-independence (Ralph et al., 1995). We stayed at each point for 12 min, recorded all birds seen or heard within a 100-m radius. We used camera traps to detect ground-dwelling birds and used binoculars to detect all other birds. In total, we established 53 camera stations ranging from 700 m a.s.l. to 3 200 m a.s.l.. The distances between any two camera stations always exceeded 500 m. The cameras were installed in the field between December 2015 and May 2016. The distribution of the point counts and camera traps were mapped out to show the sample effort at different elevations. In addition to systematic data obtained from point counts and camera traps, species observed during field trips were also recorded. The second author M.K., who works at HPWS and HKNP, is an experienced bird-watcher and collected anecdotal information and data through photography and direct observations between 2012 and 2015.

**RESULTS**

During the four surveys, we collected information from 304 count points. Of the 53 cameras installed, one was stolen and one was broken. The remaining 51 cameras accumulated more than 7 500 working days of images.

In total, 319 species were recorded, representing 72 families and 18 orders (Table 1), with one species listed as critically endangered, five species listed as vulnerable, and 13 species listed as near threatened in the IUCN Red List (IUCN, 2016). The percentage of birds of each family is shown in Figure 2. In terms of number of individuals recorded during the surveys, the most abundant families were Pycnonotidae (989 individuals), Leiothrichidae (850 individuals), and Columbidae (608 individuals). Several families recorded, such as Alaudidae, Artamidae, Indicatoridae, Psittacidae, Troglodytidae, and Upupidae, contained only one identified individual. The number of different species at different elevations is shown in Figure 3. The distributions of the point counts and camera traps at different elevations are shown in Figure 4. We observed 3 719 (82%) individuals from 215 (87%) species under 1 500 m a.s.l.. Sampling effort was biased towards elevations below 1 500 m a.s.l..
Table 1  Bird species observed in the Putao area of northern Myanmar from 2013 to 2017

