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Short Notes

A survey of the Critically Endangered Spoon-billed Sandpiper *Eurynorhynchus pygmeus* in Bangladesh and key future research and conservation recommendations

JEREMY P. BIRD, ALEXANDER C. LEES, SAYAM U. CHOWDHURY, ROBERT MARTIN and ENAM UL HAQUE

As the scale of the decline in the Critically Endangered Spoon-billed Sandpiper has become apparent, the urgency to understand the size and distribution of the remaining population in order to identify key threats and implement targeted conservation actions has intensified. Bangladesh has been recognised as an important non-breeding range state since the largest single flock of 202 individuals ever recorded was found at Moulevir Char in 1989. Annual winter totals have been considerably lower in recent years as survey attention has focused on Myanmar. We conducted surveys in coastal Bangladesh between 6 March and 8 April 2010 to determine the continuing importance of Bangladesh for wintering Spoon-billed Sandpiper, gather information about the species's foraging ecology and habitat preference, and assess potential threats. A minimum 49 Spoon-billed Sandpipers were seen at three locations. Foraging birds displayed a marked preference for firm sandy intertidal mudflats with a thin layer of soft mud collecting in ripples, spending 98% of their time feeding within small pools left by the receding tide, singly or in small groups. Shorebird hunting, recently identified as a significant threat to Spoon-billed Sandpiper in Myanmar, was found in some areas. Our preliminary surveys yielded variable catch rates and overall prevalence, but suggest that hunting may have decreased locally since advocacy work was conducted in 2009. We discuss other plausible threats to Spoon-billed Sandpiper and their intertidal habitats, concentrating on large-scale infrastructure development and widespread small-scale habitat conversion. Our surveys covered only a fraction of potentially suitable intertidal habitats and were largely confined to known sites. We therefore list priority research actions designed to elucidate the true status of Spoon-billed Sandpiper in Bangladesh and allow priorities to be set for conservation actions identified in the species's action plan.

INTRODUCTION

The Spoon-billed Sandpiper *Eurynorhynchus pygmeus* is a migrant shorebird that breeds in the Russian Arctic centred on the coast of the Chukotsk Peninsula (e.g. Dixon 1918, Tomkovich *et al.* 2002). It is known to winter in intertidal habitats in South-East and South Asia from the Minjiang estuary, south-east China, west to the Bay of Bengal, where the largest wintering concentrations have been recorded both historically and in recent years (BirdLife International 2001, Zöckler & Bunting 2006, Zöckler *et al.* 2010). A rapid deterioration in the conservation status of the Spoon-billed Sandpiper was first detected in 2000 when breeding-season surveys of sites monitored during the 1970s indicated that a marked decline in the population had taken place (Tomkovich *et al.* 2002). This decline has been tracked during subsequent summer surveys in Russia between 2000 and 2009 (see Zöckler 2003, Syroechkovski 2005, Syroechkovski & Zöckler 2008, Syroechkovski & Zöckler 2009). In response, the species was uplisted from Vulnerable to Endangered on the IUCN Red List in 2004, and then again to Critically Endangered in 2008 (BirdLife International 2009). Targeted efforts to gather supporting data from the wintering grounds began with a survey of the Indian Sunderbans (though this failed to record Spoon-billed Sandpiper) in 2005 (Zöckler *et al.* 2005) followed by a survey in Bangladesh deploying three teams in January 2006 that recorded 11 individuals (Zöckler & Bunting 2006). In January of 2008, 2009 and 2010 exploratory surveys identified a significant wintering population at several coastal sites in Myanmar (Zöckler & Htin Hla 2009, Zöckler *et al.* 2010). These concerted survey efforts since 2000 have informed a global population estimate of 120–250 breeding pairs with an estimated total population of 500–800 individuals (C. Zöckler pers.comm. 2010).

Bangladesh retains the record for the highest single count of Spoon-billed Sandpipers—202 birds in 1989 from Moulevir Char, a small island in the vast Lower Meghna delta (Bakewell & Howes 1989a, 1989b in BirdLife International 2001). The species was recorded as early as the 1920s (BirdLife International 2001) and regularly from the late 1980s through the 1990s (Thompson *et al.* 1993, Thompson & Johnson 2003) right around Bangladesh's coastline from outer islands south of the Sunderbans in the west, through the Lower Meghna delta and south-east to Teknaf on the border with Myanmar (BirdLife International 2001, BirdLife International 2009). Although the known breeding distribution has been relatively well monitored since the 1970s (Tomkovich *et al.* 2002), the core wintering areas remained largely unknown until very recently. The history of the species in Bangladesh hinted at the importance of the Bay of Bengal (BirdLife International 2001), since confirmed through recent searches in Bangladesh and Myanmar listed above. However, the reporting rate in Bangladesh declined through the 1990s (Thompson & Johnson 2003), but whether this was a reflection of the inferred population declines observed on the breeding grounds or a reduction in search effort, or both, is unclear. Perhaps partly in response to a return of only 11 Spoon-billed Sandpipers during the first targeted search for this species in Bangladesh in 2006 (Zöckler & Bunting 2006) attention has shifted to Myanmar in the last three winters in a successful effort to discover a part of the 'missing' wintering population.

Recent records from Bangladesh including 21 Spoon-billed Sandpipers seen on Sonadia Island, Cox's Bazar District, in February 2006 (M. Z. Islam in Zöckler &

Bunting 2006) and 15 at Damar Char, Greater Noakhali District in April 2008 (Zöckler 2008), hinting at the continuing importance of Bangladesh for the species in the non-breeding season. After discovering the importance of the country for shorebirds, particularly Spoon-billed Sandpiper, Bakewell & Howes (1989a) recommended a full coastal survey of Bangladesh. This recommendation remains paramount over 20 years later, and refining the global population estimate and reducing its confidence limits through continued surveys in Bangladesh and Myanmar is a stated research priority (Zöckler *et al.* 2008, BirdLife International 2009). JB, AL and RM joined colleagues SUC and EUH between 6 March and 8 April 2010 in Bangladesh, aiming to (1) assess shorebird survey effort to date, (2) record numbers of Spoon-billed Sandpipers and other threatened waders at known and previously unsurveyed sites, (3) gather new data about foraging ecology, (4) improve our understanding of potential threats to priority shorebirds and their habitats, and finally (5) do all of the above in March, two months later than previous midwinter counts in January, in order to provide supporting evidence for a hypothesis that Spoon-billed Sandpipers may move north into the Bay of Bengal before migrating overland to the Yellow Sea (supported by two historic records of Spoon-billed Sandpiper from Assam: Saikia & Bhattacharjee 1990).

METHODS

Shorebird surveys

In the absence of a predictive model to determine the likely non-breeding distribution of Spoon-billed Sandpipers, potentially suitable sites were identified from satellite images freely sourced from Google Earth, the Landsat Programme (http://landsat.gsfc.nasa.gov/), ASTER (*http://glovis.usgs.gov/*) and Flash Earth (http://www.flashearth.com/) following guidelines detailed in Bunting & Zöckler (2009). Suitable sites were then ground-truthed and shorebird populations assessed following methods for counting non-breeding waders outlined in Bibby *et al.* (2000). Shorebirds were surveyed in three main areas: around Sonadia Island, Cox's Bazar District; at the Feni estuary and Hatiya Islands of Greater Noakhali District; and in the Lower Meghna delta around Bhola District. Additional short surveys were undertaken at the Sangu estuary and Bodur Makam, Teknaf.

Spoon-billed Sandpiper habitat preferences and foraging ecology

At foraging sites we took basic notes on substrate type (sand, mud, sand-mud mix) and substrate-depth (no mud, shallow mud = <15cm, deep mud = >15 cm). Pearson's Chi-square test was used to test the null hypothesis of uniform distribution of foraging Spoon-billed Sandpiper between substrate types and depths. This survey was predominantly focused on covering as many disparate areas as possible, which left relatively little time for prolonged observations of feeding birds to gather detailed data on foraging ecology. Therefore HD digital video recordings were taken using a Sony DSC-W220 digital camera handheld to a Swarowski ATM 65 HD Scope & 30 WA eyepiece for subsequent analysis. Sediment samples were collected at survey sites to allow future analysis of particle size, nutrient content and heavy metal content.

Hunting interviews

To investigate the threat of hunting to shorebirds we carried out opportunistic semi-structured interviews following guidelines outlined by FAO (1990) and in consultation with R. F. A. Grimmett. These were designed to assess (1) numbers of trappers, (2) number of trapping locations, (3) frequency of hunting, (4) abundance and composition of harvested species, (5) methods used to hunt shorebirds, (6) which socio-economic group(s) are trapping, (7) whether hunters have alternative income sources, (8) if hunting is for subsistence use or trade, (9) if trapping rights exist, (10) the value of the trapping/trade. To assist these interviews, awareness-raising materials were carried and distributed, including identification cards illustrating local wader species. These were primarily used to identify species that interviewees recognised and/or were hunted. Interviewees received Royal Society for the Protection of Birds (RSPB) pin badges as thanks for participating.

RESULTS

Shorebird surveys

In total a minimum of 49 Spoon-billed Sandpipers (hereafter SBS) were recorded, comprising 25 individuals at Sonadia, 23 at Damar Char and 1 at Teknaf (Table 1). Counts at Sonadia and Teknaf probably comprised all or almost all the SBS present, but at Damar Char the count may only have represented a fraction of the wintering or passage population. At this site the main high-tide roost was inaccessible during our survey and birds may have dispersed at low tide to other foraging grounds in three cardinal directions. Taken together, our counts alone represent the highest annual total of SBS in Bangladesh since the 257 birds recorded in January 1989 and 'about 100' seen during Asian Waterbird Census counts in 1992 (Thompson *et al.* 1993). Although it is tempting to speculate that the high numbers recorded during our survey might pertain to northbound passage birds, without a full winter survey it is impossible to confirm this hypothesis. Our failure to find SBS (or other shorebirds of conservation concern) at the Sangu estuary suggests that this site is not regionally important but may yet prove to hold small numbers of these key species on passage, while at the Feni estuary coverage was inadequate during this survey to draw firm conclusions. We recorded significant numbers of other globally threatened shorebird species (Table 1) including the highest counts of Asian Dowitcher *Limnodromus semipalmatus* and Great Knot *Calidris tenuirostris* ever recorded in Bangladesh and the highest count of Spotted Greenshank *Tringa guttifer* since 1988 (Thompson *et al.* 1993, Thompson & Johnson 2003, P. Thompson pers. comm. 2010). These findings are provided for general interest here but will be the focus of a forthcoming more detailed paper.

Spoon-billed Sandpiper habitat preferences and foraging ecology

Of the 12 main foraging sites (i.e. not roosting sites or saltpans) where we recorded shorebird numbers, substrate type and depth (Table 1), SBS was only recorded at sites with a mixed substrate composed of a firm sand base-layer and a soft mud component collecting between sand ripples (χ^2=11.99, df=1, P<0.0001). Significantly we did

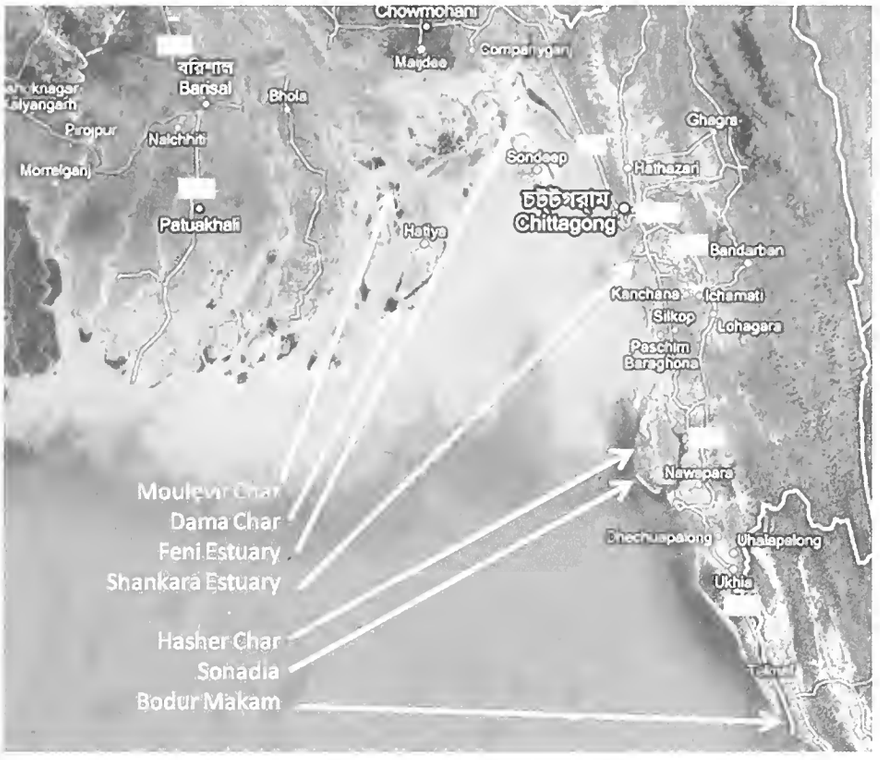

Figure 1. Sites visited during Spoon-billed Sandpiper surveys in March–April 2010. Base layer © Google Earth.

Table 1. Habitat characteristics and abundance of shorebirds of conservation concern. Detailed findings relating to species other than SBS will be the subject of a forthcoming paper.

Site name	Coordinates	Date	Site description	Mud depth	Spoon-billed Sandpiper (CR) *Eurynorhynchus pygmeus*	Spotted Greenshank (EN) *Tringa guttifer*	Asian Dowitcher (NT) *Limnodromus semipalmatus*	Black-tailed Godwit (NT) *Limosa limosa*	Eurasian Curlew (NT) *Numenius arquata*	Great Knot (VU) *Calidris tenuirostris*	Estimated shorebird total
Tajiakata	21.4959°N 91.9154°E	08/03/2010	mud	shallow	–	–	–	–	15	–	
Belekadia	21.5311°N 91.8425°E	08/03/2010	high-tide roost	n/a	–	–	–	–	–	5	600
Belekadia	21.5311°N 91.8425°E	09/03/2010	mud	deep	–	–	–	–	11	–	110
Kaladia	21.5546°N 91.8635°E	09/03/2010	sand-mud mix	shallow	20	4	–	–	39	2	1,200
Baradia	21.5434°N 91.8932°E	10/03/2010	salt pan	n/a	–	–	–	–	–	–	150
Kaladia	21.5512°N 91.8632°E	10/03/2010	mud	deep	–	–	–	–	35	256	700
Hasher Char	21.6049°N 91.8491°E	10/03/2010	mud	deep	–	2	–	52	40	5	1,100
Hasher Char	21.6049°N 91.8491°E	11/03/2010	mud	deep	–	24	–	70	20	170	2,350
Kaladia	21.5546°N 91.8635°E	11/03/2010	sand-mud mix	shallow	23	2	–	–	12	45	450
Halodia	21.5466°N 91.8548°E	11/03/2010	sand-mud mix	shallow	2	–	–	–	15	20	300
Belekadia	21.5311°N 91.8425°E	12/03/2010	mud	deep	–	–	–	–	5	3	80
Mog Char	21.4724°N 91.9128°E	12/03/2010	mud	deep	–	–	–	–	–	–	60
Shangu estuary	22.1136°N 91.8443°E	13/03/2010	mud	shallow	–	–	–	–	–	–	840
Feni estuary	22.8166°N 91.4142°E	16/03/2010	mud	deep	–	–	–	–	2	–	720
Char Kandia	22.8155°N 91.4070°E	17/03/2010	mud	deep	–	–	–	–	–	–	250
Char Fakura	22.7776°N 91.3662°E	17/03/2010	mud	deep	–	–	–	–	3	–	220
Feni estuary/ Char Kandia	22.7968°N 91.4234°E	18/03/2010	mud	deep	–	–	–	–	17	–	770
Feni estuary	22.7768°N 91.4381°E	18/03/2010	mud	shallow	–	–	–	–	–	–	55
Nijhum Dweep	22.0741°N 90.9772°E	26/03/2010	mud	deep	–	–	–	–	2	–	350
Damar Char	22.0236°N 91.0584°E	27/03/2010	high-tide roost	n/a	–	–	–	9,000	150	–	34,100
Damar Char	22.0340°N 91.0560°E	28/03/2010	sand-mud mix	shallow	19	5	34	–	–	26	
Damar Char	22.0236°N 91.0584°E	28/03/2010	high-tide roost	n/a	–	–	–	8,500	75	–	34,900
Damar Char	22.0340°N 91.0560°E	28/03/2010	sand-mud mix	shallow	23	14	12	–	–	8	
Bodur Makam	20.7517°N 92.3351°E	04/04/2010	sand-mud mix	shallow	1	–	–	–	–	–	280
Kaladia	21.5546°N 91.8635°E	05/04/2010	sand-mud mix	shallow	3	–	–	–	13	–	185
Belekadia	21.5311°N 91.8425°E	08/03/2010	high-tide roost	n/a	–	–	2	8	23	200	930

not find this species in areas of deep (>15 cm) mud (χ^2=5.99, df=1, P<0.025), despite the presence of thousands of individuals of other shorebird species at many of these sites. Detailed analysis of the biochemical constitution of these substrate types is beyond the scope of this paper and will be dealt with separately. A preference for mudflats with a sand/mud mix has previously been documented in SBS not only in Bangladesh (Thompson *et al.* 1993) but also in Myanmar (N. Clark pers. comm. 2010), Thailand (D. Sibley *in litt.*), Vietnam (Pedersen *et al.* 1998) and Japan (BirdLife International 2001).

Foraging birds spent c.98% of their time (based on 10 minutes 47 seconds of video footage) feeding within small pools left by the receding tide, both at the tide edge and up to 600 m from the open sea. Apart from when tidal conditions produced concentration effects, birds typically foraged singly or occasionally in groups of 2–6, or with other small waders such as Red-necked Stints *Calidris ruficollis*. Videos obtained at Sonadia (SOM 1. http://tiny.cc/kid9h) and Damar Char (SOM 2. http://tiny.cc/kz81q) document their predominantly solitary feeding habits and preference for such small pools. We found the 'hyperkinetic' foraging technique of SBS to be an excellent aid to their identification at long range—constantly running around, typically with head down (and with apparently reduced vigilance relative to other calidrids, although some bird species actually have a surprisingly good field of view behind their heads, so they can feed, head down, while maintaining vigilance; in the case of SBS, they may feed alone or widely spaced to guarantee a good view of attacking predators: D. Buckingham *in litt.* 2010). Typically birds foraged for food by wading around rapidly in shallow water that did not reach tibial height (1–3 cm) and appeared to use the bill as a shovel, inserting it into the substrate and extracting prey items from underneath submerged mud (Plate 1a & b). Such a feeding strategy would permit them to take both marine epifauna and infauna (Sutherland *et al.* 2000). These shovelling motions were predominantly directed to the front, but sometimes also sideways (Plate 1c; see Swennen & Marteijn 1988, Pedersen *et al.* 1998). Assessing intake rates was difficult, as swallowing movements (Plate 1d) were never conspicuous and food items too small and rapidly processed to be identifiable, but some successful feeding bouts are evident in the video (e.g. SOM 2: 4 minutes 44 seconds). We also observed SBS processing larger food items on four occasions, which required more extensive mandibulation for 1–2 seconds, but were unable to ascertain their identity. It appeared that some prey detection or at least 'shovelling site selection' was undertaken visually, with birds walking on 'tip toes' with neck outstretched (e.g. SOM 2: 5 minutes 35 seconds). Some agonistic interactions were observed with birds chasing Red-necked Stints *Calidris ruficollis* and being displaced by Red-necked Stints, Lesser Sand Plover *Charadrius mongolus* and Sanderling *Calidris alba*.

Hunting interviews

We were able to speak with a cross section of different inhabitants at Sonadia, including one former bird hunter, a locally employed NGO worker and local fishermen. A former bird hunter (active <5 years ago) indicated that previously 10–20 people in his village on Sonadia were involved in bird hunting but that this number had fallen to just 2–3 individuals/village after anti-hunting campaigns by local NGOs. However, it was also claimed that there

Plate 1. Montage of images of a feeding Spoon-billed Sandpiper; see text for details (A. Lees).

were still 25–30 trappers active across a broader region encompassing five villages, many of which fell outside the influence of awareness campaigns. The interviewee reported that circa 500 birds per year per hunter were taken and sold locally with current prices per bird at circa 80–100 BDT ($US1.1–1.7) for large species such as Eurasian Curlew *Numenius arquata*, with small sandpipers *Calidris* and plovers *Charadrius* valued at just 10 BDT ($0.1). There is apparently no longer an open market as hunting is recognised as being illegal and birds are only sold locally. The local NGO worker reported substantially higher hunting activity, with an estimate of 100 hunters (c.20/village) out of a total population of 7,000 people from six villages. However, he also indicated that the hunters would be happy to stop catching birds if alternative income sources could be found. Hunting is predominantly carried out using monofilament nets set at high-tide roosts, often with live decoys tethered to the ground. A group of villagers interviewed at a different village on Sonadia also indicated that hunting was formerly more frequent and that visiting professional bird hunters targeted a high-tide roost that could yield 500 birds in a single catch with coordinated flushing. They reported no such activity in the last two years after campaigns by the Coastal and Wetland Biodiversity Management Project (CWBMP).

DISCUSSION

Minimum totals of 1, 23 and 25 Spoon-billed Sandpipers at three disparate coastal sites in March and April 2010 provide clear evidence that Bangladesh remains critically important for the species. According to the most recent extrapolation from numbers of birds in the breeding grounds the global population is estimated at 500–800 individuals (C. Zöckler pers. comm. 2010). Based on this estimate, this survey may have observed up to 10% of the global population. In 2010 an estimated 236–286 SBS were recorded on the wintering grounds (assuming there was no double-counting between different range states), in Bangladesh (49), Myanmar (150–200 birds in the Bay of Martaban, 14 at Nan Thar island and 1 in the Irrawady Delta: Zöckler *et al.* 2010), Thailand (10) and China (12) (Bunting & Zöckler 2010). It follows that the wintering grounds for very roughly 50–70% of the global population are therefore being overlooked. The estimates and extrapolations made above are largely supposition: they may vary considerably but the data are not available to ascertain accurate figures. We are confident, however, that Bangladesh offers a relatively cost-effective opportunity for further surveys to identify important new sites (i.e. with no recent records) that may support a proportion of the 'missing' individuals.

Threats to shorebirds in Bangladesh

Sonadia Island is a globally important site for SBS and other threatened shorebirds, dolphins and marine turtles. It is therefore considered ecologically important by the government; in 1999 it was declared as an Ecologically Critical Area (ECA) under the Bangladesh Environment Conservation Act, 1995 (Zöckler 2009). The site is not recognised as an Important Bird Area (IBA) (BirdLife International 2004) but should qualify during a currently planned revision of Bangladesh's IBAs (P. Thompson *in litt.* 2010). The CWBMP has worked to strengthen conservation planning and awareness and to develop alternative livelihoods for local people in the ECAs of Sonadia and Teknaf area since 2005, but it ends in 2010. A feasibility study by Pacific Consultants International for the construction of a deep-water port in Bangladesh has identified Sonadia Island as the priority site, with construction expected to begin in December 2010 (Mahmud 2009), but it is not yet clear if this project is to go ahead and more recently there have been reports of plans for other sites for port development. If it does go ahead at Sonadia Island this development funded by a public-private partnership will almost certainly have a dramatic and deeply negative impact on a whole suite of threatened species.

As well as the proposed deep-sea port at Sonadia there have been long-term plans dating back to the 1980s for several cross-dams, originally proposed under the Land Reclamation Project of the Bangladesh Water Development Board with technical cooperation from the Netherlands, particularly for a cross dam between Hatiya and Nijumdip in Noakhali District (P. Thompson *in litt.* 2010). Smaller cross-dams have already been used to reclaim land and establish polders along the Noakhali coastline, and proposals have also been made to connect Sandwip with the main Noakhali coastline (Rashid 1989). These plans reportedly re-emerge periodically (P. Thompson pers. comm.). If implemented, they would threaten a vast area of the least explored (and potentially most significant) intertidal habitats in the Lower Meghna delta. There are no immediate plans for this development but changes to the status quo should be monitored.

Localised conversion of intertidal habitats to saltpans, shrimp-ponds and mangrove plantation additively impact large areas of Bangladesh's coastline. The extent to which these processes affect habitats is dependent on the overall rate of conversion in one of the fastest accreting systems on earth. If conversion is slower than mud/sandflat creation the impact on shorebirds is likely to be minimal, particularly if shorebirds are adapted to move between these ephemeral habitats as areas are rendered unsuitable by succession and others become available. However, if rates of conversion are faster than accretion of new habitat, then conversion may represent a threat within Bangladesh. It is possible that the sandy substrates selected by SBS are relatively stable compared to soft mud deposits. If that is so, this provides a greater need to protect existing sites from development, on the assumption that suitable sites are limiting and may not be replaced quickly. Aquaculture of *bagda* shrimp *Penaeus monodon* was expanded from 51,812 ha in 1983–1984 to 142,110 ha in 1993–1994 (Zöckler *et al.* 2008). Between 1960–61 and 1999–2000, 142,835 hectares of mangrove were planted (Bangladesh Forest Department 2010) and this rate may have increased since; mangrove plantation is a tool for stabilising newly accreted areas and for the protection of the hinterland in cyclonic storms, and is strongly advocated by government and development NGOs in Bangladesh; but the biodiversity impacts are unknown. The area of intertidal habitat in Bangladesh remains absolutely vast, and although SBS appears to utilise a very specific and apparently localised substrate, habitat availability is probably unlikely to be limiting carrying capacity. However, given the paucity of information on the SBS prey-base and the exact use of its morphologically divergent bill, we should not be complacent. It is plausible

that only certain prey types might be affected by, e.g., climate change, sea-level changes or marine pollution, and this species may be adversely affected if there is no alternative prey, or if bill morphology precludes prey-switching (Durell 2000).

We gathered limited anecdotal data through semi-structured interviews to supplement previous assessments of hunting pressure on shorebirds, particularly around Sonadia where an awareness-raising campaign was implemented in 2009. Shorebird hunting was reported to have declined recently, following the ban on international trade in wild birds and local people's perception of the risk of contracting zoonotic infections whilst handling wild birds (e.g. avian influenza). Moreover, an awareness-raising campaign carried out by MarineLife Alliance through the UNDP/GEF-funded CWBMP may have helped reduce local hunting pressure (Zöckler 2009). Given limited past surveys it remains unclear whether the hunting threat in Bangladesh represents the clear and present danger that it evidently poses to shorebirds in Myanmar (Zöckler *et al.* 2010b) and elsewhere (Lees & Bird in prep.). However, considering that we encountered shorebird hunters, including individuals who claimed to have caught SBS historically then it must be taken seriously. The Bangladesh Wildlife Preservation Order 1973 protects circa 70% of the country's bird species including SBS (Siddiqui *et al.* 2008). The act has recently been amended (awaiting final approval and will be released shortly), and will protect all wild birds except House *Corvus splendens* and Large-billed Crows *C. macrohynchos*.

Plausible threats to shorebirds and intertidal habitats in Bangladesh that were not discussed or observed during this survey are rural development, particularly on sensitive coastal *chars*, pollution, hydrological regime change and climate change (for thorough treatment of these threats see Zöckler *et al.* 2008).

Recommendations

The Spoon-billed Sandpiper faces real and potential threats in the breeding, passage and wintering parts of its range: it has poor breeding productivity, perhaps owing to nest predation and bad weather, and there are concerns that breeding habitat in the south of its range is no longer suitable owing to climate change; key stopover sites on migration, particularly intertidal wetlands in the Yellow Sea, have been converted for urban and industrial development; and in the wintering areas the main documented threat is hunting with waders regularly trapped in nets (Zöckler *et al.* 2008, Syroechkovski *et al.* 2009, Zöckler *et al.* 2010b). Conservation actions proposed or already underway (see Zöckler *et al.* 2008) are helping to address a number of these threats and should be encouraged. However, the completeness of this list of threats, and their relative impacts in the past and present on the global population, remain poorly understood. Prioritising conservation actions is further hampered by the absence of robust population size and trend estimates; the urgency of one action versus another is contingent on understanding the size of the remaining population.

The surveys presented here did not fulfil the recommendation of Bakewell & Howes (1989a) for a full coastal survey of Bangladesh. This remains a research priority, so we outline below some suggestions for future work in or relating to Bangladesh. These are designed to supplement rather than repeat those identified in the current action plan for Spoon-billed Sandpiper (Zöckler *et al.* 2008), so future conservation planning needs to consider the ideas detailed in the action plan alongside those that follow.

Research actions

- A thorough spatiotemporal analysis of survey effort in Bangladesh is required to examine the survey frequency and duration at suitable coastal sites and intertidal habitat types surveyed, coupled with presence/absence and abundance data for SBS. This should permit more robust analysis using Geographical Information Systems (GIS) of habitat suitability, shed light on any movements during the non-breeding season, and (if sufficient data are available) an assessment of wintering population size and population trends for Bangladesh.
- Further SBS surveys coupled with a thorough ground-truthing of habitat quality might allow habitat choice to be effectively modelled and thus indicate potential priority sites for future survey effort. This exercise is dependent on high-resolution images of coastal South and South-East Asia at low tide but previous studies have indicated that satellite imagery can be used to predict grain size and benthic invertebrate distributions (Wade & Hickey 2008). Alternatively/in addition to this exercise accessing shipping data, if available, that models sediment accretion/erosion around Bangladesh's coastline could shed light on how habitats have changed over time (e.g. why sites like Moulevir Char are apparently less suitable for SBS now than when 202 were recorded in 1989). It could also reveal potential new search sites in recently accreted areas. This recommendation is based on the supposition that port developers and the mainstream shipping industry collect such data.
- If GIS analysis cannot effectively detect suitable habitat, then an 'eye-balling' of satellite imagery may help identify potentially suitable sites (Bunting & Zöckler 2009), although this technique is not without its limitations: examination of Google Earth by eye reveals apparently similar habitats around Sonadia Island which when ground-truthed vary radically in their suitability for SBS. Overall, however, in the absence of anything more effective we believe this remains a useful tool.
- Aerial surveys using a fixed-wing aircraft in January (and ideally, although of lower priority, repeated in March) could rapidly survey the entire coastline. If feasible, this would be the most effective method for identifying wader concentrations and potentially suitable wintering sites that could then be searched for SBS (see e.g. Clark *et al.* 1993, Engilis *et al.* 1998, Warnock *et al.* 1998). However, the specialisation of SBS to feeding within a particular substrate type raises the possibility that they could occur away from wader concentrations and render aerial surveys ineffective, but this may not not be the case as SBS was always significantly outnumbered by commoner species utilising the same substrate type. Indeed, the converse is likely: many sites with high-wader concentrations may prove to be inappropriate for SBS.
- Boat-/land-based surveys are needed of all key sites (e.g. historical point localities, sites identified on satellite images and sites identified during aerial

surveys) in January and March 2011 to provide an accurate population estimate and identify hotspots for longer-term monitoring of SBS populations.

- After an initial investment to identify key shorebird/SBS sites and habitat, monthly monitoring of key sites and at least annual monitoring of all sites with recent records offers the potential to improve knowledge of local and regional movements, timing of migration and population trends. These aims would be abetted by a sample of the population being colour-ringed. However, any catching of SBS in Asia risks acting as a training exercise for local hunters in effective means for capturing waders, and should first consider hunting pressure and the need for education and awareness raising programmes as a precursor. Capturing individuals for colour-ringing would also provide an opportunity to undertake stable isotopic analyses to determine the likely summer breeding ground of this wintering subpopulation. Furthermore sexual dimorphism in bill measurements of SBS (N. Clark *in litt.* 2010) would allow the collection of data to assess whether there are any spatial differences in wintering locations in different sexes as has been observed in other calidrine waders (e.g. Sutherland *et al.* 2000).

Conservation actions

- Collaboratively the proposal to build a deep-water port at Sonadia needs addressing. At the very least we would advocate a thorough environmental impact assessment, the results and recommendations of which should be adhered to. A wider campaign to raise awareness of the potentially negative impacts of this development should also be considered.
- Presently only 7% of sites where SBS has been recorded in Bangladesh are designated IBAs (Zöckler *et al.* 2008) and none of the important coastal areas east of the Sundarbans is a designated Ramsar site. The planned revision of Bangladesh's IBA network will hopefully address the first issue here but separate attention should focus on adopting new sites under the Ramsar Convention. The efficacy of site prioritisation work within a highly mobile system is hard to ascertain but a precautionary approach that assumes SBS may not be capable of shifting sites regularly should be adopted until local and seasonal movements are understood.
- To understand the impact of hunting on shorebirds in Bangladesh, a large sample of structured interviews should be collected with a process for conducting awareness-raising in hunting hotspots afterwards, ideally with local staff trained to continue this work. This work should build off an awareness-raising and advocacy campaign conducted by MarineLife Alliance under the CWBMP in 2008–2009 around Sonadia.
- Ongoing strengthening of institutional and logistic capacity within Bangladesh will facilitate the implementation of future research and conservation actions; BirdLife International is currently investigating how best to support local conservation capacity (M. Crosby pers. comm. 2010).

It is important to reiterate that these few conservation recommendations supplement a comprehensive list of possible actions identified by Zöckler *et al.* (2008). We have concentrated on first identifying the research needs that can help to prioritise between that longer list of potential conservation actions under the headings of species protection, habitat protection, site management, habitat and site restoration, awareness-raising and education and capacity building (as in Zöckler *et al.* 2008). A clearer understanding of the status, movements and trends of SBS is a start-point rather than an end-point for the recovery of SBS populations in Bangladesh. Nationally and globally a long-term strategy will be reliant on the effective implementation of targeted conservation actions, prioritised according to urgency, potential returns and cost.

CONCLUSION

Our survey indicates that Bangladesh remains a critical wintering area for Spoon-billed Sandpipers and suggests that incomplete survey coverage to date might explain a reduction in reporting rate of SBS, although this requires further study (see recommendations above). It also reinforces the notion that SBS displays a degree of relatively high habitat specificity for a calidrine wader and indicates that hunting may still be a threat to its long-term survival. Given the species's precarious position, there is an urgent need for conservation interventions now as outlined by the action plan and in this paper. Our recommendations list the key research priorities for SBS in Bangladesh in the coming years. Lack of funding to conduct the necessary research and implement conservation actions risks compromising the species's long-term survival. If the number of people paying to visit Thailand in recent years fuelled by a 'last chance to see' mentality is any indication of the interest in and enthusiasm for this enigmatic wader, it would be nice to believe that it is possible to mobilise sufficient financial resources to tackle the most pertinent threats through research and conservation actions.

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New information on the Large-billed Reed Warbler *Acrocephalus orinus*, including its song and breeding habitat in north-eastern Afghanistan

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We report in detail on the first well documented, probable breeding location of the Large-billed Reed Warbler *Acrocephalus orinus*, found in north-east Afghanistan, give a description of its song and summarise its identification criteria using new information from live birds. Fifteen birds were captured and measured in the presumed breeding season, and later their identity was confirmed using DNA markers. In one of the localities visited many birds were singing. We also describe the habitat and assess some conservation issues.

INTRODUCTION

This paper provides greater detail on the discovery of the Large-billed Reed Warbler *Acrocephalus orinus* in north-east Afghanistan during fieldwork in the summers of 2008 and 2009 (Timmins *et al.* 2009). Having been described in 1867 on the basis of a single specimen, with no further evidence of the species found in the following 130+ years, doubts about the validity of the Large-billed Reed Warbler were sometimes voiced, e.g. the species was omitted from the OBC checklist (Inskipp *et al.* 1996, Svensson *et al.* 2008, 2010). Two events effectively put an end to such resigned speculations.

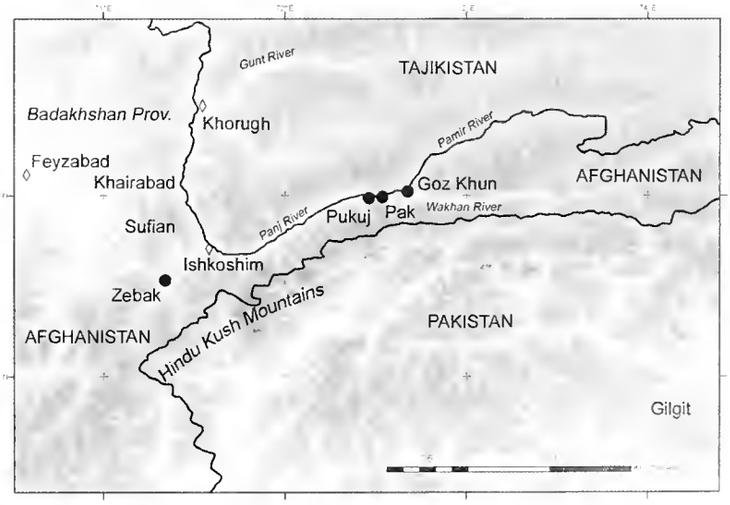
First, it was shown that the type specimen had a significantly different mitochondrial cytochrome b gene from all other known *Acrocephalus* species (Bensch & Pearson 2002), differing by some 7% from its nearest relative Blyth's Reed Warbler *A. dumetorum*. Then, remarkably, a live bird was caught in spring 2006 in a mist-net south-west of Bangkok in Thailand (Round *et al.* 2007). The following years saw the detection of more Large-billed Reed Warbler specimens in museums, catalogued invariably as Blyth's Reed Warbler (Table 1; Pearson *et al.* 2008, Svensson *et al.* 2008, 2010), and the capture of an additional individual in Thailand (Nimnuan & Round 2008). Debate over the species's seasonal movements, or lack thereof (Vaurie 1955, 1959, Bensch & Pearson 2002), became more robust with the inclusion of these additional records, especially the correlation of dates with geographic locality (Svensson *et al.* 2008) and the reinterpretation of wing morphology (Svensson *et al.* 2010).

In particular, four birds from north-east Afghanistan in July, which had been collected in 1937 by Walter N. Koelz, pointed to breeding in this area, and a fifth bird, a juvenile, collected in August in south-east Kazakhstan, suggested a perhaps rather extensive breeding range in Central Asia (Table 1). Adding to this, two historical specimens collected in Myanmar (Svensson *et al.* 2008) and the live birds captured in March from Thailand (Round *et al.* 2007, Nimnuan & Round 2008) appeared to affirm (western) South-East Asia as a potentially significant wintering area for the species (Svensson *et al.* 2008, 2010). There are also further unconfirmed but plausible records which have been described in some detail elsewhere (Round & Kennerley 2007, Svensson *et al.* 2010), although speculation of Large-billed Reed Warblers at Kanha Tiger Reserve in India (Raju *et al.* 2008) have now been refuted (Raju *et al.* 2009).

REDISCOVERY IN NORTH-EASTERN AFGHANISTAN IN 2008

While on 3 June carrying out a conservation assessment of the breeding bird communities of Wakhan District, Badakhshan Province, north-eastern Afghanistan, RJT observed singing *Acrocephalus* warblers (Fig. 1; note *Times atlas of the world* uses the name Vakhan, but it is otherwise almost universally spelt Wakhan). The birds were found in riparian bushlands around the confluence of the Wakhan and Pamir rivers, the two main rivers of the upper Wakhan that subsequently become the Panj river (otherwise known

Figure 1. Map showing localities in north-eastern Afghanistan where the Large-billed Reed Warbler *A. orinus* was found in 2008 and 2009 (black circles). The historical collection sites of Sufian and Khairabad, Afghanistan, and Gilgit, northern Pakistan, are also shown (white circles). Shading indicates elevation, with higher elevations being darker. International country boundaries are marked by broad black lines, while major rivers are indicated with narrower grey lines. The boundary between Afghanistan and Tajikistan in part follows the course of the Panj and Pamir rivers. Topographic source: USGS (2006), Shuttle Radar Topography Mission, 3 Arc Second, Filled Finished-A 2.0. scenes (12 scenes SRTM_f03_n035e071 to SRTM_f03_n037e074), Global Land Cover Facility, University of Maryland, College Park, Maryland, February 2000.



as the Amu Darya), near the village of Goz Khun (2,800 m asl; altitudes derived from GPSs with electronic barometers and rounded to the nearest 50 m). Recordings of the song of the first bird observed were made using a Sony Professional Walkman analogue recorder and a Sennheiser MKE 300 microphone. One of the more memorable initial impressions of the sighting was the bird's bill, which appeared especially long. Other observed features included a rather plain unmarked face except for a paler area from the lore to the eye, whitish crescents above and below the eye, a white throat, short primary projection and a largely pale lower mandible. These features suggested Blyth's Reed Warbler, a species unfamiliar to RJT. No more recordings of these birds were made during the 2008 survey.

The recordings consisted of approximately ten minutes of the at times intermittent, song of a single bird. These recordings were digitised using the computer program Audacity and saved as wav files. Four segments of the recordings were sent to LS and SO for analysis and use for playback respectively. Later the full recordings were sent to LS for more detailed analysis. The full recording has been archived at the Avian Vocalisations Center, Michigan State University, USA, and a part of the sequence can be found and downloaded at http://avocet.zoology.msu.edu/recordings/6322.

LS concluded that the song was not that of Blyth's, or any of the majority of other potential *Acrocephalus* spp. within range, thus leaving two main possibilities: either one of the little known western subspecies of Blunt-winged Warbler *A. concinens* or Large-billed Reed Warbler. Despite several differences (see below), the strong overall similarity of the song to that of Blyth's Reed Warbler suggested the likelihood of it being that of Large-billed Reed Warbler.

In conjunction with the newly discovered museum specimens from north-eastern Afghanistan, the field evidence from 2008 presented an overwhelming case for the need to determine precisely the identity of the birds in Wakhan.

THE 2009 SURVEY IN NORTH-EAST BADAKHSHAN

Owing to logistical and security constraints, it was only possible for an Afghan team to visit the province of Badakhshan in the breeding season of 2009. Thus prior to the survey three research assistants (AMR, HN and NM) of the Wildlife Conservation Society Afghanistan Program were trained by SO in mist-netting methods, bird measuring techniques and collection of tail-feather samples for genetic analysis. All three had, however, been closely involved with ornithological work in Wakhan and elsewhere in Afghanistan since summer 2006. Using a part of the 2008 recording, SO edited (Audacity 1.2.5) a two-minute segment for use in playback with a digital player (Phillips AZ1850).

AMR and HN arrived at Goz Khun, the site of the 2008 recording, on 1 June and chose an appropriate location for mist-netting the following day (details of net sites are given in Table 2). They used three 10 m long mist-nets along the edge of the riparian bushland and played the 2008 song recording for several hours each session. On several days they failed to capture any reed warblers, and they moved their net sites most days. On 6 June NM joined the team, but later the same day moved to a new area near the village of Pak (2,800 m asl), a site 10 km south-west of Goz Khun. On 7 June, AMR and HN continued with a single mist-net in the vicinity of Goz Khun, while simultaneously NM erected the other two mist-nets in the Pak area. AMR and HN continued mist-netting at Goz Khun until 8 June, with one last attempt on 25 June, but they failed to capture any birds in the later period.

On 9 June NM moved to Pukuj (2,800 m asl), a village 6 km west of Pak, where on 10 June he erected mist-nets

Table 1. List of specimens of Large-billed Reed Warbler in museum collections, with dates, localities and mensural data.

Date	Locality	Museum and reg. no.	Collector	Age and sex	Primary projection	Wing	Tail	Bill (S)	Hind claw	Tarsus
13.11 1867	Sutlej Valley, Himachal Pradesh, N India	NHM 1886.7.8.1742	A. O. Hume	adult unk.	(12)	(61)	(56)	18.7	7.8	23.0
Oct. 1869	Mussorie, Uttar Pradesh, N India	NHM 1898.9.1.1233	W. E. Brooks	adult fem.	(9.5)	(59)	(53)	19.4	7.5	23.7
3.5 1879	Kyeikpadein, Lower Pegu, Burma	NHM 1882.1.20.933	E. W. Oates	adult fem.	11.5	61	52	19.2	7.3	23.7
25.8 1879	Gilgit, Hindu Kush, N Pakistan	NHM 1897.12.10.2457	J. Biddulph	juv. male	12.5	61	53	18.3	7.1	23.1
25.1 1880	Kyeikpadein, Lower Pegu, Burma	NHM 1882.1.20.932	E. W. Oates	adult male	11	60.5	50.5	18.0	7.7	23.0
18.8 1900	nr Zharkent, SE Kazakhstan	AMNH 594.681	N. Zarudny	juv. male	13	63	55	18.3	7.5	23.6
9.5 1933	Bhadwar, Kangra, Himachal Pradesh, N India	UMMZ 80.739	W. N. Koelz	adult male	13	64	57	18.2	7.8	23.2
19.5 1933	Baijnath, Kangra, Himachal Pradesh, N India	UMMZ 80.740	W. N. Koelz	adult male	12.5	61	55	18.1	7.1	22.5
16.7 1937	Khairabad, NE Afghanistan	AMNH 466.225	W. N. Koelz	adult male	12.5	60	51.5	19.0	7.1	23.3
18.7 1937	Sufiyan, [Wakhan], NE Afghanistan	AMNH 466.248	W. N. Koelz	adult male	12.5	63	55	18.2	7.3	23.7
21.7 1937	Zebak, [Wakhan], NE Afghanistan	AMNH 466.238	W. N. Koelz	adult male	13	64.5	55	18.3	7.3	23.5
22.7 1937	Zebak, [Wakhan], NE Afghanistan	AMNH 466.236	W. N. Koelz	adult male	12.5	65.5	56	19.2	7.3	23.8

NHM = Natural History Museum, Tring, UK. AMNH = American Museum of Natural History, New York, USA. UMMZ = University of Michigan Museum of Zoology, Ann Arbor, USA. Measurements in millimetres. Primary projection measured as distance between tip of outermost secondary to tip of wing when wing is folded. Bill (s) means length of bill to skull. Values within brackets are unreliable due to unfinished moult.

Table 2. Net sites where reed warblers were caught, their locations and times in use.

Net site number†	Location	Latitude and longitude* (decimal degrees)	Altitude (m)	Dates used	Number of nets
1	Goz Khun	37.02002°N 72.67698°E	2,800	3 June	3
2	Goz Khun	37.02105°N 72.67828°E	2,800	6 June	3
3	Goz Khun	37.01993°N 72.67857°E	2,800	7 June	1
4	Goz Khun	37.02279°N 72.67702°E	2,800	8 June	1
5	Pak	36.99378°N 72.53047°E	2,800	7 June	2
6	Pak	36.98970°N 72.54617°E	2,800	8 June	2
7	Pak	36.99002°N 72.54579°E	2,800	8 June	2
8	Pak	36.99282°N 72.53997°E	2,800	9 June	2
9	Pukuj	36.98641°N 72.46568°E	2,800	10 June	2
10	Zebak	36.53488°N 71.33936°E	2,600	14 June	2
11	Zebak	36.53113°N 71.34892°E	2,600	15 June	2
12	Zebak	36.53208°N 71.34270°E	2,600	16 June	2

† Some other net sites were used, but these caught no birds of interest, and are thus not included in the table.
* Datum used: WGS84

in similar riparian bushlands to the other sites. On 11 June NM moved again, to Zebak (2,600 m asl), one of the historical collection sites (Table 1; Svensson *et al.* 2008), a village area located outside the Wakhan valley between the towns of Ishkoshim and Boharak in the district of Zebak, where he stayed until 16 June.

Investigators removed the two outer rectrix feathers from each bird caught, except for one which escaped, measured them following the protocol laid out in Svensson (1992) and took photographs of most (but no standard photographic method was followed). All data and samples were forwarded on to LS and UO for further analysis. No further recordings of the song or calls were made in 2009.

The team captured 20 reed warblers for detailed assessment (Table 3), although feather samples from only 19 were taken, with an eventual total of 15 Large-billed Reed Warblers and two Blyth's Reed Warblers being determined on the basis of genetic analysis (see below). Photographs suggest that the bird that escaped before a sample could be taken for genetic analysis was most likely to have been a Large-billed Reed Warbler.

The novelty of the work for NM, HN and AMR had a number of repercussions on the data collected. Most importantly, their measurements (Table 3) must be treated as provisional as they clearly contain errors. Second, they unfortunately did not take photographs of all of the captured birds, including only 12 of the 15 confirmed Large-billed Reed Warblers (Table 3).

GENETIC ANALYSIS

DNA was extracted from the feather samples of all 19 reed warblers, plus two Cetti's Bush Warblers *Cettia cetti* caught during the same period and used as controls (Table 3). The protocol for extraction, amplification and sequencing of the cytochrome *b* gene followed standard procedures, as described in Olsson *et al.* (2005). These sequences, which will be deposited in GenBank, were compared to that obtained from the live bird caught in Thailand 2006 (Round *et al.* 2007) and to those from the museum specimens described by Svensson *et al.* (2008). Of the 19 reed warblers sampled, 15 could be conclusively identified as Large-billed Reed Warblers and another two as Blyth's Reed Warblers (Table 3).

Interestingly, data from the museum samples studied by Svensson *et al.* (2008) revealed that the haplotypes were divided into three surprisingly distinct, but seemingly not geographically structured, clusters (Fig. 2 in Svensson *et al.* 2008). Variation within a panmictic population would not normally show a pattern whereby the haplotypes are divided into such clear-cut groups. Indeed, the amount of divergence between these clusters was of a magnitude that would suggest that they came from different isolated subpopulations. We are not aware of any other case among Passeriformes in which the individual variation in a sympatric population exceeds 0.7% (uncorrected p) in the cytochrome *b* gene (UO unpublished data). Although divergence *per se* cannot be taken as a direct measure of taxonomic status, the amount of divergence present within *A. orinus* is at a level commonly found between different subspecies, and recently Bowie *et al.* (2009) proposed species status for a population diverging by 1.6% in the mitochondrial NADH dehydrogenase subunit 2.

In the case of *A. orinus,* divergence between the most different haplotypes in the new material presented here reaches 1.9% (uncorrected p). There is no geographical pattern evident in the distribution of the haplotypes, speaking against the existence of multiple populations evolving in isolation. Individuals representing more than one haplotype cluster (Fig. 2 in Svensson *et al.* 2008) were found in all localities, with the largest genetic variety found in Goz Khun (haplotypes present from all three of the main clusters). This patterning clearly demands further investigation.

DESCRIPTION AND IDENTIFICATION OF LARGE-BILLED REED WARBLERS

Species identification of birds captured in 2009 was based solely on the results of the genetic analysis, but with few exceptions the photographs (e.g. Plates 1–3; see also Plate

Table 3. Mensural and other data collected from the reed warblers caught in June 2009.

Plate no.	Bird no. & measurer	Date	Time captured	Net site no.	Location	Wing	Tail	Tarsus	Wing-tip (wt)	p2 < wt	p1 > pc	Emargination of p5	Bill (S)	Bill W	Bill D	Hind claw
Large-billed Reed Warbler																
y	1: HN & AMR	03/06	07h30	1	Goz Khun	60.0	60.0	22.6	3, 4	5.4	3.5	Prom.	18.6	4.0	3.5	6.9
5	2: HN & AMR	03/06	07h30	1	Goz Khun	60.0	55.0	23.1	3, 4, 5	7.3	1.0	Prom.	17.1*	4.7	3.5	6.5
y	3: HN & AMR	03/06	08h00	1	Goz Khun	58.0	58.0	22.9	3, 4, 5	6.4	2.0	Prom.	15.7*	3.9	3.3	7.0
x	4: HN & AMR	03/06	09h30	1	Goz Khun	60.0	57.0	23.2	3, 4, 5	5.5	4.6	Unk.	16.2*	4.0	3.1	6.8
x	6: HN & AMR	06/06	11h00	2	Goz Khun	58.0	56.0	23.0	3, 4, 5?	5.7	4.6	Unk.	18.0	4.0	3.3	6.5
y	8: HN & AMR	08/06	06h00	4	Goz Khun	63.0	61.0	23.0	3, 4	6.0	4.6	Prom.	17*	4.1	3.0	5.5
x	5N: NM	07/06	06h35	5	Pak	63.0	59.0	22.3*	3, 4	7.4	1.8	Unk.	17.3	4.5	3.4	7.0
y	6N: NM	07/06	09h00	5	Pak	60.0	55.0	23.1	3, 4	5.9	2.0	Red?	18.2	4.2	3.1	6.9
y	7N: NM	08/06	10h00	6	Pak	60.0	64*	22.1*	3* [4>3>5]	5.1	1.0	Prom.	17.8	3.7	3.6	6.4*
2	8N: NM	08/06	15h35	7	Pak	59.0	66*	23.1	3, 4	6.3	2.3	Red?	15.4*	3.9	3.4	6.9
y	9N: NM	09/06	07h00	8	Pak	62.0	63.0	24.4	3, 4, 5	7.3	1.1	Red.	18.1	4.2	3.4	7.4
y	10N: NM	09/06	08h20	8	Pak	64.0	65*	22.3*	3, 4	7.2	2.0	Prom?	16.6*	4.0	3.5	6.3*
4	15N: NM	14/06	05h35	10	Zebak	61.0	63.0	22.4*	3, 4	9.3	1.0	Red.	18.4	3.1*	4.2	7.5
1	17N: NM	15/06	06h30	11	Zebak	61.0	69*	21.6*	3, 4 [4>3>5]	5.8	1.7	Prom.	18.4	3.4	3.4	6.5
3	19N: NM	16/06	04h54	12	Zebak	61.0	69*	23.1	3, 4	6.6	3.0	Red?	17.3	3.7	3.3	6.6
Blyth's Reed Warbler																
6	11N: NM	10/06	05h15	9	Pukuj	60.0	61*	21.0	3, 4	6.1	2.1	Prom.	15.6	3.5	3.6	5.0
7	13N: NM	10/06	07h30	9	Pukuj	61.0	58*	22.1	3, 4, 5	6.3	1.0	Prom.	14.4	4.0	3.4	5.4
reed warbler$																
y	7: HN & AMR	07/06	not recorded	3	Goz Khun	63.0	$	$	$	$	$	Prom.	$	$	$	$
Eurasian Reed Warbler†																
-	5: HN & AMR	06/06	10h30	2	Goz Khun	59.0	60.0	23.0	3, 4	5.9	4.6	-	17*	4.1	3.4	7.0
Clamorous Reed Warbler†																
-	18N: NM	16/06	04h54	12	Zebak	91.0	82.0	50.5	3, 4	6.0	1.0	-	25.0	5.0	5.4	10.4
Cetti's Bush Warbler†																
-	9: HN & AMR	08/06	13h30	4	Goz Khun	71.0	71.0	22.0	4, 5	14.0	13.0	-	12.0	3.0	4.0	5.0
-	12N: NM	10/06	05h15	9	Pukuj	68.0	73.0	22.1	3, 4	6.7	11.9	-	14.3	2.6	3.5	7.2

Column notes

Plate number: numbers refer to the plate on which photographs of the individual bird are reproduced; x = no photographs were taken of these birds; y = photographs taken, but not included here. Bird # 15N was also illustrated in Timmins *et al.* (2009; Plate 1), as was bird # 8 on Plate 5. The bird photographed in the net (Plate 2 in Timmins *et al.* 2009) was one of the four captured on 3 June.

Locations of net sites are given in Table 2.

Measurements are in mm. Measurement techniques followed Svensson (1992). Wing: wing length; tail: tail length; tarsus: tarsal length; wing-tip: primaries that make up the tip of the wing; p2<wt: length of primary 2 (p2) less than wing tip; p1>pc: length of primary 1 (p1) greater than primary coverts; bill (S): bill length to skull; bill W: bill width; bill D: bill depth; hind claw: length of hind claw.

Wing-tip: the photographs were not appropriate to assess this character independently, with the exception of two birds given in brackets. Emargination of p5: this was assessed from photographs taken, not at the time of capture. Prom. = prominent; Unk = unknown; Red. = reduced compared with p3 and p4.

Other notes

* Probably erroneous measurement. Measurements are given provisionally, as some (and possibly many) are certainly not accurate. NM, HN and AMR were novices at capturing and measuring birds, having had very little experience prior to the work in June 2009. An indication as to which of the measurements are most likely to be erroneous was made by LS, with the aid of the photographs of the captured birds; these are flagged with an asterisk (*). None of the measurements was used in the analysis of potential diagnostic differences described in the paper.

$ This bird escaped before further measurements or a sample were taken, but photographs suggest it was a Large-billed Reed Warbler.

† In addition to Large-billed and Blyth's Reed Warblers, two other *Acrocephalus* species (Eurasian Reed Warbler *A. scirpaceus* and Clamorous Reed Warbler *Acrocephalus stentoreus brunnescens*) were also captured, and these are included in the table along with two Cetti's Bush Warblers *Cettia cetti albiventris* as they were sequenced and used as controls within the genetic analyses.

5 in Timmins *et al.* 2009) and provisional measurement taken (Table 3) support these identifications. However, one individual, #15N, differed more substantially from the rest, primarily in bill coloration and plumage (Plate 4; see below), but an independent evaluation by the authors as to whether some error could have occurred between photograph labelling and sample labelling and or processing concluded that this was not reasonably possible. The provisional measurements of this bird (Table 3) are largely consistent with identification as a Large-billed Reed Warbler. Caution, as already mentioned, must be exercised in using the provisional mensural data, and bill measurements in particular appear to exhibit significant error. For example the bills of birds # 8N (Plate 2) and # 10N appear relatively long on the photographs, thus not matching their recorded short measurements (Table 3). The photographs do however suggest that several birds (see below) had bill lengths close to the known range of bill length in Blyth's Reed Warblers.

Description of the captured birds

Although notes on plumage were not taken during the 2009 field survey, the photographs taken of 12 of the Large-billed Reed Warblers allow a retrospective characterisation of the plumage. All 12 of the Large-billed Reed Warblers, the one bird that escaped and the two Blyth's Reed Warblers were clearly adults and not fledged juveniles from the then current season. In general, the plumage coloration of the Large-billed Reed Warblers seemed very similar to that of Blyth's Reed Warbler (compare Plates 1–5 with Plates 6–7), and especially in one bird (# 15N: Plate 4) even bore a close resemblance to the eastern subspecies of Eurasian Reed Warbler *A. scirpaceus fuscus*, both of which were present in the area together with the Large-billed Reed Warbler. The upperparts were dull rufous-brown, the underparts cream-white, with the sides of the breast, flanks, lower belly and vent tinged more saturated ochre or pink-buff. Only the throat and chin were a cleaner whitish, although at least some of the Large-billed Reed Warblers had a faint darker wash to the lower throat. Legs were rather nondescript pinkish-brown or grey-brown.

One feature which comes through on nearly all the photographs of the captured birds, but which is not quite so evident on museum specimens, is the long-looking tail especially compared with the short, relatively rounded wings (Plates 1–3). The appearance of a relatively short, rounded wing on the live birds in the photographs seems most likely attributable to the (on average shorter, compared with Blyth's) length of primaries 5–10 relative to the wing-tip (Table 3 in Svensson *et al.* 2010). The third primary (p3), however, appeared to be equal to p4, or not shorter than p5 (Table 3). This will be worth keeping in mind during future searches in museum collections for undetected Large-billed Reed Warbler specimens, as the relatively short wings and long tail might not always be eye-catching on a study specimen.

Another feature which is difficult to examine in detail on specimens, but which can readily be studied on live and handled birds, is the face pattern. Both eye-lids were pale, the lower more white, the upper more buff-tinged and broader, but there was no impression of a full pale eye-ring. The supercilium was short and relatively indistinct on all birds, usually off-white to buffish-white, and blended in particular with the upper eye-lid, which was generally slightly darker. On some birds, at certain angles, the supercilium appeared faintly to extend beyond the eye (Plate 2 and 5; a subtlety brought about by a very slightly paler plumage tract on the crown-sides above the eye-crescents), while on others it appeared not to go beyond the upper eye-lid, and on one bird (# 15N: Plate 4) the supercilium was barely present even proximal to the eye. The loral tract was rather variable and somewhat indistinct, merging imperceptibly into the supercilium and darkest next to the eye, but never darker than other areas of the head or face, and thus generally not giving the impression of an eye-stripe. This face pattern is very similar to Blyth's and it is unlikely that useful differences between the two species will be found.

As explained above, we have treated the mensural data from the 15 birds trapped in 2009 (Table 3) with caution, and these measurements were not used in the analysis of morphometric differences between Blyth's and Large-billed Reed Warblers (see below). Nevertheless, it is evident both from the biometrics and from photographs taken (Plates 1–2 and 8) that most of the birds had a quite long and broad bill, although others appeared more like Blyth's Reed Warbler (Plates 3–5) and the shortest bill measurements (Table 3) overlapped substantially with those of Blyth's Reed Warbler (Svensson *et al.* 2010). But whether these short measurements were accurate requires confirmation. The same potential problems are present in the other biometrics obtained during the 2009 survey (Table 3). Of the 12 Large-billed Reed Warblers for which photographs were taken, the lower mandible was pinkish grading to a yellowish tip and cutting edge, lacking any prominent darker pigmentation patches (Plate 2), although at least three (# 2, # 15N and # 17N: Plates 5, 4 and 1 respectively) and possibly two to four more of the birds (# 8, # 6N, # 9N, # 19N: Plate 3) appeared to have a faint (or in one bird quite prominent) darker patch towards the tip or more medially on the ventral edge. The upper mandible coloration was relatively uniform dark brown, bar the paler cutting edge, in most, although one bird (# 19N: Plate 3) had what appeared to be a distinctly paler mid-section.

Identification summary

Svensson *et al.* (2010) should be consulted for a full account of biometrics and identification criteria. Here we will only give a summary of the most useful clues, based in part on the results from the 2009 survey. Clearly it is a priority in the future to obtain an extensive series of biometrics based on live birds (corroborated against DNA data) to determine fully the similarities and differences between the two species and thus provide reliable measurement-based methods for in-the-hand field identification of both Large-billed and Blyth's Reed Warblers.

Bill

As the name implies, Large-billed Reed Warbler has a long and rather broad bill. It is probably usually at least 18.0 mm to skull (Table 1), but slightly shorter bills might occur in large samples, perhaps down to 17.0 or at least 17.5 mm, as suggested by photographs (Plates 3–5) and the provisional measurements of some of the captured birds. Based on a large sample, Blyth's Reed Warbler has a maximum bill length of 18.0 mm (Svensson *et al.* 2010). When seen from above, the bill of Large-billed has often

rather straight, evenly tapering sides and a rather broad tip (Plate 8a), lacking the clearly concave sides and more pointed (or pinched in) tip of most Blyth's Reed Warblers (Plate 8c). But a few of both species are less typical as to this (e.g. Plate 8b of a Large-billed and 8d of a Blyth's). A further distinction between the two species at the population level appears to be that Large-billed Reed Warbler has on average a more evenly dark upper mandible, and a paler pinkish or yellowish lower mandible lacking (especially in the museum specimens) a prominent darkish tip or a darkish smudge just inside the tip. Almost all Blyth's observed by LS have had a slight darkish smudge on the lower mandible just inside the tip, although in a very small proportion either this can be so weakly marked as to be difficult to discern in certain lights or angles, or the whole bill is a little darker than average (melanin-rich birds, also with darker legs and even a little darker plumage overall). However, the two Blyth's captured in Wakhan either lacked such a bill pattern or fell into the latter group of barely discernible darker pigmentation (Plate 7), and thus had lower mandibles like those of the majority of Large-billed. The upper mandibles of these two birds were also very similar in uniformity to those of Large-billed. Therefore, great caution should be exercised, especially under field conditions, as there is clearly some overlap both as to shape and colour of the bill between the two species.

Claws

Large-billed has slightly longer and more pointed claws than Blyth's. The hind claw of Blyth's is usually both short and bluntly tipped, whereas in Large-billed it is more acutely pointed. Mean length of hindclaw is 7.3 mm in Large-billed and 6.1 mm in Blyth's (Svensson *et al.* 2010; Table 1). The middle claw is also about 1.0 mm longer in Large-billed than in Blyth's, being on average 6.3 mm and 5.3 mm respectively. The measurements (Table 3) and photographs taken in 2009 appear to support this prior assessment based on historical specimens.

Tarsus

Large-billed Reed Warbler has on average a somewhat longer tarsus than Blyth's, with mean values of 23.4 mm and 22.1 mm respectively, but there is considerable overlap due to individual variation (Svensson *et al.* 2010; Table 1). On museum specimens, the tarsus of Large-billed can look slightly darker grey than on the average Blyth's, but this possible difference should be better studied on live birds in the future. Unfortunately few of the photographs show the tarsus and legs clearly enough for comparison.

Tail

Large-billed Reed Warbler has a somewhat longer tail than Blyth's, especially noticeable when compared to wing length in the majority of live birds, and this is further enhanced by its on average somewhat blunter wing (Tables 2 and 3 in Svensson *et al.* 2010). In comparison Blyth's has a shorter appearing tail relative to its otherwise similar wings. We estimate that the majority of Large-billed Reed Warblers will prove to have a tail length between 51–63 mm, based both on museum specimens (Table 1) and the plausible measurements of live birds (Table 3, a few implausible extremes being discounted, especially when compared to photographs of the same individuals), whereas Blyth's Reed Warblers have tail lengths of 45–56 mm based on a sample of 185 skins (Svensson *et al.* 2010). This population-level difference, together with bill characteristics, should be a useful criterion in the field for provisional identification. As already discussed by Svensson *et al.* (2010) on the basis of museum specimens, the photographs suggest that there is no difference in absolute width or terminal shape of the rectrices between the two species, and that both species are rather variable in this respect.

Wing formula

In the museum specimens of Large-billed Reed Warbler it is common for the second outermost primary (p2) to fall in length between p6/7 or shorter (primaries numbered from outer inwards). Often the tip of p2 falls around p7 or 7/8, and sometimes equals p8. When between p6/7 in length, it is nearer p7 than p6. However, Round *et al.* (2007) reported that on the first Large-billed Reed Warbler captured in Thailand p2 fell between p8 and p9. In Blyth's Reed Warbler, p2 falls between p5/6, equal to p6, between p6/7 or, least often, equal to p7; only once has LS seen p2 fall between p7/8. It follows from these differences that Large-billed Reed Warbler has a slightly more blunt-tipped wing on average than Blyth's Reed Warbler, but there is significant overlap between the two (Table 3 in Svensson *et al.* 2010). Unfortunately this character was not assessed on the captured birds and neither can it be accurately determined from the photographs taken.

Based both on museum specimens and the captured birds Large-billed Reed Warbler has invariably an emargination on the outer web of p5, usually as prominent as that on p3–4 (Plate 9a), more uncommomly slightly less pronounced (as in 3–5 of the 12 captured and photographed birds: Table 3, Plate 9b,c). Blyth's Reed Warblers more commonly have reduced emargination of p5 compared with p3–4 (although the two birds from Pukuj were well emarginated: Plate 9d), especially in immature birds, and a few young Blyth's Reed Warblers lack any emargination of p5. It remains unclear whether a larger sample of immature Large-billed might also show a higher proportion of reduced emargination than adults.

Song

Based on the single available recording, the song of Large-billed Reed Warbler resembles most closely that of Blyth's Reed Warbler but differs in several details. There are few close resemblances to any other known *Acrocephalus* songs in LS's experience, except for short phrases and vaguely a slowed-down version of a Marsh Warbler *A. palustris* or Black-browed Reed Warbler *A. bistrigiceps* song. But anyone familiar with Blyth's Reed Warbler, Marsh Warbler, Eurasian Reed Warbler and Paddyfield Warbler *A. agricola* should find it fairly easy to recognise a Large-billed Reed Warbler from its song, being clearly different from these species, yet contextually similar enough to be recognisable as that of an *Acrocephalus*.

In common with the song of Blyth's Reed Warbler, that of Large-billed Reed Warbler is characterised by both the persistent repetition of short phrases or melodic figures several times and by the fairly slow general pace of the song (Figs. 2–5). Phrases are repeated either exactly or with only minor modifications. A phrase can be repeated 2–6 times, rarely more, but on average slightly fewer times than phrases repeated by Blyth's Reed Warbler (which

Plate 1. A Large-billed Reed Warbler showing a characteristic long bill, flattened head shape, relatively short, somewhat rounded wings enhancing the length of the long tail. Note also the short and subdued pale supercilium and pale lores, paler than in most Blyth's Reed Warblers, as well as a suggestion of a darker pigmentation patch on the lower mandible . Bird # 17N, 15 June 2009, near Zebak village.

Plate 2. A Large-billed Reed Warbler showing a long bill with a relatively uniform pale lower mandible. Note the very subtle continuation of the supercilium behind the eye. Bird # 8N, 8 June 2009, near Pak village.

Plate 3. Large-billed Reed Warbler showing in comparison to Plate 1 an apparently shorter tail and bill, but note the appearance of relatively short rounded wings which help enhance the apparent length of the tail. Note that the upper mandible on this bird appears to grade somewhat paler from the culmen. Bird # 19N, 16 June 2009, near Zebak village.

Plate 4. A Large-billed Reed Warbler showing several extreme characters including an extensively darker patch on the lower mandible, relatively dark lores and lack of a clear supercilium combined with strong contrast with the white throat, and also the appearance of a relatively short tail and bill. Birds such as this would be imposible to separate from Blyth's and even Eurasian Reed Warblers, without vocalisations, biometrics and/or genetic analysis. Bird # 15N, 14 June 2009, near Zebak village.

Plate 5. A Large-billed Reed Warbler showing a darker patch on the lower mandible and an apparently shorter bill than average. Such birds would be impossible to distinguish from Blyth's Reed Warblers. Note also the subtle continuation of the supercilium beyond the eye. Bird # 2, 3 June 2009, near Goz Khun village.

Plate 6. Blyth's Reed Warbler: note the short bill, but a tail that does not appear very short. Bird # 11N, 10 June 2009, near Pukuj village.

Plate 7. Blyth's Reed Warbler: note the short bill. However this bird appears to lack any dark pigmentation on the lower mandible. Bird # 13N, 10 June 2009, near Pukuj village.

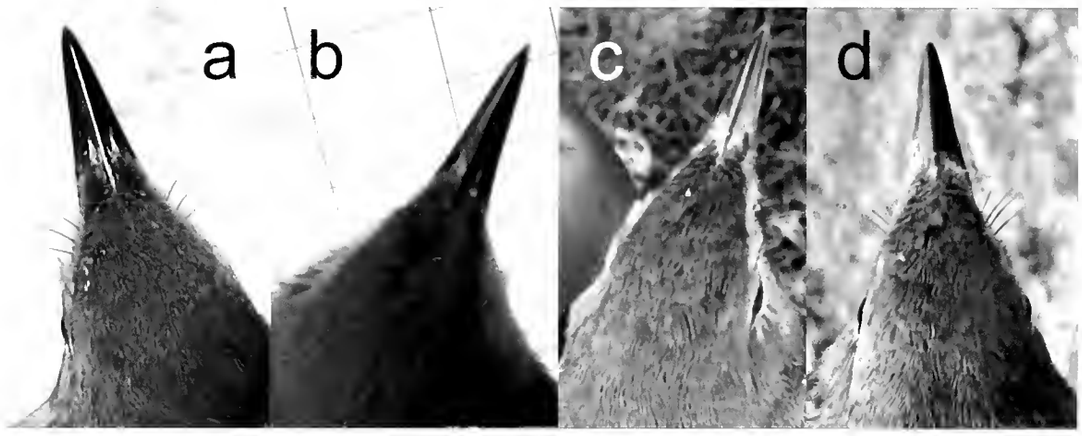


Plate 8. Bill shape, as viewed from above, in the Large-billed Reed Warbler. (a) bird # 2; (b) bird # 3; and Blyth's Reed Warbler: (c) bird # 11N; (d) bird # 13N.

Plate 9. Difference in emargination of the fifth primary in Large-billed Reed Warbler and Blyth's Reed Warbler. (a) Large-billed Reed Warbler showing clear emargination: bird # 17N; (b & c) Large-billed Reed Warbler showing reduced emargination: birds # 9N & 15N; (d) Blyth's Reed Warbler showing clear emargination: bird # 11N.

often repeats a phrase 10–15 times before switching to a new one) (Fig. 6). The pace of the full song is subtly faster than in Blyth's Reed Warbler, but clearly slower than that of a Marsh Warbler. A full song sequence of a Marsh Warbler will, without exception, include accelerations and very quick outbursts of notes, with rather few elaborate phrase repetitions included. In Large-billed Reed Warbler, the song appears to keep a steady and moderate pace.

The Large-billed Reed Warbler song recorded lacked the common insertion of 2–5 clicking call notes between phrases so characteristic of Blyth's Reed Warbler (Fig. 6), although a couple of the strophes have some clicking-like notes within them (Figs. 2, 3). This may well serve as the easiest way of identifying singing Large-billed Reed Warblers. Another difference may be the slightly feebler or more 'trembling' voice of the Large-billed Reed

Plate 10. Typical vegetation communities in Wakhan, 28 June 2008; note in particular small patches of 'short' riparian bushland along the river bank.

Plate 11. Riparian bushland in the Wakhan river valley, 28 June 2008. Goz Khun lies in the distance to the right, with the mountains of Tajikistan forming the background.

Plate 12. Relatively short, and fairly open, bushland along the Panj river in the Pak area, 31 May 2008.

compared with the clearer and perhaps louder voice of Blyth's Reed. This 'trembling' voice quality, meaning that notes are subdivided into briefer ones, at times creates a slight similarity with that of the Marsh Warbler. The Large-billed Reed Warbler also seems to include more variation and 'improvisations' than Blyth's Reed Warbler; the song of the latter can appear mechanical, following a rather 'rigid' melodic structure.

In summary, Large-billed and Blyth's Reed Warblers are extremely similar (cryptic species), being normally impossible to separate definitively in the field on structural differences alone, and with some difficult (perhaps impossible) to separate even in the hand. This is particularly important to remember in areas of potential sympatry (South and South-East Asia and at least south-western Central Asia), where for the time being song and/or genetic confirmation will be required for positive identification, except perhaps for extreme birds seen by persons highly familiar with both species. Extreme individuals of Large-billed would be those with a very long and broad bill, long claws, long tail and short wings.

Svensson *et al.* (2010) discussed reports on the internet regarding two putative field records of Large-billed Reed Warbler, in which birds reportedly had a habit of half-spreading (fanning) their tails and then slowly folding them again when moving around in the canopy. One of these records (Raju *et al.* 2008) has now, however, been relatively conclusively shown to refer to Blyth's Reed Warbler, based on the capture and measurement of three birds at Kanha Tiger Reserve in India (Raju *et al.* 2009). Furthermore there is a widely reported behaviour of Blyth's of frequently flicking, cocking and fanning (or flirting) the tail (Baker 1997, Grimmett *et al.* 1998, Rasmussen & Anderton 2005). Such behaviour requires re-evaluation in both species, although LS has not observed it in Blyth's Reed Warblers in northern Europe.

Despite the difficulty of field identification, it is imperative that reliable and widely accepted methods are established, not least because a reasonable global conservation assessment for the species depends on it (see later). We urge fieldworkers who believe they have

Figure 2. An approximately 11.5 second song sequence of the Large-billed Reed Warbler recorded in 2008. Note the rather varied nature of this sequence in comparison to the others (Figs. 3–5) and the addition of five 'clicking' notes after c. 4.5 seconds, which are somewhat reminiscent of the commonly inserted clicking notes of Blyth's (Fig. 6).

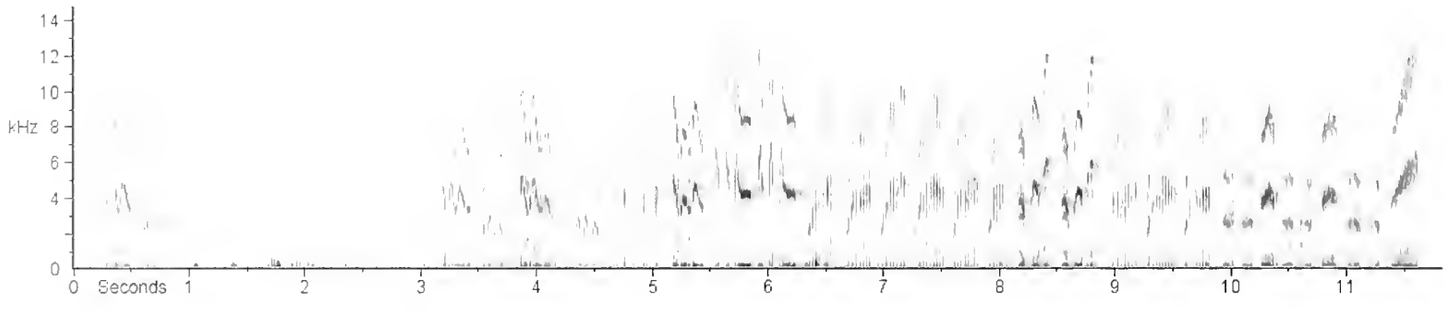


Figure 3. An approximately 9 second song sequence of the Large-billed Reed Warbler recorded in 2008. Note the repetition of phrases and also the addition of 'clicking-like' notes between phrases in the early part of the sequence, which are somewhat reminiscent of the commonly inserted clicking notes of Blyth's.

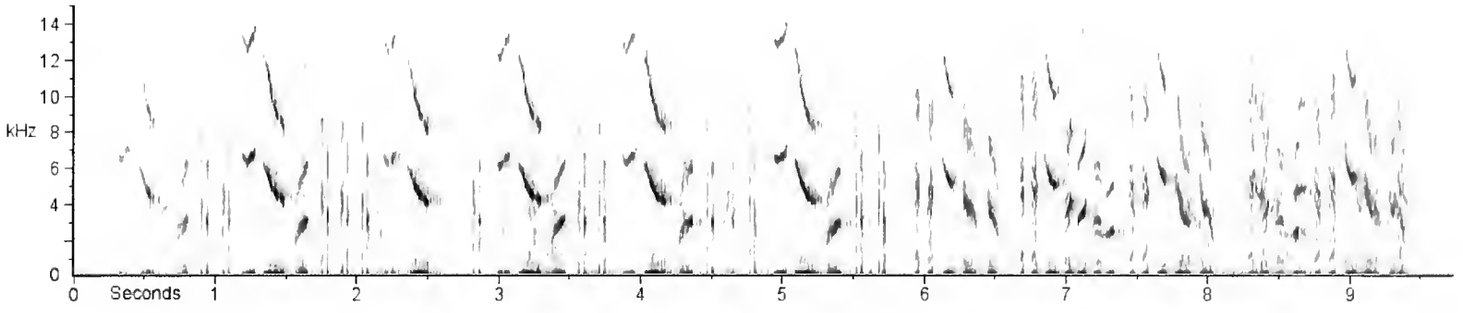


Figure 4. An approximately 14 second song sequence of the Large-billed Reed Warbler recorded in 2008. This sequence came c. 3.5 seconds after that in Fig. 3. Note the repetition of phrases, and the lack of clear clicking notes.

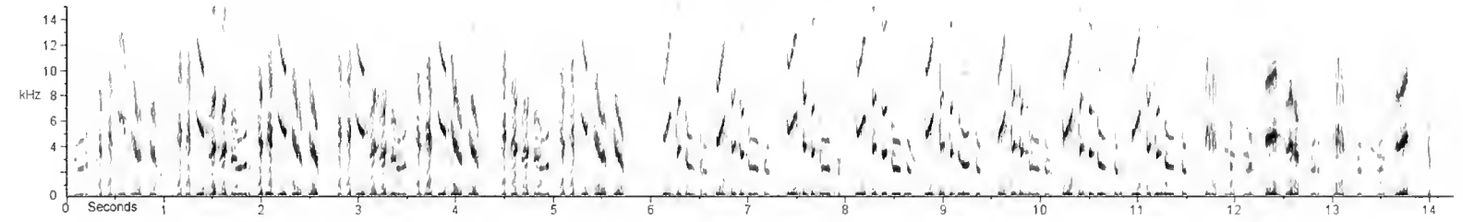


Figure 5. An approximately 9 second song sequence of the Large-billed Reed Warbler recorded in 2008. This sequence came c. 16.5 seconds after that in Fig. 4. Note the repetition of phrases and the lack of 'clicking notes'.

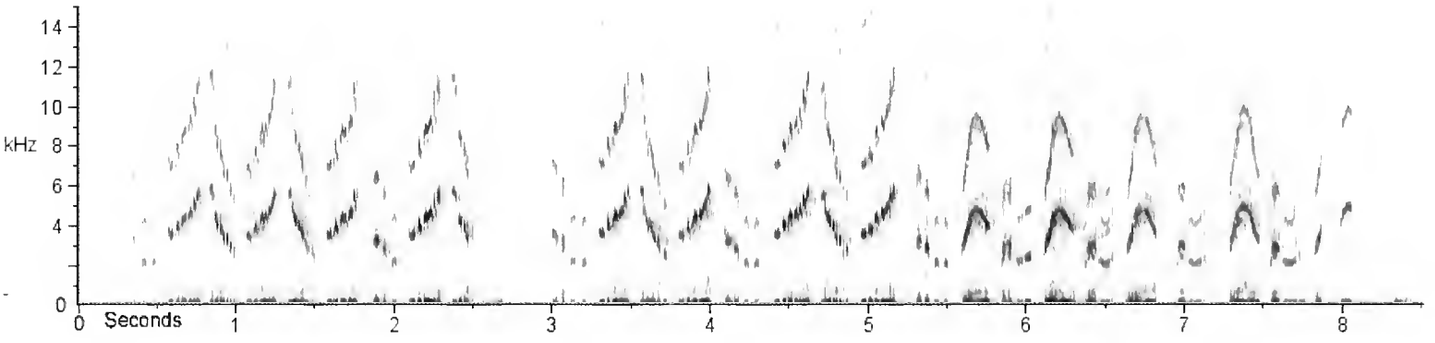
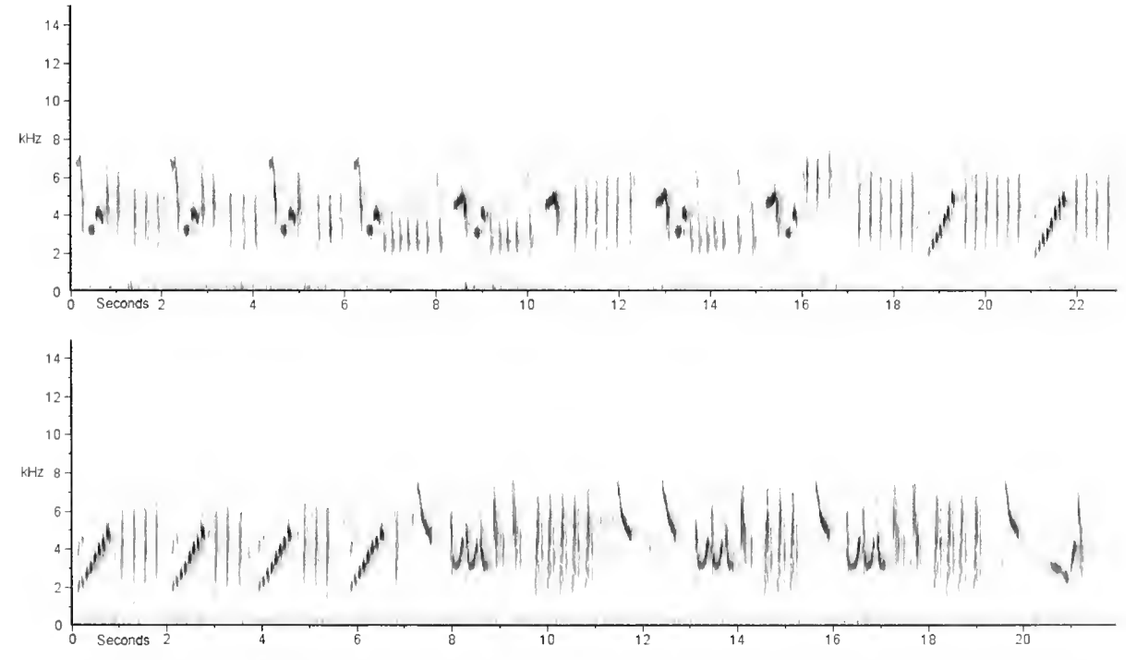


Figure 6. Partial song sequence of a Blyth's Reed Warbler. The two segments (a) and (b) are contiguous. The time scale (x axis) is more compressed than in Figs. 2–5. Note in particular the slightly slower pace of the song, most phrases lasting approximately a second, compared to approximately half a second in the Large-billed recording, and the insertion of clicking notes (vertical bars) between phrases. LS; Uppsala, Sweden, June 1984.



found *A. orinus* populations to make recordings of vocalisations and to take standardised measurements (Svensson 1992) and samples for genetic analysis from birds caught, whenever possible.

HABITAT AND ECOLOGY

That Large-billed Reed Warblers breed within the surveyed area is currently supposition, although the observation of many singing birds in 2008, and the dates over which Large-billed Reed Warblers were caught in 2009 strongly support this. Additionally AMR and HN observed a reed warbler with food items in the bill on 25 June at Goz Khun, which more than likely would have been a Large-billed Reed Warbler. The significance of the 2008 observations was not appreciated at the time, hence no additional effort was directed to confirmation of breeding, while in 2009 the emphasis was on capturing and thus confirming the identity of the birds, rather than confirmation of breeding which would have over-stretched the then current abilities of AMR, HN and NM.

Badakhshan, like most of northern Afghanistan, lies in the rainshadow of the Hindu Kush range, and Wakhan and Zebak are dominated by arid habitats at high altitude. Within both these areas, short stature, sparse, semi-desert plant communities predominate on both slopes and in valleys, while dense tall vegetation is rare within the landscape and typically associated with riparian areas and irrigated plantations (Plate 10). Additionally there are sporadic areas of arable, largely irrigated farmland and riparian grazing lands. Altitudes of the confirmed sites of Large-billed Reed Warbler range between approximately 2,600 m asl at Zebak and 2,800 m asl at the three sites (Goz Khun, Pak and Pukuj) in the Wakhan valley. The historical specimens from Sufian (Sufiyan) and Khairabad (Table 1, Fig. 1) were probably collected at lower altitudes still, as it appears that Koelz spent minimal time, a day or two at most, at these localities (see http://www.ummz.umich.edu/birds/collection/koelzafghanlocalities.pdf for details of his itinerary), thus suggesting that specimens were collected in the main valley, rather than from higher-altitude tributary valleys in the vicinity. The lowest altitudes possible at these two localities would be c.1,800 and 1,400 m asl respectively (elevations derived from global SRTM data; see Fig. 1).

At Goz Khun in June 2008 singing Large-billed Reed Warblers were common throughout the riparian bushlands. A minimum of 13 birds presumed to be the same species were seen and/or heard, but probably significantly more, during several hours of morning observation (c.05h00 to 08h00) along a route of just over 2 km, thus making it the second commonest species after 'Sind' Mountain Chiffchaff *Phylloscopus sindianus* recorded in this habitat. Reed warblers (based largely on singing densities) appeared scarce or absent in areas where thickets were smaller in size, shorter in stature and more open in their composition, perhaps not surprising given the preference of *Acrocephalus* for thick vegetation. The area in which the birds appeared commonest consisted of relatively tall (2+ m), thick riparian bushland, composed primarily of various shrubs, most notably sea buckthorn *Hippophae* (see Plates 3 and 4 in Timmins *et al.* 2009). At this site the shrubs form dense impenetrable thickets, often several tens of metres in width, both on older river terrace and newer sedimentary formations, and are interspersed with open grassy glades and stream channels (Plate 11).

The abundance of reed warblers in riparian bushlands at Goz Khun contrasted markedly with the results of the 2008 survey at other locations and in other well-vegetated habitats. In the Pak and Pukuj areas of riparian bushland, which are somewhat patchily distributed over the irrigated area of two outwash fans and the adjacent riparian terrace of the Panj river, six hours of observation on 31 May and 1 June yielded few records of reed warblers. This area was surveyed prior to the Goz Khun site (and somewhat later in the day), and reed warbler song heard in this area was retrospectively identified as such, because RJT was still familiarising himself with the common resident species. But this factor, although perhaps leading to some under-recording of reed warblers, surely does not fully account for the difference in abundance recorded between sites. The 2009 net sites lie roughly within the area surveyed in 2008, and confirm the presence of Large-billed Reed Warblers there; they also suggest, particularly in the Pak area, that Large-billed Reed Warblers were still numerous and widespread even if densities were significantly lower than at the Goz Khun site (assuming no reason for change in abundance between sites over the two years). The lower calling densities found in 2008 seem most likely attributable to differences in bushland characteristics when compared to Goz Khun. Thicket height in the 2008 surveyed area of Pak and Pukuj was rarely above 1.5 m, while thickets were generally smaller and less dense than at Goz Khun (Plate 12). The Zebak area was not surveyed on foot in 2008, so a direct comparison of habitats is not possible. But nets catching the species at this site in 2009 were set within mixed orchard plantations of apricot, black cherry, willow and white poplars, with the nets between the trees and unidentified thorn-bush hedges. It is however not known if birds were resident in such habitat, or attracted in from other vegetation types in the vicinity by song playback. However, based on notes taken by RJT while driving through the area in 2008 and by NM during the 2009 netting, and subsequently interpretation of remote imagery, habitats in this area were otherwise broadly similar to those in the Wakhan valley.

Higher up the Wakhan valley, where the valley was narrower and the valley terrain more rugged, reed warblers were not detected by RJT in sporadic riparian thickets along the Wakhan river. But these thickets were rarely dense, were generally richer in shrub species (juniper *Juniperus*, rose *Rosae* and tamarisk *Tamarix* were all more in evidence than at Goz Khun) and were invariably small (rarely more than 5 m wide). Probably even more notable was the lack of any records of reed warblers within birch-dominated (*Betula*) riparian thickets that occur in association with narrow, generally rugged, tributary valleys of the Wakhan river at still slightly higher elevations (c.3,400–3,600 m). Over 25 hours of observation during the course of seven days between 7 and 28 June 2008 was spent by RJT in four different birch-dominated tributary thickets.

It was thus perhaps not surprising that reed warblers were also not detected in the main Wakhan valley within small, but often quite dense, plantations of poplar *Populus* and willow *Salix*, along with other trees and shrubs. Several such plantations, often in close association with bushlands and or small scrubby thickets, were surveyed by RJT

between 31 May and 1 June in the Pak and Pukuj area, and later in the survey (29 June–1 July) over eight hours were spent in the Ishkoshim area where such vegetation was considerably more extensive.

Thus riparian bushland was the only habitat in which reed warblers were detected. Taken together with the relatively extensive survey effort in structurally similar complex areas of vegetation, this suggests that Large-billed Reed Warblers may well have a narrow breeding habitat niche. Also noteworthy is the apparent coincidence of the species's use of riparian bushlands with lower, broad, permanently human-inhabited valley areas. This is presumably because broad flat valley bottoms allow extensive riparian bushlands to form, and these same features are favoured by people for settlement and agriculture. In the Wakhan valley at least, riparian thickets in areas outside of major human use zones probably do not support large populations of Large-billed Reed Warblers.

It is also interesting to speculate on the capture of two Blyth's Reed Warblers at Pukuj, in an area of relatively mixed, low-stature open habitat, while none was captured at the four productive net sites at Goz Khun. This species has a wide geographical range, which now must be considered with some caution due to the potential past confusion between the two species (Svensson *et al.* 2010). North-eastern Afghanistan has previously been considered to lie within the south-easterly extent of the species's breeding range (Svensson *et al.* 2010), and the current results obviously support this. Although there is a possibility that these two birds were only late passage migrants, Svensson *et al.* (2010) were able to verify five specimens of Blyth's Reed Warblers collected historically in June–July from north-eastern Afghanistan, including the localities of Zebak and Khairabad, thus strongly suggesting that breeding takes place. The habitat in which the two birds were caught is typical of the relatively broad range of breeding habitats that the species occupies, which are generally drier (although usually in the vicinity of 'wet' areas) and dominated by woody species when compared to the norm for *Acrocephalus* breeding habitats (Baker 1997, Beaman & Madge 1998, Gavrilov & Gavrilov 2005, LS unpublished data).

The altitudinal range of Blyth's Reed Warbler within Central Asia has been reported as up to 1,000 m by Dement'ev *et al.* (1968), with breeding in the Tien Shan as high as 900–1,200 m (Kor'ev & Zarudny 1906 in Dement'ev *et al.* 1968) and up to 2,000 m (Gavrilov & Gavrilov 2005). However, considerable caution is needed in interpretation of these reports given the uncertainty of the geographical range of Large-billed Reed Warbler, especially as N. A. Zarudny collected a juvenile Large-billed Reed Warbler within the Tien Shan region (Table 1; Fig. 1 in Svensson *et al.* 2008). The altitude of Pukuj (and Zebak in the case of the historical specimens) is thus considerably higher than generally accepted for breeding Blyth's Reed Warblers. However, being at the southern extent of the species's potential breeding range, some increase in the upper altitude limit seems logical, and thus breeding within such habitat would not appear to be out of the question. If Wakhan and Zebak are typical of the breeding habitats of both species in southern Central Asia, then widespread sympatry (or at least close parapatry) between the two seems likely. This will obviously complicate any future endeavours to improve understanding of the breeding range of the Large-billed Reed Warbler, and potential breeding sites will need careful and systematic survey.

The reed warblers observed in the Goz Khun area in 2008, although skulking like other *Acrocephalus* species, were observed on a number of occasions singing from relatively high and exposed perches within the bushland. Such behaviour also appears to be characteristic of Blyth's (Beaman & Madge 1998, Baker 1997). Unfortunately the below-par health of RJT on 3 June, the effects of acclimatisation to altitude and the novelty of the fauna resulted in minimal notes being taken, especially on behaviour of the reed warblers.

CONSERVATION ISSUES

Passerine birds are not trapped or hunted by local people in Badakhshan, and the main threat to the Large-billed Reed Warbler appears to be habitat loss. Local people cut fuel-wood from the riparian bushlands and they are cleared to make way for arable and grazing lands. High livestock densities are also likely to exert their toll on the extent and composition of the riparian bushlands.

The international border between Afghanistan and Tajikistan within the Wakhan valley follows the Panj river. This geopolitical boundary has resulted in very interesting land use differences between the two countries, which shed considerable light onto potential future scenarios for the conservation needs of the riparian bushlands and the Large-billed Reed Warbler. Both RJT (in 2008) and SO (in September 2009, while on the Tajik side of the valley) independently noted that riparian bushlands were largely non-existent or very impoverished on the Tajik side of the river. It was also noteworthy that infrastructure on the Tajik side of the border was significantly more advanced, with an all-season surfaced road, many bridges and electric supply-lines along most of the valley, whereas there was only an unsurfaced track, few bridges and no electricity network on the Afghan side. The irrigation system was also more developed and engineered on the Tajik side of the valley. Clearly agricultural conversion and livestock grazing have significantly reduced the riparian bushlands in Tajikistan in contrast to those on the Afghan side of the river.

However, almost certainly riparian bushlands would have once been more extensive on the Afghan side than they currently are, if it were not for heavy grazing and, probably to a lesser extent, use of riparian areas for arable land. Even in Afghanistan, much of the agriculture is irrigated and often on high terraces, outwash fans or low gradient valley sides, and thus not directly on former areas of riparian bushland (although some certainly is). But livestock densities are certainly significantly higher than natural ungulate densities would have been and, given the aridity of the landscape, livestock are largely concentrated in the close vicinity of the Panj river or its tributary streams, being commonly seen out on islands in braided river sections. As a consequence, extensive areas of riverbank and terrace support closely cropped grazing meadows.

Currently in Wakhan it seems that riparian bushlands are used by local communities primarily for fuel-wood and fodder and, to a lesser extent, for construction timbers. As such, the presence of the bushlands is vital for the supply of these materials, and thus there appears to exist

a delicate balance in favour of maintaining some extent of bushlands, as alternative sources for fuel, fodder and construction timber supplies are otherwise limited. Although no socio-economic surveys have been undertaken to determine the extent of management, its social context and the ultimate uses of bushland, it is clear that some form of community management is taking place at least locally in some areas. In support of this, a significant proportion of the riparian bushlands in the Pak and Pukuj areas (spread out over glacial outwash fans) were certainly being deliberately fostered by local communities through a simply engineered system of irrigation.

In the Goz Khun area, the bushlands are largely natural in occurrence and occupy a broad braided stream plain at the confluence of the Wakhan and Pamir rivers. It was here, on both sides of the international border, that riparian bushlands were best developed and most extensive in the region surveyed, with an extent covering tens of hectares. But they are seemingly used in the same manner as other bushland areas by local communities and even here it was observed, on the basis of remnant stumps, that one fairly large area of several hectares had been cleared at some point in the past.

A further consideration in the balance of land use and resultant vegetation types is the extent to which human management favours the persistence of riparian bushland over 'climax' riparian woodlands and forest. There are currently none of the latter in Wakhan, with the possible exception of birch thickets outside of permanently inhabited areas, and any tree growth appears to be highly controlled by human intervention. However, in the absence of people it would be easy to envisage many riparian areas of bushland developing a woodland or forest character, other than those regularly scoured by floodwaters.

Despite the current ongoing conflict within Afghanistan, the local economy appears to be increasing, probably driven predominantly by external aid largely in the form of infrastructural development. These factors, together with an almost certainly increasing human population, seem very likely to increase pressure on bushlands as livestock herds increase in size and arable agricultural intensity increases to support a growing population and economy with easier access to distant markets. At the same time, alternative sources of construction materials, fodder and, particularly, fuel (energy) will likely become available, thus decreasing the reliance of local communities on the bushlands, which might then be vulnerable to clearance.

Although some bushland is always likely to survive in inaccessible areas, such as river islands, establishing long-term protection for significant tracts of riparian bushland in this part of Afghanistan is a matter of urgency. Conservation measures will have to consider the complex balance between different land uses and investigate in more detail than our discussion above how likely future development scenarios for the area will change these. It will be particularly important to consider how riparian bushlands can best be conserved in the face of agricultural and livestock intensification and changes in fuel-wood use. Conservation measures will probably have to include some proactive set-aside of areas of bushland protected from agricultural conversion, excessive grazing and wood removal, and perhaps also development of alternative fuel supplies. Agricultural intensification, which could theoretically help take pressure off bushlands, will probably occur without conservation intervention, but 'best-practice' and recognition of the significance of bushlands is unlikely to be fostered without concerted efforts. The Agha Khan Foundation for instance has apparently been successfully fostering the development of plantations within Wakhan, a policy that seems more likely than not to help maintain bushland area.

Any current conservation *in situ* initiatives in Afghanistan are doubly difficult due both to remoteness of sites and security issues. To reach Wakhan requires many days travel by car from Kabul, while part of the route between Feyzabad (itself a full day's drive from Wakhan), the provincial capital of Badakhshan, and Ishkoshim, the town at the head of the Wakhan valley, has often been deemed unsecure owing to tribal rivalries.

In order to understand more precisely the possible significance and conservation priority of riparian bushland habitat in north-eastern Afghanistan, a visual search of remote imagery covering north-eastern Afghanistan, eastern Tajikistan, northern Pakistan and adjacent areas of China, available on Google Earth, was undertaken by RJT in March 2010. Many of the images were dated 2005 or later and almost all were detailed enough to be reasonably certain of distinction of bushlands from farmland, grasslands and, in many cases, even plantations. This analysis suggested that large patches of riparian bushland as found around Goz Khun (Plate 11) are very rare within the landscape, with few if any other river valleys in the area searched appearing to have bushland as extensive as in the Wakhan valley. However, smaller patches within heterogeneous mosaics, usually dominated by agricultural land (as at Pak and Pukuj), are relatively frequent within broad mid-altitude valleys of at least the three western nations, although such valleys themselves are a relatively rare landscape feature.

Despite the general impoverishment of riparian bushlands along the Tajik bank of the Panj river, SO (September 2009) was able to determine, in addition to small patches, generally on islands, within the Wakhan valley, that patches of bushland also still occur further downstream on islands within wider stretches of this river, such as north of the city of Khorugh, and along the course of the Gunt river (a tributary of the Panj) between 2,600 and 3,300 m of altitude. This pattern was also apparent on the images reviewed on Google Earth.

The conservation outlook for the species will depend importantly on the broadness or otherwise of its altitudinal and habitat distribution across its potential Western Himalayan breeding range. It is thus a priority to determine not only its geographical breeding range, but also its ecological tolerances, in order to understand more fully the species's global conservation needs. Such work should be particularly focused in countries where land-use patterns are significantly different from Afghanistan, notably where economic development is more advanced, as evidence presented here suggests that conservation status may prove to be inversely related to economic development. The ongoing conflict within Afghanistan may at least in the short term allow somewhat easier proactive protection of bushlands because of subdued economic development, but there is a great need to try to locate breeding populations in nations with greater stability, where conservation interventions may stand a better chance of long-term success.

Currently the Large-billed Reed Warbler is listed as Data Deficient (DD) on the IUCN 2010.1 Red List.

Given all the uncertainties, including the possibility it has a relatively large global breeding range, we suggest that the species should remain listed as DD until more research has been conducted. However, based on the evidence presented in this paper, it seems reasonably probable, if the speculated habitat association is correct, that the species's 'area of occupancy' if taken to only include its total breeding habitat (arguably 'the smallest area essential at any stage to the survival of existing populations of' the species: IUCN 2001) might well be smaller than 2,000 km², even with a breeding range covering most of the western Himalayas. The species may thus potentially qualify for IUCN status Vulnerable, on the basis of criterion B2 (IUCN 2001). But at present there is no evidence to suggest severe fragmentation or fluctuation in its population, nor a very restricted breeding distribution, evidence of which would also be required for a 'VU B2' listing.

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An analysis of records of three passage migrants in Thailand: Tiger Shrike *Lanius tigrinus*, Yellow-rumped Flycatcher *Ficedula zanthopygia* and Mugimaki Flycatcher *F. mugimaki*

PHILIP D. ROUND

Records of three passage migrants in Thailand are analysed to show seasonal and geographical differences in their distribution. While two of these, Tiger Shrike *Lanius tigrinus* and Yellow-rumped Flycatcher *Ficedula zanthopygia*, are early autumn migrants, the third species, Mugimaki Flycatcher *F. mugimaki*, is a much later autumn migrant and, in contrast to the other two, comprises birds that winter in Thailand as well as passage migrant individuals that winter beyond the country's southern border. Disproportionately more Mugimaki Flycatchers are recorded on spring migration than the other two species. Definitive-plumaged males of both flycatcher species were recorded earlier on spring and autumn migration than others (grouped female or immature birds). Although in recent decades the numbers of migrants reported have increased due to increased ornithological recording, the numbers of Tiger Shrikes have not increased in proportion to those of Yellow-rumped Flycatchers, possibly indicating a decline in numbers.

INTRODUCTION

In the late 1960s and early 1970s, the journal *British Birds* presented a series of papers analysing the patterns of occurrence of scarce migrant birds in the British Isles. These were eventually compiled in book form (Sharrock 1974). The clear and straightforward graphical analyses therein were invaluable in giving a much wider and easily comprehensible picture of seasonal occurrence patterns, and differing geographical distributions of the species covered, inspiring ornithologists and providing the stimulus for future fieldwork and data synthesis. Similarly detailed analyses for an Asian site (Hong Kong, probably one of the most heavily watched sites anywhere on the East Asian flyway) were provided by Chalmers (1986) and Carey *et al.* (2001) who gave seasonal breakdowns of records for most migrant species.

Increased field observation and submission of ornithological records for Thailand and other South-East Asian countries are now also beginning to generate datasets large enough to examine better the distribution and seasonality of many migrant birds. Roughly one in three of all bird species in Thailand is at least partly migratory. Precise patterns of occurrence differ widely among species, and in some are undeniably complex. Thailand may be host to three or four discrete populations of (e.g.) Black Bittern *Dupetor flavicollis* and Chestnut-winged Cuckoo *Clamator coromandus*: passage migrants, non-breeding winter visitors from countries to the north, summer (wet-season) breeding visitors, and possibly some year-round residents as well (Lekagul & Round 1991).

However, the overwhelming majority of migrant species, both landbirds and waterbirds, are non-breeding visitors from countries to the north that spend the Palaearctic winter in tropical South-East Asia. For many of these Thailand marks the southern limit of their South-East Asian winter range. Even here, however, the situation is complicated by the country's c.14° latitudinal span, and its range of habitats, from seasonally dry monsoon forests to rainforest. Many Palaearctic migrants, although common in 'continental Thailand' (north of c.12°N), scarcely enter the Thai-Malay Peninsula (e.g. Siberian Rubythroat *Luscinia calliope*). Others, e.g. Arctic Warbler *Phylloscopus borealis* and Eastern Crowned Warbler *P. coronatus*, appear not to winter much north of c.14° or 15°N, and indeed the peninsular provinces may be their major wintering area in the country.

The present paper seeks to examine the patterns of occurrence of three Palaearctic migrant visitors which are unusual in that they occur chiefly as spring and autumn passage migrants: Tiger Shrike *Lanius tigrinus*, Yellow-rumped Flycatcher *Ficedula zanthopygia* and Mugimaki Flycatcher *F. mugimaki*. These species are easily identified and, though not scarce, are sufficiently noteworthy to be recorded by amateur observers, yielding a reasonably large dataset.

METHODS

The principal sources of data were records submitted by local or visiting birdwatchers from 1980 onwards; my own sight records and mist-net captures; published records or major compilations where dates and localities were given (e.g. Robinson & Kloss 1921–1924, Riley 1938, Deignan 1945, Meyer de Schauensee 1946); the small number of specimens held in the Centre for Thai National Reference Collections, Environment and Resources Department, Thailand Institute of Scientific and Technological Research, Bangkok, and in the Boonsong Lekagul collection stored in the National Science Museum, Bangkok.