| Species               | English name                  | IUCN* | Rappole et al., 2011** | Habitat*** | Abundance**** | Source***** |
|-----------------------|-------------------------------|-------|------------------------|------------|---------------|-------------|
| **ACCIPITRIFORMES**   |                               |       |                        |            |               |             |
| Accipitridae          |                               |       |                        |            |               |             |
| Accipiter nisus       | Eurasian Sparrowhawk          | LC    | Fo                     | +          | An            |             |
| Accipiter trivirgatus | Crested Goshawk               | LC    | Fo,V                   | +          | CP,An         |             |
| Accipiter virgatus    | Besra                         | LC    | Fo                     | +          | CP,An         |             |
| Aviceda jerdoni       | Jerdon's Baza                 | LC    | x                      | Fo         | +             | An          |
| Aquila heliaca        | Eastern Imperial Eagle        | VU    | x                      | Fo         | +             | An          |
| Buteo burmanicus      | Himalayan Buzzard             | LC    | Fi,Fo                  | +          | An            |             |
| Buteo japonicus       | Eastern Buzzard               | LC    | x                      | Fi         | +             | An          |
| Circus cyaneus        | Hen Harrier                   | LC    | Fi                     | +          | An            |             |
| Circus melanocephalus | Pied Harrier                  | LC    | V                      | +          | An            |             |
| Gyps himalayensis     | Himalayan Vulture             | NT    | x                      | Fo         | +             | An          |
| Haliaeetus humilis    | Lesser Fish Eagle             | NT    | x                      | Fo,R       | +             | CP,An       |
| Ictiniaetus malaiensis| Black Eagle                   | LC    | Fi                      | Fo         | +             | An          |
| Lophotriorchis kienerii| Rufous-bellied Hawk-Eagle     | LC    | Fi                      | +          | An            |             |
| Milvus migrans        | Black Kite                    | LC    | x                      | Fi,Fo      | +             | An          |
| Nisaetus nipalensis   | Mountain Hawk-Eagle           | LC    | Fi,Fo                  | +          | CP,An         |             |
| Spilornis cheela      | Crested Serpent Eagle         | LC    | Fi,Fo                  | +          | CP,An         |             |
| **ANSERIFORMES**      |                               |       |                        |            |               |             |
| Anatida               |                               |       |                        |            |               |             |
| Mergus merganser      | Common Merganser              | LC    | R                      | +          | An            |             |
| Tadorna ferruginea    | Ruddy Shelduck                | LC    | R                      | ++         | An            |             |
| **APODIFORMES**       |                               |       |                        |            |               |             |
| Apodida               |                               |       |                        |            |               |             |
| Cypsiurus balasiensis | Asian Palm Swift              | LC    | Fi,V,G                 | ++         | CP,An         |             |
| Hirundapus caudacutus | White-throated Needletail     | LC    | x                      | V,R        | ++             | CP,An       |
| Hirundapus giganteus  | Brown-backed Needletail       | LC    | V,R                    | ++         | CP,An         |             |
| **BUCEROTIFORMES**    |                               |       |                        |            |               |             |
| Bucerotida            |                               |       |                        |            |               |             |
| Aceros nipalensis     | Rufous-necked Hornbill        | VU    | Fo                     | +          | CP,An         |             |
| Buceros bicornis      | Great Hornbill                | NT    | Fo                     | +          | An            |             |
| Rhytiorchus undulatus | Wreathed Hornbill             | LC    | Fo                     | +          | CP,An         |             |
| Upupidae              |                               |       |                        |            |               |             |
| Upupa epops           | Common Hoopoe                 | LC    | V                      | +          | An            |             |
| **CAPRIMULGIFORMES**  |                               |       |                        |            |               |             |
| Podargidae            |                               |       |                        |            |               |             |
| Batrachostomus hodgsoni| Hodgson's Frogmouth           | LC    | Fo                     | +          | An            |             |
| **CHARADRIIFORMES**   |                               |       |                        |            |               |             |
| Jacanidae             |                               |       |                        |            |               |             |
| Actitis hypoleucus    | Common Sandpiper              | LC    | Fi,R                   | +          | An            |             |
| Calidris temminckii   | Temminck's Stint              | LC    | x                      | R          | +             | An          |
| Gallinago gallinago   | Common Snipe                  | LC    | x                      | G          | +             | CP,An       |
| Species                              | English name                  | IUCN* | Rappole et al. 2011** | Habitat*** | Abundance**** | Source***** |
|-------------------------------------|-------------------------------|-------|-----------------------|------------|---------------|-------------|
| CHARADRIIFORMES                     |                               |       |                       |            |               |             |
| Jacanidae                           |                               |       |                       |            |               |             |
| Lymnocryptes minimus                | Jack Snipe                    | LC x  | Fi,R                  | +          | An            |             |
| Scolopax rusticola                  | Eurasian Woodcock             | LC x  | Fo                    | +          | CT            |             |
| Tringa ochropus                     | Green Sandpiper               | LC    | R                     | +          | An            |             |
| Tringa stagnatilis                 | Marsh Sandpiper               | LC    | R                     | +          | An            |             |
| Charadriidae                        |                               |       |                       |            |               |             |
| Charadrius dubius                   | Little Ringed Plover          | LC x  | Fi,R                  | +          | An            |             |
| Charadrius placidus                 | Long-billed Plover            | LC x  | Fi,R                  | +          | An            |             |
| Vanellus cinereus                   | Grey-headed Lapwing           | LC x  | G,R,Fi                | +          | CP,An         |             |
| Vanellus duvaucelii                 | River Lapwing                 | NT    | G,R,Fi                | +          | CP,An         |             |
| Vanellus indicus                    | Red-wattled Lapwing           | LC    | G,R,Fi                | +          | CP,An         |             |
| Vanellus vanellus                   | Northern Lapwing              | NT x  | Fi,R                  | ++         | CP,An         |             |
| Ibidorhynchidae                     |                               |       |                       |            |               |             |
| Ibidorhynchus struthersii           | Ibisbill                      | LC    | Fi,R                  | +          | An            |             |
| Turnicidae                          |                               |       |                       |            |               |             |
| Turnix suscitator                   | Barred Buttonquail            | LC x  | Fi                    | +          | CP,An         |             |
| CICONIIFORMES                       |                               |       |                       |            |               |             |
| Ciconiidae                          |                               |       |                       |            |               |             |
| Ciconia nigra                       | Black Stork                   | LC    | Fo,R                  | +          | An            |             |
| COLUMBIFORMES                       |                               |       |                       |            |               |             |
| Columbidae                          |                               |       |                       |            |               |             |
| Chalcophaps indica                  | Emerald Dove                  | LC x  | Fo                    | +          | CP,An         |             |
| Ducula aenea                        | Green Imperial Pigeon         | LC    | Fo                    | ++         | CP,An         |             |
| Ducula badia                        | Mountain Imperial Pigeon      | LC    | Fo                    | ++++       | CP,An         |             |
| Macropygia unchall                  | Barred Cuckoo-Dove            | LC    | Fo                    | +          | An            |             |
| Spilopelia chinensis                | Spotted Dove                  | LC    | Fi,Fo                 | ++++       | CP,An         |             |
| Streptopelia orientalis             | Oriental Turtle Dove          | LC    | Fi,Fo                 | ++++       | CP,An         |             |
| Streptopelia decaocto               | Eurasian Collared Dove        | LC    | Fi,Fo                 | +++        | CP,An         |             |
| Treron apicauda                     | Pin-tailed Green Pigeon       | LC    | Fo                    | +++        | CP,An         |             |
| Treron sphenurus                    | Wedge-tailed Green Pigeon     | LC    | Fo                    | ++         | CP,An         |             |
| CORACIIFORMES                       |                               |       |                       |            |               |             |
| Alcedinidae                         |                               |       |                       |            |               |             |
| Alcedo atthis                        | Common Kingfisher             | LC    | R                     | +          | CP,An         |             |
| Alcedo hercules                      | Blyth's Kingfisher            | NT    | R                     | +          | An            |             |
| Ceryle rudis                        | Pied Kingfisher               | LC    | R                     | +          | CP            |             |
| Halcyon smyrnensis                  | White-throated Kingfisher     | LC    | R                     | +          | CP            |             |
| Megaceryle lugubris                  | Crested Kingfisher            | LC    | R                     | +          | CP            |             |
| Meropidae                           |                               |       |                       |            |               |             |
| Merops orientalis                   | Green Bee-eater               | LC    | Fo                    | +          | CP            |             |
| Nyctyornis athertoni                | Blue-bearded Bee-eater        | LC    | Fo                    | +          | CP            |             |
| Species                     | English name                | IUCN* | Rappole et al. 2011** | Habitat*** | Abundance**** | Source***** |
|-----------------------------|-----------------------------|-------|-----------------------|------------|--------------|-------------|
| **CUCULIFORMES**            |                             |       |                       |            |              |             |
| Cuculidae                   |                             |       |                       |            |              |             |
| *Cacomantis merulinus*      | Plaintive Cuckoo            | LC    |                       | Fo         | +            | CP          |
| *Centropus bengalensis*     | Lesser Coucal               | LC    |                       | Fo         | +            | An          |
| *Clamator coromandus*       | Chestnut-winged Cuckoo      | LC    |                       | Fo         | +            | CP          |
| *Cuculus canorus*           | Common Cuckoo               | LC x  |                       | Fo         | +            | CP          |
| *Cuculus micropterus*       | Indian Cuckoo               | LC    |                       | Fo         | ++           | CP,An       |
| *Cuculus poliocephalus*     | Asian Lesser Cuckoo         | LC x  |                       | Fo         | +            | CP,An       |
| *Hierococcyx sparverioides* | Large Hawk-Cuckoo           | LC    |                       | Fi,Fo      | ++           | CP,An       |
| *Surniculus dicruroides*    | Fork-tailed Drongo-Cuckoo   | LC    |                       | Fo         | ++           | CP,An       |
| **FALCONIFORMES**           |                             |       |                       |            |              |             |
| Falconidae                  |                             |       |                       |            |              |             |
| *Falco severus*             | Oriental Hobby              | LC    |                       | Fi         | +            | CP,An       |
| *Falco tinnunculus*         | Common Kestrel              | LC x  |                       | Fo         | +            | An          |
| **GALLIFORMES**             |                             |       |                       |            |              |             |
| Phasianidae                 |                             |       |                       |            |              |             |
| *Arborophila atrogularis*   | White-cheeked Partridge     | NT    |                       | Fo         | ++           | CP,CT,An    |
| *Arborophila mandelli*      | Chestnut-breasted Partridge | VU x  |                       | Fo         | +            | An          |
| *Arborophila rufogularis*   | Rufous-throated Partridge   | LC    |                       | Fo         | +++          | CP,CT,An    |
| *Arborophila torqueola*     | Common Hill Partridge       | LC    |                       | Fo         | +++          | CP,CT,An    |
| *Gallus gallus*             | Red Junglefowl              | LC    |                       | G          | +            | An          |
| *Lophura leucomelanos*      | Kalij Pheasant              | LC    |                       | Fo         | ++           | CT          |
| *Polypelectron bicalaratum* | Grey Peacock Pheasant       | LC    |                       | Fo         | ++           | CP,CT,An    |
| *Tragopan blythii*          | Blyth's Tragopan            | VU    |                       | Fo         | +            | CT          |
| *Tragopan temminckii*       | Temminck's Tragopan         | LC    |                       | Fo         | +            | CT          |
| **GRUIFORMES**              |                             |       |                       |            |              |             |
| Rallidae                    |                             |       |                       |            |              |             |
| *Amaurornis phoenicurus*    | White-breasted Waterhen     | LC x  |                       | G          | +            | An          |
| Gruidae                     |                             |       |                       |            |              |             |
| *Grus grus*                 | Common Crane                | LC    |                       | Fi,R       | ++           | CP,An       |
| **PELECANIFORMES**          |                             |       |                       |            |              |             |
| Ardeidae                    |                             |       |                       |            |              |             |
| *Ardea insignis*            | White-bellied Heron         | CR    |                       | R          | +            | An          |
| *Ardeola bacchus*           | Chinese Pond Heron          | LC x  |                       | R          | +            | An          |
| *Bubulcus ibis*             | Cattle Egret                | LC    |                       | R          | +            | An          |
| *Butorides striata*         | Striated Heron              | LC    |                       | R          | +            | An          |
| *Ixobrychus cinnamomeus*    | Cinnamon Bittern            | LC x  |                       | R          | +            | CP          |
| **PICIFORMES**              |                             |       |                       |            |              |             |
| Megalaimidae                |                             |       |                       |            |              |             |
| *Megalaima asiatica*        | Blue-throated Barbet        | LC    |                       | Fo         | ++           | CP,An       |
| *Megalaima australis*       | Blue-eared Barbet           | LC x  |                       | Fo         | +            | An          |
| *Megalaima franklinii*      | Golden-throated Barbet      | LC    |                       | Fo         | +++          | CP,An       |
| Species                        | English name            | IUCN* | Rappole et al. 2011** | Habitat*** | Abundance**** | Source***** |
|-------------------------------|-------------------------|-------|-----------------------|------------|---------------|-------------|
| **PICIFORMES**                |                         |       |                       |            |               |             |
| **Megalaimidae**              |                         |       |                       |            |               |             |
| Megalaima lineata             | Lineated Barbet         | LC    | Fo                    | +          | An            |             |
| Megalaima virens              | Great Barbet            | LC    | Fo                    | ++++       | CP,An         |             |
| **Picidae**                   |                         |       |                       |            |               |             |
| Blythipicus pyrrohtis         | Bay Woodpecker          | LC    | Fo                    | ++         | CP,An         |             |
| Chrysophlegma flavinucha      | Greater Yellownape      | LC    | Fo                    | +          | An            |             |
| Dendrocopos canicapillus      | Grey-capped Pygmy Woodpecker | LC  | Fo                    | +          | An            |             |
| Dendrocopos cathpharius       | Crimson-breasted Woodpecker | LC  | Fo                    | +          | An            |             |
| Dendrocopos darjellensis      | Darjeeling Woodpecker   | LC    | Fo                    | +          | CT            |             |
| Dendrocopos hyperthrus        | Rufous-bellied Woodpecker | LC  | Fo                    | +          | An            |             |
| Dendrocopos macei             | Fulvous-breasted Woodpecker | LC  | Fo                    | +          | CP,An         |             |
| Jynx torquilla                | Eurasian Wryneck        | LC    | V                     | +          | An            |             |
| Picus chlorolophus            | Lesser Yellownape       | LC    | Fo                    | +          | CP,An         |             |
| Sasia ochracea                | White-browed Piculet    | LC    | Fo                    | +          | CP,An         |             |
| **PASSERIFORMES**             |                         |       |                       |            |               |             |
| **Cettiidae**                 |                         |       |                       |            |               |             |
| Abroscopus albogularis        | Rufous-faced Warbler    | LC    | Fo                    | ++         | CP,An         |             |
| Abroscopus schisticeps        | Black-faced Warbler     | LC    | Fo                    | +          | An            |             |
| Abroscopus superciliaris      | Yellow-bellied Warbler  | LC    | x                     | Fo         | +++           | CP,An       |
| Cettia brunnifrons            | Grey-sided Bush Warbler | LC    | Fi                    | +          | An            |             |
| Cettia castaneocoronata       | Chestnut-headed Tesia   | LC    | Fo                    | ++         | CP,An         |             |
| Horornis fortipes             | Brownish-flanked Bush Warbler | LC  | x                     | G          | ++            | CP,An       |