Although specimens and ringing records (mainly from Laem Phak Bia, a coastal site in the Gulf of Thailand: Round & Kongtong 2009) distinguished among sex and age classes of the three taxa, these contributed only a small proportion of records, most of the rest being sight-records. For the two flycatchers, sight-records distinguished only between birds in definitive adult male body plumage (with black upperparts) and 'others' (brown-plumaged, female/immature individuals). While male and female Tiger Shrikes in spring differ in plumage (females with much reduced black on forehead: Wells 2007), few field observers distinguished between the sexes. Additionally, Tiger Shrike is unusual in that adults have two complete moults per year (Prys-Jones 1991). Adults

undergo a post-nuptial moult on the breeding grounds into a brown, juvenile-like plumage, so that many autumn adults are difficult to separate reliably from juveniles. Accordingly, in this analysis no distinction was made between sexes or age-classes in Tiger Shrike, while the two flycatchers' age and sex classes were given as definitive males and 'others'.

Records for each species were grouped by ten-day period throughout the year in order to standardise the nationwide pattern of occurrence. Maps were used to illustrate the geographical scatter of records, based on the six regions first proposed by Kloss (1915) and subsequently depicted in King *et al.* (1975): North (alternative name North-West), North-East, South-East, West (South-West), Central and South (Peninsula).

RESULTS

Over 720 records for the three species were subjected to analysis. Although these covered a span of years from 1896 to the present, more than 90% of the records for each of the three species post-dated 1980 (Fig. 1). Although initially it was assumed that the overwhelming majority of records would be from the Central Region, which includes the city of Bangkok, where most observers are concentrated, sightings from the Central Region only contributed 39.7% of records of the three species combined. A major surprise was the paucity of records from the Northern Region (only 4.4% of records of all three species), even though this includes Chiang Mai, Thailand's second largest city, which supports many resident birdwatchers. The North-East, the largest region in terms of land area, was expectedly little-watched, with the exception of Khao Yai National Park (at the extreme south-west of the region, and the major source of records).

Tiger Shrike

A total of 202 records involving 324 individual birds was compiled (Fig. 2), of which 259 were in autumn and 56 in spring. Only nine individuals (2.8%) were from the midwinter period (November to mid-March), indicating that this species was almost exclusively a spring and autumn passage migrant. The earliest autumn record was 11 August and the latest 18 October, though almost all (98.8%) occurred before 10 October (median date 13 September: Table 1). Although the peak autumn passage period overall was the second week of September, disproportionately more of those after the first ten days of September were from the South, reflecting a geographical shift in the population. The peak period of occurrence around Bangkok and elsewhere in continental Thailand appeared to be during the last week of August and the first week of September.

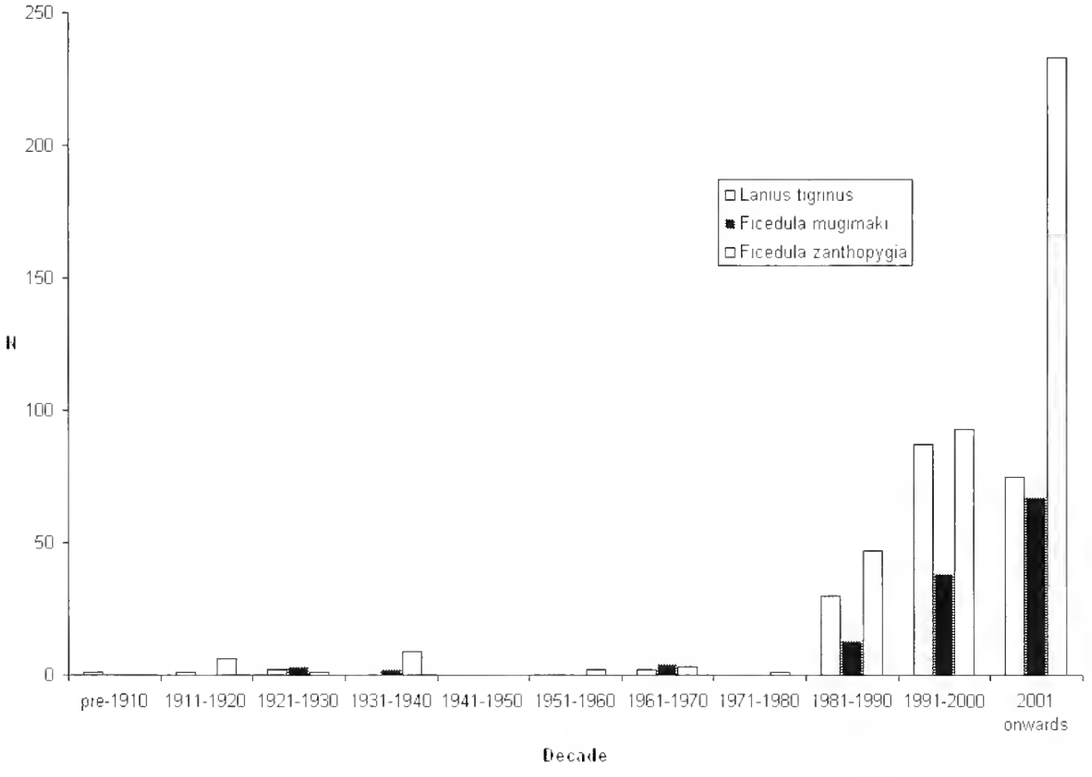

Figure 1. Records of three study species according to decade.

Table 1. Occurrence of Tiger Shrike *Lanius tigrinus*, Yellow-rumped Flycatcher *Ficedula zanthopygia* and Mugimaki Flycatcher *F. mugimaki* on passage in Thailand.

		Autumn passage		Spring passage	
		range	median	range	median
Lanius tigrinus	all	11 August–18 October	13 September	12 March–6 June	30 April
Ficedula zanthopygia	definitive male	1 August–10 October	4 September	19 March–2 May	10 April
	other age-classes	13 August–8 November	10 September	21 March–9 May	17 April
Ficedula mugimaki	definitive male	not available		27 March–29 April	10 April
	other age-classes	not available		27 March–30 April	16 April

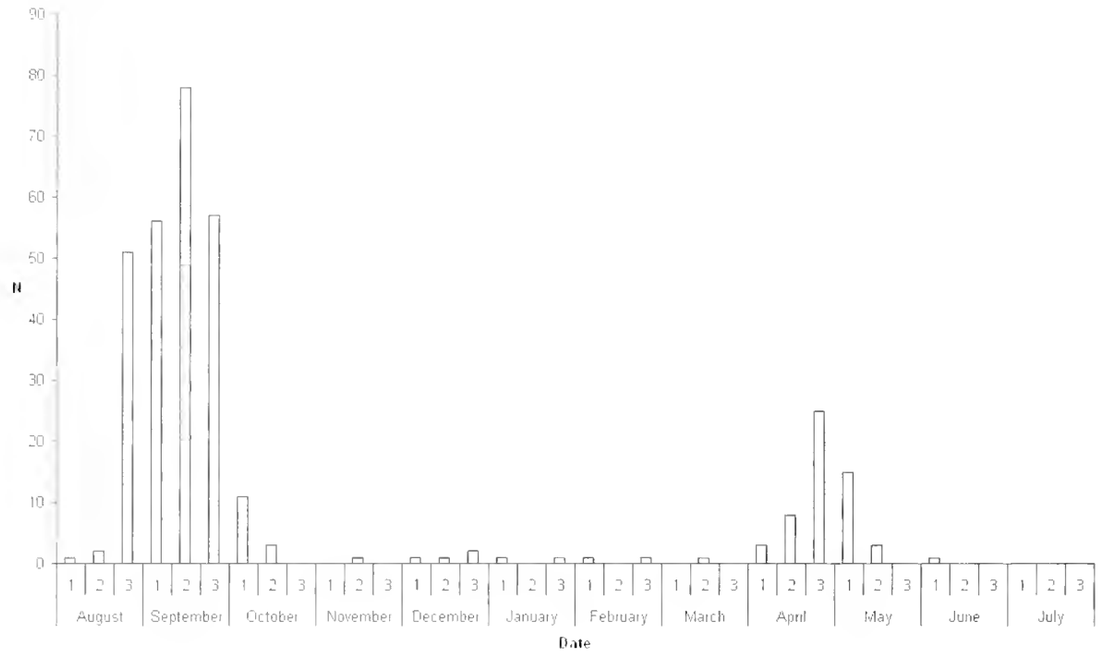

Figure 2. Seasonal distribution of records of Tiger Shrike *Lanius tigrinus* by ten-day period.

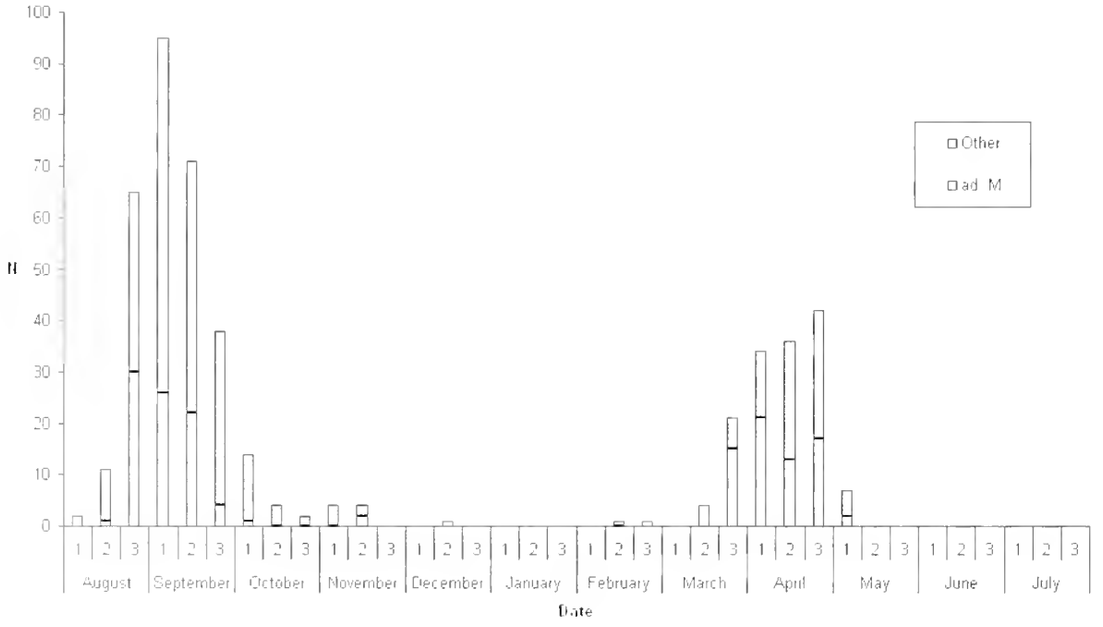

Figure 3. Seasonal distribution of records of Yellow-rumped Flycatcher *Ficedula zanthopygia* by ten-day period.

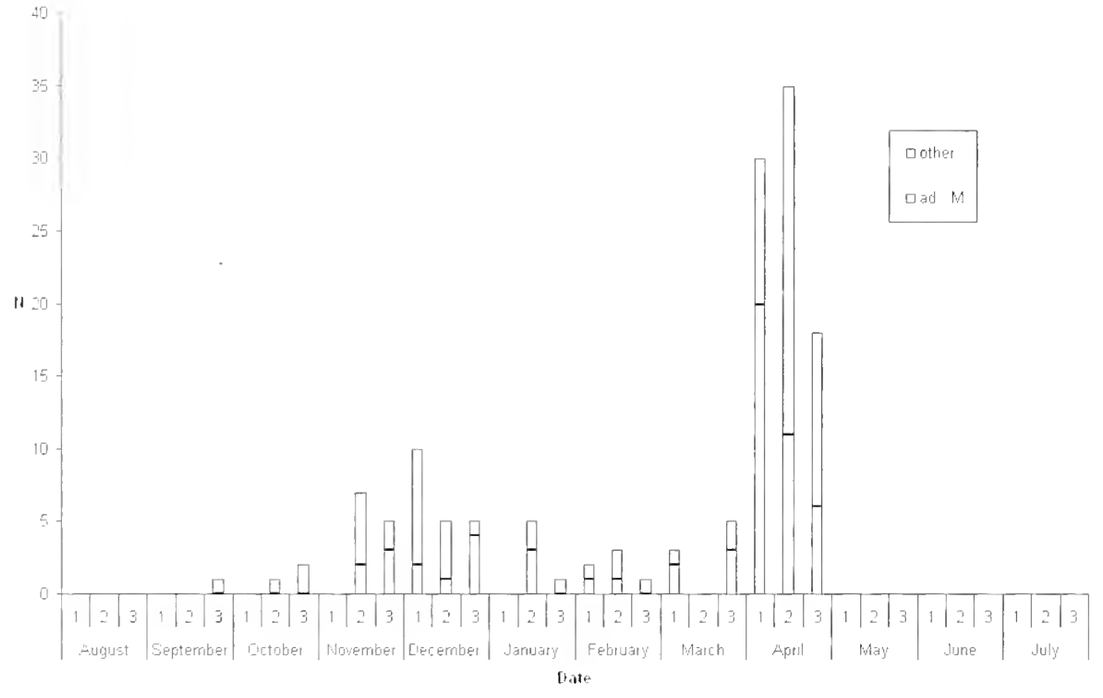

Figure 4. Seasonal distribution of records of Mugimaki Flycatcher *Ficedula mugimaki* by ten-day period.

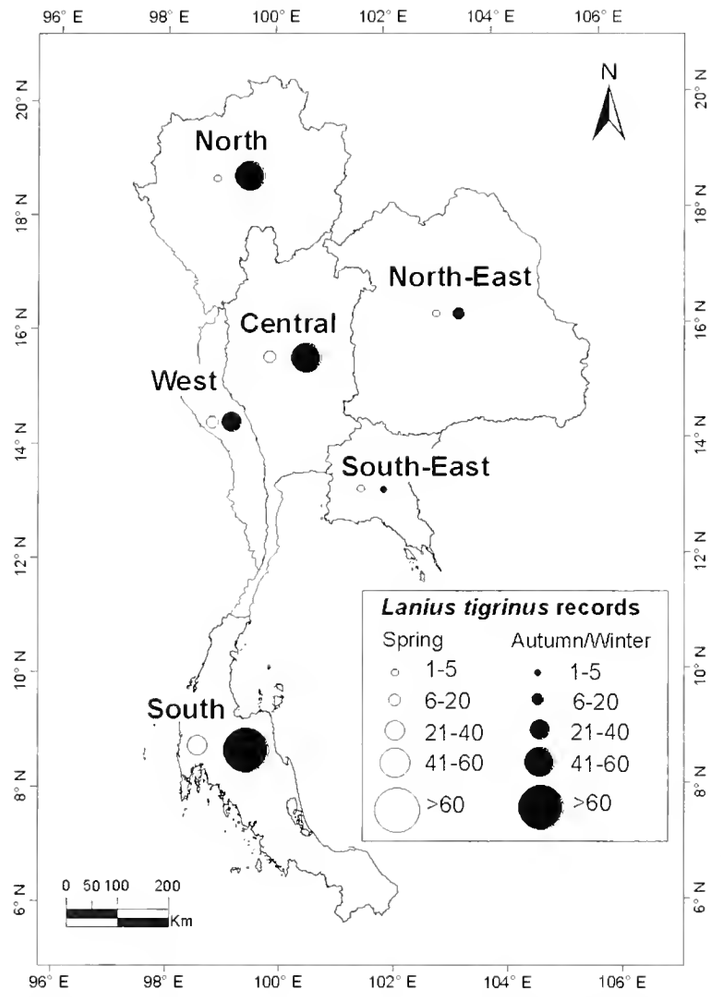

Figure 5. Distribution of records of Tiger Shrike *Lanius tigrinus* by region.

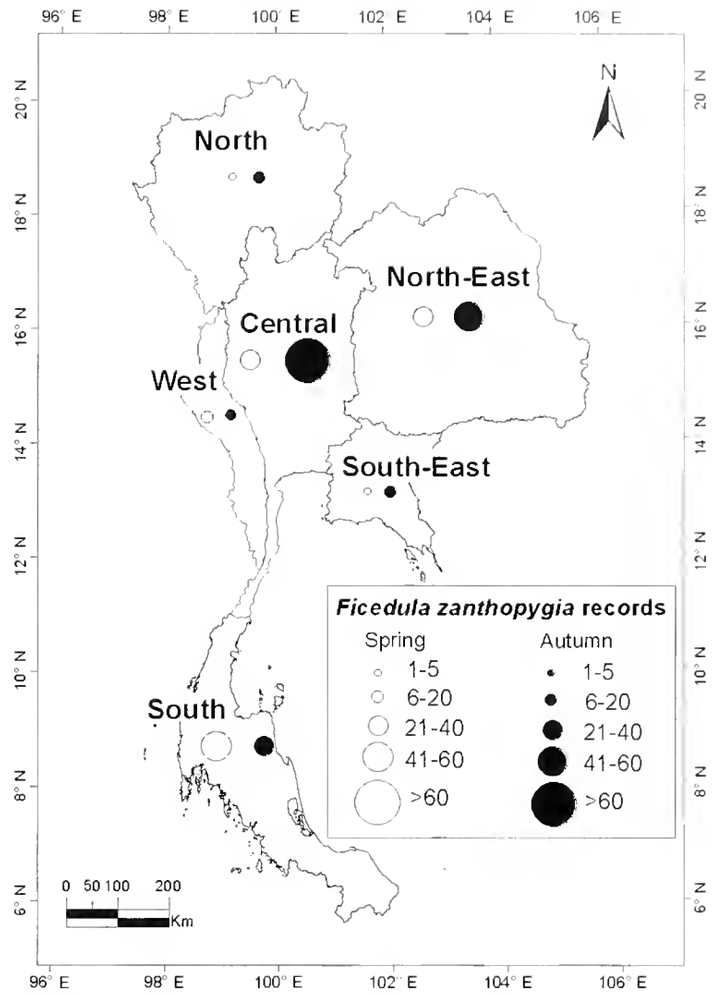

Figure 6. Distribution of records of Yellow-rumped Flycatcher *Ficedula zanthopygia* by region.

The earliest apparent spring passage record was 12 March, although since no others were recorded until 6 April there is a possibility that this was an aberrant wintering bird. The latest date was 6 June, although the peak spring passage was in the last ten days of April and the median date was 30 April (Table 1).

For both passage seasons combined proportionately more records were obtained from the South (46.3%) relative to the Central Region (27.9%) than in the other two species examined (Fig. 5). Additionally, five of the nine midwinter records of Tiger Shrikes were from the South, suggesting the possibility that a small population may genuinely overwinter in the provinces adjacent to the Malaysian border.

Yellow-rumped Flycatcher

The dataset comprised 395 records of 457 individuals. This species was similarly almost exclusively a spring and autumn passage migrant, with only seven individuals (1.5%) recorded during the midwinter period, from mid-November to mid-March. More than twice as many individuals were recorded in autumn (306) than in spring (144).

Autumn passage was recorded from 1 August onwards to early November, although 71% of all autumn records were in the last ten days of August and the first twenty days of September, and only 20 individuals (6.5% of autumn records) were obtained after the beginning of October (Fig. 3). Spring passage was recorded from 19 March to 9 May (Table 1), with over three-quarters of those sighted during March being male (Fig. 3). Most observers did not distinguish between brown-primaried first-year males and black-primaried adult males. The median date for spring males (10 April) was one week earlier than that for females (17 April; Table 1).

Adult males also constituted a significantly higher proportion of earlier-arriving birds in autumn: 42.3% of August birds were adult males, compared with only 25.5% of September birds ($\chi^2 = 7.44$; $p < 0.01$; Fig. 3). The median date for adult males in autumn was 4 September compared with 10 September for other age/sex-classes combined (Table 1). Four of seven midwinter birds were black-bodied males. The winter sample is too small to draw any firm conclusions and does not necessarily imply that proportionately more adult males overwinter, since some could have been first-winters that had completed their body moult. The proportion of black body-plumaged males in spring was exactly 50%, all first-year males having by then acquired black upperparts.

Fifty percent of records of Yellow-rumped Flycatchers were from the Central Region compared with only 21.2% from the South (Fig. 6). Records from the South did not figure disproportionately among the few Yellow-rumped Flycatchers recorded in midwinter, so there was no evidence of a significant wintering population anywhere, including in the extreme southernmost provinces, even though Yellow-rumped Flycatcher winters in Malaysia (Wells 2007).

Mugimaki Flycatcher

The pattern of occurrence of Mugimaki Flycatchers differed markedly from the other two species. It was in

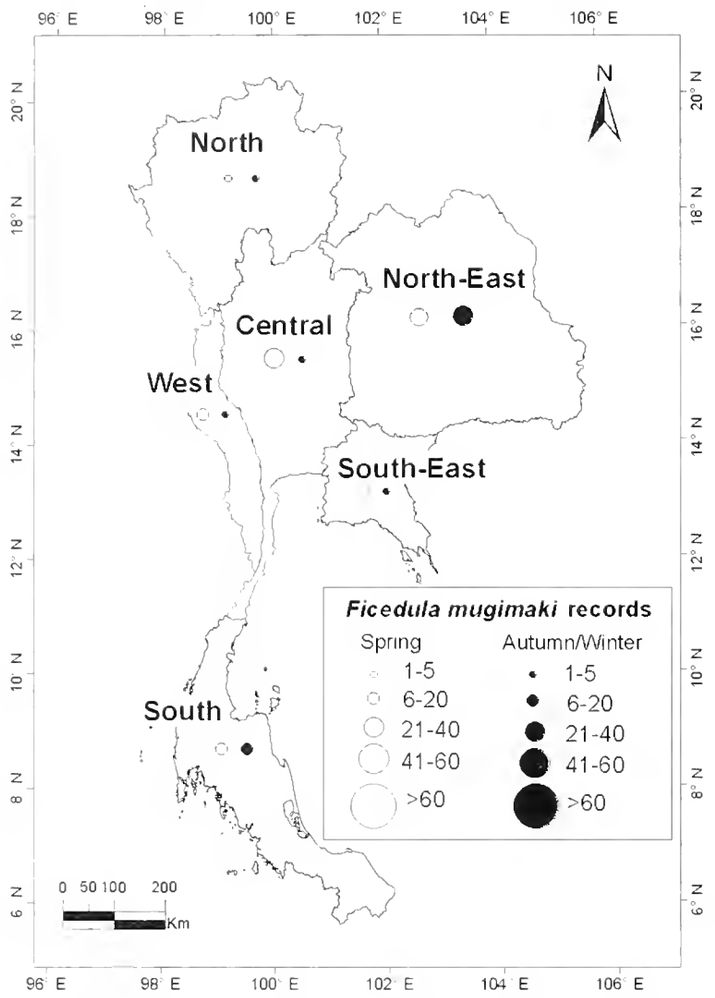

Figure 7. Distribution of records of Mugimaki Flycatcher *Ficedula mugimaki* by region.

general less frequently recorded: there were only 127 records of 139 individuals for analysis. Mugimaki Flycatcher was also a much later autumn migrant. Apart from one (atypically early) report on 22 September, all records spanned the period 2 October to 30 April. There was a consistent and more frequent midwinter presence: 47 individuals (33.8%) were from the period 1 November to 8 March. Relatively few were found in autumn, but in most cases it was not possible to distinguish reliably between autumn passage and wintering.

The marked spring passage was considered to span the period 27 March to 30 April. Of 83 individuals throughout the month of April, nearly half (42%) were in the middle ten days of the month (Fig. 4). Median spring passage dates were 10 April for adult males and 16 April for 'brown' birds that included both females and first-year males (Table 1).

The geographical spread of records also differed markedly from the other two species, with many more (34%) from the North-East than any other region. This compared with 26.8% from the Central Plains and 23.6% from the Peninsula, a relatively more even geographical spread among regions (Fig. 7). Mugimaki Flycatcher showed a greater affinity for forest and taller trees than Yellow-rumped Flycatcher and was not usually recorded in coastal mangrove scrub, and other relatively open habitats where most watching and ringing of migrant birds is undertaken. It also has a greater affinity for upland habitats. Although most Central Region records were at or near sea-level, the headquarters area of Khao Yai National Park, the source of most of the North-East Thailand records, lies at 700–800 m elevation.

DISCUSSION

All three species considered have breeding ranges in the Eastern Palaearctic, with the smallest range being found in Tiger Shrike, breeding mainly in Ussuriland, the Korean Peninsula, Japan and north-east China (Brazil 2009). Two of the three breed in smaller woodlots and parks (including in urban areas: J. W. Duckworth *in litt.*) in addition to forest. The third, Mugimaki Flycatcher, is the most restricted to forest on the breeding grounds (Brazil 2009) and also tends to be more restricted to taller woodland on passage in South-East Asia than the other two. Although both Tiger Shrike and Yellow-rumped Flycatcher winter commonly in Malaysia (Wells 2007), neither does so regularly or widely in peninsular Thailand (apart from a few Tiger Shrikes that possibly winter in the extreme southern provinces, immediately adjacent to the Malaysian border). Mugimaki Flycatcher is a winterer and passage migrant in both seasons in Malaysia but commonest above the montane ecotone (Wells 2007). In Laos this species is also mainly associated with hill-slope and montane habitats, both on passage and in winter (Duckworth *et al.* 1998, J. W. Duckworth *in litt.*). It is highly likely, therefore, that many more might be recorded during winter if the little-covered southern Thai mountains were more accessible.

As passage migrants, Tiger Shrike and Yellow-rumped Flycatcher showed overall many more records in autumn than in spring, while the reverse was true in Mugimaki Flycatcher. The relative scarcity of both Tiger Shrike and Yellow-rumped Flycatcher in spring is unlikely to be an artifact of coverage as, in general, more birdwatchers and bird photographers are searching for birds at that time than in autumn.

Some other migrant shrikes (e.g. the Western Palaearctic-breeding, African-wintering Red-backed Shrike *L. collurio* and Lesser Grey Shrike *L. minor*) are noted 'loop migrants', and take a more easterly route on northward (spring) migration than on southward (autumn) migration (Moreau 1961, 1972). There is no obvious reason, however, why there should be any parallel among the Eastern Palaearctic–South-East Asian migrant species. Additionally, Tiger Shrike is very rare in Hong Kong, with only nine records, all of which were in autumn (Carey *et al.* 2001), so it is unlikely that spring migrants take a more easterly northwards route. Nor are there many records to the west (see below). Because Tiger Shrike is a relatively late spring migrant, with northwards passage extending well into May (latest Thai-Malay Peninsula date 17 May: Wells 2007) some may be overlooked. The most likely explanation, however, is that most northbound spring migrants, having fattened in Malaysian or Indonesian wintering areas, overfly Thailand (and southern China). This interpretation is corroborated by the scarcity of records from Laos in spring, even though coverage by visiting birdwatchers in Laos probably reaches its annual peak at that time (J. W. Duckworth *in litt.*).

The depiction of differing geographical distributions among the three species is still tentative as even now some regions (especially the South-East) are much less-visited than others, and would surely contribute many more

records if better covered. In the case of Yellow-rumped Flycatcher the disparity between the 50% of records from the Central Plains region compared with only 21.2% from the South may to some extent be due to a proportionate disparity of (especially autumn) coverage between the two regions. However, Wells (2007) suggested that the species was less common in the Thai peninsular provinces in autumn than in spring, and this is borne out by the present analysis.

The apparent scarcity of Yellow-rumped Flycatcher records from the North (which contributed just 2.8% of records for both seasons combined) might be partly due to inadequate coverage of favoured lowland garden or parkland habitats in that (mainly hilly or mountainous) region. But such a pattern might also occur if Yellow-rumped Flycatcher had a slightly more north-east/south-west migratory orientation that caused it largely to miss the North on both migrations. North-East Thailand contributed 15.3% of spring records, while Yellow-rumped Flycatcher is also regular in Laos in spring (J. W. Duckworth *in litt.*). This would tend to rule out spring overflight as a cause for scarcity in the North. In Tiger Shrike by comparison, overflight is a more likely explanation as there were equivalently few spring records from both the North and North-East.

The Yellow-rumped Flycatcher in Hong Kong has a pattern of occurrence similar to that of Tiger Shrike. It is very scarce in spring (only one record: Carey *et al.* 2001), suggesting that it either overflies southern China or follows a route that bypasses the coast. Although more frequent in autumn, it is still much less common there than in Thailand. The peak passage in Hong Kong, in mid-September, more or less corresponds with that 8° latitude further south, in Thailand's Central Region.

In autumn, Mugimaki Flycatcher was a much later migrant, with passage peaking over one month later than the other two. This made it difficult to distinguish between migrants and winterers. The late timing of passage in this species is also corroborated from night-time interceptions in Malaysia (Wells 2007). The predominance of spring passage records almost certainly accurately reflects a genuine greater abundance then, especially since the chances of encountering any individual passage migrant should be lower in spring than in autumn. Not only is the total population of any given Palaearctic migrant in spring smaller than that in autumn, owing to winter mortality, but spring migrants in general may also make shorter migration stop-overs, owing to the imperative to return to the breeding grounds to take up territory. In Hong Kong, where the Mugimaki Flycatcher is similarly a scarce winter visitor and passage migrant, it is also recorded more commonly in spring than in autumn (Carey *et al.* 2001).

In general, the broad correspondence between Thailand and Hong Kong in records of the three species gives no reason to speculate that autumn and spring migratory routes differ in major respects for any of them, other than in possible spring overflight of northern South-East Asia and southern China. Nor does any species pass much to the west in either season. Yellow-rumped Flycatcher is a vagrant to peninsular India, while neither Tiger Shrike nor Mugimaki Flycatcher have been recorded there (Rasmussen & Anderton 2005). In Burma, Yellow-rumped Flycatcher and Tiger Shrike are known from the extreme east of the country and Tenasserim only, while there are no records of Mugimaki Flycatcher (Robson 2008).

The Mugimaki Flycatcher showed a generally more eastern distribution in Thailand than either Tiger Shrike or Yellow-rumped Flycatcher. Well-watched forest sites in Western Thailand, such as Kaeng Krachan National Park, which covers a similar altitudinal range to Khao Yai, have yielded many fewer records than the latter site, while there were only two records from the very heavily watched mountains in Chiang Mai Province, in the western part of the North. Definitive male Mugimaki Flycatchers accounted for 42% of spring records, proportionately fewer than in Yellow-rumped Flycatcher. Although this might be expected, since male Mugimaki Flycatchers may not attain black upperparts until their second year, the difference in the proportions of recognisable males was not statistically significant.

Although the numbers of all three migrant species recorded increased markedly after 1980, owing to greatly increased coverage by birdwatchers and to better collation of records, the numbers of Tiger Shrikes recorded did not increase in proportion to those of Yellow-rumped Flycatchers, and indeed there were fewer Tiger Shrike records post-2000 than in the preceding decade (Fig. 1). Given the fact that the peninsula contributed most records of Tiger Shrike overall, one possible reason for this disparity might be that coverage increased more in the Central Region post-2000 than it did in the South (where either coverage, or record submission, may have actually declined). Another possibility is that the decline in records reflects an ongoing global decline in numbers of Tiger Shrike that was reported by BirdLife International (2009).

This analysis shows how records collected mainly by amateur birdwatchers may make a contribution to the scientific record in Thailand and South-East Asia as they have long done in Europe and North America. Although the present paper has drawn on records spanning a roughly 110-year period, over 80% of the records of each species post-dated 1990 and therefore provided a reasonable 'snapshot' of present patterns. Studies on the phenology of breeding and migration have assumed added urgency owing to the weight of evidence that climate change is having major impacts on birds and biological systems (Crick & Sparks 1999, Butler 2003, Coppack & Both 2003, Sanderson *et al.* 2006). Migrant birds may be at elevated risk from climate change because their annual cycles are adapted to cope with the vicissitudes of climate in widely separated wintering and breeding areas, which may differ in the extent to which they are affected by climate change. Additionally, clearance of forest for agriculture has impacted the status of both resident and migrant birds, removing large swathes of habitat for inhabitants of forest, while simultaneously opening up huge areas for those that favour open country. Wells (2007) has documented a gradual southwards expansion of the winter range of migratory Black Drongos *Dicrurus macrocercus*, an open-country winterer, in Malaysia, and range shifts among a suite of other migrant species might be expected.

Migrant birds additionally face a number of other threats including direct persecution, and indirect disturbance. Mortality during nocturnal migratory flights due to collisions and disorientation caused by communications towers, other man-made structures, and gas flares from offshore oil-fields has also been

demonstrated and could cause population declines (Lid 1977, Morris *et al.* 2003). Improved understanding of migrant bird ecology, and a capacity to monitor changes in the numbers and distribution of migrant birds, are therefore of great importance.

Although this paper establishes a rough baseline on seasonality and distribution for the three species considered, more intensive and systematic monitoring, from a greater and more even spread of sites, for a greater range of species, and comparing seasonal patterns decade by decade, or by five-year period, into the future would refine and improve understanding. This could be done through better collation of records from local birdwatching groups (several of which already exist for the Thai regions), university bird clubs, and possibly in future even formally established bird observatories, including those in neighbouring countries. Round & Kongtong (2009) recommended the establishment of a bird observatory at one coastal site, the Laem Phak Bia Environmental Research and Development Project, Phetchaburi, where ringing has already been implemented for a decade, and which contributed a number of records to the present analysis.

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A rapid bird survey of the Menyapa mountains, East Kalimantan, Indonesia

NICK W. BRICKLE, JAMES A. EATON and FRANK E. RHEINDT

We report on a rapid bird survey in the Menyapa Mountains of East Kalimantan Province, Indonesia. Six days were spent at altitudes of between 150 m and 1,600 m during November 2007. A total of 184 species were recorded including one new species for Kalimantan, one new for Indonesia, and several range extensions, highlighting the interest and importance of the Menyapa region. The status, distribution and taxonomy of several montane species are discussed in general, including species both detected and undetected by this survey.

INTRODUCTION

Ornithological survey work in Kalimantan has been far less extensive than in neighbouring Sabah and Sarawak (Sheldon *et al.* 2001, Mann 2008). This is particularly so for upland areas. Here we report on a rapid survey of one such area, the Menyapa Mountains of East Kalimantan Province, Indonesia. We extend our findings to consider the distribution and taxonomy of some montane species in general.

Survey area

The Menyapa Mountains are a range of mid-elevation hills (maximum 2,130 m) some 300 km north of Balikpapan and 150 km east of the Sarawak border, lying entirely within the Indonesian province of East Kalimantan (Figure 1). The forested hills above around 500 m are designated as a mix of watershed protection forest ('*Hutan Lindung*') and an inactive logging concession owned by PT Muggitriman. There is no history of commercial logging, and illegal logging has been very limited as a result of the

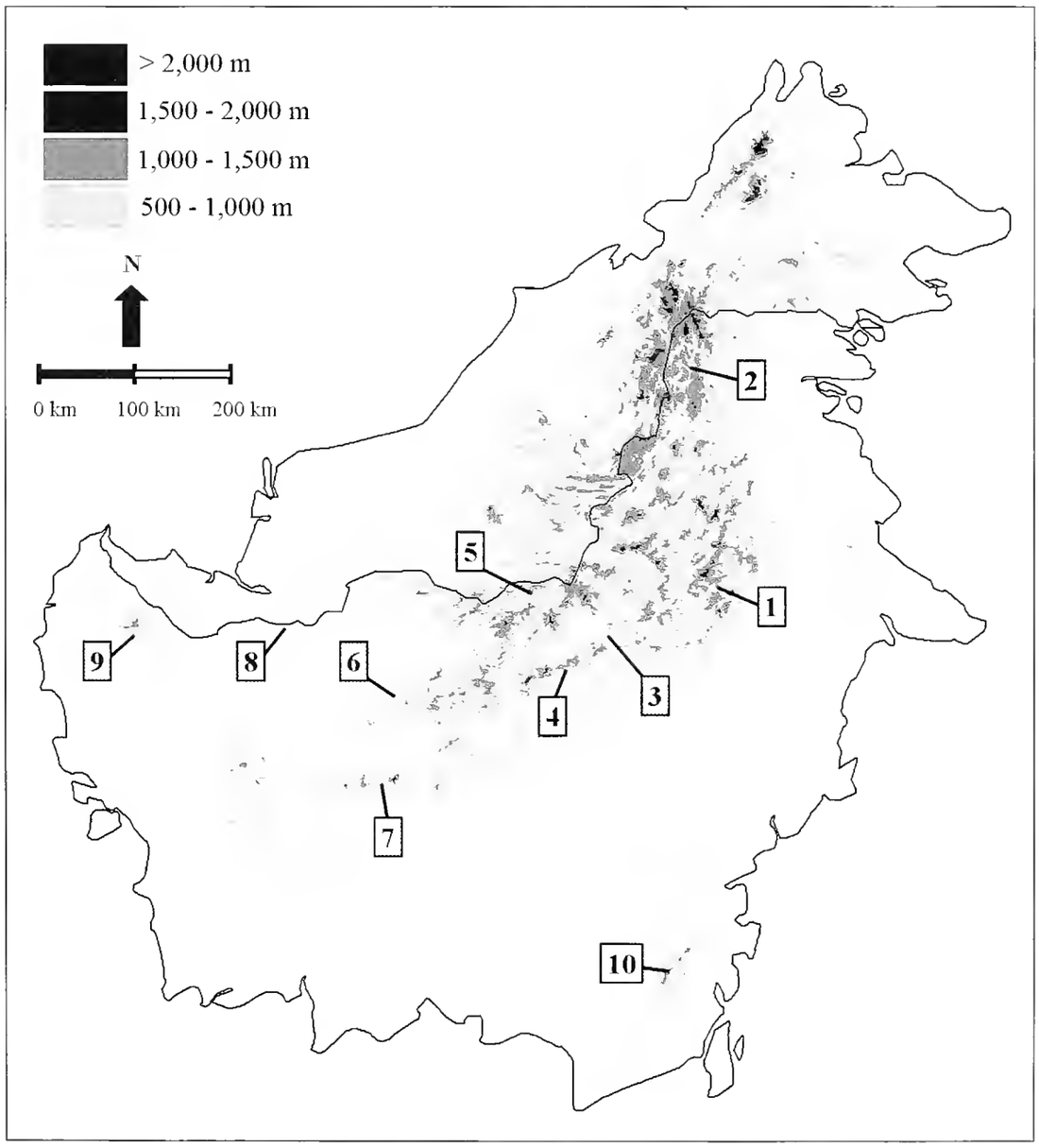

Figure 1. Topography of Borneo, showing broad elevational bands. Numbers indicate locations referred to in the text: (1) Menyapa Mountains; (2) Kelabit Uplands and Kayan Mentarang; (3) Upper Mahakam; (4) Müller Range and Barito Ulu; (5) Batu Tibang; (6) Mt Kenepai; (7) Bukit Baka; (8) Liang Kubung; (9) Mt Nyiut; (10) Muratus/ Meratus Range.

poor access. Gaharu wood (agarwood) collectors are active in the area but the scale is small and any damage is very localised. Generally the forest throughout the Menyapa range is in excellent condition.

Lowland areas to the west and east are dominated by land designated as logging concession or industrial plantation. Forest exploitation is very advanced to the east, with the active logging concession of PT Nakarta Rimba working into the foothills of the Menyapa Mountains, and beyond this huge oil palm estates now dominate the landscape. Land to the west is also designated as a logging concession, owned by PT Essam Timber, but this concession has never been actively exploited and the area remains largely intact forest.

Between 1996 and 2002 a road was constructed from the lowlands in the east to connect with the logging concession of PT Essam to the west of the Menyapa Mountains. This unsurfaced road stretched over 150 km across the Menyapa range and formed the most direct route to access and remove timber from the PT Essam concession. However, once opened it was found uneconomic to use the road as intended, and exploitation of the concession was abandoned almost before it began. The road was then cut off from vehicular access following a bridge collapse in 2005. However, three serviceable 4×4 cars were left behind and adopted by enterprising gaharu collectors. Both the cars and the road itself have been crudely maintained and are now used to ferry occasional teams of gaharu collectors to drop-off points from which they access the forest.

The Menyapa Mountains form part of the central mountainous region of the island of Borneo, but are isolated by land below 1,000 m from other adjacent ranges. To the north lie the Kelabit Uplands and Kayan Mentarang ranges that span the Kalimantan–Sarawak border. To the west lies the Batu Tibang range of East Kalimantan. To the south-west lies the Müller range (see Figure 1).

Previous ornithological survey work in the mountains of Kalimantan

To our knowledge, the closest previous ornithological surveys to the Menyapa Mountains were those conducted by H. C. Siebers in 1925, reported by Kloss (1930). Siebers collected above 'Long Petah' on the Telen river, which is probably in the vicinity of the current road-head near the logging concession of PT Nakarta Rimba on the route we took to access the Menyapa Mountains.

Ornithological survey work in other montane areas within Kalimantan is also sparse. To the west and south-west of Menyapa, previous survey work includes that reported by Büttikofer (1899), who visited Mt Kenepai (1,136 m) and nearby Liang Kubung (c.1,200 m); Baron Victor von Plessen (reported in Stresemann 1938), who visited the upper Mahakam River region; Priemé & Heegaard (1988), who visited Mt Nyiut ('Niut'; 1,000–1,500 m) in the far west of Kalimantan; Rice (1989), who produced some short notes on fieldwork at 1,600 m on Bukit Baka on the border of West and Central Kalimantan provinces; and Wilkinson *et al.* (1991a), who reported on bird surveys within the Barito Ulu region of north-central Kalimantan, although mostly under 800 m elevation. In the far south of Kalimantan, Davison (1997) reported on a survey of the isolated Muratus ranges ('Meratus'; 1,300 m). To the north of Menyapa bird survey work has been more extensive, particularly from the Kayan Mentarang ranges (1,500–1,900 m), including work by Pfeffer (1960–1961), van Balen & Aspinall (1996), van Balen (1997, 1999), van Balen & Nurwatha (1997) and Sebastian (2007). Beyond these surveys, there has been little other published work. A wealth of literature exists for montane areas in Sabah and Sarawak on the other hand, compiled and reviewed in Smythies (1999), Sheldon *et al.* (2001) and Mann (2008).

METHODS

Between 21 and 27 November 2007 JAE and NWB joined a survey team from The Nature Conservancy en route to the low-lying land to the east of the Menyapa Mountains to survey for the presence of Bornean Orang-utan *Pongo pygmaeus*. Data on bird species present were collected by direct observation and records of calling birds. No systematic or quantitative survey methods were used due to time and access constraints. Survey effort focused on the following areas, habitats and altitudes:

- degraded lowland forest (active logging concession), 200–500 m: 4 man-days;
- primary submontane forest, 500–1,500 m: 4 man-days;
- primary montane forest, 1,500–2,000 m: 4 man-days.

Bird names, sequence and species-level taxonomy generally follow Inskipp *et al.* (1996) except where more recent published information is available (taxa marked with *). IUCN Red List categories follow IUCN (2010).

RESULTS

A total of 184 species were recorded. Detailed accounts are given below for (a) threatened species (Endangered or Vulnerable by IUCN 2010); (b) species for which our records represent significant range extensions; and (c) species notable for other given reasons. An annotated list of all species recorded during the survey is given in the Appendix.

Mountain Serpent Eagle *Spilornis kinabaluensis*

Bornean endemic. Vulnerable. At least five birds were seen and sound-recorded at 1,300–1,650 m. This represents a notable southerly range extension for this species, with the only previous Kalimantan records from Kayan Mentarang (Voous 1961, van Balen 1999, Sebastian 2007).

Wallace's Hawk Eagle *Nisaetus nanus*

Vulnerable. A single bird seen soaring above the Nakarta Rimba concession at around 150 m. This species is an uncommon but widespread resident in Kalimantan (Mann 2008).

Ferruginous Partridge *Caloperdix oculea*

A pair was heard calling at around 350 m. Only a single Kalimantan record exists of this species, recorded at Mt Latuk within the Kayan Mentarang ranges (Pfeffer 1960–1961). Ferruginous Partridge also appears scarce in Sabah and Sarawak, with only an handful of previous records (Mann 2008).

Red-breasted Partridge *Arborophila hyperythra*
Bornean endemic. Regularly heard, and seen once, at 1,200–1,500 m. There are very few previous records of Red-breasted Partridge from Kalimantan, seemingly having only previously been recorded in Barito Ulu in northern Central Kalimantan (Wilkinson *et al.* 1991a) and in the Kayan Mentarang region (Finsch 1905, van Balen & Nurwatha 1997, Smythies 1999). The species's range in Sabah and Sarawak is relatively wide, stretching north from Barito Ulu as far as Mt Kinabalu (Mann 2008).

Crimson-headed Partridge *Haematortyx sanguiniceps*
Bornean endemic. Regularly recorded at 1,200–1,650 m. Few previous records from Kalimantan, mostly from the north-east, including the watersheds of Kapuas–Mahakam and Mahakam–Teweh (Smythies 1957) and the Kayan Mentarang ranges (Pfeffer 1960–1961, van Balen & Nurwatha 1997, Sebastian 2007).

Crested Fireback *Lophura ignita*
Near Threatened. A single male crossed the track at 200 m. Birds in the Menyapa Mountains belong to the nominate group, which consists of two Bornean races (*ignita* and *nobilis*) that differ only slightly in size (McGowan 1994). It is questionable to which of these two races Menyapa birds belong, because precise subspecies range limits in this part of Borneo are not clear. The nominate Bornean group differs greatly from Sumatran *L. i. rufa* and may well be split in the future, in which case the threat status of Bornean birds (*L. ignita sensu stricto*) will need to be re-assessed.

Bulwer's Pheasant *Lophura bulweri*
Bornean endemic. Vulnerable. A male and three females crossed the track in the early morning at 1,100 m. Local gaharu collectors knew this species well, suggesting it is regular in the area. This species is an uncommon submontane resident with a patchy distribution across central Borneo (Mann 2008).

Barred Eagle Owl *Bubo sumatranus*
Heard calling nightly at around 1,600 m. Three of the five previous Kalimantan records of this species have been from lowland sites, including the Sangkulirang Peninsula (Eames 2005) and Sungai Wain (Slik & van Balen 2006) in east Kalimantan, and Tanjung Puting National Park in south-central Kalimantan (Bohap & Galdikas 1987, Nash & Nash 1988). Only Büttikofer (1899) and Sebastian (2007) recorded Barred Eagle Owl in upland habitat, at Liang Kubung and Kayan Mentarang respectively. In Sabah, Sarawak and Brunei this species is more widespread, but typically below 1,000 m (Mann 2008). Our record is notable, not least for its altitude.

Mountain Scops Owl *Otus spilocephalus*
Several heard at night above 1,100 m. Previously recorded from only two locations in Kalimantan: Kayan Mentarang (Robson 1993, van Balen 1997) and Gunung Liang Kubung in west Kalimantan (Banks 1937).

*Grey Nightjar *Caprimulgus jotaka*
At least four birds were heard and seen at dawn and dusk at 1,100 m. This species is listed as occurring in Kalimantan by Andrew (1992) and Sukmantoro *et al.* (2007), although it is not clear where the record(s) originate, as no reference is given and no record could be located. Additionally no records are listed for Kalimantan by Mann (2008). Grey Nightjar appears to be an uncommon winter visitor to Borneo, based on records from Sabah, Sarawak and Brunei, and so its presence in Kalimantan is not to be unexpected.

*Bornean Frogmouth *Batrachostomus mixtus*
Recorded at night once at around 1,100 m. Only a few Kalimantan records exist of this species: far to the south of Menyapa in the isolated Muratus Range (Davison 1997); 'Bahau' (Stresemann 1937); the Kayan Mentarang ranges (van Balen & Nurwatha 1997, Holmes 1997); and the Bulungan river in east Kalimantan, close to Menyapa (Stresemann 1937). This species is more commonly recorded from the far north of Borneo, in Sabah and northern Sarawak (Mann 2008).

*Bornean Swiftlet *Collocalia dodgei*
Bornean endemic. *Collocalia* swiftlets were commonly encountered in the montane zone above 1,500 m and appeared to show green-glossed mantles. Moyle *et al.* (2008) showed that the island of Borneo harbours two *Collocalia* swiftlet species: (1) the widespread Glossy Swiftlet *C. esculenta* from the lowlands and foothills; and (2) the montane Bornean Swiftlet *C. dodgei*, a close relative of the better known Linchi Swiftlet *C. linchi* from Java. The two Bornean species closely resemble each other but differ in the colour of their plumage gloss (green in *C. dodgei*, blue in *C. esculenta*). *C. dodgei* has so far only conclusively been recorded from above 2,500 m on Mt Kinabalu (Sabah), but Moyle *et al.* (2008) suggested the species may be more widespread in suitable montane habitat throughout the island. Our record of green-glossed birds above 1,500 m suggests that *C. dodgei* occurs south to the Menyapa Mountain range in Kalimantan. Future confirmation of our record with photographs or specimen collection is desirable, not least to establish the reliability of mantle colour as an identification feature.

White-throated Needletail *Hirundapus caudacutus*
A small party of six birds was seen above the PT Nakarta Rimba logging concession at around 200 m. This species is listed as occurring in Kalimantan by Andrew (1992) and Sukmantoro *et al.* (2007), although it is not clear where the record(s) originate, as no reference is given and no record could be located. No records are listed for Kalimantan by Mann (2008), suggesting our record may be the first. In Sabah, Sarawak and Brunei White-throated Needletail is considered an uncommon passage migrant, with numerous records (Mann 2008), so its occurrence in Kalimantan is not unexpected.

Golden-naped Barbet *Megalaima pulcherrima*
Bornean endemic. Commonly encountered above 1,100 m. This represents a notable southerly range extension for this species in Kalimantan, with the only previous records being to the north from the Kayan Mentarang ranges (van Balen 1997, Sebastian 2007).

Bornean Barbet *Megalaima eximia*
Bornean endemic. Commonly seen and heard at 1,100–1,600 m. Known in Kalimantan from previous records at only four locations, including Kayan Mentarang (Holmes 1997, Sebastian 2007), Barito Ulu (Wilkinson *et al.*

1991a), Liang Kubung (Büttikofer 1899) and Mt Nyiut in the far west (Priemé & Heegaard 1988).

GIANT PITTA *Pitta caerulea*
A bird heard calling within the Nakarta Rimba logging concession at around 150 m. Only three previous records from Kalimantan: near to Menyapa at the upper Mahakam river (reported in Büttikofer 1899), Mt Lumut, also in east Kalimantan (Wielstra & Pieterse 2010) and Gunung Palung National Park in the far south (Laman *et al.* 1991, Holmes 1997).

RED-RUMPED/STRIATED SWALLOW
Cecropis daurica/striolata
Two hirundines seen flying at around 1,600 m could not be conclusively identified to either species. Records of Red-rumped Swallow are very sparse in Borneo, and there is no confirmed record for Kalimantan, but they may be overlooked on inconclusively identified (Mann 2008). Striated Swallow appears more widespread, but again identification is not always conclusive (Mann 2008). Close attention should be paid to 'red-rumped' swallows seen anywhere in Borneo.

ASIAN HOUSE MARTIN *Delichon dasypus*
Three birds seen at around 1,600 m. This appears to be only the second record from Kalimantan, after the type specimen was collected near Pontianak in West Kalimantan by Diard in 1826 (reported in Smythies 1999). Several records exist from Sabah, Sarawak and Brunei, where this is presumed to be an accidental visitor (Mann 2008).

OLIVE-BACKED PIPIT *Anthus hodgsoni*
A single bird observed foraging along the forest-lined access track at around 650 m. This appears to be the first record of Olive-backed Pipit for Indonesia (Andrew 1992, Sukmantoro *et al.* 2007). The bird was a typical *Anthus* in shape, walking slowly through the grassy margins of the track. The upperparts were olive-green with a white supercilium behind the eye, buff in front, black spot at the rear of the ear-coverts, obvious black moustachial stripe and thick breast streaking. When the bird flushed at 10 m range it flew into the forest, giving a typical sharp *tzeet* call. Several previous records of Olive-backed Pipit exist from Sarawak, Sabah and Brunei, where it is considered a rare winter visitor (Mann 2008), making our record, while very notable, perhaps not entirely unexpected.

SUNDA CUCKOOSHRIKE *Coracina larvata*
Regularly encountered in singles and pairs above 1,100 m. Considered a montane resident in Borneo, but while there are numerous records from mountains in Sabah and Sarawak (Mann 2008) there appear to be only two previous records from Kalimantan, from Kayan Mentarang (Sebastian 2007) and Barito Ulu (Wilkinson *et al.* 1991a), suggesting a widespread but patchy distribution.

GREY-CHINNED MINIVET *Pericrocotus solaris*
Regular encounters with small flocks at 1,100–1,600 m. This represents a notable southerly range extension for this species in Kalimantan, with the only previous records being to the north from the Kayan Mentarang region (Robson 1993, van Balen 1997, Sebastian 2007). Also known from Mt Dulit and Mt Mulu in Sarawak, Gunung Pagon in Brunei, and north to Mt Kinabalu in Sabah (Mann 2008).

STRAW-HEADED BULBUL *Pycnonotus zeylanicus*
Vulnerable. This species was present on the river adjacent to the start of the Menyapa Mountain track, at around 280 m. Three chicks were also being kept in a cage at the base camp station. This species is still an uncommon resident throughout Kalimantan, in contrast to Sumatra where it has become extremely scarce due to poaching pressure.

BLACK-AND-WHITE BULBUL *Pycnonotus melanoleucos*
Near-threatened. This species was commonly encountered in the Menyapa Mountains between 300 and 700 m. Elsewhere on Borneo it is an uncommon lowland to hill forest resident, with few records from montane areas.