| Tesia cyaniventor             | Grey-bellied Tesia      | LC    | Fo                    | +          | CP            |             |
| Tesia olivea                  | Slaty-bellied Tesia     | LC    | Fo                    | ++         | CP,An         |             |
| **Sturnidae**                 |                         |       |                       |            |               |             |
| Acridothers albocinctus       | Collared Myna           | LC    | V                     | ++++       | An            |             |
| Acridothers tristis           | Common Myna             | LC    | V                     | ++++       | An            |             |
| Agropsar sturninus            | Purple-backed Starling  | LC    | x                     | V          | +             | An          |
| Ampeliceps coronatus          | Golden-crested Myna     | LC    | x                     | V          | +             | An          |
| Gracula religiosa             | Hill Myna               | LC    | V                     | +          | An            |             |
| Sturnia malabarica            | Chestnut-tailed Starling| LC    | G,V                   | ++         | CP            |             |
| **Leiothrichidae**            |                         |       |                       |            |               |             |
| Actinodura egertoni           | Rusty-fronted Barwing   | LC    | Fo                    | ++         | CP,An         |             |
| Actinodura waldeni            | Streak-throated Barwing | LC    | Fo                    | +          | CP,An         |             |
| **Aegithalidae**              |                         |       |                       |            |               |             |
| Aegithalos bonvaloti          | Black-browed Bushtit    | NE    | x                     | Fo         | +             | CP          |
| Aegithalos concinnus          | Black-throated Bushtit  | LC    | Fo                    | +          | CP            |             |
| **Nectariniidae**             |                         |       |                       |            |               |             |
| Aethopyga ignicauda           | Fire-tailed Sunbird     | LC    | x                     | Fo         | +             | CP,An       |
| Aethopyga nipalensis          | Green-tailed Sunbird    | LC    | Fo                    | ++         | CP,An         |             |
| Aethopyga saturata            | Black-throated Sunbird  | LC    | Fo                    | ++         | CP,An         |             |
| Species             | English name          | IUCN | Rappole et al. 2011** | Habitat*** | Abundance**** | Source***** |
|---------------------|-----------------------|------|------------------------|------------|--------------|-------------|
| **PASSERIFORMES**   |                       |      |                        |            |              |             |
| Nectariniidae       |                       |      |                        |            |              |             |
| Aethopyga siparaja  | Crimson Sunbird       | LC   | Fo                     | +          | An           |             |
| Arachnothera longirostra | Little Spiderhunter    | LC   | Fo                     | +          | An           |             |
| Arachnothera magna  | Streaked Spiderhunter | LC   | Fo                     | ++         | CP,An        |             |
| Chalcoparia singalensis | Ruby-cheeked Sunbird | LC   | Fo                     | +          | An           |             |
| Alaudidae           |                       |      |                        |            |              |             |
| Alauda gulgula      | Oriental Skylark      | LC   | G                      | +          | An           |             |
| Pellorneidae        |                       |      |                        |            |              |             |
| Alcippe castaneceps | Rufous-winged Fulvetta| LC   | Fo                     | ++         | CP,An        |             |
| Alcippe cinea       | Yellow-throated Fulvetta| LC   | Fo                     | ++         | CP,An        |             |
| Alcippe morrisonia  | Grey-cheeked Fulvetta | LC   | Fo                     | ++         | CP,An        |             |
| Alcippe nipalensis  | Nepal Fulvetta        | LC   | Fo                     | +          | CP,An        |             |
| Alcippe poioicephala| Brown-cheeked Fulvetta| LC   | Fo                     | +          | CP,An        |             |
| Alcippe rufogularis | Rufous-throated Fulvetta| LC   | Fo                     | +          | CP,An        |             |
| Motacillidae        |                       |      |                        |            |              |             |
| Anthus hodgsoni     | Olive-backed Pipit    | LC   | Fi,Fo                  | ++         | CP,An        |             |
| Anthus richardi     | Richard's Pipit       | LC   | V                      | +          | An           |             |
| Anthus roseatus     | Rosy Pipit            | LC   | x                      | Fi         | ++          | An           |
| Anthus rufulus      | Paddyfield Pipit      | LC   | x                      | Fi         | +           | An           |
| Motacilla alba      | White Wagtail         | LC   | R                      | ++         | CP,An        |             |
| Motacilla cinerea   | Grey Wagtail          | LC   | V                      | +          | An           |             |
| Motacilla citreola  | Citrine Wagtail       | LC   | V                      | +          | An           |             |
| Artamidae           |                       |      |                        |            |              |             |
| Artamus fuscus      | Ashy Woodswallow      | LC   | V                      | +          | An           |             |
| Elachuridae         |                       |      |                        |            |              |             |
| Elachura formosa    | Spotted Wren-babbler  | LC   | x                      | Fo         | +           | An           |
| Muscicapidae        |                       |      |                        |            |              |             |
| Anthipes monileger  | White-gorgeted Flycatcher| LC   | Fo                     | +          | An           |             |
| Brachypteryx hyperythra | Rusty-bellied Shortwing | NT   | Fo                     | +          | CP           |             |
| Brachypteryx montana| White-browed Shortwing| LC   | Fo                     | +          | An,CT        |             |
| Chaimarornis leucocephalus | White-capped Water Redstart | LC   | R                      | ++         | CP,An        |             |
| Copsychus saularis  | Oriental Magpie Robin | LC   | V,Fi,G                 | ++         | CP,An        |             |
| Cyornis banyumas    | Hill Blue Flycatcher  | LC   | Fo                     | ++         | CP,An        |             |
| Cyornis rubeculoides| Blue-throated Flycatcher| LC   | Fo                     | +          | An           |             |
| Cyornis tickelliae  | Tickell’s Thrush      | LC   | Fo                     | +          | An           |             |
| Enicurus lescchenauti| White-crowned Forktail| LC   | R                      | +          | An           |             |
| Enicurus maculatus  | Spotted Forktail      | LC   | R                      | +          | CP,An        |             |
| Enicurus schistaceus| Slaty-backed Forktail | LC   | R                      | ++         | CP,An        |             |
| Enicurus scouleri   | Little Forktail       | LC   | R                      | +          | CP,An        |             |
| Eumyias thalassinus | Verditer Flycatcher   | LC   | Fo                     | +          | CP           |             |
| Ficedula albicilla  | Taiga Flycatcher      | LC   | x                      | Fo         | +           | CP,An        |
| Species | English name | IUCN* | Rappole et al. 2011** | Habitat*** | Abundance**** | Source***** |
|---------|-------------|-------|-----------------------|-------------|--------------|-------------|
| **PASSERIFORMES** | | | | | | |
| **Muscicapidae** | | | | | | |
| Ficedula hyperythra | Snowy-browed Flycatcher | LC | Fo | + | An |
| Ficedula strophiata | Rufous-gorgeted Flycatcher | LC | Fo | + | CP,An |
| Ficedula superciliaris | Ultramarine Flycatcher | LC x | Fo | + | CP |
| Luscinia svecica | Bluethroat | LC x | Fo | + | An |
| Monticola solitarius | Blue Rock Thrush | LC | R | + | CP |
| Muscicapa ferruginea | Ferruginous Flycatcher | LC x | Fo | + | CP |
| Myiomea leucura | White-tailed Robin | LC | Fo | + | CT |
| Myophonus caeruleus | Blue Whistling Thrush | LC | Fo,V,R | +++ | CP,An |
| Niltaea grandis | Large Niltaea | LC | Fo | ++ | CP,An |
| Niltaea macgignoriae | Small Niltaea | LC | Fo | + | CP,An |
| Niltaea sundara | Rufous-bellied Niltaea | LC | Fo | + | CP,An |
| Phoenicurus auroreus | Daurian Redstart | LC | Fo,V | + | CP |
| Phoenicurus hodsoni | Hodgson's Redstart | LC x | V | + | CP,An |
| Rhyacornis fuliginosa | Plumbeous Water Redstart | LC | R | ++ | CP,An |
| Saxicola caprata | Pied Bushchat | LC | Fo | + | An |
| Saxicola ferreus | Grey Bushchat | LC | Fo | + | CP,An |
| Saxicola torquatus | Siberian Stonechat | LC | V | + | An |
| Tarsiger hyperythrus | Rufous-breasted Bush Robin | LC x | Fo | + | An |
| Tarsiger indicus | White-browed Bush Robin | LC x | Fo | ++ | CT |
| **Campephagidae** | | | | | | |
| Coracina melaschistos | Black-winged Cuckooshrike | LC | Fo | ++ | CP,An |
| Pericrocotus brevirostris | Short-billed Minivet | LC | Fo | ++ | CP,An |
| Pericrocotus ethologus | Long-tailed Minivet | LC | Fo | + | CP |
| Pericrocotus roseus | Rosy Minivet | LC | Fo | + | CP |
| Pericrocotus solaris | Grey-chinned Minivet | LC | Fo | ++ | CP,An |
| Pericrocotus speciosus | Scarlet Minivet | LC | Fo | + | CP |
| **Chloropseidae** | | | | | | |
| Chloropsis hardwickii | Orange-bellied Leafbird | LC | Fo | ++ | CP,An |
| **Cinclidae** | | | | | | |
| Cinculus pallasii | Brown Dipper | LC | R | ++ | CP,An |
| **Cisticolidae** | | | | | | |
| Cisticola juncidis | Zitting Cisticola | LC x | V | + | An |
| Orthotomus sutorius | Common Tailorbird | LC | G,V | + | CP,An |
| Prinia crinigera | Striated Prinia | LC x | Fo | + | CP |
| Prinia inornata | Plain Prinia | LC x | G | + | An |
| Prinia rufescens | Rufescent Prinia | LC x | G | + | An |
| Prinia superciliaris | Hill Prinia | LC | G | + | An |
| **Corvidae** | | | | | | |
| Cissa chinensis | Common Green Magpie | LC | Fo | ++ | CP |
| Corvus macrorhynchos | Large-billed Crow | LC | Fo,V | +++ | CP,An |
### Continued

| Species | English name | IUCN* | **Rappole et al. 2011** | Habitat*** | Abundance**** | Source***** |
|---------|--------------|-------|-------------------------|------------|---------------|-------------|
| **PASSERIFORMES** | | | | | | |
| Corvidae | | | | | | |
| *Dendrocitta formosae* | Grey Treepie | LC | Fi,Fo | +++ | CP,An |
| *Dendrocitta frontalis* | Collared Treepie | LC | Fo,V | ++ | CP,An |
| *Garrulus glandarius* | Eurasian Jay | LC | Fo | + | An |
| *Urocissa flavirostris* | Yellow-billed Blue Magpie | LC | Fo | + | An |
| **Dicaeidae** | | | | | | |
| *Dicaeum minullum* | Plain Flowerpecker | LC | Fo | + | CP |
| **Dicuridae** | | | | | | |
| *Dicrurus aeneus* | Bronzed Drongo | LC | Fo | ++ | CP,An |
| *Dicrurus hottentottus* | Hair-crested Drongo | LC | Fo | ++ | CP,An |
| *Dicrurus leucophaeus* | Ashy Drongo | LC | Fo | ++ | CP,An |
| *Dicrurus macrocercus* | Black Drongo | LC | Fi,Fo | ++++ | CP,An |
| *Dicrurus paradiseus* | Greater Racket-tailed Drongo | LC | Fo | + | An |
| *Dicrurus remifer* | Lesser Racket-tailed Drongo | LC | Fi,Fo | + | CP,An |
| **Emberizidae** | | | | | | |
| *Emberiza pusilla* | Little Bunting | LC | Fi | ++ | CP,An |
| **Estrildidae** | | | | | | |
| *Lonchura striata* | White-rumped Munia | LC | Fi,G | ++ | CP,An |
| **Eurylaimidae** | | | | | | |
| *Psarisomus dalhousiae* | Long-tailed Broadbill | LC | Fo,V | + | An |
| *Serilophus lunatus* | Silver-breasted Broadbill | LC | Fo | + | An |
| **Fringillidae** | | | | | | |
| *Carpodacus erythrinus* | Common Rosefinch | LC | G | + | CP,An |
| *Procarduelis nipalensis* | Dark-breasted Rosefinch | LC | G | ++ | CP,An |
| **Hirundinidae** | | | | | | |
| *Hirundo rustica* | Barn Swallow | LC | V | + | An |
| *Riparia chinensis* | Asian Plain Martin | NE | R | +++ | CP,An |
| **Indicatoridae** | | | | | | |
| *Indicator xanthonotus* | Yellow-rumped Honeyguide | NT | x | Fo | + | An |
| **Irenidae** | | | | | | |
| *Irena puella* | Asian Fairy Bluebird | LC | V | +++ | An |
| **Lanidae** | | | | | | |
| *Lanius collurioideis* | Burmese Shrike | LC | V | + | An |
| *Lanius cristatus* | Brown Shrike | LC | V | + | An |
| *Lanius schach* | Long-tailed Shrike | LC | Fo,V | ++ | CP,An |
| *Lanius sphenocercus* | Chinese Grey Shrike | LC | x | V | + | An |
| **Leiothrichidae** | | | | | | |
| *Cutia nipalensis* | Himalayan Cutia | LC | Fo | + | CP,An |
| *Garrulax caerulatus* | Grey-sided Laughingthrush | LC | x | Fo | ++ | CP,CT |
| *Garrulax leucolophus* | White-crested Laughingthrush | LC | Fo | ++++ | CP,CT,An |
| Species | English name | IUCN* | Rappole et al. 2011** | Habitat*** | Abundance**** | Source***** |
|---------|--------------|-------|-----------------------|------------|--------------|-------------|
| **PASSERIFORMES** | | | | | | |
| **Leiothrichidae** | | | | | | |
| *Garrulax monileger* | Lesser Necklaced Laughingthrush | LC | Fo | + | CP |
| *Garrulax pectoralis* | Greater Necklaced Laughingthrush | LC | Fo | ++ | CP,CT |
| *Garrulax ruficollis* | Rufous-necked Laughingthrush | LC | x | Fo | ++ | CP,An |
| *Garrulax rufogularis* | Rufous-chinned Laughingthrush | LC | Fo | + | CP |
| *Garrulax striatus* | Striated Laughingthrush | LC | Fo | ++ | CP,An |
| *Garrulax rufaltis* | Chestnut-backed Laughingthrush | NT | Fo | + | An |
| *Heterophasia annectans* | Rufous-backed Sibia | LC | Fo | + | CP,An |
| *Heterophasia picaoides* | Long-tailed Sibia | LC | Fo | ++ | CP,An |
| *Heterophasia pulchella* | Beautiful Sibia | LC | Fo | ++ | CP,An |
| *Leiothrix argentauris* | Silver-eared Mesia | LC | Fo,G | ++++ | CP,An |
| *Leiothrix lutea* | Red-billed Leiothrix | LC | Fo | + | An |
| *Minla cyanuropetra* | Blue-winged Minla | LC | Fo | +++ | CP,An |
| *Minla ignotincta* | Red-tailed Minla | LC | Fo | ++ | CP,An |
| *Minla strigula* | Bar-throated Minla | LC | Fo | ++ | CP,An |
| *Trochalopteron affine* | Black-faced Laughingthrush | LC | Fo | ++ | CT |
| *Trochalopteron squamatum* | Blue-winged Laughingthrush | LC | Fo | ++ | CT |
| *Trochalopteron subunicolor* | Scaly Laughingthrush | LC | Fo | ++ | CT |
| *Liocichla phoenicea* | Red-faced Liocichla | LC | Fo | + | An |
| **Locustellidae** | | | | | | |
| *Megalurus palustris* | Striated Grassbird | LC | G | + | An |
| **Monarchidae** | | | | | | |
| *Hypothymis azurea* | Black-naped Monarch | LC | Fo | + | CP |
| *Terpsiphone paradisi* | Indian Paradise Flycatcher | LC | Fo | + | CP,An |
| **Oriolidae** | | | | | | |
| *Oriolus traillii* | Maroon Oriole | LC | Fo | ++ | CP,An |
| **Paridae** | | | | | | |
| *Machlolophus spilonotus* | Yellow-cheeked Tit | LC | Fo | + | CP,An |
| *Melanochlora sultanea* | Sultan Tit | LC | Fo | + | An |
| *Parus monticulus* | Green-backed Tit | LC | Fo | ++ | CP,An |
| *Periparus ater* | Coal Tit | LC | Fo | + | An |
| *Periparus rubidiventris* | Rufous-vented Tit | LC | Fo | + | CP |
| **Passeridae** | | | | | | |
| *Passer domesticus* | House Sparrow | LC | V | ++ | An |
| *Passer montanus* | Eurasian Tree Sparrow | LC | G,V | ++++ | CP,An |
| *Passer rustlans* | Russet Sparrow | LC | x | V | + | An |
| **Pellorneidae** | | | | | | |
| *Gampsorhynchus rufulus* | White-hooded Babbler | LC | Fo | + | CP |
| *Pellorneum albiventre* | Spot-throated Babbler | LC | Fo | + | CP |
| *Pellorneum ruficeps* | Puff-throated Babbler | LC | Fo | + | CP |
| Species                  | English name                  | IUCN* | Rappole et al. 2011** | Habitat*** | Abundance**** | Source***** |
|-------------------------|-------------------------------|-------|-----------------------|------------|---------------|-------------|
| **PASSERIFORMES**       |                               |       |                       |            |               |             |
| *Phylloscopidae*        |                               |       |                       |            |               |             |
| Phylloscopus cantator   | Yellow-vented Warbler         | LC    | Fo                    | +          | CP            |             |
| Phylloscopus claudiae   | Claudia's Leaf Warbler        | LC    | x                     | Fo         | ++            | CP,An       |
| Phylloscopus davisoni   | Davison's Leaf Warbler        | LC    | x                     | Fo         | +             | An          |
| Phylloscopus fuscatus   | Dusky Warbler                 | LC    | Fo                    | +          | An            |             |
| Phylloscopus maculipennis | Ashy-throated Warbler     | LC    | Fo                    | +          | CP            |             |
| Phylloscopus reguloides | Blyth's Leaf Warbler          | LC    | Fo                    | +          | CP            |             |
| Phylloscopus whistleri  | Whistler's Warbler            | LC    | x                     | Fo         | +             | An          |
| Seicercus affinis      | White-spectacled Warbler      | LC    | Fo                    | ++         | CP,An         |             |
| Seicercus burkii       | Green-crowned Warbler         | LC    | Fo                    | ++         | CP,An         |             |
| Seicercus castaniceps  | Chestnut-crowned Warbler      | LC    | Fo                    | ++         | CP,An         |             |
| Seicercus poliogenys   | Grey-cheeked Warbler          | LC    | Fo                    | ++         | CP,An         |             |
| Seicercus tephrocephalus | Grey-crowned Warbler       | LC    | Fo                    | +          | An            |             |
| **Pittidae**            |                               |       |                       |            |               |             |
| Hydromis nipalensis    | Blue-naped Pitta              | LC    | x                     | Fo         | ++            | CT          |
| *Pnoepygidae*           |                               |       |                       |            |               |             |
| Pnoepyga pusilla        | Pygmy Wren-Babbler            | LC    | Fo                    | +          | CP,An         |             |
| *Pycnonotidae*          |                               |       |                       |            |               |             |
| Alophoixus flavoeolus   | White-throated Bulbul         | LC    | Fo                    | +++        | CP,An         |             |
| Alophoixus pallidus     | Puff-throated Bulbul          | LC    | x                     | Fo         | ++            | CP,An       |
| Hemixos flavala         | Ashy Bulbul                   | LC    | Fo                    | ++         | CP,An         |             |
| Hypsipetes leucocephalus | Black Bulbul                | LC    | Fo, V                 | ++++       | CP,An         |             |