*BORNEAN BULBUL *Pycnonotus montis*
Bornean endemic. Frequently seen at 1,100–1,600 m. We here follow Fishpool & Tobias's (2005) treatment of Bornean birds (taxon *montis*) as specifically distinct from mainland taxa of the Black-crested Bulbul *P. melanicterus*. An uncommon resident of north-central mountains of Borneo (Mann 2008).

*PALE-FACED BULBUL *Pycnonotus leucops*
Bornean endemic. Common above 1,200 m. A close relative of the widespread Flavescent Bulbul *P. flavescens* from mainland South-east Asia, with which it is widely considered conspecific. Fishpool & Tobias (2005) and Myers (2009) pointed to considerable morphological and vocal differences and indicated that species status for this montane Bornean endemic may be warranted. In view of our own unpublished preliminary data on this form we here treat it as a separate species. Our records represent a notable southerly range extension in Kalimantan, with the only previous sightings being to the north from Kayan Mentarang (van Balen 1997).

*BORNEAN LEAFBIRD *Chloropsis kinabaluensis*
Bornean endemic. The montane form of Blue-winged Leafbird *C. cochinchinensis* on Borneo is treated as a separate species, *C. kinabaluensis*, by several authors (Wells *et al.* 2003, Mann 2008, Myers 2009, Phillipps & Phillipps 2009). We recorded it commonly above 1,100 m in the Menyapa Mountains, apparently replacing *C. c. viridinucha* at higher altitudes without any morphological intergradation (see below). This apparent local parapatry in the Menyapa Mountains supports the separation of *C. kinabaluensis* as a species. The distribution of *C. kinabaluensis* is believed to be limited to Borneo's northern mountain ranges only, as far south as Mt Dulit and the Usun Apau Plateau. Previous surveys in montane habitat in Kayan Mentarang have recorded '*C. (cochinchinensis) flavocincta*' (*sic*) (van Balen 1997) which is considered to refer to the form *C. kinabaluensis*, while Büttikofer (1899) recorded '*C. viridinucha*' (*sic*) from Mt Kenapai and Liang Kubung, as did Wilkinson *et al.* (1991b) from Barito Ulu in central Kalimantan. Our sightings from Menyapa therefore appear to represent a notable southerly range extention in the species's distribution.

Blue-winged Leafbird
Chloropsis cochinchinensis viridinucha
A pair seen at around 300 m. See taxonomic and distributional notes above.

*Bornean Whistling Thrush *Myophonus borneensis*
Bornean endemic. Seen once at around 1,600 m. We follow Collar (2004) in recognising *M. borneensis* as specifically distinct from *M. glaucinus* and *M. castaneus*. Previous records from Kalimantan were made by Büttikofer (1899) at Liang Kubung to the west of Menyapa, and by van Balen & Nurwatha (1999) in Kayan Mentarang. In Sabah and Sarawak this species is widely distributed north to south, including Mts Kinabalu, Dulit, Mulu, Penrissen, Pueh Tegora and Bau (Everett 1890, Smythies 1957, Mann 2008), suggesting a wide distribution throughout the central ranges.

White-browed Shortwing *Brachypteryx montana*
Recorded above 1,600 m. Only the second confirmed site for this species in Kalimantan, being previously known from the Kayan Mentarang region to the north (van Balen 1997) and adjacent ranges in Sarawak and Sabah (Mann 2008).

Bornean Stubtail *Urosphena whiteheadi*
Bornean endemic. Recorded twice at around 1,600 m. This species has previously been recorded in Kayan Mentarang to the north by van Balen (1997) and to the south-west at Mt Kenepai (Büttikofer 1899), Barito Ulu (Wilkinson *et al.* 1991b) and Gn Liang Kubung (Smythies 1957).

Mountain Tailorbird *Orthotomus cuculatus*
Commonly heard and seen occasionally above 1,100 m. In Kalimantan previously only known from three widely separated sites: Kayan Mentarang in the north (Holmes 1997, Sebastian 2007), Mt Muratus in the far south (Davison 1997), and Mt Nyiut in the far west (Priemé & Heegaard 1988).

Mountain Leaf Warbler *Phylloscopus trivirgatus*
Common above 1,500 m; sound recordings made. Previously recorded at only three locations in Kalimantan: Kayan Mentarang in the north (Sebastian 2007), Mt Muratus in the far south (Davison 1997), and Mt Nyiut in the far west (Priemé & Heegaard 1988). This species is commonly recorded on mountains in Sabah and Sarawak (Mann 2008), and the lack of records from Kalimantan is surprising, given how widely separated the known sites are.

Yellow-breasted Warbler *Seicercus montis*
Commonly encountered in mixed feeding flocks at higher altitudes (from around 1,000 m). Only two previous Kalimantan records are apparent: from the far south in the Muratus Mountains (Davison 1997) and from the far west, at Mt Nyiut (Priemé & Heegaard 1988). The species is more commonly recorded in mountains of both Sabah and Sarawak, including Trus Madi, Mt Kinabalu, Crocker Range, Mt Pueh and the Apad Runan range, adjacent to the East Kalimantan border (Mann 2008). Our record fills a gap in the species's distribution in east-central Kalimantan, but the lack of further records from Kalimantan remains hard to explain, and suggests a very patchy distribution.

Sunda Bush Warbler *Cettia vulcania*
Seen and heard twice at 1,650 m. Apparently only the second record for Kalimantan, having previously been recorded from Kayan Mentarang (van Balen 1997). The species is also found from Mt Kinabalu in Sabah in the north, to Mt Murud in Sawarak to the south (Mann 2008).

Eyebrowed Jungle Flycatcher *Rhinomyias gularis*
Bornean endemic. Recorded once at around 1,600 m. This species has previously been recorded in Kayan Mentarang, to the north, by van Balen (1997) and to the far south of Kalimantan in the isolated Muratus Mountains (Davison 1997).

Grey-streaked Flycatcher *Muscicapa griseisticta*
Seen twice, at 350 m and 1,300 m. Apparently only the fourth record for Kalimantan of this rare non-breeding season migrant, previous sightings being from Kayan Mentarang and near Pontianak (van Balen & Aspinall 1996) and the Sangkulirang Peninsula (Eames 2005). Only a further 5–6 records exist from the whole of Borneo (Mann 2008).

Ferruginous Flycatcher *Muscicapa ferruginea*
Seen once at 650 m. Appears to be only the second published record for Kalimantan of this rare non-breeding season migrant, having previously been collected nearby at 'Punt 1', 1,172 m, above Long Petah, Telen River, East Kalimantan by Siebers in 1925 (reported in Kloss 1930).

Indigo Flycatcher *Eumyias indigo*
Several recorded above 1,500 m. Previous Kalimantan records have all been from Kayan Mentarang (van Balen 1997, Sebastian 2007), so this represents a notable, if not unexpected, range extension southwards.

Snowy-browed Flycatcher *Ficedula hyperythra*
Heard and seen occasionally above around 1,000 m. This species has only been recorded from two sites in Kalimantan: the Kayan Mentarang ranges to the north of Menyapa (Sebastian 2007) and in the far west at Mt Nyiut (Priemé & Heegaard 1988). Our record therefore represents a notable south-easterly range extension within Kalimantan. There are also relatively few records of Snowy-browed Flycatcher from Sabah and Sarawak, including from Mt Pueh, Mt Tamo Abo, Mt Mulu and Mt Kinabalu (Mann 2008).

Blue-and-white Flycatcher *Cyanoptila cyanomelana*
An adult male seen at 650 m. There are more records of this winter visitor in Sabah, Sarawak and Brunei, than Kalimantan, where it is only known form four previous records, including Mt Kenapai (Büttikofer 1899), Bukit Baka (Rice 1989), Mt Lumut (Wielstra & Pieterse 2010) and Tanjung Selor (Holmes 1997).

Bornean Whistler *Pachycephala hypoxantha*
Bornean endemic. Seen commonly at around 1,600 m. This species has previously been recorded for Kalimantan from Kayan Mentarang (van Balen & Nurwatha 1997, Sebastian 2007), Barito Ulu (Wilkinson *et al.* 1991a) and Mt Nyiut far to the west (Priemé & Heegaard 1988), but interestingly was not recorded nearer to the west by Büttikofer (1899) at Mt Kenepai or Liang Kubung. Bornean Whistler has also been recorded from Mt

Kinabalu in Sabah, south to the Pueh Range in Sarawak (Mann 2008), suggesting something of a patchy and broken distribution among the mountains of north-central Borneo, and making our records an apparent range extension to the south-east.

SUNDA LAUGHINGTHRUSH *Garrulax palliatus*
Commonly encountered above 1,100 m. Previously only recorded in Kalimantan from Kayan Mentarang (van Balen & Nurwatha 1997, Sebastian 2007) and the far south of Kalimantan at Gunung Palung National Park (Laman *et al.* 1991). Interestingly this species was not recorded by Büttikofer (1899) at Mt Kenepai or Liang Kubung, which lie between these other records. In Malaysia this species is found from Mt Kinabalu in the north to Mt Dulit in the south (Mann 2008), suggesting a limited and patchy distribution in Borneo and making our records a notable range extension within the central ranges.

*CHESTNUT-HOODED LAUGHINGTHRUSH
Rhinocichla treacheri
Commonly encountered above 1,100 m. Bornean populations were recently split off from Sumatran and mainland Asian birds (now Spectacled Laughingthrush *R. mitrata*) on morphological grounds (Collar 2006). Previously recorded in Kalimantan from Kayan Mentarang (Finsch 1906, van Balen & Nurwatha 1997, Sebastian 2007), Bukit Baka in northern Central Kalimantan (Rice 1989), the Schwaner and Müller ranges (reported in Mann 2008) and in the far south-east in the isolated Muratus Mountains (Davison 1997). The species was not, however, recorded to the west by Büttikofer (1899) at Mt Kenepai or Liang Kubung. The distribution of this species in Kalimantan therefore appears patchy, but widespread.

*BLYTH'S SHRIKE BABBLER *Pteruthius aeralatus*
Commonly heard, seen twice, from above 1,100 m. This species is widely known as White-browed Shrike Babbler, but we here follow Rheindt & Eaton (2009) in including Bornean populations in the newly delimited South-East Asian 'Blyth's Shrike Babbler' *P. aeralatus*, distinct from Javan birds and two other forms from mainland Asia. In Kalimantan the species is previously only known from three widely separated sites: Kayan Mentarang in the north (Holmes 1997, Sebastian 2007), Mt Muratus in the far south (Davison 1997), and Mt Nyiut in the far west (Priemé & Heegaard 1988). Our record therefore fills a gap in the distribution by lying in the centre of these previous records.

*STREAKY-BREASTED SPIDERHUNTER
Arachnothera affinis everetti
Very common between 1,100 and 1,600 m. Previously recorded by Büttikofer (1899) to the west at Mt Kenepai and Liang Kubung, close to Menyapa in the upper tributaries of the Mahakam (Stresemann 1938), and in Kayan Mentarang (van Balen & Nurwatha 1997). At Menyapa this species appeared to be replaced by Grey-breasted Spiderhunter *Arachnothera modesta*, at lower elevations (the latter commoner up to 300–400 m).

YELLOW-RUMPED FLOWERPECKER
Prionochilus xanthopygius
Several seen at around 300–500 m including several males. Records of this species are relatively sparse from Kalimantan, including by Büttikofer (1899) at Mt Kenepai, Liang Kubung and the upper Mahakam river, by Wilkinson *et al.* (1991a) at Barito Ulu and by van Balen & Nurwatha (1997) at Kayan-Mentarang. Yellow-rumped Flowerpecker is more widely distributed to the north and west in Sabah, Brunei and Sarawak (Mann 2008).

BLACK-SIDED FLOWERPECKER *Dicaeum monticolum*
Commonly seen above around 1,000 m. Suprisingly few records exist from Kalimantan of this species, including from Kayan Mentarang (Holmes 1997, Sebastian 2007), from the Muratus Mountains (Davison 1997) and Gunung Liang Kubang (Büttikofer 1899). More commonly recorded in mountains of Sabah and Sarawak (Mann 2008).

BLACK-CAPPED WHITE-EYE *Zosterops atricapillus*
Several flocks encountered at around 1,400 m. This species has previously been recorded in Kayan Mentarang to the north (van Balen 1997) and to the far south-east of Kalimantan in the Muratus Mountains (Davison 1997), so our record fills a gap in the north–south distribution.

PYGMY IBON *Oculocincta squamifrons*
Bornean endemic. Seen frequently at around 300 m. This species has a patchy distribution across the north-central ranges of Borneo, typically being recorded as mid-altitudinal. Previous records from Kalimantan were made by Büttikofer (1899) at Mt Kenepai and Liang Kubung, from Kayan Mentarang (Pfeffer 1960–1961, but not by subsequent observers in the region), and from Barito Ulu (Wilkinson *et al.* 1991a).

BLACK-AND-CRIMSON ORIOLE *Oriolus cruentus*
Regularly heard and seen above 1,000 m. Only the second confirmed site record for Kalimantan, having previously been recorded in the Kayan Mentarang region (Smythies 1957, Robson 1993, van Balen 1997, Sebastian 2007, Pfeffer 1960–1961). Our record therefore represents a notable southerly range expansion. In Malaysia this species is known as far north as Mt Kinabalu in Sabah, and as far south as Mt Mulu in Sarawak (Mann 2008).

HAIR-CRESTED DRONGO *Dicrurus hottentottus*
Occasionally seen and heard at all altitudes. This species is a widespread but local resident in lowland and submontane forest in Sabah, Sarawak and Brunei (Mann 2008) but surprisingly only three previous records exist from Kalimantan localities: Kutai National Park in the lowlands of east Kalimantan (Duckworth & Kelsh 1988); Barito Ulu, in central Kalimantan (Wilkinson *et al.* 1991a); and Matasirih Island off the coast in south Kalimantan (Oberholser 1917). The lack of records is surprising, and suggests a very patchy distribution.

SHORT-TAILED MAGPIE *Cissa thalassina*
Seen once at around 1,600 m. This constitutes the first record for Kalimantan (Andrew 1992, Sukmantoro *et al.* 2007), being known previously only from Sabah and Sarawak, from Kinabalu in the north to Mt Dulit in the south (Mann 2008).

BORNEAN TREEPIE *Dendrocitta cinerascens*
Bornean endemic. Common above 1,000 m. Only the

fourth confirmed site for Kalimantan, filling a gap in the north–south distribution. Previous Kalimantan records are from the Kayan Mentarang ranges (van Balen 1997), Müller ranges (Reid 1997) and Mahakam drainage (Smythies 1999).

Notable species not recorded

Collared Owlet *Glaucidium brodiei*
Recorded in Kalimantan only at Mt Kenepai (Büttikofer 1899), in Kayan-Mentarang (van Balen & Nurwatha 1997) and at Sungai Wain Protection Forest near Balikpapan (Slik & van Balen 2006). In Sabah and northern Sarawak it is a relatively widespread but rare resident from 500 to 2,000 m (Mann 2008). Given the wide distribution, this species might also be expected in the Menyapa Mountains.

Dulit Frogmouth *Batrachostomus harterti*
Known from only a handful of records in Borneo, including Mt Dulit, the Usun-Apau Plateau, and the Kelabit Highlands in Sarawak, Poring in Sabah, and Gunung Liang Kubang in Kalimantan (Sharpe 1892, Hose 1893, Büttikofer 1899, Smythies 1957, Babbington 1992). These records suggest a rare bird with a relatively large distribution. It might well be found in the Menyapa Mountains with more intensive searches.

Whitehead's Trogon *Harpactes whiteheadi*
Previously only recorded in Kalimantan from the Kayan Mentarang ranges to the north (van Balen 1997). This species appears to have a very restricted northerly range within Borneo. It was the only species of trogon not recorded by Büttikofer (1899).

Whitehead's Broadbill *Calyptomena whiteheadi*
Previously recorded in Kalimantan from the Kayan Mentarang ranges to the north (van Balen 1997, Sebastian 2007), from Gunung Duk Nan (Pfeffer 1960–1961), Mau on Sungai Bengalun (Smythies 1999), Gunung Batu Timbang and Madang (Smythies 1957). This species appears to have a restricted northerly range within Borneo. It was not recorded by Büttikofer (1899).

Hose's Broadbill *Calyptomena hosii*
Widely distributed in the northern half of Borneo, but more typically at altitudes lower than we focused on. It may well be present in lower parts of the Menyapa Mountains.

Fruithunter *Chlamydochaera jefferyi*
Only two records exist from Kalimantan: from Mt Nyiut in the far west (Priemé & Heegaard 1988) and Bukit Baka on the border of West and Central Kalimantan (Rice 1989). This species appears restricted to the western ranges in Kalimantan, so its occurrence in Menyapa may be unlikely.

Mountain Wren Babbler *Napothera crassa*
Known from Kalimantan from the Kayan Mentarang ranges (van Balen & Nurwatha 1997, Sebastian 2007) and Mt Nyiut in the far west (Priemé & Heegaard 1988). Considered to have a fairly wide distribution across northern Kalimantan, but not recorded in Menyapa during our survey, nor by Büttikofer (1899) at Mt Kenepai or Liang Kubung, suggesting a more restricted distribution.

Eyebrowed Wren Babbler *Napothera epilepidota*
Apparently widely distributed across the mountains of the northern half of Borneo (Mann 2008), and previously recorded in Kalimantan from Kayan-Mentarang (van Balen & Nurwatha 1997), upper Telen River (Smythies 1957), Barito Ulu (Wilkinson *et al.* 1991b), Mt Liang Kubung (Büttikofer 1899), Kapuas drainage (Smythies 1957) and Mt Nyiut (Priemé & Heergaard 1988). Our lack of records possibly suggests a patchy occurrence across this range.

Whitehead's Spiderhunter *Arachnothera juliae*
Previously recorded in Kalimantan only from the Kayan Mentarang ranges to the north (Robson 1993, van Balen 1997, Sebastian 2007). More commonly recorded in the mountains of Sabah and northern Sarawak (Mann 2008), suggesting a limited northerly distribution within Borneo.

Mountain Black-eye *Chlorocharis emiliae*
Limited to mountains in the north-central ranges at 1,500–2,600 m. Records exist from Mt Kinabalu in Sabah in the north to the Pueh Ranges in Sarawak to the south, and in Kalimantan from Kayan Mentarang (Sebastian 2007) and Mt Nyiut (Priemé & Heegaard 1988). Given this, the species might well be expected within the Menyapa Mountains, perhaps at higher elevations than those we surveyed.

DISCUSSION

Biological importance
Our records from the Menyapa Mountains show a high proportion of the distinct montane Bornean avifauna to be present, extending the known range of many species southwards, and filling a gap in the north–south distribution of other species. Notably we recorded one species previously unknown from Kalimantan, Short-tailed Magpie, one species new for Indonesia, Olive-backed Pipit, and a number of other species only recorded very rarely. Several Bornean montane species were not recorded during our survey, which may indicate more restricted northerly or westerly ranges, but this is hard to conclude based on such a short visit. Further survey work in the Menyapa Mountains would undoubtedly yield more interesting information.

Conservation status
Conservation of the Menyapa Mountains remains a priority as they represent one of the largest remaining blocks of undisturbed forest at middle to high altitudes in Kalimantan. Currently they are not under direct threat, as several logging concessions that exist within and around them are inactive, but conditions could change rapidly. If the road to PT Essam is re-opened fully, or the PT Muggitriman concession becomes active, the situation could deteriorate. Plans underway to convert the Muggitriman concession into restoration forest, freeing it from the risk of commercial logging, would be extremely welcome if successfully implemented. Efforts to minimise access to the current PT Essam road, or to reduce gaharu

collecting generally, could also reduce disturbance to the forest interior.

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APPENDIX
Bird records for the Menyapa Mountains and foothills, 21–27 November 2007

Taxonomy of species marked * deviates from Inskipp *et al.* (1996).

Common name / Scientific name	Common name / Scientific name
Oriental Darter *Anhinga melanogaster*	Glossy Swiftlet *Collocalia esculenta*
Lesser Fish Eagle *Ichthyophaga humilis*	*Bornean Swiftlet *Collocalia dodgei*
Mountain Serpent Eagle *Spilornis kinabaluensis*	Black-/Mossy-nest Swiftlet *Aerodramus maximus/salangana*
Crested Serpent Eagle *Spilornis cheela*	Edible-nest Swiftlet *Aerodramus fuciphagus*
Crested Goshawk *Accipiter trivirgatus*	Silver-rumped Needletail *Rhaphidura leucopygialis*
Black Eagle *Ictinaetus malayensis*	White-throated Needletail *Hirundapus caudacutus*
Rufous-bellied Eagle *Aquila kienerii*	Brown-backed Needletail *Hirundapus giganteus*
Blyth's Hawk Eagle *Nisaetus alboniger*	Pacific Swift *Apus pacificus*
Wallace's Hawk Eagle *Nisaetus nanus*	Grey-rumped Treeswift *Hemiprocne longipennis*
Black-thighed Falconet *Microhierax fringillarius*	Whiskered Treeswift *Hemiprocne comata*
Red-breasted Partridge *Arborophila hyperythra*	Blue-eared Kingfisher *Alcedo meninting*
Crimson-headed Partridge *Haematortyx sanguiniceps*	Blue-banded Kingfisher *Alcedo euryzona*
Ferruginous Partridge *Caloperdix oculea*	*Rufous-backed Kingfisher *Ceyx rufidorsa*
Crested Fireback *Lophura ignita*	Rufous-collared Kingfisher *Actenoides concretus*
Bulwer's Pheasant *Lophura bulweri*	Oriental Pied Hornbill *Anthracoceros albirostris*
Great Argus *Argusianus argus*	Black Hornbill *Anthracoceros malayanus*
Ruddy Cuckoo Dove *Macropygia emiliana*	Rhinoceros Hornbill *Buceros rhinoceros*
Little Cuckoo Dove *Macropygia ruficeps*	Helmeted Hornbill *Buceros vigil*
Emerald Dove *Chalcophaps indica*	Bushy-crested Hornbill *Anorrhinus galeritus*
Jambu Fruit Dove *Ptilinopus jambu*	Wrinkled Hornbill *Aceros corrugatus*
Blue-crowned Hanging Parrot *Loriculus galgulus*	Wreathed Hornbill *Aceros undulatus*
*Dark Hawk Cuckoo *Cuculus bocki*	Gold-whiskered Barbet *Megalaima chrysopogon*
Moustached Hawk Cuckoo *Cuculus vagans*	Red-throated Barbet *Megalaima mystacophanos*
*Sunda Lesser Cuckoo *Cuculus lepidus*	Mountain Barbet *Megalaima monticola*
Banded Bay Cuckoo *Cacomantis sonneratii*	Yellow-crowned Barbet *Megalaima henricii*
*Rusty-breasted Cuckoo *Cacomantis variolosus*	Golden-naped Barbet *Megalaima pulcherrima*
Violet Cuckoo *Chrysococcyx xanthorhynchus*	Blue-eared Barbet *Megalaima australis*
Drongo Cuckoo *Surniculus lugubris*	Bornean Barbet *Megalaima eximia*
Raffles's Malkoha *Phaenicophaeus chlorophaeus*	Brown Barbet *Calorhamphus fuliginosus*
Greater Coucal *Centropus sinensis*	Crimson-winged Woodpecker *Picus puniceus*
Mountain Scops Owl *Otus spilocephalus*	Olive-backed Woodpecker *Dinopium rafflesii*
Bornean Frogmouth *Batrachostomus mixtus*	Maroon Woodpecker *Blythipicus rubiginosus*
Barred Eagle-owl *Bubo sumatranus*	Buff-rumped Woodpecker *Meiglyptes tristis*
*Grey Nightjar *Caprimulgus jotaka*	Buff-necked Woodpecker *Meiglyptes tukki*

Common name / Scientific name
Black-and-red Broadbill *Cymbirhynchus macrorhynchos*
Banded Broadbill *Eurylaimus javanicus*
Black-and-yellow Broadbill *Eurylaimus ochromalus*
Green Broadbill *Calyptomena viridis*
Giant Pitta *Pitta caerulea*
Garnet Pitta *Pitta granatina*
Barn Swallow *Hirundo rustica*
Pacific Swallow *Hirundo tahitica*
Red-rumped/Striated Swallow *Cecropis daurica/striolata*
Asian House Martin *Delichon dasypus*
Grey Wagtail *Motacilla cinerea*
Olive-backed Pipit *Anthus hodgsoni*
Sunda Cuckooshrike *Coracina larvata*
Fiery Minivet *Pericrocotus igneus*
Scarlet Minivet *Pericrocotus flammeus*
Grey-chinned Minivet *Pericrocotus solaris*
Bar-winged Flycatcher-shrike *Hemipus picatus*
Straw-headed Bulbul *Pycnonotus zeylanicus*
Black-and-white Bulbul *Pycnonotus melanoleucus*
Black-headed Bulbul *Pycnonotus atriceps*
*Bornean Bulbul *Pycnonotus montis*
Grey-bellied Bulbul *Pycnonotus cyaniventris*
*Pale-faced Bulbul *Pycnonotus leucops*
Yellow-vented Bulbul *Pycnonotus goiavier*
Olive-winged Bulbul *Pycnonotus plumosus*
Cream-vented Bulbul *Pycnonotus simplex*
Red-eyed Bulbul *Pycnonotus brunneus*
Spectacled Bulbul *Pycnonotus erythrophthalmos*
Finsch's Bulbul *Alophoixus finschii*
Ochraceous Bulbul *Alophoixus ochraceus*
Grey-cheeked Bulbul *Alophoixus bres*
Hairy-backed Bulbul *Tricholestes criniger*
Buff-vented Bulbul *Iole olivacea*
Streaked Bulbul *Ixos malaccensis*
*Cinereous Bulbul *Hemixos cinereus*
Greater Green Leafbird *Chloropsis sonnerati*
Lesser Green Leafbird *Chloropsis cyanopogon*
Blue-winged Leafbird *Chloropsis cochinchinensis*
*Bornean Leafbird *Chloropsis kinabaluensis*
*Bornean Whistling Thrush *Myophonus borneensis*
White-browed Shortwing *Brachypteryx montana*
Yellow-bellied Prinia *Prinia flaviventris*
Bornean Stubtail *Urosphena whiteheadi*
Sunda Bush Warbler *Cettia vulcania*
Mountain Tailorbird *Orthotomus cuculatus*
Dark-necked Tailorbird *Orthotomus atrogularis*

Common name / Scientific name
Ashy Tailorbird *Orthotomus ruficeps*
Arctic Warbler *Phylloscopus borealis*
Mountain Leaf Warbler *Phylloscopus trivirgatus*
Yellow-breasted Warbler *Seicercus montis*
Eyebrowed Jungle Flycatcher *Rhinomyias gularis*
Grey-streaked Flycatcher *Muscicapa griseisticta*
Dark-sided Flycatcher *Muscicapa sibirica*
Asian Brown Flycatcher *Muscicapa dauurica*
Ferruginous Flycatcher *Muscicapa ferruginea*
Mugimaki Flycatcher *Ficedula mugimaki*
Snowy-browed Flycatcher *Ficedula hyperythra*
Little Pied Flycatcher *Ficedula westermanni*
Blue-and-white Flycatcher *Cyanoptila cyanomelana*
Verditer Flycatcher *Eumyias thalassina*
Indigo Flycatcher *Eumyias indigo*
Malaysian Blue Flycatcher *Cyornis turcosus*
Bornean Blue Flycatcher *Cyornis superbus*
Grey-headed Canary Flycatcher *Culicicapa ceylonensis*
Oriental Magpie Robin *Copsychus saularis*
White-rumped Shama *Copsychus malabaricus*
White-throated Fantail *Rhipidura albicollis*
Pied Fantail *Rhipidura javanica*
Black-naped Monarch *Hypothymis azurea*
Asian Paradise-flycatcher *Terpsiphone paradisi*
Bornean Whistler *Pachycephala hypoxantha*
Sunda Laughingthrush *Garrulax palliatus*
*Chestnut-hooded Laughingthrush *Rhinocichla treacheri*
White-chested Babbler *Trichastoma rostratum*
Ferruginous Babbler *Trichastoma bicolor*
Short-tailed Babbler *Malacocincla malaccensis*
Temminck's Babbler *Pellorneum pyrrogenys*
Black-capped Babbler *Pellorneum capistratum*
Sooty-capped Babbler *Malacopteron affine*
Scaly-crowned Babbler *Malacopteron cinereum*
Rufous-crowned Babbler *Malacopteron magnum*
Chestnut-backed Scimitar Babbler *Pomatorhinus montanus*
Grey-throated Babbler *Stachyris nigriceps*
Grey-headed Babbler *Stachyris poliocephala*
Chestnut-winged Babbler *Stachyris erythroptera*
*Bold-striped Tit Babbler *Macronous bornensis*
Fluffy-backed Tit Babbler *Macronous ptilosus*
*Blyth's Shrike Babbler *Pteruthius aeralatus*
Chestnut-crested Yuhina *Yuhina everetti*
Golden-bellied Gerygone *Gerygone sulphurea*
Ruby-cheeked Sunbird *Chalcoparia singalensis*
Plain Sunbird *Anthreptes simplex*

Common name / Scientific name	Common name / Scientific name
Olive-backed Sunbird *Cinnyris jugularis*	Rufous-winged Philentoma *Philentoma pyrhopterum*
Temminck's Sunbird *Aethopyga temminckii*	Ashy Drongo *Dicrurus leucophaeus*
Little Spiderhunter *Arachnothera longirostra*	Bronzed Drongo *Dicrurus aeneus*
*Streaky-breasted Spiderhunter *Arachnothera affinis everetti*	Hair-crested Drongo *Dicrurus hottentottus*
Grey-breasted Spiderhunter *Arachnothera modesta*	Greater Racket-tailed Drongo *Dicrurus paradiseus*
Yellow-rumped Flowerpecker *Prionochilus xanthopygius*	White-breasted Woodswallow *Artamus leucorynchus*
Orange-bellied Flowerpecker *Dicaeum trigonostigma*	Crested Jay *Platylophus galericulatus*
Black-sided Flowerpecker *Dicaeum monticolum*	Short-tailed Magpie *Cissa thalassina*
Black-capped White-eye *Zosterops atricapillus*	Bornean Treepie *Dendrocitta cinerascens*
Pygmy Ibon *Oculocincta squamifrons*	Slender-billed Crow *Corvus enca*
Black-and-crimson Oriole *Oriolus cruentus*	Common Hill Myna *Gracula religiosa*
Large Woodshrike *Tephrodornis gularis*	Dusky Munia *Lonchura fuscans*

Mass northbound migration of Blue-tailed *Merops philippinus* and Blue-throated *M. viridis* Bee-eaters in southern Thailand, spring 2007–2008

ROBERT DeCANDIDO, CHUKIAT NUALSRI and DEBORAH ALLEN

Counts of migrating Blue-tailed Bee-eaters *Merops philippinus* and Blue-throated Bee-eaters *M. viridis* were made from late February through early April 2007 and again in spring 2008 in southern Thailand at Promsri Hill, just west of the city of Chumphon. A total of 20,916 bee-eaters were counted, averaging 24.1.birds/hour in 2007 and 31.9.birds/hour in 2008, the highest totals for any migrating *Merops* spp. to date. *M. philippinus* composed 95.5% (18,079) of the bee-eaters identified in migration. *M. viridis* was much less common, composing only 4.5% (854) of identified migrants. There were also 1,983 unidentified *Merops* migrants, 9.5% of the total flight. In 2007 and 2008, the first migrant flocks of both species were seen by late February-early March. The seasonal peak of the *M. philippinus* flight was in mid- to late March. The peak of the *M. viridis* flight occurred in late March through early April. Significantly more bee-eaters were counted when winds had an easterly component sea-breeze (NE, E, SE) from the nearby Gulf of Thailand, than when winds were from other directions. The daily peak of bee-eater migration occurred in the early afternoon from 12h00 to 14h00, with increasing easterly winds, one to two hours earlier than the peak of raptor migration. Because of the significant year-to-year variation in numbers of migrants counted at our watch site, we recommend (a) additional counts be made from early February through late May to determine the extent of spring bird migration through this area of South-East Asia; (b) initiate a satellite telemetry tracking program for migratory *Merops* spp. to determine where in the Oriental region these two species are returning to breed; (c) establish a network of migration watch sites in Thailand, and when practicable, neighbouring countries, in order to map diurnal landbird migration routes and important stopover areas, similar to the Asian Waterbird Census; and (d) develop educational materials, such as colouring books for children and on-line information flyers with colour photographs for adults, to make everyone aware of this spring migration phenomenon in southern Thailand.

INTRODUCTION

During the last half-century, biologists have begun to map broad patterns of bird migration on continental South-East Asia via satellite telemetry, bird banding and point count observations (McClure 1974, Lane & Parish 1991, McClure 1998, Tordoff 2002, DeCandido *et al.* 2004b, Higuchi *et al.* 2005, DeCandido *et al.* 2006, Shiu *et al.* 2006, Yamaguchi *et al.* 2008). Two of the most distinctive non-passerine species that migrate by day through the Thai-Malay peninsula are the Blue-tailed Bee-eater *Merops philippinus* and Blue-throated Bee-eater *M. viridis* (Wells 1999, Burt 2002, DeCandido *et al.* 2004a, Marks *et al.* 2007, Round 2008). During spring migration, *M. philippinus* are returning to breed as far north as 27°N from south-west China east to Kinmen Island (Taiwan), possibly with a small population at 30°N, while *M. viridis* are returning to breed in southern China to around 33°N (Cheng 1987, Fry *et al.* 1992, Duckworth *et al.* 1999, Carey *et al.* 2001, Liu & Lei 2005–2008, Liu *et al.* 2008, Round 2008, Wang *et al.* 2009, Wu *et al.* 2009). Bee-eaters use a combination of thermal soaring/gliding as well as active flapping flight during migration (Fry *et al.* 1992, Sapir 2009). However, little is known about the magnitude, timing, seasonal duration or daily pattern of migration of any bee-eater species in spring (February–April) or autumn (August–December) on continental eastern Asia.

As part of our research on raptor migration in Thailand (see DeCandido & Nualsri 2009), we also monitored northbound *Merops* migration near the city of Chumphon. Our study site, Promsri Hill (elevation 144 m), afforded an opportunity to study the migration of these birds passing over the open countryside of southern Thailand on the Isthmus of Kra. Specific research questions were: (1) what is the relative proportion of *M. philippinus* vs *M. viridis* during northbound migration; (2) what is the degree of year-to-year variation in the number of *Merops* counted in migration at this watch site; (3) is there a difference in the seasonal timing of migration between the two species; (4) how do wind speed and direction affect bee-eater migration (see Liechti 2006); and (5) how does the pattern of bee-eater migration compare to raptor migration in southern Thailand? By addressing such questions, we hoped to provide information to biologists, conservationists and birdwatchers interested in understanding a crucial time in the life history of these two bee-eater species. From a broader perspective, documenting spring *Merops* migration phenology provides baseline data to those interested in understanding the relationship between climate change and large-scale animal migrations. Several recent studies have reported shifts in the timing of known bird migrations during the last decade (Shi *et al.* 2006, Gordo 2007), and we wanted to stimulate interest in this possibility in South-East Asia by studying some of the region's migratory birds.

METHODS

Chumphon (10°28′N 99°13′E, sea-level) is a small town near the east coast of south-central Thailand, c.475 km south-west of Bangkok. The city is located on the Isthmus of Kra, the narrowest portion of Thailand. From late February to early April 2007 and again in 2008, we made daily counts of bee-eaters, migrating raptors and other land birds from a site 15 km west of Chumphon City known locally as Promsri Hill or Khao Klai. The watch site (10°30′N 99°04′E) afforded an unobstructed 360° view of northbound migrants, and sits on the crest of a hill, c.5 km west of the main N–S highway (Phetkasem Road, Highway 4). The hill is the southern terminus of a low N–S ridge on military land, and is accessible by permit only. Much of this ridge comprises seasonal grasses, scrub

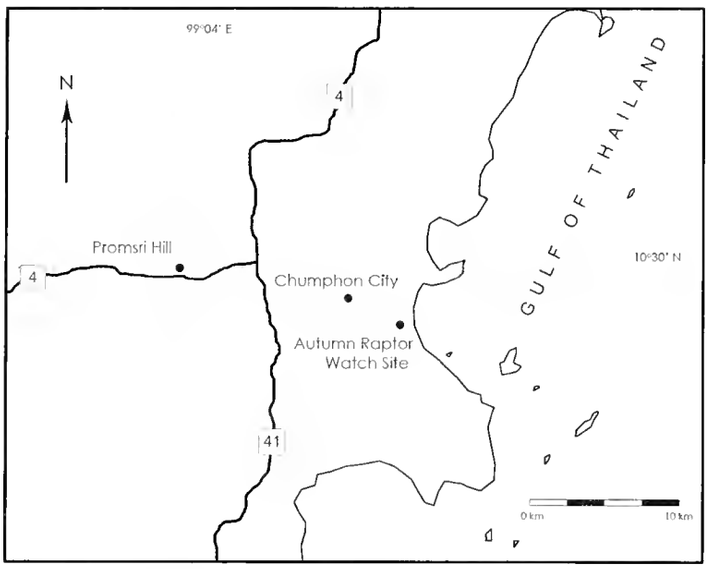

Figure 1. Detailed map of south-central Thailand showing the Promsri Hill migration watch site in relation to Chumphon City, the main road (Route 4), and the autumn raptor watch site used since 2000.

and second growth, on average less than 2 m in height. Most of the surrounding area and nearby hills have been developed for pasture and agriculture (banana, oil palm), with second-growth forest occupying perhaps the upper 10% of these hills. On clear days it was possible to see east c.25 km to the Gulf of Thailand; south c.5 km to a tall hill (Khao Thai Dang); west c.10 km to a hill (Khao Nam Lod) that is part of a N–S ridge; and north c.3 km.

Two species of bee-eater, *Merops philippinus* and *M. viridis*, were counted on migration by RDC and CN using 8× and 10× binoculars. We often had help from others who visited the site on a daily basis, usually after 13h00, and called migrant flocks to our attention that might otherwise been overlooked. We made daily counts during the course of two spring seasons: in 2007, from 28 February to 3 April (35 days; 388 hours of observation); and in 2008, from 28 February to 31 March (32 days; 343 hours of observation). Observations usually began by 07h00 local time, and ended by 18h30 each day. In 2009, CN made observations on migrating bee-eaters and raptors up to three days per week from 1 April to 10 May. During inclement weather such as thunderstorms, we remained in the area of the watch site looking for migrants. For one day in 2008 when rain prevailed all day (10 March), no count was made. Since Wells (1999) mentioned that a few flocks of *M. viridis* were heard migrating at night in Malaysia, we listened for calls of migrant individuals (flocks) for 2–3 hours up to four evenings per week beginning at around 19h00 from the terrace of our residence in the adjacent valley, c.300 m from the watch site.

In both years, wind speed and direction, temperature, humidity and barometric pressure were measured hourly with a hand-held weather station (Kestrel 4000, Nielsen-Kellerman corporation, USA). Wind direction was determined with a compass. Weather conditions typically were hazy and humid with little wind in the morning until 09h00, then becoming clear with scattered cumulus clouds. Until c.09h00 to as late as c.11h00 each day, light west (less than 10 km/hr) winds prevailed, then these switched to easterly due to the interaction of the north-east low-pressure monsoon (Guo *et al.* 2002) combined with a sea-breeze from the nearby Gulf of Thailand (Khedari *et al.* 2002). However, the exact timing of the wind switch varied greatly in 2007 compared with 2008, as did the intensity of the easterly winds.

To locate migrating flocks of bee-eaters, observers scanned primarily to the south and south-east, the direction from which almost all migrants approached the watch site. Many bee-eaters were first heard calling as part of a flock before being seen, and with experience it was possible to locate and distinguish flocks of the two species from these calls. Bee-eaters were considered migrants if they passed south to north across an imaginary east to west line at the watch site, and continued north and out of sight. We did not attempt to age or sex migrants. In order to best evaluate the daily and seasonal pattern of bee-eater migration, we pooled the 2007–2008 data of all individuals we counted at the site, including those *Merops* individuals we could not identify to species. To determine the seasonal peak migration period for *M. philippinus* in 2007 and 2008, we used the highest ten-day average in each year. Since we saw many fewer *M. viridis* individuals, we used the highest five-day average in both years to determine their seasonal peak of migration through southern Thailand. We also calculated a median date of peak passage (the date at which 50% of the migrants had

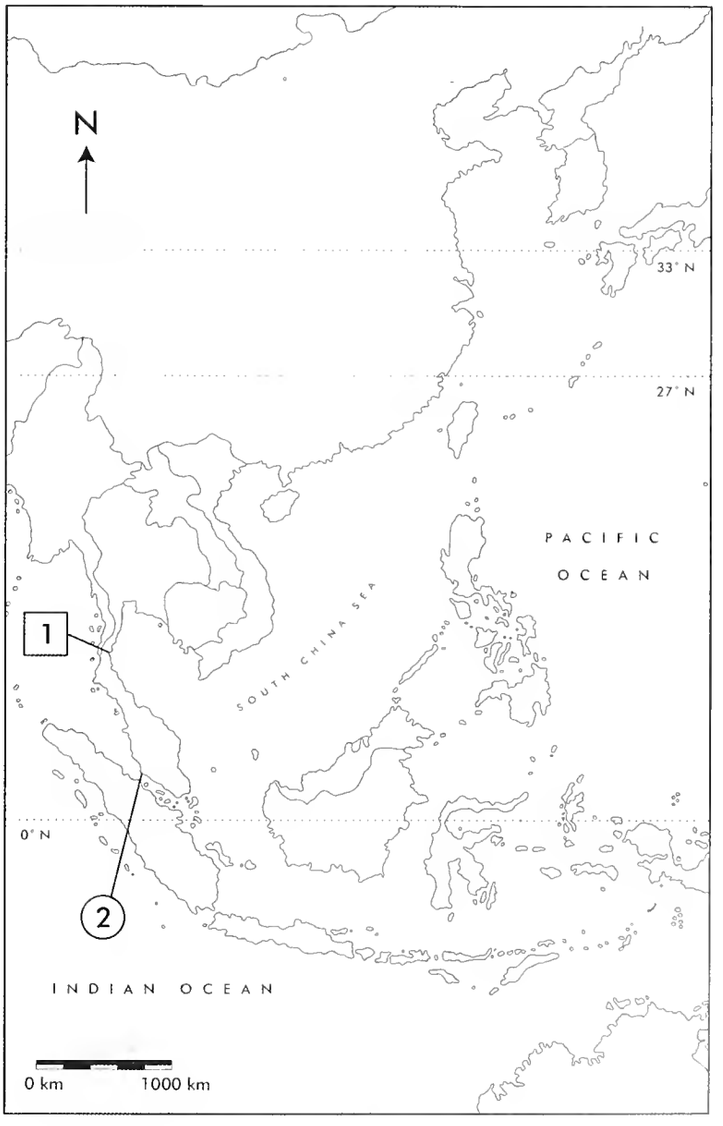

Figure 2. Map of the Far East showing the two primary continental spring bee-eater migration count sites: (1) Promsri Hill (Thailand) and (2) Tanjung Tuan (West Malaysia). *Merops philippinus* return to breed as far north as 27°N from south-west China east to Kinmen Island (Taiwan), while *M. viridis* return to breed in China to approx. 33°N.

been counted) for each bee-eater species, by pooling 2007–2008 data.

We hypothesised that more bee-eaters would pass the watch site when winds had an easterly component (NE to SE) than when winds were from other directions, primarily west to south. Data from prior studies (DeCandido *et al.* 2004, DeCandido & Nualsri 2009) indicated that during migration in this part of Thailand, many birds including raptors 'drift' to the east (spring) or west (autumn) with the prevailing winds. Our initial observation of migrant *Merops* flocks in February 2007 indicated this was also the case with bee-eaters at our watch site. We used a Chi-square test with one degree of freedom (Preacher 2001) to analyse the effect of wind direction on the number of bee-eaters passing the watch site.

We also counted individuals of several raptor species on migration by hour during spring 2007–2008, most commonly: Black Baza *Avecida leuphotes*, Chinese Goshawk *Accipiter soloensis*, Grey-faced Buzzard *Butastur indicus*, Japanese Sparrowhawk *Accipiter gularis* and Oriental Honey-buzzard *Pernis ptilorhynchus orientalis* (details in DeCandido & Nualsri 2009). We compared the hourly raptor migration counts to the hourly bee-eater migration counts in both years to examine the effects of weather (primarily wind speed and direction) on migrant flocks of bee-eaters and raptors. We also noted other migrant species including small numbers of Ashy Minivet *Pericrocotus divaricatus* travelling in flocks; small numbers of Ashy Woodswallow *Artamus fuscus* and Black Drongo *Dicrurus macrocercus* migrating as singles; Oriental Pratincole *Glareola maldivarum*; Sand Martin *Riparia riparia*, Red-rumped Swallow *Hirundo daurica*, Striated Swallow *Hirundo striolata* and many Barn Swallow *Hirundo rustica*. Certain species were recorded only as seasonal or year-round residents in the area: Brown-backed Needletail *Hirundapus giganteus*, White-throated Needletail *Hirundapus caudacutus*, Fork-tailed Swift (both *Apus p. pacificus* and *A. p. cooki*), House Swift *Apus affinis*, Germain's Swiftlet *Collocalia germani* and Asian Palm Swift *Cypsiurus balasiensis*. To identify migrants, we consulted Lekagul & Round (1991), Wells (1999) and Robson (2002). Scientific names follow Inskipp *et al.* (1996).

RESULTS

Most bee-eaters were observed migrating south to north within 100 m of the watch site, and were only observed travelling in flocks. Beyond c.125–150 m, it was very difficult to detect and identify a small flock of birds even with 10× binoculars. Only single species flocks were observed: individuals of *M. philippinus* were never observed in *M. viridis* flocks or vice versa. Rarely, flocks of the two species migrated within c.25 m of each other.

In 2007–2008, a total of 20,916 bee-eaters were counted, averaging 24.1.birds/hour in 2007 and 31.9.birds/hour in 2008. Two-year totals were 18,079 *M. philippinus* (95.5% of all *Merops* we identified to species), 854 *M. viridis* (4.5%) and 1,983 unidentified *Merops* individuals (9.5% of the total flight). In spring 2008, we counted 2,220 (23.7%) more migrant *Merops* than spring 2007. Figure 3 shows the hourly count of all bee-eater migrants for 2007–2008. Most bee-eaters were seen from 11h00–16h00 (66.7%) with 13h00–15h00 being the peak time for migrants (30.0% of all bee-eaters

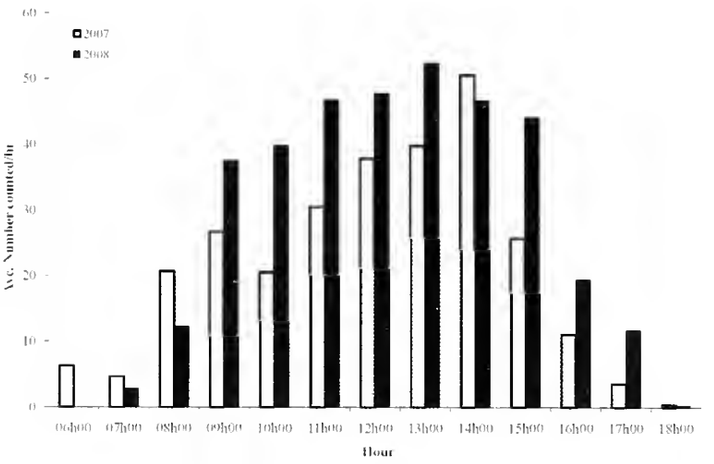

Figure 3. Average number of bee-eaters counted by hour in spring 2007–2008 at Promsri Hill, Thailand.

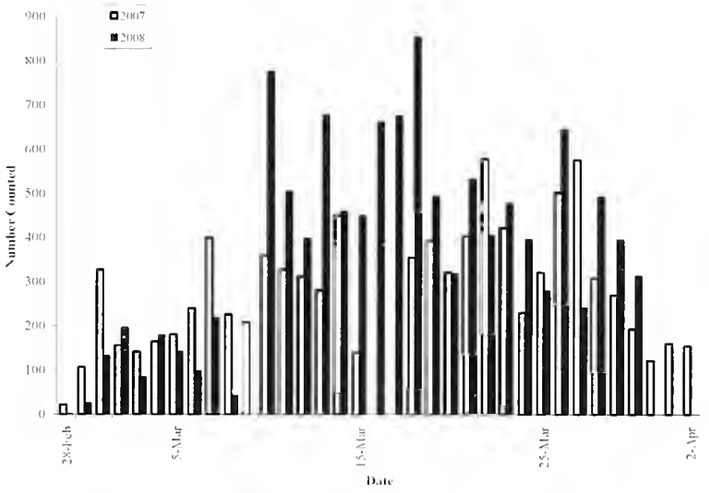

Figure 4. Number of bee-eaters counted per day in spring 2007–2008 at Promsri Hill, Thailand.

counted). However, the single peak hour of migration in 2007 (14h00–15h00) was an hour later compared with 2008 (13h00–14h00). The highest hourly total occurred from 15h00–16h00 on 11 March 2008 when 243 bee-eaters passed the watch site.

Figure 4 shows daily totals of bee-eater migrants in both spring seasons. In 2007, the peak 10-day time-frame of the migration occurred from 18 March to 27 March inclusive, averaging 410 migrants/day. In 2008, the peak time-frame occurred from 11 to 20 March, averaging 595 migrants/day. The highest single-day count of migrating bee-eaters in this study was 854 on 19 March 2008. In spring 2007–2008 the median date of peak passage for all bee-eaters in southern Thailand was 19 March.

The first flock of migrating *M. philippinus* was seen on 28 February 2007, and on 1 March in 2008. The first flock of migrating *M. viridis* was seen on 3 March 2007 as well as 3 March 2008. The two species were observed on migration until the last day of the study in both years. In 2009, CN observed flocks of both species until 5 May.

Figure 5 shows the 2007–2008 average number of *M. philippinus* vs *M. viridis* seen per day at the Promsri Hill watch site. Our data indicate that the seasonal peak of *M. viridis* occurs in late March to early April, several days later than the peak of *M. philippinus*. The two-year median date of peak passage for *M. philippinus* was 20 March and for *M. viridis* 28 March.

In 2007, for the ten-day peak time-frame (19–28 March) for *M. philippinus*, the mean flock (N= 349 flocks)

size was 9.2 birds (Standard Deviation [S. D.] = 9.6). On 28 March 2007, the mean flock size for *M. philippinus* (N = 496; 54 flocks) was 9.2 (S.D. = 5.2). The largest flock of migrant *M. philippinus* was 107, passing the watch site between 14h00–15h00 on 23 March 2007. For *M. viridis* in 2007, for the five-day peak time-frame of migration (27–31 March), the mean flock size (N = 23 flocks) was 7.9 (S.D. = 5.1). In 2007, the largest flock of migrant *M. viridis* was 18, passing the watch site between 11h00–12h00 on 27 March.

In 2008, for the ten-day peak time-frame (11–20 March) for *M. philippinus* migration, the mean flock size (N = 458 flocks) was 10.9 (S.D. = 10.0). On 19 March 2008, the mean flock size for *M. philippinus* (N = 831; 78 flocks) was 10.7 (S.D. = 8.5). In 2008, the largest flock of migrant *M. philippinus* was 63, passing the watch site between 11h00–12h00 on 12 March. For *M. viridis* in 2008, for the five-day peak time-frame of migration (27–31 March), the mean flock size (N = 51 flocks) was 6.1 (S.D. = 5.8). In 2008, the largest flock of migrant *M. viridis* was 27, passing the watch site between 09h00–10h00 on 27 March.

In both years, significantly greater numbers of bee-eaters passed the watch site when winds had an easterly (NE, E or SE) component than when winds were from other directions ($\chi^2 = 17.2$, $p < 0.05$). Bee-eaters approaching the watch site used flapping flight interspersed with glides, occasionally soaring upwards on thermals combined with deflection currents on the east side of the observation ridge. Most flocks were migrating less than 20 m above observers' heads, and frequently the flocks came up the hillside at eye-level to feed on insects just above the surrounding vegetation. Occasionally, especially during spring 2007 before 09h00, flocks would stop to feed for up to 10 minutes c.25 m beyond the watch site, using bare tree branches as hunting perches.

Figure 6 shows the hourly pattern of bee-eater vs raptor migration in spring 2007–2008. In the morning, migration activity began on average at about 07h30 (bee-eaters) and 08h00 (raptors). Flocks of bee-eaters began to pass the watch site while individuals of three raptor species, Black Baza, Chinese Sparrowhawk and Grey-faced Buzzard, began to coalesce into flocks and slowly soar up on strengthening thermals mostly to the east (50 m to 5 km) of the watch site. Migrant bee-eater numbers began to increase markedly by 08h00 but levelled off between 09h00 and 10h00 at the watch site. During the morning, raptor migration increased slowly until 11h00 and then levelled off. However, from late morning to early afternoon, bee-eater migrants were seen in increasing number until 14h00. By comparison, although raptor migration also increased markedly in the afternoon, it peaked one to two hours later than the peak passage of bee-eaters (Fig. 6). Bee-eater migration usually ended by c.17h45 while raptors, particularly Black Bazas, Chinese Sparrowhawks, Grey-faced Buzzards and Oriental Honey-buzzards, continued their migration.

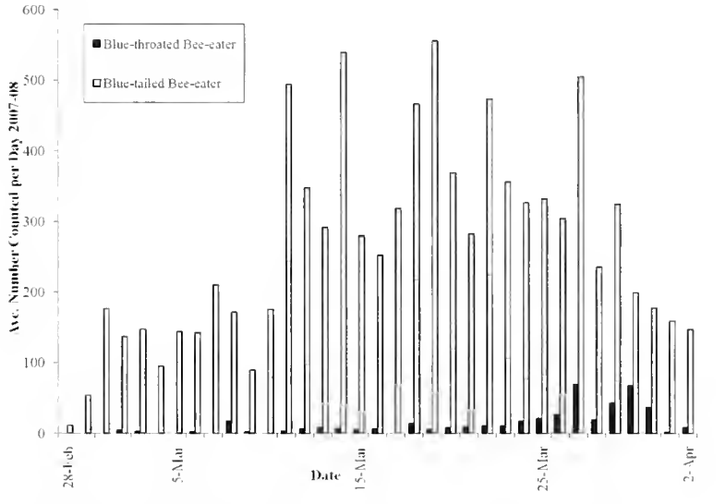

Figure 5. Average number of Blue-throated *vs* Blue-tailed Bee-eaters counted per day in spring 2007–2008 at Promsri Hill, Thailand.

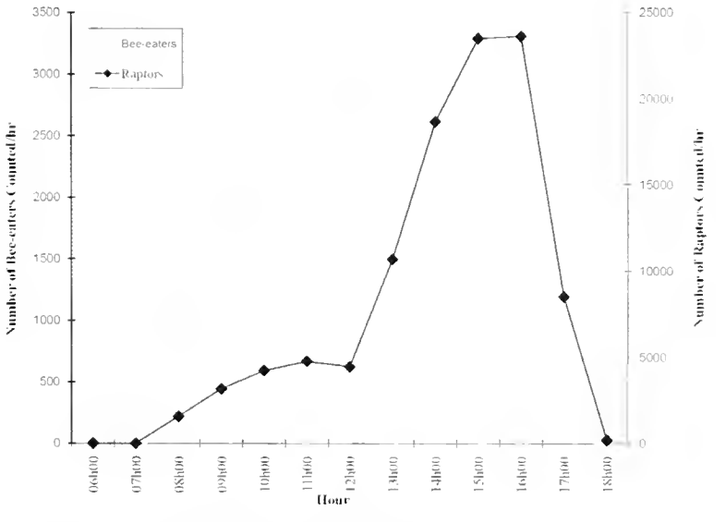

Figure 6. Total number of bee-eaters *vs* raptors counted by hour in spring 2007–2008 at Promsri Hill, Thailand.

DISCUSSION

Southern Thailand, particularly the area near the city of Chumphon on the Isthmus of Kra (Figs. 1 & 2), is a spring and autumn hotspot for many birds that migrate by day, including bee-eaters, Black Drongos (DeCandido *et al.* 2004c) and raptors (DeCandido *et al.* 2004b, DeCandido & Nualsri 2009). Bee-eaters are colourful and gregarious birds, yet little is known about their migration route(s) and ultimate destination(s) in the region during either north- or southbound migration. Historically in Indochina, only a handful of bee-eater migration reports have presented empirical data, often from only single days of observation (see David-Beaulieu 1944, 1949-1950, Melville & Fletcher 1982, Tizard 1996, Evans 2001). The only long-term study of migrant bee-eaters in eastern Asia comes from Hong Kong (Carey *et al.* 2001), where a mean of 22.0 *M. philippinus* were counted each spring during the 1990s.

Our observations at Promsri Hill confirm a significant northbound migration of two bee-eater species, *M. philippinus* and *M. viridis*, through Thailand each spring (Fig. 4). The number of migrants reported in this study are the highest totals for any location in Asia: 18,079 *M. philippinus* (95.5% of identified individuals), 854 *M. viridis* (4.5%) and 1,983 unidentified *Merops* individuals (9.5% of the total flight). Average flock size was greater for *M. philippinus* than for *M. viridis*, and the largest flocks of *M. philippinus* were two to three times larger than *M. viridis* flocks. Overall, our spring counts averaged 28.6 bee-eaters/hr in 2007–2008 with the highest hourly count (287) on 23 March 2007. By comparison in spring 2000–2001 at a location on coastal West Malaysia (Tanjung Tuan),

bee-eaters averaged 12.9 migrants/hr with a peak hourly total of 101 on 21 March 2001 (DeCandido *et al.* 2004a). Other published accounts including Wells (1999) and DeCandido *et al.* (2004d) also reported many fewer migrant *M. viridis* in Malaysia during spring. However in Laos, migrant *M. viridis* are considered to be much more common than migrant *M. philippinus*, but the latter is the only year-round resident *Merops* breeding there (David-Beaulieu 1949–1950, Evans 2001, Dersu & Associates 2008, W. Duckworth *in litt.* 2009).

Prior bee-eater research in South-East Asia on coastal west Malaysia revealed that the spring migration of bee-eaters begins in earnest in early March (DeCandido *et al.* 2004a,d). Our data show that the peak of the *M. philippinus* migration in southern Thailand is from mid- to late March (Fig. 5), with 20 March being the median date of peak passage. This is slightly earlier than Wells (1999), who reported peak passage in Malaysia from late March through early April. After mid-April, no *M. philippinus* were seen migrating in Singapore, while the migration in Malaysia was mostly complete by early May (Wells 1999). Observations made by CN at Promsri Hill in April to mid-May 2009 are in agreement with these reports: up to 100 *M. philippinus* were seen in migration per day through late April, declining to ≤ 30/day by early May.

Our 2007–2008 data suggest that the *M. viridis* migration peaks in late March to early April in southern Thailand (Fig. 5), with 28 March being the median date of peak passage, more than a week later than *M. philippinus*. The first flock of *M. viridis* was seen on 3 March 2007, a few days after the first flocks of *M. philippinus* had passed our watch site. Observations by CN in spring 2009 show that up to 20/day *M. viridis* migrate through southern Thailand through late April, declining to ≤ 10/day in early May. However, because we were only able to do part-time counts in spring 2009, it might be that later arriving *M. viridis* were overlooked, leading us to miss the true migration peak for this species in southern Thailand. Round (2008) suggested that *M. viridis* migration peaks 2–4 weeks later than *M. philippinus*, with 'a discernible return passage in southern Thailand noted in late April'. In Laos (Savannakhet province) on 12 April 2007, a flock of 20 was observed (Dersu & Associates 2008). In Hong Kong, seven *M. viridis* were seen at Shuen Wan on 24 April 2008 (G. Welch *in litt.* 2009). In Malaysia, Wells (1999) reported the peak of the spring *M. viridis* migration from March through early April. Wells (1999) also suggested that the *M. viridis* migration begins earlier in the season than *M. philippinus* migration, with the earliest migrant *M. viridis* seen in Singapore on 23 and 25 January; on the west coast of Malaysia on 11 February; and scattered migrant flocks in central Thailand by mid-February. In southern Thailand, further full-time observations are needed in April to determine the extent and peak migration time for *M. viridis*.

Wind direction was the most important factor in the number of bee-eaters we counted in migration in spring 2007 and 2008. Significantly more bee-eaters were seen when winds had an easterly component than when winds were from other directions. Figure 6 shows the effect of this east wind (sea-breeze), from the Gulf of Thailand c.25 km to the west of the watch site. In both years, the easterly sea-breeze increased throughout the day as thermal strength developed, and combined with winds from the north-east low-pressure monsoon (Simpson 1994, Guo *et al.* 2002, Khedari *et al.* 2002). Migrating bee-eaters and raptors 'drifted' inland toward the watch site because of this prevailing late morning through afternoon easterly wind (Fig. 6; see also DeCandido & Nualsri 2009). Greatest number of migrants were observed on afternoons with these conditions, particularly in spring 2008, when east winds generally began earlier and were a few km/hr stronger than in 2007. We recorded a 23.7% increase in the number of bee-eaters counted in migration in 2008, as well as an earlier hourly peak in the flight (Fig. 3). On the other hand in autumn 2003, during a southbound raptor migration study at a watch site east of the city of Chumphon (Fig. 1), we counted most migrants before 12h00 when winds were from the north-west (DeCandido *et al.* 2004). During the southbound migration season in southern Thailand, particularly before 12h00, westerly winds predominate, because of the presence of the south-west high pressure monsoonal weather system centred over the Bay of Bengal–Andaman Sea (Singhrattna *et al.* 2005, Hoyos & Webster 2007).

At Promsri Hill, the earlier arrival of bee-eaters than raptors in the morning was due to several factors including: the greater proportion of bee-eaters that began migration earlier than raptors; the greater degree to which bee-eaters used active flight, and the lesser dependence on thermals than broad-winged raptors; and finally, the greater likelihood that bee-eaters would drift inland and pass the watch site on light (< 5 km/hr) easterly winds beginning by c.08h00 (Fig. 6). Typically, at Promsri Hill, bee-eater migration was underway by 07h30 each morning with flocks stopping to feed in the area of the watch site for up to 15 min before resuming migration. In 2007–2008, the nearby lowlands were often foggy in the early morning, while the watch site atop Promsri Hill and surrounding highlands were clear, with insect activity. As easterly winds (and thermal activity) increased by 09h00, flocks of bee-eaters passed the watch site, and the first strong movement of raptors began (Fig. 6). During the day, single-species flocks of bee-eaters frequently came up the hill at or just above eye-level, with individuals pursuing and catching insects on the wing. Members of the flock migrated across a 10–30 m front, and it might be 1 min before all migrants in a large flock passed the watch site. Bee-eaters were very vocal on migration, and with some experience the two species could be distinguished by their calls. From c.13h00 until 16h00, many *Merops* flocks soared 50–75 m above the watch site utilising thermals and deflection currents from the ridge, but after 16h00 bee-eaters were almost always again passing at eye-level. By 18h00, when bee-eater migration had ceased, flocks did not roost in trees near the watch site. Although Wells (1999) reported nocturnal migration of *M. philippinus* in Malaysia, we did not detect bee-eaters passing over our residence in the nearby valley at night.

In the future, we hope that biologists address several questions about bee-eater migration in Thailand: is the peak of *M. viridis* migration in late March/early April as our data suggest, or later in April? Do the first bee-eater flocks pass the Promsri Hill watch site in the first half of February, or as early as January? Is the spring migration of bee-eaters concluded by early May, or do some flocks continue to pass through southern Thailand into June? How extensive is the migration to the west and east of Promsri Hill? Data from 1 April 2004 show that at least 100 *M. philippinus* migrated north in 90 minutes of

observation at a site c.18 km to the west of Promsri Hill (S. F. Bailey *in litt.* 2009). This suggests that the total number of *Merops* migrating through southern Thailand each spring could be on the order of 50,000–100,000 birds. Perhaps the most important question to answer is: where are these north-bound bee-eaters returning to nest in Asia? Our *Merops* migration data recorded in 2007–2008 at Promsri Hill, combined with our previous study in Malaysia (DeCandido *et al.* 2004a), suggest that some of these migrants are the same ones observed in Hong Kong where the peak of spring migrant sightings is 24 April to 17 May (see Carey *et al.* 2001). At Kinmen Island (Taiwan) *M. philippinus* return each year in April to breed (Yuan *et al.* 2006). Early arrival dates from 2005–2009 range from 9 to 12 April, with the majority of the migrants arriving several days later (H.-W. Yuan *in litt.* 2009). It is not known if these *M. philippinus* primarily utilised a continental (overland) route to reach Tinmen, or made long-distance over-water crossings from the Philippines and Borneo similar to the route used by migrant Chinese Sparrowhawks and Grey-faced Buzzards each spring (see Germi 2009). By comparison, in southern China the first *M. philippinus* arrive from 26 March each year, and begin nesting in mid-April (Wu *et al.* 2009).

Both *M. philippinus* and *M. viridis* breed over a wide latitudinal range, in different climates and habitats. It is likely there are differences in timing of breeding at different latitudes, and migration timing would therefore also be expected to differ between populations of both species. *Merops philippinus* is already nesting by February in Indochina, and it is unlikely that migrants observed in March–April at Promsri Hill are from populations that return to breed in central and northern Thailand, Laos, Cambodia, Vietnam and environs (see Duckworth *et al.* 1999, Evans 2001). Rather, it is likely that the *Merops* we observed in migration are returning to nest in southern China east to Kinmen Island, Taiwan.

Further bee-eater migration surveys are needed in South-East Asia to determine the precise timing and migration phenology of different populations of these two species. We recommend that a coordinated network of 3–4 migration study sites be established across Thailand and Malaysia, and, when feasible, in the rest of South-East Asia similar to the regional approach taken by the Asian Waterbird Census to monitor migrants and protect critical habitats along that flyway. Satellite telemetry tracking of several bee-eater migrants in spring would quickly elucidate migration route(s), critical stopover areas and ultimate destinations (see Higuchi *et al.* 2005). Finally, we recommend that educational materials for children including on-line resources such as drawings of the local birds, as well as colouring books, be made freely available. For adults, on-line information flyers about bee-eaters and other migrants in South-East Asia (see van de Kam *et al.* 2008) written in Thai should be developed, and these should include requests for information about *Merops* sightings during migration seasons.

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Recent and historical bird records for Kalaw, eastern Myanmar (Burma), between 1895 and 2009

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The first published bird records in 97 years are presented for Kalaw, a site in eastern Myanmar, and compared with historical records collected 97–114 years previously. Recent (2005–2009) records for Kalaw include one globally threatened genus (*Gyps* vulture sp.), at least seven new distributional records and one new breeding record for East Myanmar, and two new altitudinal records for South-East Asia. Historical (1895–1912) Kalaw records include four globally threatened species and one new distributional record for East Myanmar. Kalaw retains the majority of bird species documented historically, but four species may now be locally extirpated (Mrs Hume's Pheasant *Syrmaticus humiae*, Black Kite *Milvus migrans*, Red-headed Vulture *Sarcogyps calvus*, Giant Nuthatch *Sitta magna*) and at least one other (Large-billed Crow *Corvus macrorhynchos*) may have declined. Over the past century, House Crow *Corvus splendens* and Eurasian Tree Sparrow *Passer montanus* have colonised Kalaw. A small but growing number of birdwatching tourists are visiting Kalaw which, together with some nearby sites, has probably received more recent bird survey effort than any other site in East Myanmar.

INTRODUCTION

Myanmar (previously Burma) supports the greatest richness of bird species in mainland South-East Asia (over 1,000: Smythies 1986) and among the largest remaining forest and wetland habitats, across a topography ranging from sea-level to nearly 6,000 m. A relatively extensive body of historical literature exists on the avifauna of Myanmar, largely developed between 1824 and 1948, when collections were made in many parts of the country (Smythies 1953, Inskipp ms). Between 1948 (national independence) and the 1990s, opportunities for scientific research were limited, and few studies of birds were conducted for almost 50 years. Since the 1990s there has been a gradual resurgence in avian research: new surveys have focused on the Chin Hills in the extreme west (Robson *et al.* 1998, Thet Zaw Naing 2003), mountains (King *et al.* 2001, Rappole *et al.* 2005, Renner *et al.* 2007) and lowlands (Tordoff *et al.* 2007) of Kachin State in the north, the Chattin Wildlife Sanctuary in central–north Myanmar (King & Rappole 2001a,b), and the Tanintharyi Division (Tenasserim) in the extreme south (Eames *et al.* 2005). These surveys have resulted in the discovery of at least one new taxon and expanded the known global populations, ranges and altitudinal limits for others, and clearly indicate that much remains to be documented of Myanmar's birds.

Many rural regions of Myanmar, including most protected areas (38 in 2004: Tordoff *et al.* 2005) are currently under restricted access, and this limits opportunities for ecological research or casual visitation. An exception to this is Kalaw town in Shan State, East Myanmar, a popular tourist destination known for its scenic hilly location and temperate climate. The presence of a small, forested reservoir close to the town, as well as ease for tourist access, has also established Kalaw as a routine stop for visiting birdwatchers, and at least six commercial birdwatching companies have visited Kalaw since 2005 (Gidean pers. obs.; also evident from internet searches). This has resulted in a growing, yet until now largely undocumented, number of recent bird records for Kalaw.

Historical bird records are also available for Kalaw and constitute some of the most detailed early inventories for any single site in eastern Myanmar. Three bird collections were made at Kalaw between 1895 and 1912: the first and second by Lieutenant-Colonel G. Rippon, in April 1895 (Rippon 1896, which includes some records by E. W. Oates, who visited Kalaw on unspecified dates) and April–May 1896 (Rippon 1897), and the third in April 1912 by J. P. Cook (Cook 1913). Rippon and Cook limited most of their collecting to within several kilometres of Kalaw town, and Rippon (1896) did not collect 'below 4,000 ft' (*c.*1,200 m). Based on these three collections, Cook (1913) compiled a preliminary list of 129 species for the Kalaw area (although we have revised his list to 125 species: see Results). Brief visits by other authors (Bingham & Thompson 1900, Bingham 1903) resulted in one additional species not mentioned in Cook's list (Burmese Bushlark *Mirafra microptera*). Cook (1913) does not mention Bingham's reports and may have been unaware of them. To our knowledge there has been no published information on the birds of Kalaw since 1913.

Elsewhere in eastern Myanmar, published bird records are available for several locations in Shan State within 70 km south and east of Kalaw (Oates 1894, Bingham & Thompson 1900, Rippon 1901, Harington 1902, Thompson & Craddock 1902, Bingham 1903, Harington 1903, Oates 1903, Kenny 1919, Wickham 1929–1930, Livesey 1933a,b, 1935a–d, 1936, 1939a–c) as well as further north and east (Comber 1905, Meyer de Schauensee 1933, 1934, 1946), and in Kayah State (previously Karenni) 150 km south of Kalaw (Smith *et al.* 1940, 1943–44 and references therein). These include bird records from hill ranges of similar elevation and habitats as Kalaw. As early as 1909, the 'Southern Shan States' were considered to be 'particularly well worked' compared with other regions of Myanmar (Harington 1909: 10); however, with the notable exception of Kalaw and some nearby sites, few birdwatchers have visited these areas recently, and the current status of most bird species in eastern Myanmar is poorly known.

Between 2005 and 2009 the authors MRB, JAE, ROH and FER made informal birdwatching visits to Kalaw accompanied by Gidean, a Kalaw resident and ornithologist. Here we present an inventory of the birds of Kalaw based on our visits and those of four other birdwatchers in the same period, and compare these with historical records collected 97–114 years previously.

Bird names, sequence and taxonomy follow Inskipp *et al.* (2001); published taxonomic deviations are noted for selected species. IUCN Red List categories (Vulnerable,

Near Threatened etc.) follow BirdLife International (2008). Kalaw reservoir, the principal locality of this paper, is commonly referred to as 'Yayayekan reservoir', a transliteration of the Burmese name, but is also variously spelt 'Yay-aye Kan' or 'Yeaye'; for clarity and because it is the only reservoir near Kalaw, we refer to it as 'Kalaw reservoir'. The ornithological regions of Myanmar (North, South-West, West, Central, East, South and Tenasserim) follow Robson (2005), which are a modified version of King *et al.* (1975) and in turn, Smythies (1953).

STUDY AREA

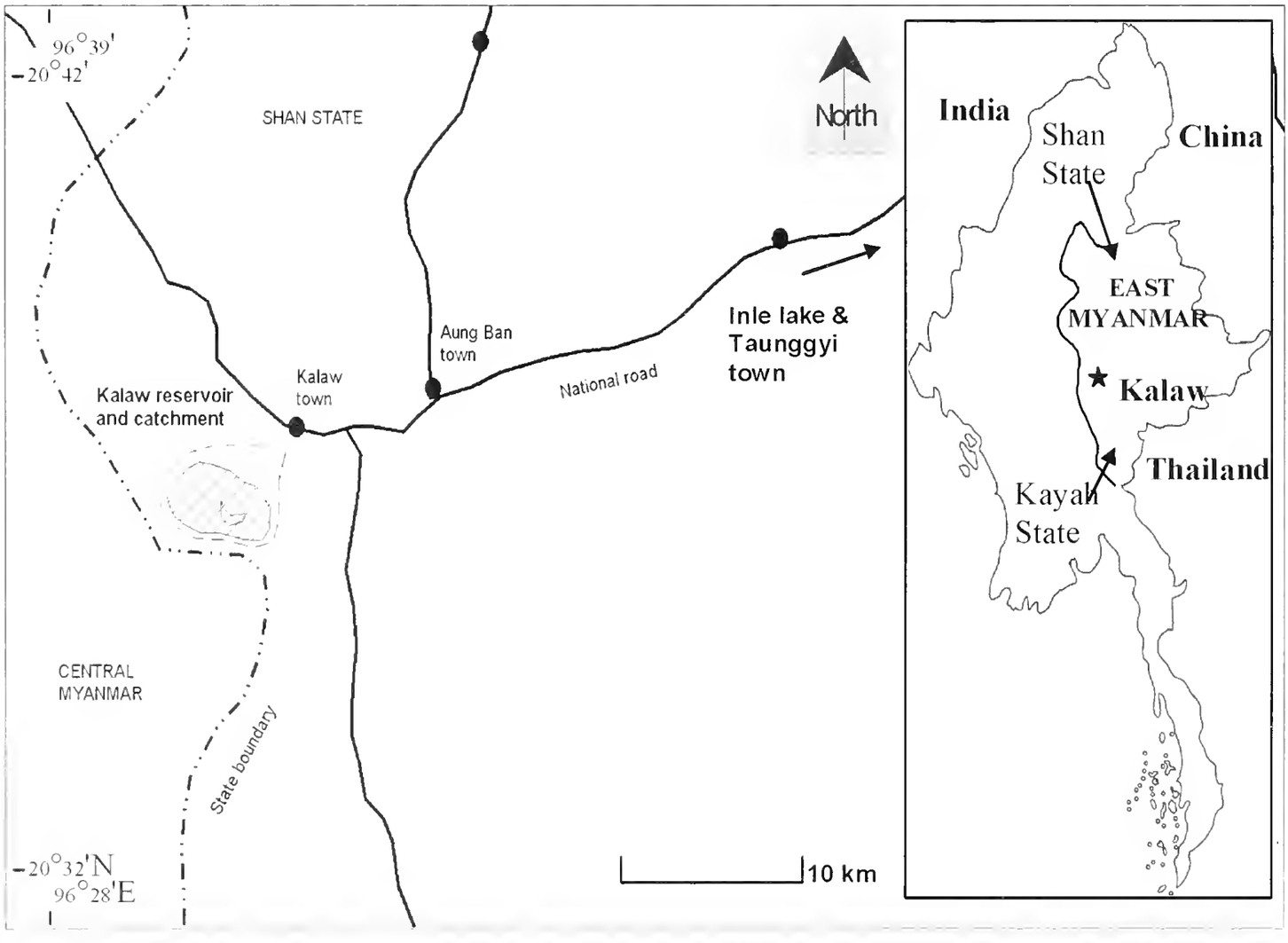
Kalaw town (20°37′60″N 96°34′00″E) lies at the western edge of the Shan Plateau in Taunggyi district of Shan State, East Myanmar (Fig. 1), at an altitude of c. 1,300 m, with surrounding hills ranging from c. 1,250 to 1,450 m. It has a temperate, sunny climate with three seasons: wet (mid-May–mid-October), cool (mid-October–mid-February) and hot (mid-February–mid-May). December and January are the driest months (no rainfall). Peak rainfall is in August (>250 mm) and from April–November there is >50 mm/month; at Aung Ban town (6 km east of Kalaw) mean annual rainfall is 1,047 mm (10-year average 1992–2001) with an average of 89 rainy days/year (Egashira & Aye Aye Than 2006). Mean monthly temperatures in Shan State range from 13.4°C (January) to 25.8°C (April) (minimum 4.3°C / maximum 30.5°C) (MAS/IRRI/IDRC 2000, Egashira & Aye Aye Than 2006). Geologically, Kalaw is located on the 'Kalaw Red Beds and equivalents' at the western extremity of the Sino–Burman Ranges, and borders the Central Zone to the west (ESCAP 1996). Red siltstones, sandstones and conglomerates give rise to the red clay soils characteristic of the region.

Kalaw lies in an area of steeply rolling, hilly terrain. The hills around town support a mosaic of cultivated lands and degraded, secondary pine-forest (canopy <15 m) with an open grassy or shrub understorey and small rock outcrops. Small stands of secondary evergreen forest with a dense shrub understorey occur in some gullies. Domestic cattle extensively graze these habitats. Small, flat river valleys have been entirely cleared and support rain-fed (non-irrigated) rice cultivation.

Early reports describe Kalaw as a small village (Rippon 1896, Cook 1913) although Cook (1913) noted it would 'shortly become a rather important station on the Southern Shan States Railway, and also probably a popular Hill Station'. Between 1914 and 1948 Kalaw was used as a summer residence by British officials, and some retired officials lived there year-round. Between 1942 and 1945, during World War II, the town was briefly occupied by Japanese forces, which used it as a rest and hospital centre.

Kalaw reservoir (20°35′56″N 96°31′26″E) is 6 km south-west of Kalaw town (Fig. 1). The waterbody is small (visual estimate 6–10 ha) and is surrounded by

Figure 1. Localities mentioned in the text. The lightly hatched area (main map) is the catchment of Kalaw reservoir; the reservoir is shaded. Dotted lines around the catchment are walking tracks.



hills, within a protected water catchment of '1,952 acres' (displayed on signs at the reservoir) (c.8 km²). The reservoir was apparently built in the 1920s (local residents pers. comm.) and has little fringing aquatic vegetation or other wetland habitats. Most of the hills around the reservoir support mature secondary evergreen forest (canopy 20–30 m, with emergents to 40 m) and a relatively intact understorey and midstorey of trees, shrubs, grasses and vines, which extend to the reservoir banks. Small seasonal streams flow into the reservoir; a single, north-flowing perennial stream drains the reservoir. At the northern edge of the catchment, the forest grades to adjoining paddyfields and degraded pine-forest and shrubland near Kalaw town. The relative lack of degradation of the forest around Kalaw catchment partly stems from the absence of large fires or commercial timber logging, at least for the past 13 years (Gidean pers. obs.).

Lands surrounding the reservoir catchment (i.e. between Kalaw town and the reservoir, and north, west and south-west of the reservoir) are sparsely populated. Several unsealed roads extend from Kalaw town around the edges of the catchment, and a single road extends to the reservoir itself. At the northern edge of the catchment this road reduces in size to a large track and from here the remaining several hundred metres to the reservoir are most easily accessed on foot. The roads around the catchment are heavily eroded and many sections are unsuitable for vehicle access. The south-west boundary of the catchment is a hill ridge, which forms an abrupt transition between the forested hills of the catchment and, to the west, a remote region of extensive, sparsely forested north–south running hill ranges which are the division between East and Central Myanmar. In contrast to the forested catchment of Kalaw reservoir, the lands around the catchment have been largely cleared of mature forest and support an extensive checker-board array of cropfields interspersed with numerous small patches of secondary forest and scrub.

We were unable to obtain demographic data for Kalaw town (GoM 2006 provides census data at the district and state levels only), but in 2004 the population of the town and surrounding areas was apparently c.20,000 people (Reid & Grosberg 2005). Six villages lie within a 3 km radius of Kalaw reservoir; in December 2008, one of these, Taryaw, contained 25–30 households (pers. obs.). Assuming an average of five people/household and 50 households/village, in 2008 the total population of these villages was 1,500 (by comparison, in 1997 another village in the Kalaw region contained 812 people, 165 households, and an average of 5 people/household: MAS/IRRI/IDRC 2000). Communities living around Kalaw reservoir are principally of the Palaung and Pa-O (Black Karen) ethnic groups; other groups present are the Intha, Shan, Taungthu, Taung-yo, Danu, Kayah, Danaw and Bamar. Most groups practise hunting to supplement subsistence cultivation activities. Kalaw town supports a diverse mix of Shan, Indian, Muslim, Nepali and Bamar peoples, as well as ethnic groups. The Bamar (also known as Burman or Burmese) comprise the majority of Myanmar's population, and govern the country.

Crop cultivation is the primary form of land use and local subsistence around Kalaw town and reservoir, of which non-irrigated rice cultivation is dominant. Other locally grown crops include tea, oranges, chilli, ginger, sesame, potato and maize (pers. obs.).

METHODS

We compiled recent bird records for Kalaw from 14 visits between 2005 and 2009. Seven of these visits were by the authors: 27–28 December 2005 (Hutchinson 2006), 12–13 and 29–30 December 2006 (Hutchinson 2007), 9–11 June 2008 (FER), between 7 and 15 November 2008 (MRB), 2–3 December 2008 (Eaton 2008), and 9–10 December 2009 (JAE). All visits by MRB, JAE, ROH and FER were with Gidean, an ornithologist and Kalaw resident for 13 years.

We supplemented our records with information from seven visits to Kalaw made by four other birdwatchers: G. Talbot (GT) (14–16 April 2006: Talbot 2006), D. Farrow (DF) (23–24 December 2006: Farrow 2006), Thet Zaw Naing (TZN) (four visits, 30 November–1 December 2006, 26–28 March 2007, 21–22 July 2007, 17–18 November 2007: Thet Zaw Naing 2007a,b, Thet Zaw Naing & van der Ven 2007, 2008), and C. Doughty (CD) (15–16 February 2007). We extracted information of these visits from available trip reports which we located during internet searches or which were provided to us by colleagues. We were able to contact most of these birdwatchers directly, and also attempted to contact two other birdwatchers who had visited Kalaw but did not receive replies.

We limited our compilation of recent records to within approximately a 10 km radius of Kalaw town, and excluded records (mainly of waterfowl and waders) described in recent trip reports as 'midway between Kalaw and Heho town or Inle Lake' (locations 20–33 km further east), because these areas support natural wetland habitats not found in the immediate vicinity of Kalaw, although we did include records of soaring raptors and a single record of Crested Treeswift *Hemiprocne coronata* 10–20 km from town. We are reasonably sure that most historical Kalaw records also originate from within 10 km of Kalaw town; Rippon (1896, 1897) similarly excluded records of waterfowl and waders from east of Kalaw, and Cook (1913) differentiated between Kalaw and another site he visited 19 km further west.

Visits by all recent birdwatchers comprised at least one full day (dawn to dusk) at Kalaw reservoir, and one early-morning or late-afternoon visit (0.5 days) to other hills within a 5 km radius of Kalaw town. Between 7 and 15 November 2008 Gidean/MRB spent three days at the reservoir and three half-days in hills around town. Visits to the reservoir by Gidean/MRB, Gidean/FER and one visit by Gidean/ROH (December 2006) comprised walking from Kalaw town, around the reservoir, along a ridge south-west of the catchment, then returning to town (a round-trip of *c.* 20 km); owing to time restrictions, visits to the reservoir by other birdwatchers were usually limited to the forested access track in the north part of the catchment.

The cumulative survey effort of these 14 visits was approximately 25 days (1.5 days/visit for all except MRB's visit of 4.5 days, accounting for the fact that at least 0.5 days/visit comprised arrival/departure and not birdwatching).

Nine of these 14 visits were in the cool, dry season (November, December), one was in the transition between the cool and hot seasons (February), two were in the hot season (March, April) and two were in the wet season (June). This imbalance in seasonal survey effort is a limitation in our coverage of the birds of Kalaw.

We compared our records with historical bird records of Kalaw obtained by Rippon (1896, 1897), Bingham & Thompson (1900) and Cook (1913). None of these authors mentions the duration of their visits, but based on the dates they provide we conservatively estimate their cumulative survey effort between 1895 and 1912 was at least 12 weeks. Rippon (1896, 1897) visited Kalaw in 'April' and 'April–May' respectively (a maximum possible total of 12 weeks); Cook (1913) visited Kalaw from at least 2–30 April 1912 (four weeks). Bingham & Thompson (1900) visited Kalaw during a 'short tour' of south-west Shan State in the 'cold weather (1899–1900)' (i.e. probably between October 1899 and February 1900). Bingham (1903) described the specimens of other collectors, who obtained them in several localities of Shan State. He included two specimens listed for Kalaw with the dates 8 January and 16 February 1902: it is not stated whether these were obtained on two visits or during a single visit to Kalaw of at least five weeks' duration. None of the authors resided at Kalaw, although Rippon and Thompson were stationed at Fort Stedman and Taunggyi town, 33 and 50 km east of Kalaw respectively; Bingham and Cook were visitors to Shan State.

In contrast to visits from 2005–2009, three of these four historical visits were skewed to the hot season (April–May) and one was in the cool, dry season.

We note the following published taxonomic revisions relevant to the eastern Myanmar populations of the following species in our inventory, which supersede Inskipp *et al.* (2001): Hodgson's Hawk Cuckoo *Hierococcyx fugax* (revised to *H. nisicolor*: King 2002), Vinous-breasted Starling *Sturnus burmannicus* (revised to *Acridotheres burmannicus*) and White-vented Myna *A. cinereus* (revised to *A. grandis*) (Lovette *et al.* 2008, Zuccon *et al.* 2008), Tickell's Leaf Warbler *Phylloscopus affinis* (revised to West Chinese Leaf Warbler *P. occisinensis*: Martens *et al.* 2008), Chestnut-crowned Laughingthrush *Garrulax erythrocephalus* (revised to *Trochalopteron erythrocephalus*: Luo *et al.* 2009) and White-bellied Yuhina *Yuhina zantholeuca* (revised to *Erpornis zantholeuca*: Cibois *et al.* 2002).

Many of the other species listed in this paper are listed by Robson (2008) under different generic and/or specific names, of which the following are not immediately recognisable compared with Inskipp *et al.* (2001): Collared Scops Owl *Otus bakkamoena* (listed by Robson as *O. lettia*), Grey Nightjar *Caprimulgus indicus* (=*C. jotaka*), Pompadour Green Pigeon *Treron pompadora* (=*T. phayrei*), Common Buzzard *Buteo buteo* (=*B. burmannicus*), Changeable Hawk Eagle *Spizaetus cirrhatus* (=*Nisaetus limnaeetus*), Red-throated Flycatcher *Ficedula parva* (=*F. albicilla*), Common Stonechat *Saxicola torquata* (=*S. maurus*), Plain Martin *Riparia paludicola* (=*R. chinensis*), Spotted Bush Warbler *Bradypterus thoracicus* (=*B. davidi*), Plain Flowerpecker *Dicaeum concolor* (=*D. minullum*) and Yellow Wagtail *Motacilla flava* (=*M. tschutschensis*). Other taxonomic revisions are mentioned under selected species accounts.

RESULTS

Species richness

We derived a list of 302 bird species for Kalaw from compilation of recent and historical records (Appendix 1). Most of these records are from within a 10 km radius of Kalaw town. Recent records (2005–2009) are for 276 species (91% of the total), of which 223 species were recorded by the authors and 53 additional species were recorded by CD, DF, TZN or GT.

Historical records (1895–1912) are for 125 species (41% of the total), which we derived from the inventories of Rippon (1896, 1897), Bingham & Thompson (1900) and Cook (1913). This total differs from Cook (1913), who derived a total of 129 species based on his list and those of Rippon (1896, 1897), for three reasons. First, we excluded two species (Striped Tit Babbler *Macronous gularis* and Yellow-breasted Bunting *Emberiza aureola*) that Cook recorded 19+ km west of Kalaw at lower elevations (although both species were recorded at Kalaw between 2005 and 2009). Second, we placed six taxa listed by Rippon or Cook under three species, i.e. *Pericrocotus speciosus* (listed by Rippon 1896) and *P. fraterculus* (Rippon 1897) under one taxon, Scarlet Minivet *P. flammeus*; *Pomatorhinus nuchalis* (Rippon 1896) and *P. ripponi* (Cook 1913) under White-browed Scimitar Babbler *P. schisticeps*; and *Lioptila melanoleuca* and *L. castanoptera* (both listed by Rippon 1896) under Black-headed Sibia *Heterophasia melanoleuca*. Third, Cook's list did not include one additional species (Burmese Bushlark) recorded by Bingham & Thompson (1900).

Our inventory excludes one species, Chestnut-shouldered Petronia *Petronia xanthocollis*, for which a single historical report from Kalaw was later invalidated (see species account).

Twenty-two species were recorded between 1895 and 1912 which were not observed between 2005 and 2009 (Table 1; and see Discussion).

Records of four species are considered to be provisional: Oriental Cuckoo *Cuculus saturatus*, Dark-rumped Swift *Apus acuticauda*, Black-naped Oriole *Oriolus chinensis* and Tickell's Blue Flycatcher *Cyornis tickelliae* (see species accounts). Records for three other species are based exclusively on vocalisations, not sightings (Lesser Shortwing *Brachypteryx leucophrys*, Striped Tit Babbler, Red-throated Pipit *Anthus cervinus*) (Appendix 1).

Forest-dwelling and open-country species constitute the majority of Kalaw records. There are few records of wetland species (waders, waterfowl, herons, etc.) owing to the low extent and diversity of wetland habitats at Kalaw.

Selected species accounts

Accounts are given for globally threatened, Near Threatened and restricted-range species recorded during recent and historical visits to Kalaw, new records for East Myanmar, records which clarify the ranges or elevations given in Robson (2008), and for selected others of distributional or conservation interest. Observer initials are given in parentheses for records from 2005–2009. Provisional records are in square brackets.

MRS HUME'S PHEASANT *Syrmaticus humiae*

Globally Near Threatened. A male and female were collected among 'pine-clad slopes'/bamboo undergrowth respectively (Rippon 1897); recorded with no other details (Bingham & Thompson 1900); Cook (1913: 270) saw the species 'several times... generally in the open jungle on rocky grass hills. On one occasion I put up five birds singly at intervals of about a minute or two.'

Table 1. Species recorded at Kalaw in East Myanmar from 1895–1912 but not from 2005–2009.

Species	Historical records	Potential factors for lack of recent records
Species for which a change in local status may have occurred		
Mrs Hume's Pheasant	See species account	Population decline
Rufous-bellied Woodpecker	See species account	No obvious reason
Black Kite	See species account	Population decline
Red-headed Vulture	See species account	Population decline
Black-billed Magpie	'Scarce'[1]; occurs further east[1, 4]	Edge of range? Historically scarce at Kalaw but 'common' further east[3, 4]
Giant Nuthatch	See species account	Population decline
Oriental Skylark	See species account	Sampling randomness* / decline?
Species for which a lack of records in 2005–2009 may only reflect sampling effects (e.g. seasonal timing)		
Pied Kingfisher	Single record[1]	Atypical habitat and altitude[6]
Hodgson's Hawk Cuckoo	Single record[1]	Seasonal timing of recent visits
Rose-ringed Parakeet	Single record[2]	Sampling randomness/atypical altitude[6]
Large-tailed Nightjar	'Very common'[2]; 'found no other'[4]	Seasonal timing of recent visits (cryptic – no calling males)
Red Collared Dove	'Only met with once'[4]	Seasonal timing[5] / atypical habitat/altitude[6]
Sarus Crane	See species account	Vagrant; atypical habitat
Pintail Snipe	Single record; 'found further east...'[1]	Sampling randomness
Chestnut-bellied Rock Thrush	Single record[3]	Sampling randomness
Pale Blue Flycatcher	Single records[2, 4]	Sampling randomness
Spot-winged Starling	'Observed by Mr. Oates'[1]; no other data	Sampling randomness; generally rare[6]
Chestnut-bellied Nuthatch	Single record[1]	Sampling randomness
Striated Bulbul	Single record[1]	Sampling randomness
Olive Bulbul	Single record[2]	Atypical altitude[6] / record possibly from outside current study area
Burmese Bushlark	Single record[3]	Edge of range[6] / record possibly from outside current study area
Blyth's Pipit	See species account	Rare visitor?

[1]Rippon (1896), [2]Rippon (1897), [3]Bingham & Thompson (1900), [4]Cook (1913), [5]Duckworth *et al.* (2002), [6]Robson (2008). *Sightings of single individuals for which lack of detection from 2005–2009 may reflect low survey effort rather than infer a decline or absence.

No phasianids were recorded from 2005–2009 except Chinese Francolin *Francolinus pintadeanus* (which remains common) and a single Red Junglefowl *Gallus gallus* (Appendix 1).

Historical reports from other areas of East Myanmar suggest pheasants were in decline over a century ago. In the Taunggyi area 50 km east of Kalaw, Wickham (1929–1930) noted that Mrs Hume's Pheasant was 'quite common' but, in the same area several years later, Livesey (1939b) reported the species had declined and attributed this to habitat loss from prescribed burning and conversion for agriculture. A male bird was seen at Taunggyi in February 1985 (King 1985). In Kayah State and the Karen Hills south of Kalaw, seven individuals were recorded by Smith *et al.* (1943–1944) but none was observed during collecting trips by Wardlaw Ramsay (1875) or Smith *et al.* (1940), the latter noting the absence of birds and scratchings, and commenting they have 'undoubtedly been exterminated'.

At Kalaw, the species may now be locally extirpated. Historical and ongoing forest loss, the small size of remaining forest around Kalaw reservoir (see Discussion), and opportunistic hunting by local communities may be key factors suppressing recruitment, as with remnant populations in North-West Thailand and elsewhere in its range (BirdLife International 2001, Choudhury 2005).

Rufous-bellied Woodpecker *Dendrocopos hyperythrus*
Recorded at Kalaw by Rippon (1896), Bingham & Thompson (1900), Bingham (1903) and Cook (1913). Cook (1913) stated it was 'one of the commonest woodpeckers at Kalaw' and located three nests with attending birds, in rotten pine stumps 1–4 m above the ground.

No sightings of this species were made from 2005–2009, and this apparent absence cannot readily be explained. Most recent visits were in November–December (winter) while historical visits were in April–May (summer), when breeding birds may have been more easily detected; yet given the striking appearance of this species, it seems unlikely its presence was overlooked in recent visits or that historical records are the result of misidentification. Possible factors include seasonal altitudinal movements and/or local decline due to historical and ongoing loss of pine-forest breeding habitat at Kalaw. Further visits to Kalaw in April–May might help clarify the local status of the species. Rufous-bellied Woodpecker is widely distributed in Myanmar (Robson 2008).

Oriental Pied Hornbill *Anthracoceros albirostris*
Two individuals were seen on 15 November 2008 at 16h00, south-west of Kalaw reservoir (Gidean/MRB). This is the only record for Kalaw.

This species was previously reported as 'common' or 'very common' from areas of southern Shan State within 50 km of Kalaw (Bingham & Thompson 1900, Rippon 1901, Wickham 1929–1930), and the absence of historical Kalaw records seems unusual given the presence of suitable forest habitats. The lack of other sightings from 2005 to 2009 suggests the species occurs at low densities at Kalaw. It is likely that populations in south-west Shan State have been impacted by historical and ongoing loss of native forest habitats, and opportunistic hunting by

local communities. On 14 November 2008 at Inle Lake (33 km east of Kalaw) the old (not fresh) casques and bills of two Oriental Pied Hornbills and two Great Hornbills *Buceros bicornis* (Globally Near Threatened) were seen for sale (MRB pers. obs.).

Large breeding populations persist in North Myanmar (Tordoff *et al.* 2007); populations elsewhere in Indochina have declined owing to hunting and habitat loss (e.g. Fuchs *et al.* 2007).

[Oriental Cuckoo *Cuculus saturatus*
A single hepatic individual was photographed on 26 March 2007 (TZN); this is the only record for Kalaw.

Thet Zaw Naing & van der Ven (2008) noted this is the first record from East Myanmar, but did not include the photograph, or a field description, of this individual. We accord this record provisional status owing to the lack of other details and difficulties of separating Oriental Cuckoo in the field from other *Cuculus* species. Robson (2005, 2008) describes the species as an uncommon to fairly common breeding visitor to West and North Myanmar and a scarce to uncommon passage migrant to Central and South Myanmar.]

Lesser Cuckoo *Cuculus poliocephalus*
One adult was heard vocalising and subsequently seen well on 10 June 2008 in evergreen forest at Kalaw reservoir (FER/Gidean).

This is the first record from East Myanmar. No photographs or sound recordings were obtained, but confusion with other *Cuculus* species was ruled out on account of the characteristic and easily identifiable call series given by this individual. Both observers have had previous field experience with the calls of Lesser Cuckoo. Robson (2005, 2008) describes the species as a scarce to uncommon breeding visitor in West and North Myanmar (as well as North-West Thailand, i.e. near Shan State), a scarce to uncommon passage migrant in Central Myanmar, and recorded but with unclear status in South (east) Myanmar.

[Dark-rumped Swift *Apus acuticauda*
Globally Vulnerable. Three individuals were seen on 28 December 2005 flying over Kalaw reservoir (ROH/Gidean).

This is the first reported sighting from East Myanmar. Identification was based on the apparent absence of white on the rump and the slender, sickle-winged shape typical of the genus *Apus*. No photographs were obtained. We accord this sighting provisional status due to the lack of a more detailed field description and/or photographs which could clearly discount the possibility of misidentification with the similar *cooki* race of Pacific Swift *A. pacificus*.

Within South-East Asia, Robson (2005, 2008) describes this little-known species as 'scarce (status unknown, but could be resident)' for North Myanmar and as recorded in 'winter (vagrant?)' for North-West Thailand; the current record is from winter. Dark-rumped Swift was not recorded during recent bird surveys in the lowlands of North Myanmar (Tordoff *et al.* 2007).

Due also to this issue of possible misidentification, many other regional records, including reports from nearby North-West Thailand, are left unresolved as "dark-rumped" swifts of one of these two species (BirdLife International 2001).]

Pin-tailed Green Pigeon *Treron apicauda*
A flock of 64 individuals seen on 3 December 2008 feeding in a fruiting tree at Kalaw reservoir was notable for its large size (JAE/Gidean). This species was also recorded at Kalaw reservoir on five other recent visits (Appendix 1). Pin-tailed Green Pigeon is an uncommon resident (subject to local movements) in Myanmar (Robson 2008).

Sarus Crane *Grus antigone*
Globally Vulnerable. A single report by Rippon (1896) with no locality or collection details is the only record for Kalaw.

There are no wetland habitats at Kalaw suitable for cranes or other large waterbirds, and Rippon (1896) noted this individual was 'probably a wanderer' from wetlands further east.

Black-tailed Crake *Porzana bicolor*
A pair was seen on 10 December 2009 along a stream in a paddyfield near forest at the northern boundary of Kalaw reservoir (JAE). Both birds were observed at close proximity and were vocal, frequently responding to call playback.

Although not considered globally threatened, this species is infrequently recorded because of its skulking habits (Taylor & van Perlo 1998). For Myanmar, Robson (2008) describes it as a scarce resident recorded from West, North, East, and South (east) Myanmar.

Black Kite *Milvus migrans*
One record by Rippon (1897) with no other details; Cook (1913) stated it was 'found close to the village'. These are the only records for Kalaw.

Historical accounts indicate the species was common in some parts of East Myanmar, including southern Shan State (Bingham & Thompson 1900, Harington 1909) and Kayah State, where Wardlaw Ramsay (1875) saw 'swarms' of them. These authors, including Rippon and Cook, assigned their records to '*Milvus govinda*'. Wickham (1929–1930) referred to *M. migrans govinda* as 'not so common in the hills as the plains, although they breed and a pair are generally noticeable round any big village' and *M. m. lineatus* was 'said to occur in [these] hills'. Black Kites were apparently highly seasonal, 'disappearing' at the start of the wet season (presumably May) and returning at the end of it, in mid–late October (Bingham & Thompson 1900, Harington 1909).

The lack of records for Black Kite from 2005–2009 suggests a decline has occurred, because our visits were in winter, coinciding with its historical seasonal occurrence, and because kites are large, soaring raptors and it seems unlikely they would have been overlooked unless at reduced densities. This is consistent with observed declines of several scavenging bird species elsewhere in Asia (Pain *et al.* 2003). Small numbers were recently recorded in the lowlands of North Myanmar (Tordoff *et al.* 2007).

Vulture *Gyps* sp.
Three immature vultures were observed on 10 December 2009, flying west over Kalaw reservoir (Gidean/JAE). All possessed streaked underparts and a pale line on the underwing coverts, suggesting White-rumped Vulture *Gyps bengalensis*, but owing to distance Himalayan Griffon

G. himalayensis could not be discounted. There are no previous records for either species from Kalaw.

Rippon (1901: 553) stated White-rumped Vulture to be the 'common Vulture of the Shan States'. Sayer & U Saw Han (1983: 11) recorded this species 'on four occasions' (no numbers given) in February and March 1983, between Inle Lake and Taunggyi town, 33–50 km east of Kalaw, and noted that vultures 'have become extremely rare in Burma as a result of poisoning with insecticides'. Htin Hla (2003) considered that White-rumped Vulture remains relatively common in Shan State, and in 2003 recorded groups of 6–45 at sites 100–150 km east of Kalaw (see account for Red-headed Vulture). Globally significant numbers of this species are also confirmed to persist in North Myanmar (Tordoff *et al.* 2007). Himalayan Griffon was only confirmed to occur in Myanmar in 2004 (Tordoff *et al.* 2007) and its status in East Myanmar is unknown.

Given the critically threatened status of Asian vultures (see below), local sightings of all species are significant.

RED-HEADED VULTURE *Sarcogyps calvus*

Globally Critically Endangered. Cook (1913) saw this species on 'several occasions'; this is the only record for Kalaw.

Between March and June 2003 up to 11 Red-headed Vultures were observed in Shan State at sites 100–150 km east of Kalaw, on 14 March (one individual), 16 April (two), 17 April (two), 16 June (four) and 19 June (two) (Htin Hla 2003): these appear to be the first documented records from East Myanmar in 71 years. Prior to these sightings, two individuals were seen in 1899–1900 at Inle Lake, 33 km east of Kalaw (Bingham & Thompson 1900), and in 1938 up to four were observed on a livestock carcass with over 10 White-rumped Vultures *Gyps bengalensis* and (reportedly) Slender-billed Vultures *G. tenuirostris* at Taunggyi town, 50 km east of Kalaw (Livesey 1939c). Rippon (1901) did not record Red-headed Vulture in south-west Shan State despite extensive collecting; nor did Wardlaw Ramsay (1875) in the Karen Hills, although he observed a vulture species ('probably *G. indicus*', thus presumably *G. tenuirostris*) continually around camp. In contrast, Wickham (1929–1930), referring generally to the hills of southern Shan State, Chin Hills (West Myanmar) and Kachin Hills (North Myanmar), stated the species was 'common in all these Hill Tracts up to about 3,000 feet but breeds even at lower level than this'; he 'took an egg of this bird in the Southern Shan Hills at about 1,200 feet [c.360 m] elevation in early January'.

Even historically, Red-headed Vulture appears to have occurred at low densities: in Myanmar it was regarded as 'not a common species' (Blyth 1875), 'distributed sparingly' (Bingham 1880) and 'not nearly so common as *G. bengalensis*' (Harington 1909). These authors note that only a few individuals would usually be present at large feeding congregations of other vultures. Throughout its global range, it was considered 'nowhere very abundant' (Blanford 1895). The Red-headed Vultures observed in Shan State in 2003 were with feeding groups of 6–45 White-rumped Vultures (Htin Hla 2003).

Red-headed Vulture was not recorded during recent surveys in North Myanmar although globally significant numbers of other vultures were found (Tordoff *et al.* 2007). Populations of all Asian vulture species have suffered severe declines in the past 20+ years throughout South and South-East Asia (BirdLife International 2001, Pain *et al.* 2003), and it is possible that Red-headed Vulture is now locally extirpated from parts of East Myanmar. Large parts of East Myanmar remain off-limits for research and have not been surveyed for many years, and the recent sightings by Htin Hla (2003) confirm that small numbers persist.

HOUSE CROW *Corvus splendens*

Counts of 66, 100+, 36 and 44 individuals were made respectively in November 2006 and March, July and November 2007 (TZN); a resident flock of 30+ individuals in Kalaw town was observed daily on 7–8 November 2008 (Gidean/MRB). The species was recorded on nine of 14 visits from 2005–2009 (Appendix 1), always around the town.

In contrast there are no confirmed historical records of House Crow from Kalaw. Rippon (1896) explicitly stated House Crow was absent but did occur 30+ km to the east; Cook (1913) recorded it provisionally, stating 'I include this as doubtful. I did not actually shoot the bird.' In the early 1900s, House Crow was 'common' in villages and towns in southern Shan State (Bingham & Thompson 1900), although there were 'many' small, remote villages where it did not occur (Harington 1909).

These data indicate the colonisation of Kalaw by House Crow in the past century. The species is an aggressive coloniser and its global range is expanding (Ryall 2002, Nyari *et al.* 2006).

House Crows at Kalaw possess the dark grey cowl of *C. s. insolens*, consistent with Smythies (1953), who noted this subspecies occurs in the central and southern latitudes of Myanmar.