| Iole propinqua          | Grey-eyed Bulbul              | LC    | x                     | Fo         | +             | An          |
| Ixos mcclellandii      | Mountain Bulbul               | LC    | Fo                    | +          | CP            |             |
| Pycnonotus cafer        | Red-vented Bulbul             | LC    | Fo, V, Fi, G          | +++        | CP,An         |             |
| Pycnonotus flaviventris | Black-crested Bulbul          | LC    | Fo                    | ++         | CP,An         |             |
| Pycnonotus jocosus      | Red-whiskered Bulbul          | LC    | Fo, V, Fi, G          | +++        | CP,An         |             |
| Pycnonotus striatus     | Striated Bulbul               | LC    | G                     | +          | An            |             |
| **Rhipiduridae**        |                               |       |                       |            |               |             |
| Rhipidura albicollis    | White-throated Fantail        | LC    | Fo                    | +          | CP,An         |             |
| **Sittidae**            |                               |       |                       |            |               |             |
| Sitta cinnamoventris    | Chestnut-bellied Nuthatch     | LC    | Fo                    | ++         | CP,An         |             |
| Sitta frontalis         | Velvet-fronted Nuthatch       | LC    | Fo                    | +          | CP,An         |             |
| Sitta himalayensis      | White-tailed Nuthatch         | LC    | Fo                    | +          | An            |             |
| **Stenostiridae**       |                               |       |                       |            |               |             |
| Chelidorthynch hypoxantha | Yellow-bellied Fantail      | LC    | Fo                    | ++         | CP,An         |             |
| Culicicapa ceylonensis  | Grey-headed Canary Flycatcher | LC    | Fo, V                 | ++         | CP,An         |             |
| **Strigidae**           |                               |       |                       |            |               |             |
| Glaucidium brodiei      | Collared Owlet                | LC    | Fo                    | +          | An            |             |
| Glaucidium cuculoides   | Asian Barred Owlet            | LC    | Fo, V                 | ++         | CP,An         |             |
| Otus spilocephalus      | Mountain Scops Owl            | LC    | Fo, V                 | +          | An            |             |
| Species                | English name                          | IUCN* | Rappole et al. 2011** | Habitat*** | Abundance**** | Source***** |
|-----------------------|---------------------------------------|-------|------------------------|------------|---------------|-------------|
| **PASSERIFORMES**     |                                       |       |                        |            |               |             |
| Sylviidae             |                                       |       |                        |            |               |             |
| Chleuasicus atrosuperciliaris | Lesser Rufous-headed Parrotbill   | LC    | Fo ++                  | CP,An      |               |             |
| Lioparus chrysotis     | Golden-breasted Fulvetta             | LC    | Fo +                   | CP         |               |             |
| Psittiparus bakeri     | Rufous-headed Parrotbill             | LC    | Fo +                   | CP,An      |               |             |
| Psittiparus gularis    | Grey-headed Parrotbill               | LC    | Fo +                   | CP,An      |               |             |
| Suthora poliotis      | Grey-breasted Parrotbill             | LC    | Fo ++                  | CP,An      |               |             |
| Tephrodornithidae     |                                       |       |                        |            |               |             |
| Hemipus picatus       | Bar-winged Flycatcher-shrike         | LC    | Fo ++                  | CP         |               |             |
| Timaliidae            |                                       |       |                        |            |               |             |
| Pomatorhinus ferruginosus | Coral-billed Scimitar Babbler       | LC    | Fo ++                  | CP,An      |               |             |
| Pomatorhinus ochraceiceps | Red-billed Scimitar Babbler        | LC    | Fo +                   | CP         |               |             |
| Pomatorhinus ruficollis | Streak-breasted Scimitar Babbler   | LC    | Fo +                   | CP         |               |             |
| Stachyris roberti     | Chevron-breasted Babbler             | N/A   | Fo ++                  | CT         |               |             |
| Stachyridopsis chrysaea | Golden Babbler                     | LC    | Fo ++                  | CP,An      |               |             |
| Stachyridopsis ruficeps | Rufous-capped Babbler              | LC    | Fo ++                  | CP         |               |             |
| Stachyridopsis ruffrons | Rufous-fronted Babbler            | LC    | Fo +                   | An         |               |             |
| Stachyris nigriceps    | Grey-throated Babbler               | LC    | Fo ++                  | CP,An      |               |             |
| Stachyris oglei       | Snowy-throated Babbler              | VU    | Fo +                   | An         |               |             |
| Troglodytidae         |                                       |       |                        |            |               |             |
| Troglodytes troglodytes | Eurasian Wren                     | LC    | Fo +                   | An         |               |             |
| Harpactes erythrocephalus | Red-headed Trogon                | LC    | Fo +                   | CT         |               |             |
| Harpactes wardi       | Ward's Trogon                       | NT    | Fo +                   | An         |               |             |
| Turdidae              |                                       |       |                        |            |               |             |
| Cochoa viridis       | Green Cochoa                        | LC    | Fo +                   | An         |               |             |
| Turdus boulboul       | Grey-winged Blackbird               | LC    | Fo +                   | An         |               |             |
| Zoothera mollissima   | Plain-backed Thrush                 | LC    | Fo +++                 | An,CT      |               |             |
| Vireonidae            |                                       |       |                        |            |               |             |
| Erpomis zantholeuca   | White-bellied Erpomis               | LC    | Fo ++                  | CP,An      |               |             |
| Pteruthius aerolatus  | White-browed Shrike Babbler         | LC    | Fo +                   | CP         |               |             |
| Pteruthius aenobarbus | Chestnut-fronted Shrike Babbler     | LC    | Fo +                   | An         |               |             |
| Pteruthius melanotis  | Black-eared Shrike Babbler          | LC    | Fo ++                  | CP,An      |               |             |
| Pteruthius xanthochlorus | Green Shrike Babbler               | LC    | Fo +                   | CP         |               |             |
| Zosteropidae          |                                       |       |                        |            |               |             |
| Yuhina bakeri         | White-naped Yuhina                  | LC    | Fo +++                 | CP,An      |               |             |
| Yuhina castaneiceps   | Striated Yuhina                     | LC    | Fo ++                  | CP,An      |               |             |
| Yuhina flavicollis    | Whiskered Yuhina                    | LC    | Fo ++                  | CP,An      |               |             |
| Yuhina gularis        | Stripe-throated Yuhina              | LC    | Fo ++                  | CP,An      |               |             |
| Yuhina nigrimenta     | Black-chinned Yuhina                | LC    | Fo ++                  | CP,An      |               |             |
| Zosterops erythropleurus | Chestnut-flanked White-eye         | LC    | Fo +                   | CP,An      |               |             |
| Zosterops palpebrosus | Oriental White-eye                   | LC    | Fo +                   | CP,An      |               |             |
Continued