LARGE-BILLED CROW *Corvus macrorhynchos*

Single birds were recorded on 28 December 2005, 13 December and 30 December 2006 (Gidean/ROH), 16 February 2007 (Gidean/CD) and 3 December 2008 (Gidean/JAE); sightings of two birds were made on 16 April 2006 (GT), from 30 November–1 December 2006 (TZN), from 17–18 November 2007 (TZN), and 10 November and 15 November 2008 (Gidean/MRB); 14 individuals were seen from 26–28 March 2007 (TZN) and five were seen from 21–22 July 2007 (TZN). Sightings were in scattered forest or cultivated lands outside Kalaw town.

Large-billed Crow was historically present at Kalaw (Rippon 1896), where it was 'common' (Cook 1913). In nearby parts of southern Shan State it was 'very common throughout the more wooded portions' (Bingham & Thompson 1900), although Wickham (1929–1930) stated it was 'never in such large numbers' as House Crow. In Kayah State south of Kalaw, it was 'common near villages and huts up to 6,000 feet' [c.1,800 m] (Smith *et al.* 1943–1944). Elsewhere in Myanmar it was widely distributed and locally abundant in some areas (flocks of 'thousands' reported) but scarce in others (Bingham 1880, Harington 1909, 1909–1910, Smythies 1953). Recent published records are from West (Robson *et al.* 1998) and North (Tordoff *et al.* 2007) Myanmar; King *et al.* (2001) found it uncommon in far North Myanmar.

The small number of individuals recorded at Kalaw from 2005–2009 indicates the species has declined there, in contrast with the colonisation of Kalaw by House Crow over the same period. Large-billed Crow is among several

scavenging species which are declining in at least localised parts of South-East Asia (Duckworth *et al.* 2002, Pain *et al.* 2003, Fuchs *et al.* 2007) and is potentially of national conservation concern in Myanmar.

Large-billed Crow has recently been split by some authors into separate species (e.g. Martens *et al.* 2000), in which the eastern Myanmar populations are assigned to Eastern Jungle Crow *C. levaillantii*, an uncommon to common resident in Myanmar (Robson 2008).

[Black-naped Oriole *Oriolus chinensis*
'Observed by Mr. Oates' (Rippon 1896; no other details); four individuals were observed from 17–18 November 2007 (TZN; no other details). These are the only records for Kalaw.

We accord these sightings provisional status in the absence of further details, owing to the difficulties of separating Black-naped Oriole in the field from Slender-billed Oriole *O. tenuirostris*, particularly as the latter is common at Kalaw and has been recorded on most visits (Appendix 1). It is possible that E. W. Oates treated both species as conspecific and made no effort to separate them, although Rippon (1896, 1901) listed both separately, suggesting this was not the case.]

Black-hooded Oriole *Oriolus xanthornus*
Single birds were seen on 13 December and 30 December 2006 (Gidean/ROH), 16 February 2007 (Gidean/CD), 21 July 2007 (TZN) and 18 November 2007 (TZN); four birds were seen from 30 November–1 December 2006 (TZN). Most of these sightings were in pine-forest and open country between Kalaw town and Kalaw reservoir.

Robson (2008) gives the altitudinal range of the species in South-East Asia as up to 915 m. These Kalaw records, at c. 1,300 m, extend the species's known upper altitudinal range in South-East Asia by c. 385 m. In India, Black-hooded Oriole is known from plains to 1,800 m (Rasmussen & Anderton 2005).

Asian Brown Flycatcher *Muscicapa dauurica*
One adult was seen on 28 December 2005 at Kalaw reservoir (ROH/Gidean).

This is the first record from East Myanmar. Misidentification with other *Muscicapa* species was ruled out due to the absence of rufescent body coloration (Brown-breasted Flycatcher *M. muttui* and Ferruginous Flycatcher *M. ferruginea*) and the lack of strong brown smudging to the flanks (Dark-sided Flycatcher *M. sibirica*). According to Robson (2005, 2008), the Palearctic nominate form *M. d. dauurica* is a common winter visitor in South-East Asia, except North and East Myanmar, while the distinct resident taxon *M. d. siamensis* is a scarce to uncommon breeding resident in adjacent North-West Thailand and north Tenasserim. The present individual was not identified to subspecies level and could have been either taxon. In view of the potential future elevation of distinct Oriental resident forms of *M. dauurica* to species level, further visits to Kalaw should aim to clarify which taxon of Asian Brown Flycatcher occurs locally.

Brown-breasted Flycatcher *Muscicapa muttui*
One adult with two juveniles was seen on 10 June 2008 at Kalaw reservoir (FER/Gidean). No photos were taken, but the adult bird was seen flying back and forth from the twig where the two juveniles were located and occasionally feeding them with small invertebrates. The two young individuals possessed the typical juvenile muscicapid plumage featuring extensive light body streaking on a brown background. The identification of the adult was also unequivocal, and confusion with Asian Brown Flycatcher can be ruled out mainly on account of bill colour and the rufescent back, flank coloration and particularly tail, also the grey-toned head, in particular the nape contrasting with the rufescent mantle. Both observers have had previous field experience with this species and Asian Brown Flycatcher.

This is the first confirmed breeding record for this species in East Myanmar. Robson (2008) describes it as 'recorded (status uncertain, probably breeds)' in North and East Myanmar, and a scarce to uncommon passage migrant in West and Central Myanmar.

Slaty-backed Flycatcher *Ficedula hodgsonii*
Bingham (1900) described the taxon *Cyornis brevirostris* based on a single male specimen from Kalaw (no specific locality details), as follows:

> Forehead, sides of the head and neck, crown, occiput, nape, back, scapulars, the greater wing-coverts, and the sides of the body under the wings uniform dark slaty blue (the colour of a dark rock-pigeon); rump and upper tail-coverts paler blue; lesser wing-coverts and the wings dark brown; tail black, the base narrowly on the two central feathers and broadly on the remainder white; chin, throat, breast, and the upper half of the stomach bright orange; lower portions of stomach, the thighs, and under tail-coverts white, faintly washed with olive-brown; under wing-coverts and axillaries pale orange-yellow. Bill, legs, and feet black; iris dark brown. B& Length 4.8 inches [= 122 mm], wing 2.9 [= 74 mm], tail 1.8 [= 46 mm], tarsus 0.6 [= 15 mm], bill from gape 0.4 [= 10 mm], from front 0.24 [= 6 mm].

Since then, the name has been overlooked or ignored; it was not included even as a synonym by Baker (1930) or Watson (1986). It is not known whether the type specimen, which was deposited in the Indian Museum, Calcutta, still exists, but it seems unlikely that it represents a distinct species that has not been found again. The description appears to fit that of Slaty-backed Flycatcher *Ficedula hodgsonii*, although the tail is much shorter (56–58 mm in *hodgsonii*: Ali & Ripley 1996).

[Tickell's Blue Flycatcher *Cyornis tickelliae*
A single adult male was observed on 30 December 2006 in evergreen forest at Kalaw reservoir (ROH/Gidean); two individuals were recorded from 30 November–1 December 2006 (TNZ) and four from 21–22 July 2007 (TZN) (no other details); also listed by Rippon (1897), who mentioned this and other flycatcher species 'appeared to be breeding or about to do so'.

Robson (2008) describes the altitudinal range of the species in South-East Asia as up to 915 m (below 600 m in Thailand). These records from Kalaw, at c. 1,300 m, would represent an extension of the species's known upper altitudinal range in South-East Asia by c. 385 m.

We regard these altitudinal records as doubtful owing to the difficulties of separating Tickell's from Hill Blue Flycatcher *C. banyumas* in the field, particularly as the latter was recorded at Kalaw on most visits from 2005–2009 (Appendix 1) and occurs from 400–2,515 m (Robson 2008). It is possible these records represent misidentifications,

possibly of the race *whitei* of Hill Blue Flycatcher. Field descriptions are not available for these records and any future sightings at Kalaw would require field descriptions to validate these apparent altitudinal records.]

BLUETHROAT *Luscinia svecica*
A single male in non-breeding plumage was observed on 9 November 2008 at 07h30, next to a stream and ricefield in open pine-forest near Kalaw reservoir (Gidean/MRB).

Robson (2005, 2008) describes the altitudinal range of the species in South-East Asia as up to 760 m, although this appears to overlook a report of its status as a common non-breeding visitor on the Xiangkhouang plateau in Laos at 1,120 m (Duckworth *et al.* 2002). The Kalaw record, at c.1,350 m, appears to extend the species's known upper altitudinal range in South-East Asia by c.230 m. In India, the species breeds from 2,600–3,800 m and winters in the lowlands (Rasmussen & Anderton 2005).

GIANT NUTHATCH *Sitta magna*
Globally Vulnerable. A male and female were collected in 1896 (Rippon 1897); two individuals were seen in 1912 of which one, a male, was collected (Cook 1913). These are the only records for Kalaw.

Kalaw is within the core distribution for this species in Myanmar (see review by BirdLife International 2001). For southern Shan State, Bingham (1903) noted it did 'not seem to be rare at an elevation of 6,000 ft and upwards' and Livesey (1933b) considered it 'not uncommon in some localities'; in contrast Bingham & Thompson (1900) said it was 'exceedingly rare'. In Kayah State south of Kalaw, Smith *et al.* (1943–1944) found it was 'not uncommon' in some localities.

BirdLife International (2001) traced only three post-1950 records for Myanmar, and noted that, although this may reflect low observer coverage rather than a decline, an undetected reduction in range and numbers may be occurring. The lack of records from 2005–2009 suggests the species is now locally extirpated at Kalaw. At some nearby sites in North-West Thailand, Giant Nuthatch has declined or is locally extirpated, and this has been attributed to the loss of mature pine-forest (BirdLife International 2001). The pine-forests of Kalaw have been subjected to extensive clearance and burning for many decades (see Discussion) and virtually all mature forest has been cleared, with only stands of young, regenerating pines remaining: this is probably the principal reason for the decline of Giant Nuthatch at Kalaw.

ASIAN HOUSE MARTIN *Delichon dasypus*
A 'small flock' was seen on 23 December 2006 over Kalaw town (DF); at least 20 individuals were seen on 10 December 2009 over Kalaw reservoir (Gidean/JAE). No photographic evidence was obtained but the dark underwing-coverts, white throat, and white undertail-coverts distinctive of this species were clearly visible on all birds. A single unidentified martin *Delichon* sp. was seen on 9 November 2008 over Kalaw reservoir with a flock of Barn Swallows *Hirundo rustica* and Red-rumped Swallows *H. daurica* (Gidean/MRB).

These are the first records of Asian House Martin from East Myanmar. Robson (2005, 2008) describes the species as an uncommon to fairly common winter visitor to West, North, Central and South Myanmar.

HUME'S WARBLER *Phylloscopus humei*
A 'few' were seen from 23–24 November 2006 (DF/Gidean); recorded from 15–16 February 2007 (CD/Gidean; no other details); single birds were observed on 7 and 8 November 2008 (Gidean/MRB); at least three were seen and heard on 10 December 2009, in company with Yellow-browed Warbler *P. inornatus* (JAE). Individuals were identified by the *tschuit* call distinctive of this species (Robson 2008) and possessed indistinct tertial tips, black legs and pallid plumage lacking the olive tones of the similar Yellow-browed Warbler *P. inornatus*. All records are presumed to be of the race *P. h. mandelli*.

These are the first records from East Myanmar. Robson (2005, 2008) describes the species as a scarce to locally common winter visitor to West and South (north-west) Myanmar.

MARTENS'S WARBLER *Seicercus omeiensis* (=EMEI SHAN WARBLER, OMEI WARBLER)
At least two adults were seen on 13 December 2006 (ROH/Gidean). Birds were observed at close proximity in good light, and sound recordings of the diagnostic contact call were made by ROH (Figure 2) and were confirmed by C. Robson. On 10 December 2009, at least three adults were seen (JAE/Gidean) of which one responded to call playback of pre-recorded song (from Sichuan, China) by flying and singing nearby for several minutes.

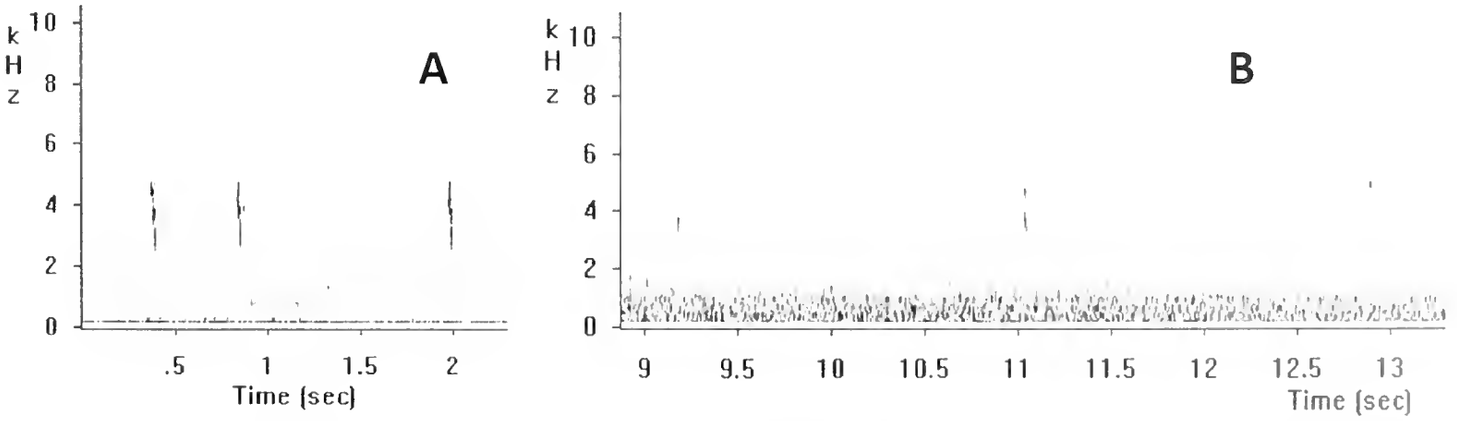


Figure 2. Sonogram of the call vocalisations of Martens's Warbler *Seicercus omeiensis*. Random excerpts from the calls series of two individuals, at (A) Kalaw, recorded by ROH, and at (B) Emei Shan (Sichuan, China) for comparison, recorded by JAE. Spacing of notes is random throughout both call series and was not selected to resemble each other; differences in note width on the sonogram are largely due to differences in quality and loudness between recordings. Sonogram prepared by FER.

These are the first records from East Myanmar. Martens *et al.* (2003) referred to 12 specimens from Myanmar: West Myanmar (Mt Victoria, Dudaw Taung) and Central Myanmar (Mt Popa, Maymyo). They went on to say that 'It still needs to be determined whether *omeiensis* s.l. breeds in Burma; two individuals were found in Karenni/Burma on 15. and 16.IV.1939 (Tring: 1948.80.883 and .884).' These are clearly the two specimens collected at Nattaung (the approximate border area between South and East Myanmar) by Smith *et al.* (1940), who referred them to '*Seicercus burkii tephrocephala*.'

Robson (2008) describes the species as an uncommon to fairly common winter visitor to East Myanmar and several regions of Thailand, Cambodia and Laos (it is at least locally common in hilly North Laos: Fuchs *et al.* 2007). Robson's (2008) citation for East Myanmar is based on the 2006 record from Kalaw.

Three other *Seicercus* species occur at Kalaw (Appendix 1), of which two, Grey-crowned Warbler *S. tephrocephalus* and Bianchi's Warbler *S. valentini*, possess superficially similar calls and/or appearance to Martens's Warbler. Grey-crowned and Bianchi's have both been recorded in most recent visits to Kalaw (Appendix 1), but in December 2009 Martens's was the most frequently observed of the three species, with an approximate ratio of 3:1:1 (JAE pers. obs.).

Black-headed Sibia
Heterophasia melanoleuca castanoptera
Between 2 and 49 individuals were observed per visit from 2005–2009: eight birds observed in April 2006 (GT), counts of 49, 11, 35 and 30 birds/visit in November–December 2006 and March, July and November 2007 respectively (TZN), counts of 10, 5, 4 and 2 individuals/day observed on 8, 9, 10 and 15 November 2008 respectively (MRB), and 30+ individuals from 9–10 December 2009 (JAE). The species was recorded during all recent and most historical visits to Kalaw (Appendix 1). All sightings were in evergreen forest at Kalaw reservoir.

All recent records of Black-headed Sibia at Kalaw are of the subspecies *castanoptera*, a restricted-range resident of south-western East Myanmar (Robson 2005) distributed along the western edge of the Shan Plateau, from Kalaw in the north to Nattaung in Kayah State in the south (Bingham & Thompson 1900, Smith *et al.* 1940), a distance of c. 150 km. Rippon (1896) and Cook (1913) described *castanoptera* as 'very common' at Kalaw; recent visits confirm that it remains locally common.

The subspecies *castanoptera* was accorded full species status by Rippon (1896), Bingham & Thompson (1900) and Cook (1913), although C. B. Ticehurst in Smith *et al.* (1940) later stated 'it certainly is a local race of *melanoleuca* and not a species... as I find that single specimens of *melanoleuca*... east of Fort Stedman [30+ km east of Kalaw] have just a trace of the chestnut markings of *castanoptera*'. Rippon (1896) listed the subspecies *H. m. melanoleuca* for Kalaw, but given some early confusion over the taxonomy of the species (see Smith *et al.* 1940) we regard his record as provisional. There are no specimens of Black-headed Sibia from Kalaw held at the Natural History Museum, UK (N. J. Collar *in litt.* 2010), and Rippon's record of *H. m. melanoleuca* cannot be substantiated. It seems that *castanoptera* is the only form of Black-headed Sibia at Kalaw.

Burmese Yuhina *Yuhina humilis*
Up to two were seen on 15 April and three on 16 April 2006 (GT); a group of three individuals was seen on 30 December 2006 (Gidean/ROH); two individuals from 26–28 March 2007 (TZN); two separate individuals on 10 June 2008 (Gidean/FER); two together on 8 November and four (in two separate groups) on 15 November 2008 (Gidean/MRB); a single bird on 3 December 2008 (Gidean/JAE); a flock of six birds on 10 December 2009 (Gidean/JAE). All sightings were in evergreen forest at Kalaw reservoir.

Burmese Yuhina is a restricted-range resident of southern East Myanmar and north Tenasserim, as well as parts of West and North-West Thailand (Robson 2005, 2008). Our records indicate it is locally common at Kalaw, yet appears to have been overlooked historically. It was recorded from other hills in the far west of Shan State (Wickham 1929–1930) and was reported to be 'very common' on a mountain 60 km south of Kalaw (Oates 1894), where it was collected again by Bingham (1903). In Kayah State, Smith *et al.* (1940) observed parties of 4–5 birds in pine-forest at 'about 6,000 ft' (c. 1,800 m).

Oriental Skylark *Alauda gulgula*
A single report from April 1895 (Rippon 1896) is the only record for Kalaw.

Oriental Skylark was historically a common resident in Myanmar (Smythies 1953). In southern Shan State it was 'very common' (Bingham & Thompson 1900, Rippon 1901), although it was not recorded there by other authors (Oates 1894, Harington 1902, Thompson & Craddock 1902, Bingham 1903, Meyer de Schauensee 1934, 1946). Myanmar populations comprise residents and winter visitors; it is currently regarded as an uncommon winter visitor to West, North and East Myanmar and is an uncommon to fairly common resident almost throughout (Robson 2008).

Historical records suggest the species may have been widely distributed but only locally abundant in southern Shan State. Cook (1913) visited Kalaw in the same month as Rippon (April) but did not record the species. The absence of other records from Kalaw may indicate the species never occurred there in large numbers. Of potential concern, most recent (2005–2009) visits to Kalaw were mainly in winter (November, December) when wintering birds may have been present, but no skylarks were recorded there or at sites in suitable open-country habitats up to 30 km further east. Alternatively, recent visits may have missed the summer breeding season, when male birds conduct conspicuous display flights and are easily detected.

Severe declines of the closely related Eurasian Skylark *A. arvensis* and other farmland birds have occurred in Europe due to agricultural intensification (Donald *et al.* 2001), and there is increasing evidence for similar declines of Oriental Skylark in South-East Asia (Duckworth 2007). New records (or their absence) of this species from Kalaw or nearby areas of Shan State would be of interest.

Fire-tailed Sunbird *Aethopyga ignicauda*
An immature male was seen on 28 December 2005 in evergreen forest at Kalaw reservoir (Gidean/ROH).

This is the first record from East Myanmar. Misidentification with the similar Mrs Gould's Sunbird *A. gouldiae* was ruled out due to the bright red tail colour of this individual. Robson (2005, 2008) describes the species

as a common resident in West and North Myanmar and a vagrant to Central Myanmar and North-West Thailand.

House Sparrow *Passer domesticus* and Eurasian Tree Sparrow *P. montanus*
Rippon (1896) and Cook (1913) reported only House Sparrow at Kalaw, the latter noting it was 'common around the village'; the only recent records are of 11 birds from 26–28 March 2007 and 38 birds from 21–22 July 2007 (TZN). In contrast, we found Eurasian Tree Sparrow to be common at Kalaw town, recorded on 13 of 14 visits from 2005–2009, Appendix 1; 90–100+ birds/visit observed in March, July and November 2007 (TZN); 30+ birds/day observed between 8 and 15 November 2008 (Gidean/MRB).

In the Shan hills near Kalaw, Eurasian Tree Sparrow was said to be the commonest sparrow species while House Sparrow was observed 'occasionally' (Bingham & Thompson 1900, Wickham 1929–1930); in contrast Rippon (1901) stated House Sparrow to be 'very common'. Further east in Shan State, Meyer de Schauensee (1946) recorded only Eurasian Tree Sparrow. Other authors do not mention either species for Shan State (Harington 1902, Thompson & Craddock 1902, Bingham 1903, Meyer de Schauensee 1934), but this may reflect a low survey effort toward these species rather than absence. Generally in Myanmar, Eurasian Tree Sparrow was considered the more abundant species and 'greatly outnumbered' House Sparrow, which had a more localised distribution but was common where it occurred (Harington 1909, 1909–1910, Smythies 1953).

Our records indicate Eurasian Tree Sparrow has colonised Kalaw in the past century, while House Sparrow may have declined over the same period.

Russet Sparrow *Passer rutilans*
A single specimen was collected at Kalaw in April 1895 (Rippon 1896, 1901); J. K. Stanford, in Stanford & Ticehurst (1935), 'saw a very large flock on a piece of waste ground at Kalaw (1,525 m), Southern Shan States, in August 1931'; one individual was seen at a roadside stop near Kalaw town on 14 April 2006 (Talbot 2006). These are the only records for Kalaw.

Elsewhere in East Myanmar, small numbers have been seen or collected over the past century. Two specimens were collected at Keng Tung in the extreme east of Shan State near the borders with Thailand and Yunnan (China) in 1933 and 1935 respectively (Meyer de Schauensee 1946), and in 2003 the species was observed at sites 100–150 km east of Kalaw (no other details given) (Htin Hla 2003). In Kayah State (south of Kalaw), two specimens were collected and another individual was seen in 1940 (Smith *et al.* 1943–1944).

Robson (2008) describes Russet Sparrow as a 'fairly common resident' in South-West, West, North, South (east) and East Myanmar, and a rare winter visitor to North-West and North-East Thailand. It appears to have declined in north-western Thailand (P. D. Round pers. comm.). Stanford's historical record of a 'very large flock' at Kalaw is noteworthy compared with the paucity of other local historical and contemporary sightings.

[Chestnut-shouldered Petronia *Petronia xanthocollis*
Baker (1926) stated that 'Sir S. M. Robinson records this bird as breeding in the Shan States at Kalau. The bird was shot and identified by him.' Wickham (1929–1930) also referred to the record, but Stanford & Ticehurst (1938–1939) noted that 'Mr. H. Whistler has put it beyond doubt that the record (2) of *Gymnoris xanthocollis xanthocollis* breeding in the Shan States cannot be accepted, and this bird may be deleted from the Burma list.' Smythies (1953) concurred with this view and did not include the species for the avifauna of Myanmar. The species is only known to occur as far east as West Bengal (Rasmussen & Anderton 2005).]

Blyth's Pipit *Anthus godlewskii*
Reported by Rippon (1897) with no other details; a single specimen was obtained by Cook (1913). These are the only records for Kalaw, and are also the first published records from East Myanmar.

Cook (1913) does not state whether he submitted his specimen to any institution (although he mentions that Rippon forwarded at least one of his other specimens, a finch, to the Natural History Museum, UK). There are no specimens of Blyth's Pipit from Kalaw held at this museum (N.J. Collar *in litt.* 2010) and Cook's record cannot be evaluated. However, in addition to Blyth's Pipit, Cook (1913) also recorded Olive-backed Pipit *Anthus hodgsoni* at Kalaw, while Rippon (1901) listed five *Anthus* species for nearby areas of Shan State, of which three, Olive-backed Pipit, Paddyfield Pipit *A. rufulus* and Red-throated Pipit *A. cervinus*, were recorded at Kalaw between 2005 and 2009 (Appendix 1). These records suggest that Rippon and Cook were reasonably familiar with *Anthus* pipits and took some care in identifying them.

Smythies (1953) treated Blyth's Pipit as a subspecies '*thermophilus*' of '*Anthus novae-seelandiae*' and noted the 'larger forms' (including *thermophilus*) of this species occur throughout the country as winter visitors.

There are few records of Blyth's Pipit from Myanmar (Inskipp ms and references therein) and its national status is unclear. For Southern Shan State, Bingham & Thompson (1900) explicitly noted that they did not observe the species there; Rippon (1901) described it as 'not common'. Robson (2005, 2008) describes it as an uncommon winter visitor to West, Central and South Myanmar and north Tenasserim, but omitted East Myanmar from his distribution.

DISCUSSION

Our compilation of 302 bird species for Kalaw, including historical and provisional records, represents 56% of the approximately 535 species listed for the 'Southern Shan States' (Smythies 1953). This proportion is large: the region spans over 450 km across East Myanmar, yet the Kalaw records largely originate from within a 10 km radius of a single town and, within that, from a small site of remnant forest, and include few wetland species owing to the low extent and diversity of wetland habitats at Kalaw.

Recent (2005–2009) records for Kalaw include two that might involve globally threatened species (an unidentified *Gyps* vulture species and a provisional report of Dark-rumped Swift), at least six new records for East Myanmar (Lesser Cuckoo, Asian Brown Flycatcher, Asian House Martin, Hume's Warbler, Martens's Warbler and Fire-tailed Sunbird), one new breeding record for East Myanmar (Brown-breasted Flycatcher) and two new

altitudinal records for South-East Asia (Black-hooded Oriole and Bluethroat). Historical (1895–1912) Kalaw records include four globally threatened species (Mrs Hume's Pheasant, Sarus Crane, Red-headed Vulture and Giant Nuthatch) and one previously overlooked record for East Myanmar (Blyth's Pipit). Provisional (unconfirmed) records for three species, Oriental Cuckoo, Dark-rumped Swift, and Tickell's Blue Flycatcher, would, if confirmed, represent new records for East Myanmar (the cuckoo and swift) or a new altitudinal record for South-East Asia (the flycatcher), but see the accounts for these species.

Comparison with historical records indicates that Kalaw retains the majority of bird species documented 97–114 years previously, but with some notable exceptions. Twenty-two species recorded from 1895–1912 were not recorded from 2005–2009 (Table 1). The absence of recent records almost certainly reflects population declines for at least three species (Mrs Hume's Pheasant, Black Kite, Red-headed Vulture) and may be used to infer a decline or local extirpation for at least one other (Giant Nuthatch). For three others (Rufous-bellied Woodpecker, Black-billed Magpie, Oriental Skylark), the lack of recent records may indicate a change in local status, but declines cannot confidently be inferred (Table 1). Large-billed Crow, recorded in low numbers from 2005–2009, has probably declined; a century ago the species was described as common at Kalaw. For Oriental Pied Hornbill, a single record from 2005–2009 suggests the species occurs at low densities at Kalaw. The scarcity of phasianid sightings from 2005–2009 and complete absence of historical or recent records of *Arborophila* partridges is notable, and probably indicates intensive long-term hunting. Gidean (pers. obs.) has never observed any *Arborophila* partridges in the past 13 years of regular birdwatching at Kalaw, and frequent opportunistic hunting in the forests occurs (see below).

These records suggest that over the past 114 years, threatening processes to birds have had the greatest impacts on three bird categories: large-bodied forest species (pheasants and probably hornbills), one small forest species (Giant Nuthatch), and wide-ranging scavengers (kites, vultures, crows).

Of the other species only recorded from 1895–1912 (Table 1), the absence of recent records may be explained by sampling randomness (insufficient recent effort to detect these species), sightings of single birds in atypical habitats or at the limits of their natural range, or the strong seasonality of breeding and migration documented for many birds in East Myanmar. Most cuckoos and some snipe are summer or wet-season visitors (March–September) (Harington 1909, Kenny 1919, Wickham 1929–1930, Livesey 1933a, 1935d), while most resident forest and open-country birds of Shan State breed in March–May (Harington 1902, Wickham 1929–1930, Livesey 1933b, 1935a,c), when some cryptic species (e.g. nightjars *Caprimulgus* spp.) are probably more easily detected. These seasonal differences emphasise the need for further visits to Kalaw in summer (mid-February–mid-May) and the wet season (mid-May–mid-October).

Our Kalaw inventory is certainly incomplete, for at least three reasons: recent visits are skewed to winter, recent survey effort has been low (25 days), and most birdwatching on recent visits was undertaken in daylight hours, so some nocturnal species, e.g. scops owls *Otus* spp., frogmouths *Batrachostomus* spp. and nightjars, were probably overlooked. It seems likely that species known from nearby areas of Shan State may be recorded in the future, e.g. Golden-fronted Leafbird *Chloropsis aurifrons* and Chestnut-tailed Starling *Sturnus malabaricus* (the former 'common everywhere': Bingham & Thompson 1900).

Kalaw is located at the eastern edge of the Sino-Himalayan mountain forests, one of the key forest regions for threatened birds in Asia (BirdLife International 2003), and historically supported two of the six key birds listed for this region, Mrs Hume's Pheasant and Giant Nuthatch. Kalaw is not located in any of the 55 Important Bird Areas in Myanmar (BirdLife International 2004). The principal conservation value of Kalaw for birds is the presence of a small but protected and forested catchment at Kalaw reservoir, which has enabled the persistence of a partly intact assemblage of forest birds. This forest provides permanent or seasonal resources for a variety of resident and migratory species and, while too small to sustain large breeding populations of some birds (e.g. hornbills), contributes to their survival at a landscape level. Although the landscape outside this catchment is largely cultivated, numerous small patches of evergreen and pine-forest persist, and this is probably an important supporting factor which contributes to the survival of local forest bird communities. If threatening processes are removed, some species, such as pheasants and partridges, might recolonise the area. Kalaw reservoir also supports two restricted-range taxa, Burmese Yuhina and the subspecies *castanoptera* of Black-headed Sibia.

Currently the largest threat to the forest of Kalaw reservoir is encroaching settlement, which is resulting in gradual but incremental burning and clearing of forest along the catchment boundaries (all authors pers. obs.). This appears to correspond to a decrease in the area of catchment under protection; in the 1920s, the total designated catchment area was apparently '20 square miles' (*c.* 52 km^2) (local residents pers. comm.). We could not verify this, but if correct, would imply that the designated area under protection (and presumably of forest) has declined by 85% over the past 90 years, to its current area of c.8 km^2 (see Study Area).

Within the catchment, local communities graze their cattle, collect fuelwood and non-timber forest products, and fish (all authors pers. obs.). Opportunistic hunting of wildlife occurs frequently (Gidean pers. obs.). Mature trees from the catchment are harvested, apparently by local communities and also by residents of Kalaw town, to provide timber for house construction (Gidean pers. obs.). The cumulative impacts of these activities are causing visible degradation of the remaining forest (Gidean pers. obs.; H. Singh, local trekking guide, pers. comm.). We observed no burning or timber logging in the catchment during our visits, no vehicles, and few people (over a three-day period in November 2008, 10–20 people/day were observed in the catchment: MRB pers. obs.). In November 2008 sections of the access track leading to the reservoir were being upgraded (MRB pers. obs.) and this may lead to increased visitation of the interior forest. Although these activities occur in many protected areas in Myanmar (Rao *et al.* 2002), the levels of human activity we observed were considerably lower than in many protected areas of nearby parts of Thailand and Laos (all authors pers. obs.). This, and the low human densities surrounding Kalaw reservoir, are probably also

significant factors in the persistence of many forest birds at Kalaw.

In the early 1900s, Kalaw apparently retained extensive pine and evergreen forest that was later cleared for construction of the Southern Shan Railway (local residents pers. comm.). Kalaw's expansion from a 'village' (Rippon 1896) to town over the past century has resulted in the conversion of most nearby land for agriculture. In the 1930s, at sites 50 km east of Kalaw, Livesey (1939b) noted pheasants and other wildlife were becoming scarce due to loss of natural habitats from systematic forest burning by the Forest Service, increasing numbers of livestock, and conversion to agricultural lands. Early colonial policies emphasised logging (Bryant 1993), and in Central Myanmar this resulted in extensive loss of old-growth forest prior to designation of at least one protected area, followed by greater access of local communities (Myint Aung *et al.* 2004). It is likely that as Kalaw expanded similar processes impacted its local environment.

Kalaw reservoir and its catchment are protected and managed under district regulations, which prohibit timber removal, cultivation and hunting. This is enforced by forest rangers; we met one team in November 2008 comprised of five rangers, who patrol the catchment on a weekly basis, on foot, returning to Kalaw town each evening (rangers pers. comm.). Each ranger was equipped with a uniform, walking boots, waterbottle, utility knife and truncheon, with two pairs of binoculars and one hand-held radio unit ('walkie-talkie') for the team (MRB pers. obs.). Signs located in the catchment state 'no timber cutting'. These enforcement efforts provide a positive basis for management of Kalaw reservoir and its catchment, although further efforts are required to halt ongoing and cumulative loss of the remaining forest.

Visiting birdwatchers represent an opportunity and information source to improve understanding of the birds of East Myanmar. A small but increasing number of birdwatchers are visiting Kalaw (Gidean pers. obs.), and together with Inle Lake (33 km to the east) Kalaw has probably received more recent bird survey effort than any other site in East Myanmar. At Kalaw, new records of phasianids, hornbills, Giant Nuthatch, scavenging species (kites, vultures, Large-billed Crow) and Oriental Skylark would help clarify the current status of these species. Visits in summer (mid-February–mid-May) and the wet season (mid-May–mid-October) would almost certainly result in new bird records for Kalaw.

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APPENDIX 1
Bird records for Kalaw: historical (columns 1–4, 1895–1912) and recent (columns 5–18, 2005–2009)

Observer	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Year of observations	**1895**	**1896**	**1899**	**1912**	**2005**	**2006**	**2006**	**2006**	**2006**	**2006**	**2007**	**2007**	**2007**	**2007**	**2008**	**2008**	**2008**	**2009**
Species	**Apr**	**Apr–May**	**?**	**Apr**	**Dec**	**Apr**	**Nov–Dec**	**Dec**	**Dec**	**Dec**	**Feb**	**Mar**	**Jul**	**Nov**	**Jun**	**Nov**	**Dec**	**Dec**
CHINESE FRANCOLIN *Francolinus pintadeanus* [*F. chinensis*]	X			X	X	X		X				X			H			X
RED JUNGLEFOWL *Gallus gallus*											X							
MRS HUME'S PHEASANT *Syrmaticus humiae* [*Phasianus humei / burmanicus*]		X	X	X														
LESSER WHISTLING-DUCK *Dendrocygna javanica*													X					
SPOT-BILLED DUCK *Anas poecilorhyncha*													X					
BARRED BUTTONQUAIL *Turnix suscitator* [*T. taigoor / T. pugnax*]	X			X														X
EURASIAN WRYNECK *Jynx torquilla*										X								
SPECKLED PICULET *Picumnus innominatus*						X			X		X	X			X	X		
WHITE-BROWED PICULET *Sasia ochracea*																X		
GREY-CAPPED PYGMY WOODPECKER *Dendrocopos* [*Iyngipicus*] *canicapillus*	X			X		X		X			X				X	X		X
FULVOUS-BREASTED WOODPECKER *Dendrocopos macei*														X				
STRIPE-BREASTED WOODPECKER *Dendrocopos* [*Dendrocopus*] *atratus*	X													X	X			X
RUFOUS-BELLIED WOODPECKER *Dendrocopos* [*Hypopicus*] *hyperythrus*	X		X	X														
GREAT SPOTTED WOODPECKER *Dendrocopos major* [*D. cabanisi*]	(X)			X					X	X								
GREY-HEADED WOODPECKER *Picus canus* [*Gecinus occipitalis*]				X						X								
COMMON FLAMEBACK *Dinopium javanense*					X											X	X	X
GREATER FLAMEBACK *Chrysocolaptes lucidus* [*C. guttacristatus*]		X		X			X		X	X		X	X				X	X
BAY WOODPECKER *Blythipicus pyrrhotis*					X	X			H	X		X	X		X		X	H
GREAT BARBET *Megalaima virens*	X			X	X	X	X	X	X	X		X	X		H	X		X
LINEATED BARBET *Megalaima lineata*							X											
BLUE-THROATED BARBET *Megalaima asiatica*					X	X	X	X	X	X	X	X	X	X	X	X	X	X
BLUE-EARED BARBET *Megalaima australis*							X		X			X	X			X		
COPPERSMITH BARBET *Megalaima haemacephala*					X		X		X	X			X	X	X	X	X	
ORIENTAL PIED HORNBILL *Anthracoceros albirostris*																X		
COMMON HOOPOE *Upupa epops* [*U. indica*]		X		X	X						X			X	X	X	X	
RED-HEADED TROGON *Harpactes erythrocephalus*					X					X						X		
INDIAN ROLLER *Coracias benghalensis* [*C. affinis*]	X			X	X		X	X	X	X		X	X	X		X	X	X
COMMON KINGFISHER *Alcedo atthis*					X		X		X			X				X		X

Observer	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Year of observations	**1895**	**1896**	**1899**	**1912**	**2005**	**2006**	**2006**	**2006**	**2006**	**2006**	**2007**	**2007**	**2007**	**2007**	**2008**	**2008**	**2008**	**2009**
Species	**Apr**	**Apr–May**	**?**	**Apr**	**Dec**	**Apr**	**Nov–Dec**	**Dec**	**Dec**	**Dec**	**Feb**	**Mar**	**Jul**	**Nov**	**Jun**	**Nov**	**Dec**	**Dec**
White-throated Kingfisher *Halcyon smyrnensis*					X		X	X	X	X	X	X	X			X	X	X
Black-capped Kingfisher *Halcyon pileata*							X											
Pied Kingfisher *Ceryle rudis* [*C. varia*]	X																	
Blue-bearded Bee-eater *Nyctyornis athertoni*															X	X		X
Green Bee-eater *Merops orientalis* [*M. viridis*]		X																
Blue-tailed Bee-eater *Merops philippinus*																X		
Chestnut-headed Bee-eater *Merops leschenaulti*																X		
Chestnut-winged Cuckoo *Clamator coromandus*						X												
Large Hawk Cuckoo *Hierococcyx sparverioides*		X		X	H				X						H			
Hodgson's Hawk Cuckoo *Hierococcyx fugax*				X														
Indian Cuckoo *Cuculus micropterus*	X											X						
Eurasian Cuckoo *Cuculus canorus*	X			X		X						X						
?Oriental Cuckoo *Cuculus saturatus*												X?						
Lesser Cuckoo *Cuculus poliocephalus*															X			
Plaintive Cuckoo *Cacomantis merulinus*				X		X						X	X		H		X	
Asian Emerald Cuckoo *Chrysococcyx maculatus*						X	X											
Drongo Cuckoo *Surniculus lugubris*						X												
Asian Koel *Eudynamys scolopacea* [*Eudynamis honorata*]	X			X								H						
Green-billed Malkoha *Phaenicophaeus* [*Rhopodytes*] *tristis*		X				X	X			X			X			X	X	
Greater Coucal *Centropus sinensis*													X					
Rose-ringed Parakeet *Psittacula krameri* [*Palaeornis torquatus*]		X																
Grey-headed Parakeet *Psittacula* [*Palaeornis*] *finschii*		X		X	X					X			X		X	X	X	
Himalayan Swiftlet *Collocalia brevirostris*					X	X		X	X	X		X			X	X	X	X
Brown-backed Needletail *Hirundapus giganteus*																X		
Asian Palm Swift *Cypsiurus balasiensis*			X?				X						X					
Fork-tailed Swift *Apus pacificus*					X			X							X	X	X	
Dark-rumped Swift *Apus acuticauda*					X?													
House Swift *Apus affinis*															X			
Crested Treeswift *Hemiprocne coronata*						X												
Barn Owl *Tyto alba*					X								X					
Collared Scops Owl *Otus bakkamoena*															X			
Collared Owlet *Glaucidium brodiei*					H			H		H					H	X	H	

Observer	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Year of observations	**1895**	**1896**	**1899**	**1912**	**2005**	**2006**	**2006**	**2006**	**2006**	**2006**	**2007**	**2007**	**2007**	**2007**	**2008**	**2008**	**2008**	**2009**
Species	**Apr**	**Apr–May**	**?**	**Apr**	**Dec**	**Apr**	**Nov–Dec**	**Dec**	**Dec**	**Dec**	**Feb**	**Mar**	**Jul**	**Nov**	**Jun**	**Nov**	**Dec**	**Dec**
Asian Barred Owlet *Glaucidium cuculoides*																X		
Spotted Owlet *Athene brama*						X												
Grey Nightjar *Caprimulgus indicus*																X		
Large-tailed Nightjar *Caprimulgus macrurus*		X		X														
Rock Pigeon *Columba livia* (feral variety) [*C. intermedia*]	X				X		X	X	X	X	X				X	X	X	X
Oriental Turtle Dove *Streptopelia orientalis* [*Turtur meena*]	X			X	X	X		X	X	X	X	X	X			X	X	X
Spotted Dove *Streptopelia chinensis* [*Turtur tigrinus*]		X		X	X		X	X	X	X		X	X	X		X	X	X
Red Collared Dove *Streptopelia* [*Aenopopelia*] *tranquebarica*				X														
Barred Cuckoo Dove *Macropygia unchall*																	X	
Emerald Dove *Chalcophaps indica*															X			
Pompadour Green Pigeon *Treron pompadora*																X	X	
Yellow-footed Green Pigeon *Treron phoenicoptera*					X	X											X	X
Pin-tailed Green Pigeon *Treron apicauda*					X	X		X	X								X	X
Wedge-tailed Green Pigeon *Treron sphenura*						X									X	X		X
Mountain Imperial Pigeon *Ducula badia*						X			H									
Sarus Crane *Grus antigone*	X																	
Black-tailed Crake *Porzana bicolor*																		X
Common Moorhen *Gallinula chloropus*							X											
Red-wattled Lapwing *Vanellus indicus* [*Lobivanellus atronuchalis* / *Sarcogrammus atrinuchalis*]	X			X		X					X	X						
Pintail Snipe *Gallinago stenura*	X																	
Green Sandpiper *Tringa ochropus*							X											
Wood Sandpiper *Tringa glareola*							X											
Common Sandpiper *Actitis* [*Totanus*] *hypoleucos*							X											
Oriental Honey-buzzard *Pernis ptilorhyncus*													X					
Black-shouldered Kite *Elanus caeruleus*							X					X	X			X	X	
Black Kite *Milvus migrans* [*M. govinda*]		X		X														
Red-headed Vulture *Sarcogyps* [*Otogyps*] *calvus*				X														
Crested Serpent Eagle *Spilornis cheela*							X							X				
Crested Goshawk *Accipiter trivirgatus*					X	X				X	X				X	X	X	X
Shikra *Accipiter badius*						X						X	X			X		
Eurasian Sparrowhawk *Accipiter nisus*							X										X	

Observer	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Year of observations	**1895**	**1896**	**1899**	**1912**	**2005**	**2006**	**2006**	**2006**	**2006**	**2006**	**2007**	**2007**	**2007**	**2007**	**2008**	**2008**	**2008**	**2009**
Species	**Apr**	**Apr–May**	**?**	**Apr**	**Dec**	**Apr**	**Nov–Dec**	**Dec**	**Dec**	**Dec**	**Feb**	**Mar**	**Jul**	**Nov**	**Jun**	**Nov**	**Dec**	**Dec**
COMMON BUZZARD *Buteo buteo*					X		X	X	X	X	X	X		X		X	X	X
CHANGEABLE HAWK EAGLE *Spizaetus cirrhatus*						X												X
COLLARED FALCONET *Microhierax caerulescens*							X											
COMMON KESTREL *Falco tinnunculus*					X	X		X						X		X	X	X
PEREGRINE FALCON *Falco peregrinus*										X								
GREAT EGRET *Casmerodius albus*							X											X
INDIAN/CHINESE POND HERON *Ardeola grayii/bacchus*							X									X		
LITTLE HERON *Butorides striatus*																X		
SILVER-BREASTED BROADBILL *Serilophus lunatus*									X	X					X			
LONG-TAILED BROADBILL *Psarisomus dalhousiae*		X		X	H							X	X		X			X
BLUE-WINGED LEAFBIRD *Chloropsis cochinchinensis*							X											
ORANGE-BELLIED LEAFBIRD *Chloropsis hardwickii*	X			X	X	X	X	X	X	X	X		X		X	X	X	
BROWN SHRIKE *Lanius cristatus*							X		X					X		X	X	X
BURMESE SHRIKE *Lanius collurioides*	X			X	X			X	X		X		X		X	X	X	
LONG-TAILED SHRIKE *Lanius schach* [*L. nigriceps*]	(X)				X	X	X	X		X	X		X	X	X	X	X	X
GREY-BACKED SHRIKE *Lanius tephronotus*	(X)				X	X	X			X			X					X
EURASIAN JAY *Garrulus glandarius* [*G. leucotis*]	X			X	X	X	X	X	X	X			X	X	X	X	X	X
RED-BILLED BLUE MAGPIE *Urocissa erythrorhyncha* [*U. occipitalis*]	X			X	X	X		X	X	X		X	X	X	X	X	X	X
COMMON GREEN MAGPIE *Cissa chinensis*															X			X
RUFOUS TREEPIE *Dendrocitta vagabunda*													X	X				
GREY TREEPIE *Dendrocitta formosae*					X		X	X		X			X	X	X	X	X	H
BLACK-BILLED MAGPIE *Pica pica* [*P. rustica* / *P. serica*]	X																	
HOUSE CROW *Corvus splendens* [*C. insolens*]				X	X		X	X		X		X	X	X		X	X	
LARGE-BILLED CROW *Corvus macrorhynchos*	X			X	X	X	X	X		X	X	X	X	X		X	X	
ASHY WOODSWALLOW *Artamus fuscus*	X				X	X		X		X		X	X		X	X	X	
?BLACK-NAPED ORIOLE *Oriolus chinensis* [*O. indicus*]	(X)?													X?				
SLENDER-BILLED ORIOLE *Oriolus tenuirostris*	X			X	X		X	X	X	X	X			X		X	X	X
BLACK-HOODED ORIOLE *Oriolus xanthornus*							X	X		X	X		X	X				
MAROON ORIOLE *Oriolus traillii*		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X
LARGE CUCKOOSHRIKE *Coracina macei*					X	X	X	X		X				X	X	X	X	
INDOCHINESE CUCKOOSHRIKE *Coracina polioptera*					X				X					X				
BLACK-WINGED CUCKOOSHRIKE *Coracina melaschistos* [*Campophaga melanoptera*]		X		X	X	X		X			X				X	X	X	

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Species																		
Rosy Minivet *Pericrocotus roseus*							X						X			X		
Small Minivet *Pericrocotus cinnamomeus* [*P. peregrinus*]	X			X								X			X			
Grey-chinned Minivet *Pericrocotus solaris*				X	X				X	X	X		X				X	X
Long-tailed Minivet *Pericrocotus ethologus*									X	X								X
Short-billed Minivet *Pericrocotus brevirostris*	(X)?									X					X	X	X	
Scarlet Minivet *Pericrocotus flammeus* [*P. speciosus* / *P. fraterculus*]	X	X			X	X	X	X	X	X	X	X	X	X	X	X		
Bar-winged Flycatcher-shrike *Hemipus picatus*			X		X	X			X			X	X		X	X	X	X
White-throated Fantail *Rhipidura albicollis*	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Black Drongo *Dicrurus macrocercus*					X		X		X		X	X	X	X			X	X
Ashy Drongo *Dicrurus leucophaeus* [*D. cinereaceus*]	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bronzed Drongo *Dicrurus aeneus*			X		X	X	X	X	X		X	X	X	X	X	X	X	X
Lesser Racket-tailed Drongo *Dicrurus remifer*				X	X	X				X					X			
Spangled Drongo *Dicrurus hottentottus*					X							X		X	X	X		
Greater Racket-tailed Drongo *Dicrurus paradiseus*												X	X					
Black-naped Monarch *Hypothymis azurea*					X	X	X	X	X	X			X	X	X	X	X	
Asian Paradise-flycatcher *Terpsiphone paradisi*						X						X			X			
Common Iora *Aegithina tiphia*		X		X	X		X	X		X		X	X	X		X	X	X
Large Woodshrike *Tephrodornis gularis* [*T. pelvicus*]	X																	X
Chestnut-bellied Rock Thrush *Monticola rufiventris*			X															
Blue Rock Thrush *Monticola solitarius*					X			X	X	X						X		
Blue Whistling Thrush *Myophonus caeruleus* [*Myiophoneus eugenii*]	X			X				X	X	X								
Orange-headed Thrush *Zoothera citrina*															X			
Long-tailed Thrush *Zoothera dixoni*						X												
Black-breasted Thrush *Turdus dissimilis* [*Merula protomelaena*]		X		X					X		X	X			X	X		
Eyebrowed Thrush *Turdus obscurus*																	X	
Lesser Shortwing *Brachypteryx leucophrys*								H										
Dark-sided Flycatcher *Muscicapa sibirica*																X		
Asian Brown Flycatcher *Muscicapa dauurica*					X													
Brown-breasted Flycatcher *Muscicapa muttui*															X			

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SLATY-BACKED FLYCATCHER *Ficedula hodgsonii*								x										
RUFOUS-GORGETED FLYCATCHER *Ficedula strophiata*									x									x
RED-THROATED FLYCATCHER *Ficedula parva*					x	x	x	x	x	x	x	x		x		x	x	x
LITTLE PIED FLYCATCHER *Ficedula westermanni* [*Cyornis melanoleucus*]		x			x			x	x	x						x	x	x
SLATY-BLUE FLYCATCHER *Ficedula tricolor*									x									
VERDITER FLYCATCHER *Eumyias thalassina* [*Stoparola melanops*]				x	x	x		x	x	x	x	x	x	x	x	x	x	x
RUFOUS-BELLIED NILTAVA *Niltava sundara*						x			x					x		x		x
VIVID NILTAVA *Niltava vivida*					x											x		
PALE BLUE FLYCATCHER *Cyornis unicolor*		x		x														
BLUE-THROATED FLYCATCHER *Cyornis rubeculoides*		x	x	x				x		x								
HILL BLUE FLYCATCHER *Cyornis banyumas*					x	x		x	x	x	x				x	x	x	x
?TICKELL'S BLUE FLYCATCHER *Cyornis tickelliae*		x?					x?			x?			x?					
GREY-HEADED CANARY FLYCATCHER *Culicicapa ceylonensis*		x		x	x	x	x	x	x	x	x	x		x	x	x	x	x
SIBERIAN RUBYTHROAT *Luscinia calliope*					x			x	x							x	x	
BLUETHROAT *Luscinia svecica*																x		
ORIENTAL MAGPIE ROBIN *Copsychus saularis*	x			x	x	x	x	x	x	x	x	x	x	x		x	x	x
WHITE-RUMPED SHAMA *Copsychus malabaricus*															x			
DAURIAN REDSTART *Phoenicurus auroreus*					x		x	x	x	x	x	x				x	x	x
WHITE-TAILED ROBIN *Myiomela leucura*						x							x		x			
WHITE-CROWNED FORKTAIL *Enicurus leschenaulti*						x		x	x	x	x	x	x		x		x	
COMMON STONECHAT *Saxicola torquata*					x	x	x	x	x	x	x	x		x		x	x	x
PIED BUSHCHAT *Saxicola* [*Pratincola*] *caprata*	x			x	x		x	x	x	x	x	x	x	x		x	x	x
GREY BUSHCHAT *Saxicola* [*Oreicola*] *ferrea*	(x)			x	x		x	x	x	x	x	x	x	x		x	x	x
SPOT-WINGED STARLING *Saroglossa spiloptera* [*Psaroglossa spiloptera*]	(x)																	
BLACK-COLLARED STARLING *Sturnus* [*Graculipica*] *nigricollis*	x			x	x			x	x	x	x	x	x	x	x	x	x	
VINOUS-BREASTED STARLING *Sturnus burmannicus* [*Graculipica burmanica*]	x											x		x		x	x	
COMMON MYNA *Acridotheres tristis*		x			x		x	x	x	x		x	x	x		x	x	
WHITE-VENTED MYNA *Acridotheres cinereus* [*Aethiopsar grandis*] (=*A. grandis*)	x							x	x			x	x				x	

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Species																		
Collared Myna *Acridotheres albocinctus* [*Aethiopsar albicinctus*]	X							X	X	X		X						
Hill Myna *Gracula religiosa*							X											
Chestnut-vented Nuthatch *Sitta nagaensis*				X	X			X	X	X						X	X	
Chestnut-bellied Nuthatch *Sitta castanea* [*S. neglecta*]	X																	
Velvet-fronted Nuthatch *Sitta frontalis*		X			X	X	X	X	X	X		X	X	X	X	X	X	X
Giant Nuthatch *Sitta magna*		X		X														
Great Tit *Parus major* [*P. minor* / *P. commixtus*]	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Yellow-cheeked Tit *Parus* [*Machlolophus*] *spilonotus*	X				X				X	X					X	X		
Black-throated Tit *Aegithalos concinnus* [*Aegithaliscus manipurensis* / *pulchellus*]	X					X			X			X				X		X
Plain Martin *Riparia paludicola*														X				
Barn Swallow *Hirundo rustica*					X		X		X			X	X	X		X	X	X
Wire-tailed Swallow *Hirundo smithii*	X		X				X					X	X					
Red-rumped Swallow *Hirundo daurica*					X		X	X		X		X	X	X		X	X	X
Striated Swallow *Hirundo striolata*		X			X						X				X			X
Asian House Martin *Delichon dasypus*									X							X?		X
Crested Finchbill *Spizixos canifrons*					X		X	X		X			X			X	X	X
Striated Bulbul *Pycnonotus* [*Alcurus*] *striatus*	X																	
Black-crested Bulbul *Pycnonotus melanicterus* [*Otocompsa flaviventris*]	(X)			X	X		X	X	X	X	X			X		X	X	X
Red-whiskered Bulbul *Pycnonotus jocosus* [*Otocompsa emeria*]	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X
Brown-breasted Bulbul *Pycnonotus xanthorrhous*	(X)			X	X			X	X	X	X	X	X	X	X	X	X	
Red-vented Bulbul *Pycnonotus cafer* [*Molpastes nigripileus*]	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sooty-headed Bulbul *Pycnonotus aurigaster*					X	X		X	X	X		X	X	X	X		X	
Flavescent Bulbul *Pycnonotus* [*Xanthixus*] *flavescens*	X				X		X	X	X	X	X	X	X		X	X	X	X
Olive Bulbul *Iole virescens* [*Hemixus tickelli*]		X																
Mountain Bulbul *Ixos mcclellandii*					X		X	X	X	X		X	X	X	X	X	X	X
Ashy Bulbul *Hemixos flavala*					X	X	X	X	X	X	X	X	X		X	X	X	X
Black Bulbul *Hypsipetes leucocephalus* [*H. concolor*]	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
White-headed Bulbul *Hypsipetes thompsoni*															X			
Brown Prinia *Prinia polychroa* [*Suya crinigera*]				X				X			X	X	X	X	X	X		X
Hill Prinia *Prinia atrogularis* [*Suya superciliaris*]	X				X	X			X					X	X		X	X

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RUFESCENT PRINIA *Prinia rufescens*					X													
GREY-BREASTED PRINIA *Prinia hodgsonii*					X		X	X		X		X	X	X	X	X	X	H
YELLOW-BELLIED PRINIA *Prinia flaviventris*														X				
PLAIN PRINIA *Prinia inornata*							X					X						
CHESTNUT-FLANKED WHITE-EYE *Zosterops erythropleurus*					X		X	X		X	X	X		X		X	X	X
ORIENTAL WHITE-EYE *Zosterops palpebrosus* [*Z. aureiventris*]		X			X	X	X	X	X				X	X		X		
JAPANESE WHITE-EYE *Zosterops japonicus* [*Z. simplex*]	X		X	X			X	X	X	X	X					X	X	X
SLATY-BELLIED TESIA *Tesia olivea*															X			
GREY-BELLIED TESIA *Tesia cyaniventer*																	X	X
ASIAN STUBTAIL *Urosphena squameiceps*					X					X						X		
SPOTTED BUSH WARBLER *Bradypterus thoracicus*							X						X					
LANCEOLATED WARBLER *Locustella lanceolata*					X				H									
THICK-BILLED WARBLER *Acrocephalus aedon*									X									
COMMON TAILORBIRD *Orthotomus sutorius*				X	X		X	X	X			X	X	X		X	X	X
DUSKY WARBLER *Phylloscopus fuscatus*						X	X	X		X	X	X		X		X	X	X
TICKELL'S LEAF WARBLER *Phylloscopus affinis*				X			X	X		X	X			X				
BUFF-THROATED WARBLER *Phylloscopus subaffinis*								X	X	X							X	X
YELLOW-STREAKED WARBLER *Phylloscopus armandii*					X				X									
RADDE'S WARBLER *Phylloscopus* [*Herbivocula*] *schwarzi*				X	X				X	X						X	X	
YELLOW-BROWED WARBLER *Phylloscopus inornatus* [*P. superciliosus*]	X				X		X	X	X	X				X		X	X	X
HUME'S WARBLER *Phylloscopus humei*									X		X					X		X
GREENISH WARBLER *Phylloscopus trochiloides* spp. [*Acanthopneuste plumbeitarsus*]						X	X	X	X	X	X	X				X	X	X
BLYTH'S LEAF WARBLER *Phylloscopus reguloides*									X		X							
WHITE-TAILED LEAF WARBLER *Phylloscopus* [*Acanthopneuste*] *davisoni*	X			X		X		X	X	X	X	X			X		X	X
GREY-CROWNED WARBLER *Seicercus tephrocephalus* [*Cryptolopha tephrocephala*]	(X)													X		X	X	X
BIANCHI'S WARBLER *Seicercus valentini*									X			X		X		X	X	X
MARTENS'S (=EMEI SHAN) WARBLER *Seicercus omeiensis*								X										X
CHESTNUT-CROWNED WARBLER *Seicercus castaniceps*					X													
STRIATED GRASSBIRD *Megalurus palustris*		X		X											X			X
LESSER NECKLACED LAUGHINGTHRUSH *Garrulax monileger*					X										X	X	X	

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GREATER NECKLACED LAUGHINGTHRUSH *Garrulax pectoralis*															X			
BLACK-THROATED LAUGHINGTHRUSH *Garrulax chinensis*					X			H							X	X		
WHITE-BROWED LAUGHINGTHRUSH *Garrulax* [*Dryonastes*] *sannio*	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CHESTNUT-CROWNED LAUGHINGTHRUSH *Garrulax erythrocephalus*						X		X	X	X					X	X	X	X
RED-FACED LIOCICHLA *Liocichla phoenicea*					H	X		X		X						X	X	X
PUFF-THROATED BABBLER *Pellorneum ruficeps* [*P. minus*]				X	X		X	X	X	X	X		X			X		X
RUSTY-CHEEKED SCIMITAR BABBLER *Pomatorhinus erythrogenys* [*P. imberbis*]		X		X	X	X		X	H	X	X			X	X	X	X	X
WHITE-BROWED SCIMITAR BABBLER *Pomatorhinus schisticeps* [*P. nuchalis / ripponi*]	(X)			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STREAKED WREN BABBLER *Napothera brevicaudata*									X									
RUFOUS-FRONTED BABBLER *Stachyris* [*Stachyrhidopsis*] *rufifrons*				X		X			X									
RUFOUS-CAPPED BABBLER *Stachyris ruficeps*																	X	X
GOLDEN BABBLER *Stachyris chrysaea*					X	X		X	X	X	X	X	X	X	X	X	X	X
GREY-THROATED BABBLER *Stachyris nigriceps*							X		H	X								
STRIPED TIT BABBLER *Macronous gularis*													H		H			
CHESTNUT-CAPPED BABBLER *Timalia pileata*															X	X		
YELLOW-EYED BABBLER *Chrysomma sinense* [*Pyctorhis sinensis*]		X			X		X			X		X	X		X	X	X	
SILVER-EARED MESIA *Leiothrix argentauris*					X	X		X	X	X	X	X	X	X	X	X	X	X
WHITE-BROWED SHRIKE BABBLER *Pteruthius flaviscapis* [*P. aeralatus*]	X					X		X	X	X	X					X		X
BLACK-EARED SHRIKE BABBLER *Pteruthius melanotis*																X		
SPECTACLED BARWING *Actinodura ramsayi*		X		X	X	X		X	X	X	X		X		X	X	X	X
BLUE-WINGED MINLA *Minla cyanouroptera*					X			X	X	X					X		X	X
BROWN-CHEEKED FULVETTA *Alcippe poioicephala*														X				
GREY-CHEEKED FULVETTA *Alcippe morrisonia*					X		X	X		X	X	X			X	X	X	X
RUSTY-CAPPED FULVETTA *Alcippe dubia*							X											
RUFOUS-BACKED SIBIA *Heterophasia annectans*													X					
BLACK-HEADED SIBIA *Heterophasia melanoleuca* [*Lioptila melanoleuca / castanoptera*]	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BURMESE YUHINA *Yuhina humilis* [*Ixulus humilis*]						X				X		X			X	X	X	X

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Species	**Apr**	**Apr–May**	**?**	**Apr**	**Dec**	**Apr**	**Nov–Dec**	**Dec**	**Dec**	**Dec**	**Feb**	**Mar**	**Jul**	**Nov**	**Jun**	**Nov**	**Dec**	**Dec**
WHITE-BELLIED YUHINA *Yuhina* [*Erpornis*] *zantholeuca*					X	X			X	X			X		X	X	X	
GREY-HEADED PARROTBILL *Paradoxornis gularis*						X			H						X			
SPOT-BREASTED PARROTBILL *Paradoxornis guttaticollis*											X				X	X		
BURMESE BUSHLARK *Mirafra microptera*			X															
ORIENTAL SKYLARK *Alauda gulgula*	X																	
YELLOW-VENTED FLOWERPECKER *Dicaeum chrysorrheum*					X										X	X	X	
YELLOW-BELLIED FLOWERPECKER *Dicaeum melanoxanthum*																X		
PLAIN FLOWERPECKER *Dicaeum concolōr*			X		X		X						X	X	X	X		
FIRE-BREASTED FLOWERPECKER *Dicaeum ignipectus*	X				X			X		X	X				X	X	X	X
SCARLET-BACKED FLOWERPECKER *Dicaeum cruentatum*															X			
OLIVE-BACKED SUNBIRD *Nectarinia jugularis*							X											
PURPLE SUNBIRD *Nectarinia* [*Arachnechtra*] *asiatica*		X	X	X				X			X							
BLACK-THROATED SUNBIRD *Aethopyga saturata* [*A. sanguinipectus*]	X				X	X		X	X	X	X	X		X	X	X	X	X
FIRE-TAILED SUNBIRD *Aethopyga ignicauda*					X													
LITTLE SPIDERHUNTER *Arachnothera longirostra*																	X	
STREAKED SPIDERHUNTER *Arachnothera magna*									X						X	X		
HOUSE SPARROW *Passer domesticus*	X			X								X	X					
RUSSET SPARROW *Passer rutilans* [*P. cinnamomeus*]	X					X												
EURASIAN TREE SPARROW *Passer montanus*					X		X	X	X	X	X	X	X	X	X	X	X	X
FOREST WAGTAIL *Dendronanthus indicus*					X													
WHITE WAGTAIL *Motacilla alba* [*M. occularis*]	(X)				X		X	X	X	X				X		X		X
YELLOW WAGTAIL *Motacilla flava*					X					X				X		X	X	
GREY WAGTAIL *Motacilla cinerea*						X	X	X	X	X	X						X	X
PADDYFIELD PIPIT *Anthus rufulus*									X									
BLYTH'S PIPIT *Anthus godlewskii* [*A. striolatus* / *A. novae-seelandiae thermophilus*]		X		X														
OLIVE-BACKED PIPIT *Anthus hodgsoni* [*A. maculatus*]	X			X	X	X	X	X	X	X	X			X		X	X	X
RED-THROATED PIPIT *Anthus cervinus*									H									
WHITE-RUMPED MUNIA *Lonchura striata*							X	X	X	X					X		X	X
SCALY-BREASTED MUNIA *Lonchura punctulata* [*Uroloncha topela*]	X			X	X	X	X	X	X	X	X		X	X		X	X	X
BLACK-HEADED GREENFINCH *Carduelis ambigua* [*Chrysomitris ambiguus*]				X	X			X	X	X						X	X	X

Observer	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Year of observations	**1895**	**1896**	**1899**	**1912**	**2005**	**2006**	**2006**	**2006**	**2006**	**2006**	**2007**	**2007**	**2007**	**2007**	**2008**	**2008**	**2008**	**2009**
Species	**Apr**	**Apr–May**	**?**	**Apr**	**Dec**	**Apr**	**Nov–Dec**	**Dec**	**Dec**	**Dec**	**Feb**	**Mar**	**Jul**	**Nov**	**Jun**	**Nov**	**Dec**	**Dec**
COMMON ROSEFINCH *Carpodacus erythrinus*					X			X	X	X	X					X	X	X
CRESTED BUNTING *Melophus lathami* [*M. melanicterus*]	X			X	X					X								
LITTLE BUNTING *Emberiza pusilla*	X			X	X			X			X							
YELLOW-BREASTED BUNTING *Emberiza aureola*							X											
CHESTNUT BUNTING *Emberiza rutila*					X		X	X		X							X	X

Key

Historical records: 1=Rippon (1896); 2=Rippon (1897); 3=Bingham & Thompson (1900); 4=Cook (1913). Rippon (1896) includes records by E. W. Oates, which are indicated in parentheses; the records by Oates were presumably recorded prior to 1895 but the year is not given. Bingham & Thompson (1900) do not give a specific list for Kalaw; here we have included only those species they explicitly mention were recorded at Kalaw.

Recent records: 5=Gidean/Rob O. Hutchinson (ROH) 27–28 December 2005; 6=Graham Talbot 14–16 April 2006; 7=Thet Zaw Naing (TZN) 30 November–1 December 2006; 8=Gidean/ROH 12–13 December 2006; 9=Gidean/Dave Farrow 23–24 December 2006; 10=Gidean/ROH 29–30 December 2006; 11=Gidean/Chris Doughty 15–16 February 2007; 12=TZN 26–28 March 2007; 13=TZN 21–22 July 2007; 14=TZN 17–18 November 2007; 15=Gidean/Frank E. Rheindt 9–11 June 2008; 16=Gidean/Mark R. Bezuijen 7–15 November 2008; 17=Gidean/James A. Eaton 2–3 December 2008; 18=Gidean/James A. Eaton 9–10 December 2009.

Historical scientific names used by Rippon (1896, 1897), Bingham & Thompson (1900) and Cook (1913) which differ from current taxonomy are shown in square brackets [ ].

H = heard only. Records marked '?' are provisional.

Breeding birds of Kothri valley, eastern Garhwal Himalayan foothills, India

DHANANJAI MOHAN and RAMAN KUMAR

In May 2008 we carried out a bird survey in Kothri valley of Lansdowne Forest Division, Uttarakhand state, India, which lies between and links two very well known protected areas, Corbett Tiger Reserve and Rajaji National Park. We recorded 150 species out of which 75 showed confirmed and 34 probable evidence of breeding. We found evidence of extension in the westward limit of the distribution of some species (Striped Tit Babbler *Macronous gularis*, Blue-winged Minla *Minla cyanouroptera*, Nepal Fulvetta *Alcippe nipalensis*, White-bellied Yuhina *Yuhina* [*Erpornis*] *zantholeuca*). We also found some species at their lowest known altitudinal breeding ranges (Slaty-headed Parakeet *Psittacula himalayana*, Little Pied Flycatcher *Ficedula westermanni*, Verditer Flycatcher *Eumiyas thalassina* and Asian Brown Flycatcher *Muscicapa dauurica*). This highlights the importance of Kothri valley as an important avifaunal habitat in the western Himalayan region.

INTRODUCTION

The Western Himalayas constitute a critical priority Endemic Bird Area (BirdLife International 2003). The western Himalayan foothills of Uttarakhand state are known for their diverse avifaunal assemblage. Knowledge of the region's bird richness mainly comes from work done at two prominent protected areas, viz. Corbett Tiger Reserve (CTR) in the east and Rajaji National Park in the west, both of which are declared Important Bird Areas (Rahmani & Islam 2004). While the bird checklist of Corbett stands at 549 (Sharma *et al.* 2003), the one for Rajaji lists 312 species of birds (Pandey *et al.* 1994). The area providing ecological connectivity between these two protected areas is a stretch of forest that is a part of Lansdowne Forest Division (Fig. 1). The most important area within this division is the valley of Kothri Rau (river), which flows in an approximately north–south direction and is accessible through a forest road which runs along the river. The avifauna of the Kothri catchment has not been studied in detail. What little published information there is comes from Ghosh & Chatterjea (2006), who surveyed the birds at Saneh, the lowest end of the valley abutting agricultural landscape in mid-October 2003 and recorded 60 species including many winter migrants.

STUDY AREA

Kothri catchment is situated in south-eastern Garhwal in Uttarakhand state with altitude varying from 300 m to a little over 1,000 m. The forests here are moist deciduous and dominated by sal *Shorea robusta*. At the head of the valley, where altitude reaches c. 1,000 m, the vegetation has an admixture of plants from the subtropical zone with tree species like *Machilus odoratissima*, *Syzygium cumini* and *Litsea* sp. being present in large numbers. Some areas in the lower parts of the valley have been planted with teak *Tectona grandis*, an exotic to this region.

The Kothri river essentially carries the water from monsoonal rains which are active in the area from end of June to September. Later the river maintains a small flow of water throughout the winter and reduces to a trickle in summer months. The lower reaches of the river do not even have a surface flow and water is limited to pools on the low-lying stretches of the riverbed. The area is known to receive a precipitation of approximately 2,000 mm annually.

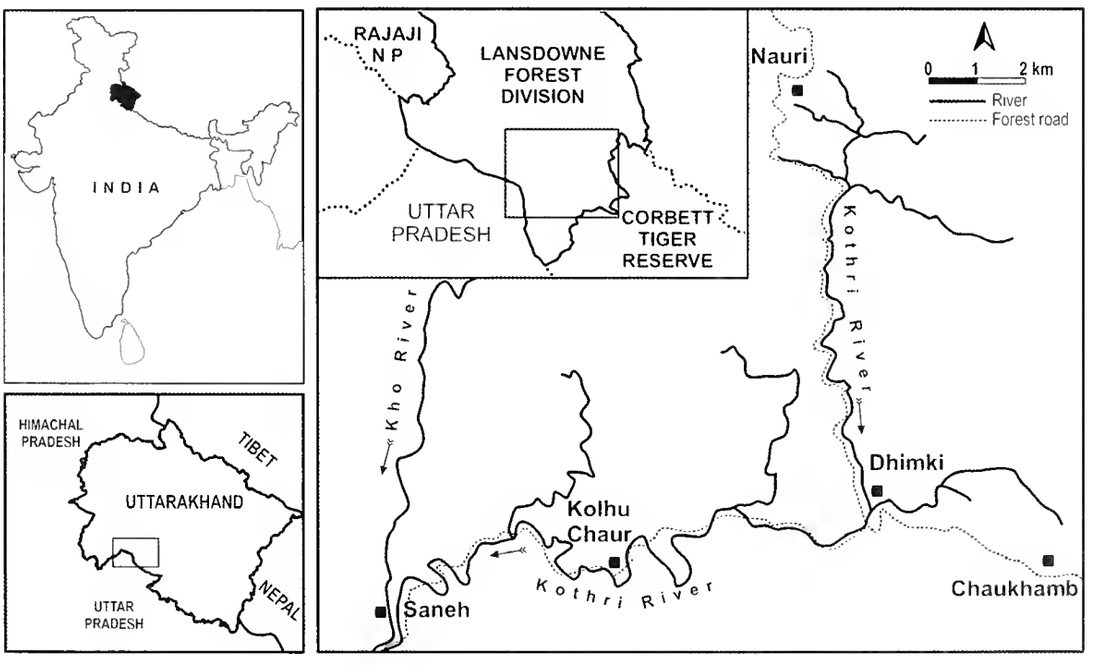

Figure 1. Location of Kothri valley, Lansdowne Forest Division, Uttarakhand, India.

METHODS

A visit to the Kothri valley was made from 21 to 26 May 2008 to collect data of birds and associated vegetation in the low-altitude forests of Uttarakhand Himalayan foothills. This survey was carried out under the Wildlife Institute of India–University of Chicago collaborative project 'Bird species numbers and densities in East and West Himalayas' (2007–2011). Kothri valley formed one of the many survey sites across the length of the Himalayas from Overa Sanctuary in Jammu and Kashmir in the west to Eaglenest Sanctuary in Arunachal Pradesh in the east. During the structured intensive data collection on the breeding birds of the study area of Kothri valley important observations were made at two locations, Kolhu Chaur in the lower part of Kothri valley (c.430 m) and Nauri near the head of the valley (c.860 m). In addition to these efforts, opportunistic records of birds encountered elsewhere in the valley, e.g. while approaching the intensive study locations or moving between them, or to other parts of the valley (e.g. Chaukhamb, c.600 m), were also noted. A special effort was made to record breeding-related activities of the birds encountered.

RESULTS

A total of 150 species of birds were observed during our survey of the Kothri valley. A large number of these were seen engaged in breeding-related activities. A list of birds seen during the survey along with observed breeding-related activity is annexed as Appendix. The most significant records are described below.

Westward range extensions

STRIPED TIT BABBLER *Macronous gularis*
A single bird was observed in the dense shrubs in front of the Kolhu Chaur Forest rest house. It was making the typical call and moving about in the shrubbery. The sighting seems to be the westernmost sighting of the bird. It has not been recorded from Corbett Tiger Reserve lying to the east of the surveyed area and has been known only from eastern Uttarakhand eastwards (Rasmussen & Anderton 2005).

BLUE-WINGED MINLA *Minla cyanouroptera*
Respectively, 5, 2 and 4 birds were seen in Nauri area (c.900 m) on three consecutive days. The bird has been recorded regularly from CTR but perhaps the present records are the westernmost for its distribution. Eastern Uttarakhand has been indicated as the westernmost limit of its distribution in literature (Rasmussen & Anderton 2005). Ali & Ripley (1983) mention that the species mostly breeds above 1,500 m in Nepal, which makes the present sighting the lowest known (presumed breeding) altitude in the western part of its distribution.

NEPAL FULVETTA *Alcippe nipalensis*
A pair was seen near Nauri. The birds were seen following each other, indicative of breeding. The species has not been recorded from CTR. However, there is a single record in 1991 (Sunderraj & Joshua 1997) from Guwalgarh Sot, Lansdowne Forest Division, close to Kothri valley, which led to the westward range extension. The other sightings of the species in Uttarakhand come from eastern Kumaon (from Kumen chak, Chuka, Sharda valley, Champawat: DM pers. obs. 2005) and from Sat Tal near Nainital (A. Verma pers. obs. 2008). Rasmussen & Anderton (2005) indicate western Nepal as its western limit of distribution. The present sighting confirms the range extension for this bird to areas west of CTR into eastern Garhwal.

WHITE-BELLIED YUHINA *Yuhina* [*Erpornis*] *zantholeuca*
A pair was observed on two consecutive mornings at Nauri. This species has been recorded at CTR but west of this there is no record in literature we have seen.

Altitudinal breeding range extensions

SLATY-HEADED PARAKEET *Psittacula himalayana*
We sighted one bird feeding its young in a cavity nest at Nauri at c.900 m. Rasmussen & Anderton (2005) indicate 1,200 m as its lower breeding limit. Thus the present sighting is perhaps one of the lowest altitude breeding records for the species.

LITTLE PIED FLYCATCHER *Ficedula westermanni*
Several pairs observed in Nauri at c.900 m and along the Kolhu Chaur–Nauri road near Dhimki (c.450 m), singing profusely, and indicating that the species is very likely to be breeding. This is perhaps the lowest breeding altitude for the species since Rasmussen & Anderton (2005) indicate 1,200 m as its lower breeding limit.

VERDITER FLYCATCHER *Eumyias thalassina*
At least one pair was observed with the male singing continuously at Nauri. The bird has been known to breed only above 1,200 m in Himalayas (Rasmussen & Anderton 2005) but Spierenburg (2005) gives 600 m as regular and 400 m occasional breeding altitude in Bhutan. However, the present sighting is the lowest breeding record for western Himalayas.

ASIAN BROWN FLYCATCHER *Muscicapa dauurica*
A bird was seen carrying nesting material on two consecutive mornings at c.850 m at Nauri. The bird has been known to breed only above 1,200 m in the Himalayas (Rasmussen & Anderton 2005). Ours therefore appears to be the lowest breeding record for the species.

Other significant records

GREAT SLATY WOODPECKER *Mulleripicus pulverulentus*
A pair and a flock of 10 birds were seen near Kolhu Chaur in the lower part of the valley. It is a rare bird of the region. In recent times it has regularly been seen only in the Chilla (eastern) part of Rajaji National Park (A. Harihar pers. comm. 2006) and a sighting has also been made at Thano reserve forest in Dehradun valley (pers. obs. 2008). Another sighting in the past was reported from eastern Himachal Pradesh (Jones 1919), perhaps the only one west of Uttarakhand.

DOLLARBIRD *Eurystomus orientalis*
A pair was observed in the Nauri area making flights together probably as a breeding display. There have been isolated records of this bird from Dehradun valley further west (Mohan 1997).

BLUE-BEARDED BEE-EATER *Nyctyornis athertoni*
One pair was observed at a nest hole in a road cutting at

Nauri. Both adults were seen to visit the nest repeatedly, bringing food for at least one chick.

LONG-TAILED BROADBILL *Psarisomus dalhousiae*
A single bird was observed in the riverine patch at Nauri. The species, although reported from the west up to the Dehradun valley, is rare in the region (Singh 2000).

COMMON GREEN MAGPIE *Cissa chinensis*
Except for a very old record from Dehradun valley (Osmaston 1935) and an isolated record from an area close to the present study site abutting eastern Rajaji National Park (Pandey *et al.* 1994), no records are known west of Kothri catchment. A pair and three birds, respectively, were observed on two consecutive mornings at Nauri.

BRONZED DRONGO *Dicrurus aeneus*
A few pairs were sighted in the Kothri valley including a nesting one at Nauri. The nest was about 2 m high nicely woven on a horizontal fork in dense semi-evergreen vegetation. Both the male and the female were taking turns at incubation. Further west the bird is known from isolated sightings in Dehradun valley (Mohan 2007) in west Uttarakhand.

DISCUSSION

Seventy-five of the 150 species observed by us during this survey showed confirmed breeding, with an additional 34 probably breeding. Of greater interest is the fact that we found evidence that species like Slaty-headed Parakeet, Little Pied Flycatcher and Verditer Flycatcher are using the Kothri catchment for breeding, which is perhaps the lowest altitude observed. Notably, several others (e.g. Striped Tit Babbler, White bellied Yuhina, Blue-winged Minla and Nepal Fulvetta) were observed here which indicate a westward extension of the known ranges.

Another interesting aspect of the avifauna was the turnover of species. In the Kothri valley the intensively surveyed areas (Kolhu Chaur and Nauri) were only c.10 km apart with altitudes ranging from 400 m to 900 m. Despite this, of the 61 species recorded at the higher site at Nauri (including confirmed and probable breeders as well as transients recorded within a 5 ha intensive survey plot) 36 were not seen on the similar-sized plot at Kolhu Chaur. Similarly, of the 49 birds species seen at the Kolhu Chaur plot 24 were not seen at the higher one.

Kothri valley therefore is an important refuge for avifauna, even though the forests here are not under the formal protected area network of India. This valley, while limited in extent, harbours a remarkable diversity of birds. Perhaps it is not merely altitude that limits the range of a species and birds may suitably breed at lower altitudes provided there is habitat continuity. The fact that the Kothri valley is oriented in a north–south direction may also explain this anomalous breeding pattern. Our study was conducted in the breeding season and we recorded 150 species. This figure is likely to magnify further during winter with the arrival of many migrant species. This underscores the importance of Kothri valley as habitat for the avifauna in the western Himalayan foothills region.

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APPENDIX
Birds recorded in the Kothri catchment, Lansdowne Forest Division, Garhwal Himalayan foothills, 21–26 May 2008

Common name	Scientific name	Location	Breeding activity observed
Red Junglefowl	*Gallus gallus*	K, N, C, D	Calling/singing
Kalij Pheasant	*Lophura leucomelanos*	K, C, N	Calling/singing
Indian Peafowl	*Pavo cristatus*	K, C, D	Probably breeding
Speckled Piculet	*Picumnus innominatus*	N	Singing/chasing
Grey-capped Pygmy Woodpecker	*Dendrocopos canicapillus*	K, N	Chasing
Fulvous-breasted Woodpecker	*Dendrocopos macei*	K, N, C, D	Drumming
Rufous Woodpecker	*Celeus brachyurus*	K	Probably breeding
Lesser Yellownape	*Picus chlorolophus*	K, N, C, D	Calling/in pair
Greater Yellownape	*Picus flavinucha*	C, N	Probably breeding
Streak-throated Woodpecker	*Picus xanthopygaeus*	K	Probably breeding
Grey-headed Woodpecker	*Picus canus*	K, N, C, D	Drumming, pairs responding to each other
Himalayan Flameback	*Dinopium shorii*	K, N, C, D	Probably breeding
Black-rumped Flameback	*Dinopium benghalense*	K	Drumming
Greater Flameback	*Chrysocolaptes lucidus*	N	Probably breeding
Great Slaty Woodpecker	*Mulleripicus pulverulentus*	K	Moving in pairs
Great Barbet	*Megalaima virens*	C, N	In pair; singing
Brown-headed Barbet	*Megalaima zeylanica*	K	Probably breeding
Lineated Barbet	*Megalaima lineata*	C, N	Probably breeding
Blue-throated Barbet	*Megalaima asiatica*	K, C, N	Singing
Coppersmith Barbet	*Megalaima haemacephala*	K, N, C, D	Feeding chicks in nest
Indian Grey Hornbill	*Ocyceros birostris*	K	Male seen alone with food
Oriental Pied Hornbill	*Anthracoceros albirostris*	K, D	Probably breeding
Common Hoopoe	*Upupa epops*	K, C	Probably breeding
Indian Roller	*Coracias benghalensis*	K	Probably breeding
Dollarbird	*Eurystomus orientalis*	N	Pairs flying together
Common Kingfisher	*Alcedo atthis*	K, D	
Stork-billed Kingfisher	*Halcyon capensis*	K, D	
White-throated Kingfisher	*Halcyon smyrnensis*	K, C, D	Probably breeding
Crested Kingfisher	*Megaceryle lugubris*	K, D	
Pied Kingfisher	*Ceryle rudis*	K	
Blue-bearded Bee-eater	*Nyctyornis athertoni*	K, N	Feeding chicks in nest
Green Bee-eater	*Merops orientalis*	K, C, D	
Blue-tailed Bee-eater	*Merops philippinus*	K, C, D	
Chestnut-headed Bee-eater	*Merops leschenaulti*	K	
Common Hawk Cuckoo	*Hierococcyx varius*	K, N, C, D	Singing
Indian Cuckoo	*Cuculus micropterus*	K	Singing
Eurasian Cuckoo	*Cuculus canorus*	K, N	Singing
Banded Bay Cuckoo	*Cacomantis sonneratii*	N	Singing
Grey-bellied Cuckoo	*Cacomantis passerinus*	K	Singing
Drongo Cuckoo	*Surniculus lugubris*	K, C, N	Singing
Asian Koel	*Eudynamys scolopacea*	K	Probably breeding
Greater Coucal	*Centropus sinensis*	K	
Alexandrine Parakeet	*Psittacula eupatria*	K, C, D	Probably breeding

Common name	Scientific name	Location	Breeding activity observed
Rose-ringed Parakeet	*Psittacula krameri*	K	On nest hole
Slaty-headed Parakeet	*Psittacula himalayana*	N	Feeding chicks in nest
Plum-headed Parakeet	*Psittacula cyanocephala*	K, N, C, D	Feeding fledged chicks
Red-breasted Parakeet	*Psittacula alexandri*	C	
White-throated Needletail	*Hirundapus caudacutus*	C	
House Swift	*Apus affinis*	K	On nest
Oriental Scops Owl	*Otus sunia*	K, N	Calling, probably breeding
Brown Fish Owl	*Ketupa zeylonensis*	D	Seen in pair, probably breeding
Brown Hawk Owl	*Ninox scutulata*	K	Calling, probably breeding
Large-tailed Nightjar	*Caprimulgus macrurus*	K, N	On nest, calling
Rock Pigeon	*Columba livia*	K	Pairing
Oriental Turtle Dove	*Streptopelia orientalis*	K	
Spotted Dove	*Streptopelia chinensis*	K, N, C, D	Pair defending nest
Red Collared Dove	*Streptopelia tranquebarica*	K	
Eurasian Collared Dove	*Streptopelia decaocto*	K	
Emerald Dove	*Chalcophaps indica*	K, N	Singing
Yellow-footed Green Pigeon	*Treron phoenicoptera*	K	Pair defending nest
Wedge-tailed Green Pigeon	*Treron sphenura*	N	Singing
River Lapwing	*Vanellus duvaucelii*	K	Probably breeding
Red-wattled Lapwing	*Vanellus indicus*	K, C, D	Probably breeding
Oriental Honey-buzzard	*Pernis ptilorhynchus*	K	
Lesser Fish Eagle	*Ichthyophaga humilis*	D	
Egyptian Vulture	*Neophron percnopterus*	K	
Red-headed Vulture	*Sarcogyps calvus*	K	
Crested Serpent Eagle	*Spilornis cheela*	K, N	
Shikra	*Accipiter badius*	K, N	
Little Cormorant	*Phalacrocorax niger*	K	
Indian Pond Heron	*Ardeola grayii*	K	
Little Heron	*Butorides striatus*	K	
Woolly-necked Stork	*Ciconia episcopus*	K	
Indian Pitta	*Pitta brachyura*	K, N, C, D	Singing
Long-tailed Broadbill	*Psarisomus dalhousiae*	N	Probably breeding
Red-billed Blue Magpie	*Urocissa erythrorhyncha*	K, N, C, D	Probably breeding
Common Green Magpie	*Cissa chinensis*	N	Probably breeding
Rufous Treepie	*Dendrocitta vagabunda*	K	Probably breeding
Grey Treepie	*Dendrocitta formosae*	N	
Large-billed Crow	*Corvus macrorhynchos*	K, D	Probably breeding
Eurasian Golden Oriole	*Oriolus oriolus*	K	Probably breeding
Black-hooded Oriole	*Oriolus xanthornus*	K	Probably breeding
Black-winged Cuckooshrike	*Coracina melaschistos*	K	
Black-headed Cuckooshrike	*Coracina melanoptera*	K, N	Singing
Rosy Minivet	*Pericrocotus roseus*	K, N, C, D	On nest at Nauri
Small Minivet	*Pericrocotus cinnamomeus*	K	Probably breeding
Scarlet Minivet	*Pericrocotus flammeus*	K, N, C, D	On nest at Nauri
Bar-winged Flycatcher-shrike	*Hemipus picatus*	K, N, C, D	Singing
Yellow-bellied Fantail	*Rhipidura hypoxantha*	N	Singing and displaying

Common name	Scientific name	Location	Breeding activity observed
White-throated Fantail	*Rhipidura albicollis*	K, N, C, D	Probably breeding
White-browed Fantail	*Rhipidura aureola*	K	Probably breeding
Black Drongo	*Dicrurus macrocercus*	K	
White-bellied Drongo	*Dicrurus caerulescens*	K	
Bronzed Drongo	*Dicrurus aeneus*	N	Incubating
Spangled Drongo	*Dicrurus hottentottus*	K, C, D	In pair; singing
Black-naped Monarch	*Hypothymis azurea*	K	In pair; singing
Asian Paradise-flycatcher	*Terpsiphone paradisi*	K, N, C, D	Feeding chicks in nest
Common Iora	*Aegithina tiphia*	K, D	In pair; singing
Large Woodshrike	*Tephrodornis gularis*	N	
Blue-capped Rock Thrush	*Monticola cinclorhynchus*	N	
Blue Whistling Thrush	*Myophonus caeruleus*	K, N, C, D	Singing
Orange-headed Thrush	*Zoothera citrina*	K, N, C, D	Singing
Asian Brown Flycatcher	*Muscicapa dauurica*	N	Carrying nesting material
Little Pied Flycatcher	*Ficedula westermanni*	D, N	Singing/chasing
Verditer Flycatcher	*Eumyias thalassina*	N	Singing
Blue-throated Flycatcher	*Cyornis rubeculoides*	K, N, C, D	Singing, chasing
Grey-headed Canary Flycatcher	*Culicicapa ceylonensis*	N	Singing
Oriental Magpie Robin	*Copsychus saularis*	K, N, C, D	Singing, displaying, carrying nesting material
White-rumped Shama	*Copsychus malabaricus*	K, N	Singing, on nest hole
Indian Robin	*Saxicoloides fulicata*	K	In pair
Spotted Forktail	*Enicurus maculatus*	N	
Pied Bushchat	*Saxicola caprata*	K	In pair
Chestnut-tailed Starling	*Sturnus malabaricus*	K, C, N	Singing, on nest hole
Brahminy Starling	*Sturnus pagodarum*	K	
Common Myna	*Acridotheres tristis*	K	On nest hole
Jungle Myna	*Acridotheres fuscus*	K	
Chestnut-bellied Nuthatch	*Sitta castanea*	K, C, N	Singing, feeding chicks in nest
Velvet-fronted Nuthatch	*Sitta frontalis*	K, C, N	Singing, feeding chicks in nest
Great Tit	*Parus major*	K, N, C, D	Singing, feeding chicks in nest
Black-lored Tit	*Parus xanthogenys*	N	
Black-throated Tit	*Aegithalos concinnus*	N	
Plain Sand Martin	*Riparia paludicola*	K	
Black-crested Bulbul	*Pycnonotus melanicterus*	C, N	
Red-whiskered Bulbul	*Pycnonotus jocosus*	K	
Himalayan Bulbul	*Pycnonotus leucogenys*	K, N, C, D	Probably breeding
Red-vented Bulbul	*Pycnonotus cafer*	K, N, C, D	Display
Ashy Bulbul	*Hemixos flavala*	C, N	Carrying nesting material
Black Bulbul	*Hypsipetes leucocephalus*	N	Young begging for food
Grey-breasted Prinia	*Prinia hodgsonii*	K, N, C, D	In pair; singing
Oriental White-eye	*Zosterops palpebrosus*	K, N, C, D	In pair; singing
Pale-footed Bush Warbler	*Cettia pallidipes*	K, N	Singing
Common Tailorbird	*Orthotomus sutorius*	K	Singing
Grey-hooded Warbler	*Seicercus xanthoschistos*	N, C, D	Singing, young begging for food
White-throated Laughingthrush	*Garrulax albogularis*	N	Courtship
White-crested Laughingthrush	*Garrulax leucolophus*	K, N	

Common name	Scientific name	Location	Breeding activity observed
Puff-throated Babbler	*Pellorneum ruficeps*	K, N	Singing
Rusty-cheeked Scimitar Babbler	*Pomatorhinus erythrogenys*	K, N	Singing
White-browed Scimitar Babbler	*Pomatorhinus schisticeps*	N	Singing
Black-chinned Babbler	*Stachyris pyrrhops*	K, N, C, D	Singing
Striped Tit Babbler	*Macronous gularis*	K	Singing
Jungle Babbler	*Turdoides striatus*	K	Probably breeding
Red-billed Leiothrix	*Leiothrix lutea*	K, N, D	In pair; singing
Blue-winged Minla	*Minla cyanouroptera*	N	Carrying food
Nepal Fulvetta	*Alcippe nipalensis*	N	In pair; singing
White-bellied Yuhina	*Yuhina [Erpornis] zantholeuca*	N	In pair; agitated
Purple Sunbird	*Nectarinia asiatica*	K	Singing
Crimson Sunbird	*Aethopyga siparaja*	K, N	With nesting material
Chestnut-shouldered Petronia	*Petronia xanthocollis*	K	Probably breeding
White-browed Wagtail	*Motacilla maderaspatensis*	K	Probably breeding
Paddyfield Pipit	*Anthus rufulus*	K	Probably breeding

Location key

Code	Place name	Elevation surveyed
K	Kolhu Chaur	400–460 m
C	Chaukhamb	600 m
D	Dhimki	450 m
N	Nauri	750–920 m

Breeding behaviour and nest tree use by Indian Grey Hornbill *Ocyceros birostris* in the Eastern Ghats, India

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The breeding ecology of Indian Grey Hornbill *Ocyceros birostris* was studied during 2007 and 2008 in Sathyamangalam Forest Division, Eastern Ghats, India. In the breeding season, 32 active nests of Indian Grey Hornbill were recorded. Nesting started early in March and ended in late June. The nesting period averaged 87 days, with the female sealed in the nest cavity for an average of 76 days and the nestlings fledging an average of 13 days after the female emerged. Nest-sealing materials used include the hornbill's own faeces, mud, cattle dung and tree bark. An average of two fledglings from each nest was recorded. Two of the 32 active nests were predated, a nesting success of 94%. Six tree species belonging to five families were used for nesting; the majority (44%) of nests were in *Melia dubia* (Meliaceae) making it the most preferred nest-tree species (Ivlev's selectivity index PI = 0.27). The nest tree dimensions (tree girth at breast height 3±1 m, tree height 23±7 m, nest height 14±7 m, girth at nest height 2±0 m) indicate the average requirements of Indian Grey Hornbill for a suitable nest site. All nests were located in the riverine habitat and hence protection of riverian habitat is emphasised.

INTRODUCTION

Hornbills Bucerotidae are one of the most recognisable groups of birds in the Old World tropics. There are 54 species of hornbills in the world (Kemp 1995) and nine species occur in India (Ali & Ripley 1987). The Indian Grey Hornbill *Ocyceros birostris*, also known as Common Grey Hornbill, is reported to occur in India, Pakistan and Nepal (Ali & Ripley 1987). In India it is distributed throughout the country, excepting for Malabar, parts of Rajasthan and Assam (Ali 2002). In southern India, this species is reported to occur in the dry deciduous tracts of the Eastern Ghats and foothill forests of the Western Ghats (Balasubramanian *et al.* 2005). Hornbills are secondary cavity nesters, using natural cavities or those excavated by other birds (Kemp 1995). The breeding habits of hornbills are unique in that the female of most species seals herself into a nest cavity and leaves only a narrow slit through which the male passes her food until the nesting period is completed (Kemp 2001). Hornbills often show high nest-site fidelity, returning to the same nest cavity year after year (Kemp 1978). Patil *et al.* (1997) provided some information on the nesting of Indian Grey Hornbill, but a review of literature reveals the absence of detailed studies on breeding ecology. The present study was undertaken to assess the breeding behaviour and nest tree preference of Indian Grey Hornbill in a forested landscape in the Eastern Ghats.

STUDY AREA AND METHODS

The present study was conducted during the two successive breeding seasons of March to May in 2007 and 2008, in the Hasanur range (940 m asl) of Sathyamangalam Forest Division (10°29′–11°43′N 76°51′–77°27′E), Eastern Ghats, India. The Eastern Ghats forms an important habitat for diverse biota across the east coast of India to traverse the states of Orissa, Andhra Pradesh, Tamil Nadu and parts of Karnataka, areas located within 11°30′–22°N and 76°50′–86°30′E along a north-east to south-west strike and covering a total area of c.75,000 km² (Murthy *et al.* 1982). The climate regime is tropical monsoon, with an average annual rainfall of 1,000–1,600 mm and mean temperatures of 20–25°C during winter and 30–32°C in summer. Vegetation in the study area varies considerably with altitude, but dry deciduous and riverine forests predominate at the study site.

As hornbills depend on tree cavities for nesting, an intensive search for nest cavities was carried out during breeding season. Cavities of trees being actively used by hornbills are identified by following breeding pairs of hornbills or breeding males carrying food to the nest, as well as by examining midden deposits of seeds below the nest cavity. Out of a total of 32 active nests located in two years, 10 were selected for monitoring the activities of the hornbills at the respective nests from 06h00 to 18h00, giving a total of 720 hours (72 hours per nest) spent at the nest sites. Details such as number of visits made by the male and quantity of food items delivered per visit were also recorded from an observation hide situated 10–20 m away from the nest, using a pair of 10×50 binoculars. The food items delivered were classified as vegetable or animal food. Seeds from 10 middens below other nests were also collected at regular intervals to identify food items delivered to the nest inmates and for use in further studies. Tree species harbouring the nests were identified by using the local floras and later confirmed at the Botanical Survey of India, Coimbatore, India. Nest tree features, such as tree girth at breast height, tree height, nest height and girth at nest height, were recorded for all the identified nests.

A preference index (PI) of the nest trees used by Indian Grey Hornbill was calculated using Ivlev's Index of Selectivity (Ivlev 1961) (PI = U-A/U+A, where U denotes utilisation of the species and A denotes availability of corresponding species). Values of PI range between -1 and +1, where -1 indicates avoidance while +1 indicates highest preference. Availability of the tree species was determined within a 1 ha belt transect (10×1,000 m) (used as an alternative for a 1 ha square plot). Availability denotes the number of individuals of a species occurring in the 1 ha plot. To find out the availability of nest tree species, the belt transect was located along the riverine habitat of the study area. The 1 ha belt transect was divided into 100 (10×10 m) plots. All the trees within the belt transect with girth at breast height (gbh) more than 20 cm

were recorded. Utilisation indicates the number of individuals of nest tree species used by the hornbills.

RESULTS

Nesting behaviour

The nesting season lasted for three months, from March to June. The hornbills started to prepare themselves for breeding in early December, when such pre-nesting behaviour as nest-cavity searching, mating and courtship feeding were recorded. Both male and female hornbills were noticed peeping into tree cavities, one after the other, and this was often noted and continued until the female entering into the nest cavity. The male hornbill feeding the female hornbill with food items was recorded, where the female sat near the nest cavity or perched in some tree, giving loud calls until the male arrived and offered her some food items, and this was also recorded in a fruiting tree. Other rare observations made at the nest tree included the male and female flying some 30 m down to the ground, holding tightly onto each other's bill and with a loud clapping sound of their wings. Mating behaviour involving three different pairs of hornbills was observed during the study. In all the cases mating took place while perching on the nest tree, and it happened before the female entered the cavity. Once we recorded a female peeping into a cavity, from where the male pushed her back with his bill, until finally she struggled, entered the cavity, peeped out and then the male offered her some fruits and perched on the next branch. The female stayed in the cavity for 20 minutes (17h15–17h35) and then, with a loud call, came out and joined the male. The next morning, the female occupied the nest and the male fed her with fruits. In the study area, females entered their cavity in the first week of March and some late nests were also recorded in April. As soon as the female entered the cavity she started cleaning the nest, and we observed her throwing out all the waste materials left in by the previous user. Later, the female in the cavity was observed to toss out the excreta of the chicks with her beak through the nest slit, and herself to turn around and eject her own excreta through the slit to form part of the nest midden. The very next day, the female started sealing the cavity entrance with her bill using mud, cattle dung and dry tree bark delivered by the male, and her own fecal matter.

For the observed 10 nests of Indian Grey Hornbill, the nesting period averaged 87 days. Begging calls of the nestlings were heard on an average of 40 days after the female entered the cavity. Clutch size could not be recorded. The female emerged on average 76 days after sealing in and the nestlings fledged an average of 13 days after the female emerged. Two fledglings from each nest were recorded; the newly fledged chicks were smaller in size than the adults, with fresh plumage and undeveloped casques. After their emergence, we observed the chicks making calls and sitting in the top branches of the nest tree or in the neighbouring tree with the adult female, in six of the observed nests. The male brought fruits and fed these to the chicks but after a few minutes both adults left to forage and returned with fruits that they delivered to the chicks, and then the chicks flew from one branch to other in the same tree. The next day we observed the chicks in the nearest fruiting tree of the nest tree, trying to forage for themselves on the fruits and flying from tree to tree. The adults fed the chicks for more than a week, but later they started to feed themselves and flew long distances following their parents.

During the 720 hours spent at 10 nests to monitor the nesting behaviour over two breeding seasons, males visited the nests 1,015 times to feed the nest inmates, an average of 17 times per day. At a later stage, after the emergence of the female from the nest cavity, she joined the male to feed the chicks in the cavities. We recorded the male feeding the nest inmates from just before sunrise at 05h45 until after sunset at 18h07. We grouped the observations into four quarters, 06h00–09h00, 09h01–12h00, 12h01–15h00 and 15h01–18h00. Of the total 1,015 visits made by males to the nest, in the first quarter males visited 374 times (37%), 206 times (20%) in the second, 183 times (18%) in the third and 252 times (25%) in the fourth. The number of visits was highest in first quarter (37%) followed by the fourth quarter (25%), at the start and end of the day. Food items like fruits and insects were regurgitated, brought to the tip of the bill and then delivered, whereas animal items like lizards were carried in the bill and delivered directly.

A total of 13,680 food items was delivered to the nest inmates at the 10 focal nests. The food items delivered to the nest inmates included both vegetable (64%) and animal (36%) matter. Vegetable matter delivered comprised fruits of 26 plant species belonging to 16 plant families, among which 14 species were identified while monitoring the nests for fruit deliveries by the male and 12 species from the middens of other nests. Animal matter delivered included lizards, birds' eggs, juvenile birds and various kinds of insect.

Indian Grey Hornbills compete among themselves for nest cavities and we observed a pair chasing another pair during nest searching. The other nest competitors in the study area were Rose-ringed Parakeet *Psittacula krameri*, Golden-backed Woodpecker *Dinopium javanense*, Common Myna *Acridotheres tristis*, Jungle Myna *Acridotheres fuscus* and Indian Palm Squirrel *Funambulus palmarum*. All these species were noted to disturb hornbills during their nest searching and also while the female was inside the nest cavity. Nests of Rose-ringed Parakeet, Common Myna and Golden-backed Woodpecker were recorded in different cavities of the same nesting tree used by Indian Grey Hornbill. All the nest cavities were found to be occupied later by the competitors after the hornbills had bred. In addition, Large Brown Flying Squirrel *Petaurista philippensis* and honeybees *Apis* sp. were recorded in two cavities each, after the use by Indian Grey Hornbill.

Two of the 32 nests were predated during the early stages, after egg laying, with both eggs and incarcerated female being taken, but the predator was not known. In both the cases, feathers of the female, eggshells and broken sealing material were found in the middens. Thirty of the 32 nests were successful.

Nest tree features

All 32 active nests identified were in live trees. All nest trees were in stream/riverine habitats. The majority of the nests were in *Melia dubia* (14) followed by *Syzygium cumini* (9), *Albizia odoratissima* (5), *Mangifera indica* (2), *Terminalia arjuna* (1) and *Terminalia bellirica* (1). Ivlev's selectivity index indicated that the most preferred nest tree species was *Melia dubia* (PI = 0.27) (Table 1).

Table 1. Preference index of the nest trees utilised by Indian Grey Hornbill.

Plant species	Family	Number of nests: First year	Second year	Re-used	Total no. of nests	Number of trees available / ha	Preference index PI = U-A/U+A
Melia dubia	Meliaceae	5	9	4	14	8	0.272727
Syzygium cumini	Myrtaceae	1	8	1	9	15	-0.25
Albizia odoratissima	Mimosaceae	3	2	2	5	6	-0.09091
Mangifera indica	Anacardiaceae	–	2	–	2	37	-0.89744
Terminalia arjuna	Combretaceae	–	1	–	1	64	-0.96923
Terminalia bellirica	Combretaceae	–	1	–	1	13	-0.85714

Table 2. Characteristics of the nest trees and cavities utilised by Indian Grey Hornbill.

Variables	Mean±SD	Range
Tree girth at breast height (m)	3±1	2–5
Tree height (m)	23±7	14–39
Nest height (m)	14±7	6–30
Girth at nest height (m)	2±0	1–3
Inner depth of the cavity(cm)	51±11	30–72
Nest entrance length (cm)	15±5	8–28
Nest entrance width (cm)	12±3	7–15

The number of nest trees used in the first year was nine involving three tree species (*Melia dubia*, *Syzygium cumini* and *Albizia odoratissima*), and in the second year 23 involving six tree species (three as in the first year plus *Mangifera indica*, *Terminalia arjuna* and *T. bellirica*). In total, 32 nests of six tree species belonging to five families were used for nesting. The majority (44%) of nests were in *Melia dubia* (Meliaceae). Re-use of nest cavities was observed in the second year (Table 1). Of the nine nests recorded in the first year, seven were re-used in the second year. The nest site characteristics were recorded for all identified nests and are presented in Table 2.