| Species                      | English name      | IUCN | Rappole et al. 2011** | Habitat*** | Abundance**** | Source***** |
|------------------------------|-------------------|------|-----------------------|------------|--------------|-------------|
| PSITTACIFORMES               |                   |      |                       |            |              |             |
| Psittacidae                  |                   |      |                       |            |              |             |
| Psittacula finschii          | Grey-headed Parakeet | NT  | V                     | +          | An           |             |
| SULIFORMES                   |                   |      |                       |            |              |             |
| Phalacrocoracidae            |                   |      |                       |            |              |             |
| Phalacrocorax carbo          | Great Cormorant   | LC   | R                     | +++        | CP,An        |             |

* LC: Least Concern; NT: Near Threatened; VU: Vulnerable; CR: Critically Endangered; NE: Not Evaluated. ** "x" means the species was recorded in this study, but not in Rappole et al. (2011). *** Fo: Forest; V: Village; Fi: Field; R: River; G: Grassland. **** + means the number is between 1–10; ++ means the number is between 11–50; +++ means the number is between 51–100; ++++ means the number is more than 100. ***** An: Anecdotal observation; CP: Counting point; CT: Camera trap.

Figure 2  Taxonomic families observed in the bird surveys
Bars show the percentage and number of each family recorded.

New record
We observed three new bird records for northern Myanmar (Agropsar sturninus, Aviceda jerdoni, and Ampeliceps coronatus) and two new record species (Arborophila mandellii and Lanius sphenocercus) for Myanmar.

Purple-backed Starling (Agropsar sturninus)
One individual was photographed (Figure 5) by M.K. on 30 April 2012 in Makung Ghang Station (E98°16'56", N27°38'13") in the Hkakabo Razi direction.

Jerdon’s Baza (Aviceda jerdoni)
One individual was photographed by Z.X.L. (fifth author) on 5 May 2016 around camp 2 at Hponyin Razi (E96°59'3", N27°36'10").

Golden-crested Myna (Ampeliceps coronatus)
One individual was photographed by M.K. on 23 November 2013 at Ziadam village (E97°55'6", N27°34'13").

Chestnut-breasted Partridge (Arborophila mandellii)
One individual was photographed (Figure 6) by M.K. on 17 November 2013. The bird was hunted by a local villager close to camp 1 at Hponyin Razi (E96°58'52", N27°36'21").
Figure 3 Species distribution in different elevations
Blue point is proportional to the observed number of individuals.

Figure 4 Distribution of count points in different elevations

Chinese Grey Shrike (*Lanius sphenocercus*)
One individual was photographed (Figure 7) by M.K. on 23 November 2013 at Jobali village close to Putao town (E97°35′, N27°2′). It was identified by its large body size, black facial mask, grey nape and upperparts, white scapular, and white spot on the wings.

DISCUSSION

Because our data came from direct observations and camera trap photos, some species could be under sampled, particularly those living in shrub and canopy habitats. Our sampling effort was more intensive in lower elevations, partly because a larger proportion of the survey area occurred at lower elevations and partly because of easier transportation in the lowland plain. The overrepresentation of lower elevation habitats in our study could explain the low frequency of many bird families in our surveys. In the future, surveys should be conducted at higher elevations, especially in the mountains above 3 000 m a.s.l.. Although our sampling effort and checklist is incomplete, the present work provides preliminary data for local diversity research and conservation projects.
Rappole et al. (2011) conducted five bird surveys in a 10,000 km² area in the Hkakabo Razi region, mainly covering the east. While the present study area also lies within the same region, we focused on the western part of Putao. Furthermore, Rappole et al. (2011) set mist nets from 500–3,000 m a.s.l., and recorded 413 species, of which 159 were not observed during our surveys. Of the 319 species recorded in the present research, 65 were not recorded by Rappole et al. (2011). The greatest difference in species occurred in the families Muscicapidae (n=7) and Accipitridae (n=6). This disparity between studies is likely explained by the different study areas sampled as well as the differences in methodology. Our methodology was more suited for detecting certain species. For example, birds of prey (Accipitridae) can be more easily observed during point counts, and some cryptic species can be captured by camera trap. In our study, one Eurasian Woodcock (Scolopax rusticola) was captured by camera trap at 1,190 m a.s.l.. We believe future exploration of new survey routes and a combination of different survey methods will lead to the discovery of additional species not previously recorded here.

The Chestnut-breasted Partridge was identified by its rufescent crown, white gorget, and chestnut breast. It was previously only known from Bhutan, Southeast Tibet, China, and Northeast India (McGowan et al., 2017). The Chinese Grey
Shrike was previously recorded in eastern Mongolia to southeast Russia, northern China, and North and South Korean, also known to migrate to east and southeast China and Korea (Yosef & International Shrike Working Group, 2017). The finding of these species formerly unrecorded in the area not only increase two new species of birds for Myanmar, but also reiterates the high biodiversity in this region and highlights the importance of long-term field observations.

**Figure 7** Photograph of Chinese Grey Shrike (*Lanius sphenocercus*) (photo by Myint Kyaw)

Based on our observations, the forest is in good condition. The Leiothrichidae, Columbidae, and Phasianidae species are forest-adapted, and their high abundance shows adequate food and resources for breeding in the local forest. Hornbills were observed almost every day around the camp sites at 1000–1500 m a.s.l. during winter, and gibbons (*Hoolock* spp.) were often heard from the camp sites below 2 000 m a.s.l.. The most abundant species observed belonged to Pycnonotidae, Leiothrichidae, Columbidae, and Phasianidae. The bulbuls (Pycnonotidae) are common birds living in tropical and subtropical areas, which can adapt to diverse habitats (Fishpool & Tobias, 2017).

In addition to the forest, the local cropland also provides important habitat for many migrating species. Farmers in Putao plant large areas of rice in June-July and harvest it in October-November. The land is barren in other months of the year. These fallow lands provide important habitat for migrating bird species. M.K. observed more than 10 000 common cranes (*Grus grus*) migrating through Putao in March 2016, where they forage in the fallow rice paddies and wetlands by the Malika riverside.

Figure 3 shows that both abundance and species richness were higher below 1 500 m a.s.l.. Species of high conservation value, (e.g., critically-endangered White-bellied Heron (*Ardea insignis*), vulnerable Rufous-necked Hornbill (*Aceros nipalensis*), and near-threatened Lesser Fish Eagle (*Haliaeetus humilis*) were all recorded under 1 500 m a.s.l.. We also observed some birds with narrow ranges such as the Snowy-throated Babbler (*Stachyris oglei*) at lower elevations. Current protected area boundaries are set too high in minimal elevation (1 000 m a.s.l. for HPWS and 900 m a.s.l. for HKNP) and should be lowered to accommodate greater biodiversity, a conclusion also drawn by former researchers (Rabinowitz et al., 1999; Renner et al., 2007). The Burmese government currently plans to extend these two protected areas to incorporate lower elevations, and is applying for World Heritage Site status for these two regions. This is an important decision with long-term benefits for local conservation. The HPWS forest connects to the Hukawng Valley extension in the west. Extending the current HPWS and HKNP borders will ensure the protection of the largest forest complex in northern Myanmar and will maintain intact habitat for important wildlife.

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**REFERENCES**

Aung T, Oo Z. 1999. Recent bird records in the Hkakabo Razi region, northern Myanmar. In: Workshop On regional Collaboration in Conservation of the Hkakabo Razi mountain ecosystem, 25-28 October 1999. Yangon, Myanmar: Forestry Department, Ministry of Forestry.

Fishpool L, Tobias J. 2017[2017-08-29]. Bulbuls (Pycnonotidae). In: Del Hoyo J, Elliott A, Sargatal J, Christie D A, De Juana E. Handbook of the
McGowan PJK, De Juana E, Kirwan GM, Boesman P. 2017[2017-09-04]. Chestnut-breasted Partridge (Arborophila mandellii). In: Del Hoyo J, Elliott A, Sargatal J, Christie D A, De Juana E. Handbook of the Birds of the World Alive. Lynx Edicions, Barcelona. http://www.hbw.com/node/52306.

Myers N, Mittermeier RA, Mittermeier CG, Da Fonseca GA, Kent J. 2000. Biodiversity hotspots for conservation priorities. Nature, 403(6772): 853-858.

Rabinowitz A, Myint T, Khaing ST, Rabinowitz S. 1999. Description of the leaf deer (Muntiacus putaoensis), a new species of muntjac from northern Myanmar. Journal of Zoology, 249(4): 427-435.

Ralph CJ, Sauer JR, Droege S. 1995. Monitoring bird populations by point counts. Albany, CA, USA: U.S. Department of Agriculture, Pacific Southwest Research Station, PSW-GTR-149.

Rao M, Htun S, Zaw T, Myint T. 2010. Hunting, livelihoods and declining wildlife in the hponkanrazi Wildlife sanctuary, North Myanmar. Environmental Management, 46(2): 143-153.

Rappole JH, Aung T, Rasmussen PC, Renner SC. 2011. Ornithological exploration in the southeastern sub-Himalayan region of Myanmar. Ornithological Monographs, 70(1): 10-29.

Renner SC, Rappole JH, Leimgruber P, Kelly DS, Shwe NM, Aung T, Aung M. 2007. Land cover in the Northern Forest Complex of Myanmar: new insights for conservation. Oryx, 41: 27-37.

Renner SC, Rappole JH, Rasmussen PC, Aung T, Aung M, Shwe NM, Dumbacher JP, Fleischer RC. 2008. A new subspecies of Tesia olivea (Sylviidae) from Chiang Mai province, northern Thailand. Journal of Ornithology, 149(3): 439-450.

Yosef R, International Shrike Working Group. 2017[2017-09-04]. Chinese Grey Shrike (Lanius sphenocercus). In: Del Hoyo J, Elliott A, Sargatal J, Christie D A, De Juana E. Handbook of the Birds of the World Alive. Lynx Edicions, Barcelona. http://www.hbw.com/node/60484.