DISCUSSION

The hornbill family is characterised by an incubation period closely correlated with body size and by an unusually long nestling stage (Kemp 1995). During this study, the nesting period of Indian Grey Hornbill lasted for an average of 87 days, very close to the 86 days for the congeneric Malabar Grey Hornbill *O. griseus* (Mudappa 2000). Indian Grey Hornbills in the study area only used cavities in the live trees, similar to the observations by Mudappa & Kannan (1997) for Malabar Grey Hornbill and Datta & Rawat (2004) for Great Hornbill *Buceros bicornis*, Wreathed Hornbill *Aceros undulatus* and Oriental Pied Hornbill *Anthracoceros albirostris*. Maheswaran & Balasubramanian (2003) reported that 80% of the nest trees used by Malabar Grey Hornbills in the Western Ghats, India, were live. Re-use of nest cavities by Indian Grey Hornbill is reported in this study, and this conforms to earlier studies on Malabar Grey Hornbill in the Western Ghats by Mudappa & Kannan (1997), Mudappa (2000) and Maheswaran & Balasubramanian (2003).

Nest sanitation observed during the present study was similar to the reports made by Kannan & James (1997) and Hussain (1984) for Great Hornbill and Narcondam Hornbill *Aceros narcondami* respectively. Courtship feeding and grappling of bills with clapping wings observed in the present study are similar to observations of Kannan & James (1997) for Great Hornbill.

In the study area, Indian Grey Hornbills used tall trees (mean 2±7 m) with large girth (mean 3±1 m) for nesting. Hornbills using tall trees with large girths were also reported in various other studies. Mudappa & Kannan (1997) reported Malabar Grey Hornbill nests at an average height of 24 m and the diameter at breast height as 60–89 cm. Maheswaran & Balasubramanian (2003) reported a mean tree height of 36±6 m and 283±101 cm width for Malabar Grey Hornbills. Kinnaird & O'Brien (1999) reported a mean height 40±10 (m) and a mean width 117±41 cm in diameter for nest trees of Sulawesi Red-knobbed Hornbill *Aceros cassidix*.

Poaching of Indian Grey Hornbills was not recorded during the study. Cattle grazing and lopping of branches of hornbill food plants for feeding livestock is the major problem of the study area. Extension of agricultural activities in the riverine forests disturbs breeding sites. As all hornbill nests were located in trees that are tall, with a large girth and in riverine habitat, protection and conservation of nest trees and the lowland riverine habitat in the Eastern Ghats is recommended.

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Biological species limits in the Banded Pitta *Pitta guajana*

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The Banded Pitta *Pitta guajana* is widely distributed over the Greater Sunda Islands and Thai-Malay Peninsula. Up to six races have been described, but only three of them are distinct and were formerly considered different species: *guajana* from Java and Bali, *schwaneri* from Borneo, and *irena* from Sumatra and Thai-Malay Peninsula. We here revisit the species status of these three forms with morphometric, plumage and vocal data. We demonstrate pronounced differences in body part measurements and sex-specific coloration amongst all three taxa. Our bioacoustic comparisons also indicate differences in frequency and timing of the two main types of vocalisation among taxa, although further sampling needs to corroborate these findings. We further show that plumage differences—and probably also vocal differences—among Banded Pitta taxa are more pronounced than between sister species in three other *Pitta* complexes. We argue that the three Banded Pitta taxa should be classified as parapatric rather than allopatric, based on their frequent and ongoing contact during glacials when sea-levels drop to create land connections across their Sundaic range. Based on comparisons with other parapatric *Pitta* species, biological species status is recommended for the three Banded Pitta taxa. Ecological and habitat differences in the three Banded Pittas probably evolved to reduce disadvantageous hybridisation during extensive glacial periods of contact.

INTRODUCTION

The Banded Pitta *Pitta guajana* is a Sundaic forest species occurring over a wide area from the Thai-Malay Peninsula through Sumatra, Borneo, Java and a number of offshore islands to Bali (Lambert & Woodcock 1996, Erritzoe 2003). A total of six subspecies have been proposed: nominate *guajana* from east Java and Bali; *affinis* from west Java; *schwaneri* from Borneo; *irena* from Sumatra and peninsular Malaysia; *bangkae* from Bangka Island; and *ripleyi* from peninsular Thailand.

Three of these six subspecies are not universally recognised. The race *bangkae* is widely assumed to be based on a mislabelled specimen from Java (van Marle & Voous 1988). Similarly, *affinis* is considered to be generally indistinguishable from nominate *guajana* in the most recent accounts (e.g. Erritzoe 2003). A third taxon, *ripleyi*, is recognised as a weak subspecies by Erritzoe (2003), but was previously synonymised with *irena* from peninsular Malaysia by Lambert & Woodcock (1996) based on their examination of a series of specimens in the Natural History Museum, Tring (henceforth BMNH). In their synonymisation of *ripleyi*, Lambert & Woodcock (2003) conceded that '...there is a tendency for birds from peninsular Thailand to have more orange-red in the supercilium than birds from Sumatra...'. However, they found considerable geographic variation across *ripleyi* and *irena* in the features used by Deignan in describing *ripleyi*, such as the distribution of scarlet in the supercilium, the colour of the central abdomen in males and the mantle coloration. Our own examination of these traits in a range of BMNH specimens of both *ripleyi* and *irena* has only shown potential weak geographical trends in some plumage characters (data not shown), but none that would definitively separate them. Therefore, we support Lambert & Woodcock's (2003) synonymisation of *ripleyi*. Since the three weak subspecies *bangkae*, *affinis* and *ripleyi* are now widely synonymised under *guajana* and *irena*, respectively, they are not further considered in this contribution.

The three remaining taxa that make up the Banded Pitta are very distinct, to the point that they were each originally described as separate species and continued to be treated as such until the late 1930s (Riley 1938). The taxa *schwaneri* from Borneo, *guajana* (including *affinis*) from Java and Bali as well as *irena* (including *ripleyi*) from Thai-Malay Peninsula and Sumatra are known to differ considerably in coloration, while vocal differences have been reported anecdotally but remain unanalysed. The two most recent treatises of the genus have both acknowledged that further analysis may demonstrate that the three taxon groups within *P. guajana* may need to be elevated to species rank (Lambert & Woodcock 1996, Erritzoe 2003).

To shed light on the taxonomic status of the three widely recognised subspecies of Banded Pitta, we examined the series of *P. guajana* housed at BMNH. We carried out plumage examinations on subsets of the BMNH series. We also measured various body parts in the same BMNH subsets and present the first statistical comparison of mensural data in Banded Pittas. Furthermore, we collected sound recordings of wild Banded Pittas from throughout their range over the years, and complement this collection with recordings from colleagues. We use this material to investigate the taxonomic classification of the taxa that are currently recognised as members of *P. guajana*.

METHODS

Any taxonomic analysis must be based on a species concept that provides the criteria for assigning species or subspecies rank. We here use Mayr's (1996) multi-dimensional Biological Species Concept (BSC), which is the most widely followed species concept in ornithology. Biological species rank is accorded to life forms that maintain their taxonomic integrity while in sympatry or parapatry with similar life forms, i.e. the gene pool of a species does not fuse with that of a neighbouring species when the two come into regional contact. Note that the BSC allows for a certain level of hybridisation as long as it is marginal and does not lead to the amalgamation of gene pools of the two taxa in question. BSC rank assignment becomes harder in taxa that do not overlap or abut geographically. In these cases, the BSC has to resort to the yardstick approach (e.g. Mayr & Ashlock 1991, Helbig *et al.* 2002), under which two taxa are assessed as discrete species if

their plumages, vocalisations and/or other characters are at least as different from each other as they are between two unequivocal species of the same genus or family.

We examined various subsets of the BMNH series of *P. guajana*. Only recognisably adult individuals were considered. Measurements of tarsus and upper mandible (as measured from the bill-tip to the point where the upper mandible meets the forehead) were taken with a calliper to the nearest tenth of a millimetre, while wing measurements were taken with a ruler to the nearest millimetre by the same person (FER) to preclude observer bias. Statistical differences between measurements were calculated using a two-tailed Mann Whitney U test as implemented in the program Word Excel. Plumage coloration of birds at BMNH was assessed against natural light. JAE took photos of BMNH specimens using a Sony DSC W90. Sound recordings of birds in the wild were made by JAE using a Sennheiser ME66 and Sony HiMd minidisc. These recordings and additional ones from colleagues and from www.xeno-canto.org (see Acknowledgements) were analysed with respect to various frequency parameters (lowest frequency and two different measures of frequency range) as well as call duration. For all sampled vocalisations, analyses were conducted and sonograms were generated using default settings in the program Syrinx Version 2.6h (by John Burt, downloadable at www.syrinxpc.com). For some recordings, the darkness level of sonogram depiction was adjusted to resemble the other recordings to prevent a measuring bias in call duration based on different levels of loudness in the original recordings.

RESULTS

Morphometrics

Table 1 provides sample sizes and mean measurements of tarsus, upper mandible and wing length for the examined BMNH subset of specimens from all three taxa. Since the size of sexes within each taxon did not differ significantly in any of the three characters, we pooled male and female measurements for the comparison amongst taxa. *P. g. guajana* from Java and Bali is significantly larger in all three characters (tarsus, upper mandible and wing length) than the remaining taxa (Table 1). There are no significant differences between *schwaneri* and *irena* in these measurements.

Our measurements generally fall within the ranges of the same characters given by Lambert & Woodcock (1996), who also worked on the BMNH series. The only exception relates to the bill measurements, which are considerably larger in Lambert & Woodcock (1996) for all taxa because of the different way these authors measured this parameter (i.e. to the base of the gape rather than to the upper base of the upper mandible). However, in agreement with our data, Lambert & Woodcock's (1996) bill measurements are also generally smaller for *P. g. schwaneri* and *P. g. irena* than for the nominate. Unfortunately, the latter authors' data are not directly comparable with ours as no exact sample sizes, means and standard deviations are given.

The inter-taxon size differences in our measurements are in good agreement with weight data provided for the three taxa by Lambert & Woodcock (1996). The weight

Table 1. Taxon-specific mean measurements of tarsus, upper mandible and wing (including sample size and standard deviation); p-values of differences between sexes or taxa refer to two-tailed Mann-Whitney U test; significant p-values are printed **bold**. The taxa *P. g. guajana* and *P. g. irena* as here defined include samples of the proposed taxa *affinis* and *ripleyi*, respectively.

	P. g. irena		***P. g. guajana***		***P. g. schwaneri***	
	male	**female**	**male**	**female**	**male**	**female**
Tarsus						
n	14	15	7	6	7	7
mean [0.1 × mm]	382	375	422	415	390	384
standard deviation	12.9	14.8	19.3	17	14	12
p-value of sex difference	0.2757		0.5222		0.5687	
p-value of taxon difference vs *irena*			**<0.0001**		0.0891	
p-value of taxon difference				*guajana* vs *schwaneri*: **0.0005**		
Upper mandible						
n	18	16	8	6	7	7
mean [0.1 × mm]	223	221	241	241	218	226
standard deviation	13.1	18.7	11.3	16.8	9.2	6.7
p-value of sex difference	0.8026		0.6527		0.2263	
p-value of taxon difference vs *irena*			**0.0006**		0.8808	
p-value of taxon difference				*guajana* vs *schwaneri*: **0.0016**		
Wing						
n	16	17	8	6	7	7
mean [mm]	101	99	104	105	99	101
standard deviation	4.0	6.8	2.5	3.9	4.1	3.4
p-value of sex difference	0.7718		0.9522		0.5222	
p-value of taxon difference vs *irena*			**0.0183**		0.8103	
p-value of taxon difference				*guajana* vs *schwaneri*: **0.0178**		

Plate 1. Banded Pitta males (lateral view): left to right, *P. g. schwaneri, P. g. guajana* and *P. g. irena*. Copyright Natural History Museum, Tring.

Plate 2. Banded Pitta males (ventral view): left to right, *P. g. schwaneri, P. g. guajana* and *P. g. irena*. Copyright Natural History Museum, Tring.

Plate 3. Banded Pitta females (lateral view): left to right, *P. g. schwaneri, P. g. guajana* and *P. g. irena*. Copyright Natural History Museum, Tring.

Plate 4. Banded Pitta females (ventral view): left to right, *P. g. schwaneri, P. g. guajana* and *P. g. irena*. Copyright Natural History Museum, Tring.

Plate 5. Banded Pitta females (dorsal view): left to right, *P. g. schwaneri, P. g. guajana* and *P. g. irena*. Copyright Natural History Museum, Tring.

Table 2. Plumage features in males and females of all three taxa.

	Head	**Throat**	**Underparts**	**Upperparts**
male *guajana*	black crown with long yellow supercilium	white becoming yellow further down	barred dark-blue and yellow (sometimes with a flush of red) with broad blue upper breast-band	medium-brown with white wing-panel
male *irena*	black crown with fiery red rear-end to supercilium fading to yellow towards front (exact distribution of red can vary individually)	white with yellow wash on sides	uniform deep-blue with red upper flank barring that varies individually in extent and width	rich brown; wing-panel more extensive white than other taxa
male *schwaneri*	black crown with long bright-yellow supercilium (brighter than *guajana*)	pale yellow becoming brighter further down	breast dark-blue, almost black, heavily barred bright yellow; belly and undertail-coverts bright blue with barring restricted to lower flanks	rich brown with white wing-panel
female *guajana*	brown crown with faintly demarcated buff supercilium	white	barred light-brown and dull-yellow to off-white with thin dark-brown upper breast-band	medium-brown with white wing-panel
female *irena*	faded black crown with supercilium fiery-red fading to buff towards front	white	barred black and buff, sometimes with orange tinge on upper flanks and breast	rich brown, wing-panel more extensive white than other taxa
female *schwaneri*	dark-brown crown with yellow supercilium becoming paler toward the bill	white with buff wash on sides	upper breast to undertail-coverts barred dark-brown or blackish alternating with dull yellow, lacking blue belly	rich brown with white wing-panel

range given for *guajana* (93–106 g) is above that of *schwaneri* (60–80 g) and *irena* (75–97 g), even though there seems to be a slight overlap between *guajana* and *irena* (Lambert & Woodcock 1996). In contrast, the range of tail lengths given for *guajana* (which includes Lambert & Woodcock's *affinis*) are 62.8–71.5 mm, only slightly—and probably not significantly—higher than that given for *schwaneri* (59–70 mm) or *irena* (59–71 mm). Unfortunately, statistical significance of differences cannot be inferred from Lambert & Woodcock's (1996) data. Nevertheless, the weights add to the conclusion that *P. g. guajana* is a much more massive bird than the Banded Pittas from Borneo, Sumatra and the Malay Peninsula.

Plumage

We closely examined a total of 57 specimens, with a breakdown as follows: *P. g. guajana*, eight males and five females; *P. g. irena*, 14 males and 15 females; *P. g. schwaneri*, seven males and seven females. Table 2 shows the plumage differences we detected between males and females and among all three taxa. Plumage differences given in Table 2 were diagnosed in all individuals examined, unless otherwise stated. Photos of representative individuals for each taxon are presented in Plates 1–5 and confirm the most salient plumage differences. In particular, males of the three taxa differ dramatically in terms of the pattern of barring on the underparts, lack or presence of a breast-band, colour of supercilium and throat pattern (Plates 1–2; Table 2). Females differ especially in their pattern of barring on the underparts, head contrast, colour of supercilium and presence or absence of a breast-band (Plates 3–5; Table 2). The three taxa also show minor differences in back coloration and the extent of white on the wing-panel in both sexes (Plates 1–5; Table 2).

Vocalisations

We obtained recordings of 16 individuals of *P. guajana* representing all three taxa (2 *guajana*, 6 *irena*, 8 *schwaneri*). The vocalisations fell into two different types: (1) the 'territorial call' (Fig. 1), a single inverted-V-shaped note (rarely accompanied by a second minor note: see Fig. 1B) typically given at 4–10 sec intervals, but sometimes more or less frequently depending on the level of agitation; and (2) the 'alarm call' (Fig. 2), a single note given at similar intervals as the territorial call but usually more drawn-out and consisting of two harmonic notes, the second of which typically covers a much wider frequency range. We refer to these vocalisations as territorial and alarm calls for the sake of simplicity, although it is uncertain whether their behavioural context is as functionally restricted as these terms imply.

We measured the highest and lowest frequency as well as the duration of each territorial call (data not shown). We also measured all alarm calls in terms of duration, lowest frequency, frequency range of first harmonic as well as frequency range of both harmonics combined (data not shown). Even though our sample sizes are too low to allow for statistical analysis, some of the vocal differences detected may not be of an individual or context-dependent nature, but may be taxon-specific. There seem to be pronounced differences in the duration of the territorial call between nominate *P. g. guajana*, which gives a short note, and the other taxa, which utter a much longer note (Fig. 1). Additionally, the territorial call of *P. g. schwaneri* may be characterised by a much narrower frequency range than that of the other taxa (Fig. 1), although more sampling is desirable for confirmation. In terms of the alarm call, *P. g. schwaneri* has a much higher-pitched lowest frequency than the other taxa as well as a much shorter call duration (Fig. 2). Some of these sound differences amongst Banded Pitta subspecies (such as the much shorter territorial call in *P. g. guajana*, or the shorter alarm call and less inflected territorial call in *P. g. schwaneri*) are noticeable in the field and have been corroborated by many unrecorded calling individuals heard by us in the native habitat of these birds. More future vocal sampling is desirable to confirm these differences.

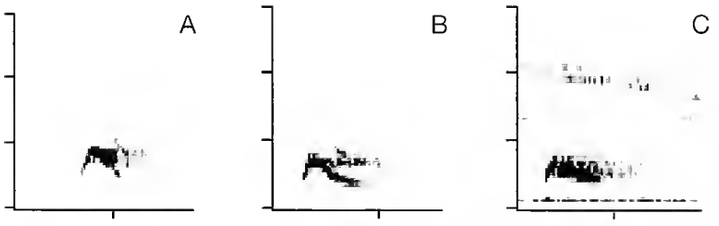

Figure 1. Territorial calls of (A) *P. g. guajana* (Carita, west Java, by R. Hutchinson), (B) *P. g. irena* (Taman Negara, Pahang, peninsular Malaysia by JAE) and (C) *P. g. schwaneri* (Poring, Sabah, Borneo by R. Hutchinson).

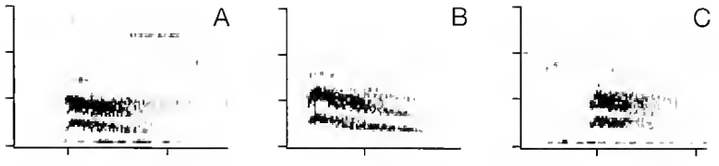

Figure 2. Alarm calls of (A) *P. g. guajana* (Carita, west Java by JAE), (B) *P. g. irena* (= '*ripleyi*') (Khao Nor Chuchi, southern Thailand by A. Meijer) and (C) *P. g. schwaneri* (Poring, Sabah, Borneo by R. Hutchinson).

DISCUSSION

The taxonomy of the Banded Pitta *P. guajana* has created much controversy. Some of the proposed subspecies, such as *bangkae*, *affinis* and *ripleyi*, are either based on potentially mislabelled specimens (van Marle & Voous 1988) or are so weak that some authors have chosen to synonymise them (Lambert & Woodcock 1996, Erritzoe 2003), a treatment that we fully concur with based on our own specimen comparisons (data not shown). The remaining three taxa (*schwaneri*, *irena* and nominate *guajana*) were treated as distinct species for a long period in the past. Calls for their re-elevation to species level have been voiced (Lambert & Woodcock 1996, Erritzoe 2003) and need to be examined more closely under the framework of the Biological Species Concept.

Our examination of specimens corroborates previous indications that there are strong and consistent plumage differences in both sexes among all three taxa (Plates 1–5). Moreover, our mensural data indicate that nominate *guajana* is distinctly larger than *irena* and *schwaneri*, although there do not seem to be such size differences between the latter two. Last but not least, we present a selection of vocal data that are indicative of frequency and/or temporal differences between *schwaneri* and the other two in alarm call delivery and amongst all three taxa in territorial call delivery (Figs. 1–2). Although vocal

sample size did not allow for firm conclusions, the bioacoustic results match our experience with these birds in the field, to the extent that an individual in the forest can usually be identified to taxon level (using such traits as call length and vocal quality based on frequency range) if both territorial and alarm calls are given.

The three taxa *irena*, *schwaneri* and *guajana* do not presently come into geographic contact. To assess their taxonomic status under the Biological Species Concept, it is necessary to judge whether their differences equal those between other closely related *Pitta* species (e.g. Mayr & Ashlock 1991, Helbig *et al.* 2002). There are three *Pitta* complexes whose member species are less differentiated in terms of plumage and/or vocalisations than the three Banded Pitta taxa. In each of these three complexes, member taxa come into contact with each other in a parapatric or sympatric fashion and behave as good biological species.

(1) The African *P. angolensis* and Green-breasted Pitta *P. reichenowi* are a closely related species pair (Irestedt *et al.* 2006) widely replacing each other over their Afrotropical distribution, but breeding and non-breeding populations of both species come into contact both west and east of the Congo Basin with little evidence of intergradation (Erritzoe 2003). Both species are sexually monomorphic and resemble each other closely. The buff breast of *P. angolensis* is replaced in *P. reichenowi* by a dull green that is delimited from the white throat by a narrow black breast patch (Erritzoe 2003). While these underparts differences parallel those among Banded Pitta taxa, the two Afrotropical pittas do not exhibit comparable differences in head coloration and can thus be regarded as more uniform than Banded Pittas.

(2) Another closely related species pair, the Blue-naped *P. nipalensis* and Blue-rumped Pitta *P. soror* (Irestedt *et al.* 2006), co-occur widely over northern Indochina as good species, although they tend to replace each other altitudinally (Erritzoe 2003). Males in both species are geographically variable but have buff to rufous head and underparts, while the nape, tail, rump and upperparts are an iridescent green to blue. Females in both species closely resemble their respective male counterparts but for the lesser degree of iridescent coloration on the upperparts, nape, rump and tail. Comparing the two species, the main characters that set them apart pertain to differences in distribution and hue of the blue-to-green iridescence on the nape and rump. There are also less marked differences in the hue of their underparts. All in all, the major differences in coloration between these two species are restricted to limited parts of the body and are comparable if not less intense than those among Banded Pittas.

(3) The Mangrove *P. megarhyncha* and Blue-winged Pitta *P. moluccensis* were formerly considered conspecific, but are now unanimously treated as different species (e.g. Erritzoe 2003) because of the lack of intergrades in areas of sympatry. *P. megarhyncha* is narrowly confined to mangrove habitat along the eastern Bay of Bengal and Straits of Malacca, but *P. moluccensis* occurs widely in South-East Asia and—although usually replaced by *P. megarhyncha* in mangrove habitat—overlaps widely with the latter in its breeding and non-breeding grounds. Apart from bill size, the only consistent morphological difference between these two sexually monomorphic species is the brown rather than black crown coloration in *P. megarhyncha* (Erritzoe 2003). In terms of plumage, the two species are therefore much more similar than the three Banded Pittas are to one another. In addition, vocal differences between *P. megarhyncha* and *P. moluccensis* are slight (e.g. description in Erritzoe 2003); in fact, their calls are doubtfully distinguishable in the field (pers. obs.) and consistent differences remain to be documented.

Thus the three strongly differentiated forms of Banded Pitta may be accepted as full species since their differences surpass those of the sympatric or parapatric species of pitta enumerated above. However, a further aspect in favour of biological species status for these three forms is the range of ecological differences among them. Bornean *schwaneri* is essentially a hill forest inhabitant, which—although occasionally recorded near sea level—is never found far from areas of topographic relief (Lambert & Woodcock 1996; pers. obs.). In contrast, *irena* from the mainland and Sumatra is characteristic of flat floodplain rainforest, although it does also occur at higher elevations (Lambert & Woodcock 1996; pers. obs.). Among the three taxa, nominate *guajana* is probably the one that is least often recorded at higher elevations. However, in contrast to the other two taxa, it has a broad tolerance for degraded, secondary and floristically poor coastal forest types and even occurs in scrub (Lambert & Woodcock 1996; pers. obs.).

Based on current disjunct distributions, the three Banded Pitta taxa are widely regarded as allopatric. However, taking into account the history of land connections in the region, they must be regarded as essentially parapatric, as they have regularly come into prolonged contact during glacial periods. Within the last three million years, Java, Bali, Sumatra, Borneo and the mainland have repeatedly been connected during c.20 glacial epochs that have each lasted c.10,000–50,000 years. These connections arise when glacial periods cause the global sea-level to drop by up to 130 m (Bintanja *et al.* 2005, Caputo 2007) and to expose areas of shallow sea. In fact, the present island distribution of Sundaic rainforests is unrepresentative of the area's biogeographic past, such that the distribution of the three taxa of Banded Pitta has probably been connected more often than not during the late Pliocene and Pleistocene (Cannon *et al.* 2009). Since we are now going through the peak of an interglacial, the present allopatry of the three Banded Pitta groups is an artefact of timing, while—at most other times in the Pleistocene—they have come into geographic contact or even overlapped regionally. Viewed against this biogeographic background, their ecological and habitat differences may have evolved as isolation mechanisms to avoid the production of hybrid offspring.

If the three Banded Pittas constituted one biological species, we would expect them to vary in a clinal fashion, given ample opportunities for gene flow during much of the late Pliocene and Pleistocene glacial epochs. Such clinality should be particularly noticeable in areas where the different taxa presently come into close geographic proximity, such as south Sumatra and west Java, which are currently only separated by 25 km of shallow shelf. However, pittas on either side of the Sunda Strait exhibit plumages and vocalisations typical of their own taxon, with no intermediacy apparent in any of the museum material inspected. In contrast to the great phenotypic differences between Sumatran and Javan pittas across the

Sunda Strait, populations of *irena* on the Sumatran and Malayan end of the Malacca Strait are identical to each other, even though geographic distance is slightly larger than between Java and Sumatra. The only alternative to species status of the three taxa would be to argue that phenotypic differences between Java, Thai-Malay Peninsula, Sumatra and Borneo have evolved within 10,000 years since the last land connection and are wiped out every time the sea-level drops and creates opportunities for contact. However, such a short time-frame for the evolution of species level differences is untenable even under the most relaxed assumptions of evolutionary speed in birds (e.g. Friesen *et al.* 2007).

Based on their morphological, vocal and ecological differences that equal or exceed those among other *Pitta* species, and based on their taxon integrity despite continual geographic contact throughout much of the past three million years, we propose biological species status for both *P. schwaneri* and *P. irena* as distinct from *P. guajana*. We propose that each of these three species be recognised as monotypic. As English names, we propose Malayan Banded Pitta, Bornean Banded Pitta and Javan Banded Pitta for *P. irena*, *P. schwaneri* and *P. guajana*, respectively. The name Banded Pitta should continue to be applied to the group as a whole. The retention of the word 'Banded' combined with a geographic attribute in the common name ensures that there is no confusion between old treatments and new ones that accept this split. The species resulting from this revision clearly require assessment as to their conservation status. Further research may demonstrate some of them (especially *P. guajana* and *P. irena*) in need of elevation to Vulnerable status.

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The birds of Namdapha National Park and surrounding areas: recent significant records and a checklist of the species

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We report significant records from several years of opportunistic observations (2004–2009) and a bird survey (2008–2009) from the low, mid- and higher elevations of Namdapha National Park and its adjoining forests. Namdapha is situated in the north-east Indian state of Arunachal Pradesh, in the Indo-Myanmar global biodiversity hotspot. We report 62 species not recorded from the area previously, including globally threatened species such as Black-necked Crane *Grus nigricollis* and Blyth's Tragopan *Tragopan blythii*, as well as significant extensions of range of species such as Black-faced Warbler *Abroscopus schisticeps*. Based on previously published reports and our own records, we compiled a checklist of the birds of Namdapha and surrounding areas of 491 species. We also provide the local vernacular names of species and species groups for 198 species based on extensive interviews with the resident *Lisu* community. Our findings suggest that further surveys are needed in the montane forests of the Eastern Himalaya to document the birdlife of the region fully.

INTRODUCTION

Arunachal Pradesh remains India's biological frontier (Mishra & Datta 2007). Almost entirely hilly, this north-east Indian state has been poorly surveyed and the avifauna of many areas remains inadequately documented. Recent surveys have resulted in the discovery of a bird species previously unknown to science, Bugun Liocichla *Liocichla bugunorum* (Athreya 2006), and the rediscovery of a bird species, Rusty-throated Wren Babbler *Spelaeornis badeigularis* after a gap of over 60 years (King & Donahue 2006).

Namdapha National Park (27°23′30″–27°39′40″N 96°15′2″–96°58′33″E; 200–4,571 m asl; 1,985 km²) and its surrounding community forests are situated in Changlang district in south-eastern Arunachal Pradesh, on India's border with northern Myanmar. With an altitudinal range of over 4,300 m and its location in the Eastern Himalaya, Namdapha is one of the most avifaunally diverse areas in the world, and the park, along with Kamlang Wildlife Sanctuary immediately to its north, has been declared an Important Bird Area (Islam & Rahmani 2004).

Most of the park has remained unexplored and the avifauna poorly documented owing to the rugged terrain, logistical difficulties and lack of motorable all-weather roads. A few organised international bird tours visit Namdapha, primarily in the winter months. In contrast, protected areas such as Eaglenest Wildlife Sanctuary in West Kameng district of Arunachal Pradesh have regular birdwatching tours and excellent year-round documentation of the birdlife at all altitudes owing to much improved access in the past few years. In Namdapha, moreover, birdwatching and birding surveys have been

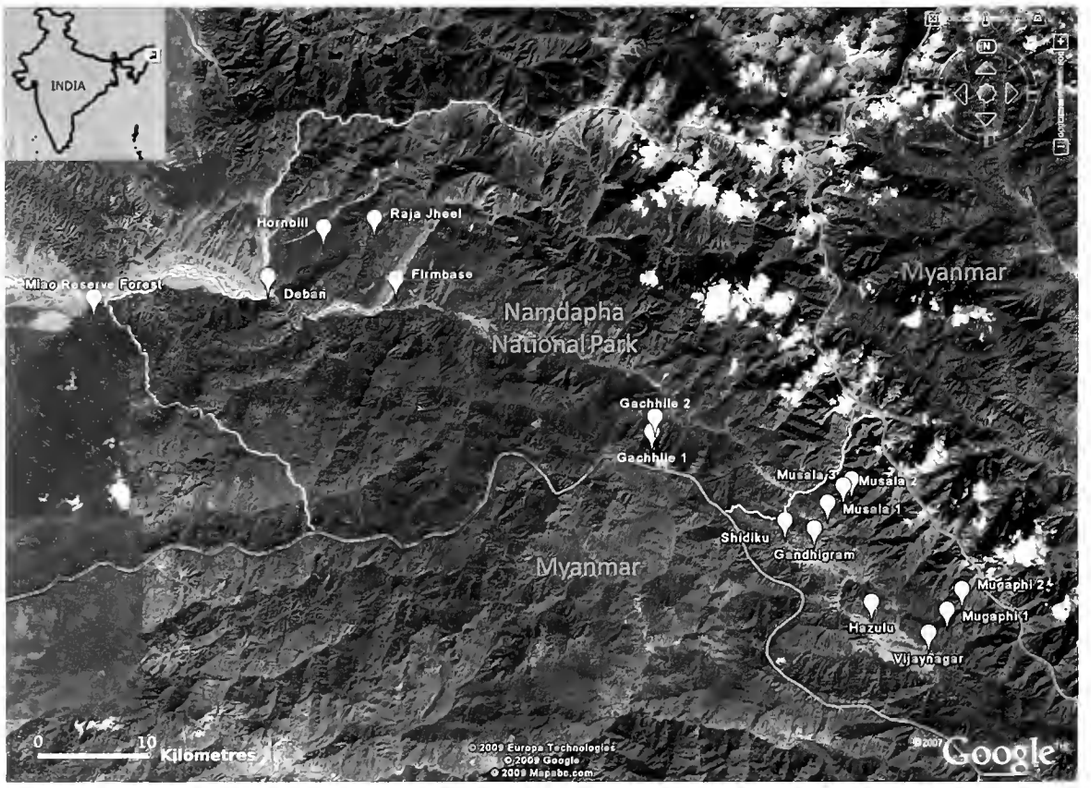

Figure 1. Map of Namdapha National Park and adjoining area with survey locations (2008-09) marked with white flags. The white lines indicate the boundaries of the national park. Source: Google Earth.

mainly in the low-altitude evergreen forest (the Assam valley tropical wet evergreen forest of Champion & Seth 1968) in the western end of Namdapha, and barring a single survey (Ripley *et al.*, 1991) the birdlife of the higher elevations and habitats is largely unknown. This high-elevation work involved several short-term surveys in the late 1980s in the Gandhigram area (in community forests to the east of the park), which led to the recording of 22 species previously unknown from the area, including the discovery of a new subspecies, *indiraji*, of the Bar-winged Wren Babbler *Spelaeornis troglodytoides* (Ripley *et al.* 1991).

Over the past five years we have visited the national park and the surrounding community forests regularly, which has led to the opportunistic documentation of several species and subspecies hitherto unknown from the area. From 9 November 2008 to 14 January 2009, over some 50 days of fieldwork, two of us (US and SD) conducted an avifaunal survey of the mid- and high altitudes (1,000–3,800 m; Fig. 1, Appendix 1) of parts of the park and of the community forest to the east of the park.

The combined records from several years of opportunistic bird sightings (1997–2008) and the results of the 2008–2009 survey are presented here. In addition, earlier published records and reports, as well as trip reports posted on the internet (Saha 1985, Chatterjee & Chandiramani 1986, Ghosh 1987, Neog & Bhatt 1991, Ripley *et al.* 1991, Alström 1994, Bostock & Gardiner 1994, Samant *et al.* 1995, Singh 1995, Athreya 1996, Choudhury 1996, Athreya *et al.* 1997, Singh 1999, Waite 2003, Birand & Pawar 2004, Chatterjee 2004, Banerjee 2009) were used to develop a checklist of the birds of Namdapha National Park and the surrounding community forests (Appendix 2). Sources used varied greatly in their level of detail and overall scope, and included single sighting records, waterfowl-specific and raptor-specific surveys, as well as dedicated bird surveys and faunal surveys. Also, the methods used in these publications varied, from opportunistic sightings and active searches to mist-netting and call playback. Several species for which reports could not be substantiated due to lack of any other information associated with the record (e.g. location, date and time of sighting) are enclosed in square brackets in the checklist. Species for which identification is tentative, or based on aural records, are also enclosed in square brackets. This represents the most up-to-date checklist of the birds of this area. Our surveys recorded 62 species hitherto unknown from the area.

We also documented the *Lisu* names (the *Lisu* are the resident tribe of the area to the east of Namdapha National Park) of a large proportion of the species found in and around Namdapha. These names are presented in the checklist. Some of the *Lisu* names are generic for particular bird groups e.g. *nye-see* for warblers and *yibh* for most waterfowl. Other names are species-specific, e.g. *chlu-nyu* for Rufous-necked Laughingthrush *Garrulax ruficollis*.

Owing to its large area and altitudinal range, Namdapha and its surrounding areas encompass a wide range of habitats. Dipterocarp-dominated Assam valley tropical wet evergreen forest (Champion & Seth 1968) occurs at lower elevations, with several bamboo species (locally known as *wachokha* and *diji*), *Zalacca secunda* (a stemless palm) and cane stands on the slopes and streambeds. The two major tree species in this habitat are *Dipterocarpus macrocarpus* and *Shorea assamica*. Other important tree species include several emergents like *Terminalia myriocarpa*, *Altingia excelsa* and *Ailanthus grandis*. This habitat type extends to about 1,300 m. Evergreen forests intergrade into northern montane wet temperate forest (Champion & Seth 1968) dominated by oaks, laurels and chestnuts. The undergrowth in these habitats is dominated by several bamboo species (genus *Chimonobambusa*; local names *mapfu*, *awa* and *ade*). Stunted rhododendron forest begins from about 2,500 m and gives way to progressively shorter montane bamboo, which in turn changes to subalpine grassy meadows at about 3,300 m. These meadows are snow-bound during the winter. Lakes, ponds and streams occur in all these habitats, and we specifically surveyed one lake at 1,700 m in broadleaved temperate forest, and ponds, swamps and paddy stubble around the villages of Gandhigram and Shidiku (1,000 m).

METHODS

Barring the records obtained during the survey, all records were based on opportunistic sightings, mostly during walks in the forest. During the bird survey in the winter of 2008–2009, in addition to opportunistic bird sightings and call records, we also used taped playback to confirm the presence of species. Prior to the survey, species expected to occur in the different habitat types were listed, and recordings of their calls and songs obtained from www.xeno-canto.org/asia. We played the calls of rarer species in habitats where they were expected to occur and, on very infrequent occasions, used playback to obtain photographs of previously unrecorded species or of individuals that appeared to differ from subspecies or morphs expected to occur in the area.

Along with these methods, we interviewed people of the local *Lisu* tribe, who have an intimate knowledge of the birdlife of the area. Interviews included showing people field guides and photographs of birds, and noting down the species that were known to the *Lisu* from various habitats and elevations. Through these interviews we were able to anticipate the occurrence of several species in different habitats, and identify species that potentially occur in the area but were not recorded during our survey. In addition, we also recorded the *Lisu* names of 198 bird species (including generic names for bird groups); for most, we independently verified the names by asking two to three *Lisu*. Nomenclature in this report follows the updated version of Inskipp *et al.* (1996), and the sequence follows Dickinson (2003). Information on species distribution and ranges was obtained mainly from Rasmussen & Anderton (2005).

RESULTS

In all, we list 491 species occurring in Namdapha and the adjoining reserve and community forests (Appendix 2), of which 62 species were encountered during our survey and so far have not been recorded from this area. Some significant records follow. Scientific names of species mentioned in the annotated text and present in Namdapha National Park are found in Appendix 2.

CHESTNUT-BREASTED PARTRIDGE *Arborophila mandellii*
19–21 December 2008, Mugaphi–2 (2,059 m): calls heard

during the afternoon and evening. 30–31 December 2008, Musala–3 (2,050 m): calls heard. First records. This species was heard only in temperate forest with predominantly bamboo undergrowth.

Blyth's Tragopan *Tragopan blythii*
We heard the call of this species for the first time on 16 December 2008 at 16h20 (dusk) at Mugaphi–2 (2,059 m). The next day, one male and two females were sighted. On 20 December 2008, at 07h20 and 16h00, we heard the call again. First record. The display of this species is well known to the *Lisu*, and the local name *nye-nee* (literally devil-bird or ghost bird) is claimed by some to refer to the 'horns' that appear during the breeding display of this bird.

Bar-headed Goose *Anser indicus*
A single flock of 12 birds seen in flight at Firmbase (434 m), following the Namdapha River. Early November 2006. First record.

[Tundra Swan *Cygnus (columbianus) bewickii*
13 December 2008, 11h30, Gandhigram (1,000 m): two birds in flight along with three Ruddy Shelducks. Both birds were tentatively identified as Bewick's Swans (about 1.5 × the size of Ruddy Shelduck) as they were equally sized and much smaller than either Mute Swan *C. olor* or Whooper Swan *C. cygnus*. All these swans are winter vagrants to the Indian subcontinent, and are known from only a smattering of records in the north-western part of the region. This represents the second winter record of swans from Namdapha (and north-east India) (after Singh 1999, who recorded the Whooper Swan) and the first photographically substantiated record of swans from anywhere in the subcontinent for over eighty years.]

White-winged Duck *Cairina scutulata*
7–8 December 2008, Gachhile–1 (1,705 m): three sightings over two days, of two females and one male. The highest altitudinal record for this species from anywhere in the world, previously known from the lowlands to 1,400 m (Robson 2005).

Gadwall *Anas strepera*
A group of 15 to 20 birds on the Noa-Dihing River near the 40th Mile (c.600 m), MV (Miao–Vijaynagar) Road.

Eurasian Wigeon *Anas penelope*
5 January 2009, 10h30, Shidiku (1,000 m): a single female sighted in a small pool in the midst of grassland and paddy stubble. First record.

(Chinese) Spot-billed Duck
Anas (poecilorhyncha) zonorhyncha
5 January 2009, 10h30, Shidiku (1,000 m): three birds (two females and one male). First seen in flight, then settled on lake. Differentiated from Indian Spot-billed Duck *Anas (poecilorhyncha) poecilorhyncha* based on the purple (not green) colour of the speculum, dark stripe on the cheek and lack of a red bill-spot. First record.

Ferruginous Duck *Aythya nyroca*
7–9 December 2008, Gachhile–1 (1,705 m): five birds (two males and three females) always seen in the more open waters of the lake. Winter range extension.

Cattle Egret *Bubulcus ibis*
Commonly found along with domesticated buffaloes in paddy stubble (1,000 m). First record.

Merlin *Falco columbarius*
12 October 2005, Miao (200 m): a single female observed by SD. This is one of the few sightings of this species from north-east India, and possibly the first from Arunachal Pradesh. Identified based on the lack of a distinct facial pattern combined with rather short wings and streaking on the nape of the neck.

Lesser Kestrel *Falco naumanni*
11 October 2005, 15h30, Deban (342 m): single male observed hovering by SD. First record.

Hen Harrier *Circus cyaneus*
Regularly seen quartering paddy stubble and open meadow all day near Gandhigram (1,000 m), noted in winter of 2005, 2006 and 2007 also by all authors. 17 December 2008, above Mugaphi–2 (3,800 m, Mugaphi summit, subalpine grassland): female quartering short grassland around the peak—an exceptionally high record for this species in the middle of the winter season.

Pallid Harrier *Circus macrourus*
A single bird seen in paddy stubble below 38 mile village in early November 2006. Not previously recorded. Identified based on black wing-tips and pale head with lack of black trailing edge on wings.

Japanese Sparrowhawk *Accipiter gularis*
13 December 2008, 14h30, Gandhigram (1,000 m): single bird seen soaring above paddy stubble. 4 January 2009, 15h15, Gandhigram: one bird in flight. An erratic winter vagrant to the subcontinent, known from a smattering of records from across the subcontinent including the Andaman Islands. Identified by the presence of a yellow eye-ring and red iris. Differentiated from Besra by lack of a clear mesial stripe and fine barring on the undersides, and from Shikra by the presence of broader barring on the primaries and secondaries and tail.

Steppe Eagle *Aquila nipalensis*
A single bird perched on a tall tree in open habitat at 40th Mile (c. 600 m), MV Road, in November 2006. Identified based on the gape-line, which extended to the rear margin of the eye. First record.

Slaty-legged Crake *Rallina eurizonoides*
7 December 2008, 12h30, Gachhile–1 (1,705 m): single bird swimming from one grass clump to another at lake edge. This species is poorly known from scattered records across India and this record is a range extension. First record.

[Black-tailed Crake *Porzana bicolor*
12 December 2008, 16h30, Gandhigram (1,000 m): single bird calling at dusk from marshy land near paddy fields. Responded to playback of taped call by calling. 13 December 2008, 08h45, Gandhigram: heard in response to playback of taped call. 4 January 2009, Shidiku: call heard from tall grass bordering small lake. A species known from very few locations in Arunachal Pradesh. Possibly

widespread but overlooked owing to its skulking habits. First record.]

Common Coot *Fulica atra*
7–9 December 2008, Gachhile–1 (1,705 m): four birds seen throughout the day on three days. First record.

Black-necked Crane *Grus nigricollis*
4–5 January 2009, Gandhigram (1,000 m): a single juvenile bird first seen in flight and then stalking through paddy stubble. In India, this species is regularly known to winter only in two valleys, Zemithang (2,000 m) and Sangti (1,500 m), both in western Arunachal Pradesh (Islam & Rahmani 2004). This record is the easternmost wintering range of this species in India, and the lowest known wintering site (1,000 m) anywhere in the world (previous lowest 1,375 m: Archibald & Meine 1996). A few *Lisu* from Gandhigram say that they have noticed solitary juvenile birds wintering in the paddy fields for the last six to seven years.

[Wood Snipe *Gallinago nemoricola*
8 December 2008, 17h00, after dusk, Gachhile–1 (1,705 m): single bird heard intermittently as it circled the lake for about five minutes. Not reported previously.]

Tawny Fish Owl *Ketupa flavipes*
13 November 2008: a single captive being carried in a wicker basket, identified by US, said to have been caught near Shidiku. First record.

Hodgson's Frogmouth *Batrachostomus hodgsoni*
The first record of this species from Namdapha (a sighting by AD and MOA in the winter of 2006–2007 with photographs) was from bamboo-dominated habitat in lowland evergreen forest (at Bornala on the Hornbill–Ranijheel–Firmbase track, c. 800 m). 9 January 2009, 18h45, Rajajheel (887 m): call heard in response to playback.

Ward's Trogon *Harpactes wardi*
18 December 2008, 07h45, Mugaphi–2 (2,059 m): call heard three times. Five birds (two males and three females) approached in response to taped call. 19 December 2008, 07h15, Mugaphi–2: call heard thrice. 30 December 2008, 13h10, Musala–3 (2,050 m): call heard. Five birds responded to taped call. Two males and two females identified and the gender of fifth bird could not be determined. The first confirmed record of this Near Threatened species from the area, and a minor, expected extension of the known range of this species. Not reported by Ripley *et al.* (1991) from the only mid- to high-elevation survey conducted in the area previously, but included by Ghosh (1987) in a checklist of the birds of Namdapha without sighting/record details. Appears to be common in the area, and in temperate forest with mossy branches the call (without sightings) was heard almost every day in the 2008–2009 survey. Recorded regularly from only a few localities in Bhutan and western Arunachal Pradesh (SD pers. obs.). There is a single record from the Mishmi Hills (Singh 1995), just north of Namdapha.

Rufous-bellied Woodpecker *Dendrocopos hyperythrus*
A single bird seen in November 2006 in evergreen forest near 55th Mile (c. 650 m), MV Road. First record.

Grey-capped Pygmy Woodpecker *Dendrocopos canicapillus*
14 January 2009, 07h30, Deban (342 m): two birds in a mixed-species flock with Greater Racket-tailed Drongo, Scarlet Minivet and other species. First record.

Darjeeling Woodpecker *Dendrocopos darjellensis*
20 December 2008, 06h30, Mugaphi–2 (2,059 m): a single bird seen and heard calling. First record.

Great Spotted Woodpecker *Dendrocopos major*
1 January 2009, 08h20, Musala–2 (1,801 m): One bird in a mixed-species flock with Greater Yellownape, Common Green Magpie, Black-winged Cuckooshrike, Greater Racket-tailed Drongo, Ashy Drongo, Rusty-fronted Barwing, Striated Laughingthrush and Maroon Oriole. A range extension for this species, which has confirmed records only from Manipur in India, but occurs in Europe and northern South-East Asia, including adjoining northern Myanmar. Identified based on the presence of the red nape and white neck-patch.

Common Flameback *Dinopium javanense*
November 2006, Hornbill camp (506 m): single birds seen on two separate occasions, both times as part of mixed-species bird flocks. First record.

Burmese Shrike *Lanius collurioides*
A single bird sighted in open habitat near the 67th Mile (c. 750 m), MV Road in November 2006. The chestnut-coloured rump distinguished this bird from Bay-backed Shrike *L. vittatus*. A significant northward range extension of the winter range of this species.

Yellow-browed Tit *Sylviparus modestus*
19 December 2008, 12h00, Mugaphi–2 (2,059 m): in a mixed-species flock with Yellow-throated and Rufous-winged Fulvettas, Golden Babbler, White-bellied Yuhina, Black-eared Shrike Babbler, Yellow-cheeked Tit and White-tailed Nuthatch. First record. 22 December 2008, 10h00, between Mugaphi–1 and Mugaphi–2 (1,974 m, few coniferous trees in temperate forest): single bird in a mixed-species flock with Green-backed Tit, Yellow-cheeked Tit and Buff-barred Warbler.

Fire-capped Tit *Cephalopyrus flammiceps*
Seen between Gandhigram and Hazulu (c. 1,000 m) in December 2006. First record.

Sand Martin *Riparia riparia*
A common species, regularly observed at Deban (342 m). No published records previously from Namdapha National Park. Pale Martin was excluded based on the known geographical range of this species, which is in north and north-west India.

Hill Prinia *Prinia atrogularis*
Common in abandoned shifting cultivation, open secondary areas, orchards and around habitation. Seen and heard several times over the entire survey period.

Dark-necked Tailorbird *Orthotomus atrogularis*
13 January 2009, 08h25, Deban (3,442 m): one female seen in bushy hedge bordering forest resthouse compound. First record.

Crested Finchbill *Spizixos canifrons*
A single flock of birds sighted in evergreen forest near 40th Mile (c. 600 m), MV Road, in November 2006. A first record and range extension of this species, but not unexpected.

Brown-flanked Bush Warbler *Cettia fortipes*
Common in hedges and bamboo thickets around habitation and cultivation. Seen singly at Gandhigram, Musala–1 (1,258 m) and Hazulu (1,000 m). First record.

Blyth's Reed Warbler *Acrocephalus dumetorum*
Regularly seen in hedges and thickets around paddy cultivation in winter, Gandhigram (1,000 m). First record.

Dusky Warbler *Phylloscopus fuscatus*
5 January 2009, 11h40, Shidiku (1,000 m): several birds sighted singly in grass clumps bordering lake. First record.

Tickell's Leaf Warbler *Phylloscopus affinis*
5 January 2009, 11h40, Shidiku (1,000 m): single bird sighted in grass clumps and low trees bordering lake. First record.

Buff-barred Warbler *Phylloscopus pulcher*
20 November 2008, 13h00, c.1,000 m, between Gandhigram and Vijaynagar: a single bird in a mixed-species flock with Nepal and Rufous-winged Fulvetta, Grey-throated Babbler, Black-eared Shrike Babbler and Grey-hooded Warbler. 17 December 2008, 09h15, above Mugaphi–2 (2,800m, rhododendron forest): one individual seen. 18 December 2008, 09h00, Mugaphi–2: a single bird seen. 22 December 2008, 10h00, between Mugaphi–1 and Mugaphi–2 (1,974 m, few coniferous trees in temperate forest): single bird in a mixed-species flock with Yellow-browed Tit, Yellow-cheeked Tit and Green-backed Tit. First record.

[Eastern Crowned Warbler *Phylloscopus coronatus*
26 December 2008, 13h00, Vijaynagar (1,200 m), secondary growth: two birds in a mixed-species flock with Speckled Piculet, Rufous-backed Sibia, Blue-winged and Red-tailed Minlas, Rufous-winged Fulvetta, Golden Babbler, Black-eared and White-browed Shrike Babblers, Lemon-rumped, Chestnut-crowned and Grey-cheeked Warblers, White-throated and Yellow-bellied Fantails, Yellow-cheeked Tit, Fire-breasted Flowerpecker, Black-breasted Sunbird, and Grey-headed Canary Flycatcher. The single wing-bar and yellow vent enabled differentiation from Blyth's Leaf Warbler. We are confident our identification is correct but as this would constitute a first Indian subcontinent record (see Rasmussen & Anderton 2005) we treat it here as tentative.]

Black-faced Warbler *Abroscopus schisticeps*
18 December 2008, 08h40 and 09h00, Mugaphi–2, temperate forest (2,060 m): flock of 6–8 birds foraging in the mid-storey and canopy. 19 December 2008, 07h20, a single flock of c.10 birds. 22 December 2008, 10h10, between Mugaphi–1 and Mugaphi–2 (c. 2,000 m): 4–6 birds in a mixed-species flock with Golden Babbler, Rufous-winged Fulvetta, Brown-throated Treecreeper, Grey-headed Canary Flycatcher, White-bellied Yuhina and other small warbler species. A range extension for this species (and the easternmost record from India), so far known in the Himalayas eastward only up to central Arunachal Pradesh, with a disjunct population in northern Myanmar.

Long-billed Wren Babbler *Rimator malacoptilus*
19 December 2008, 10h30, Mugaphi–2 (2,059 m): calls heard. Three individuals sighted in response to tape playback. One bird sighted at 13h40. Only the second time that this species has been sighted in or near Namdapha (first record in Ripley *et al.* 1991). Appears to be fairly common in the understorey of temperate forest.

Scaly-breasted Wren Babbler *Pnoepyga albiventer*
The song of this species was heard at several locations throughout the survey period including Gachhile, Mugaphi, Musala, Rajajheel and Hornbill (c.500–2,200 m). An apparently common species, hitherto unrecorded from the area.

Wedge-billed Wren Babbler *Sphenocichla humei*
19 December 2008, 09h15, Mugaphi–2 (2,059 m): one bird sighted, although there were definitely more present. 2 January 2009, 08h15, Musala–2 (2,050 m): a flock of 7–8 birds in bamboo undergrowth in temperate forest (previous record in Athreya *et al.* 1997).

[Streak-breasted Scimitar babbler *Pomatorhinus ruficollis*
18 December 2008, 09h40, Mugaphi–2 (2,059 m): call heard. A single aural record throughout the 2008–2009 survey period and a first record from the area.]

Snowy-throated Babbler *Stachyris oglei*
10 January 2009, 06h00 and 07h55, Rajajheel (887 m): calls heard. 11 January 2009, 07h45, Rajajheel: flock of 6–8 birds. This species appears to be highly habitat-specific, always found by us in or near thickets of *wachukha* (*Lisu* name), a large thick-stemmed bamboo on moderate to steep slopes in the lowlands (up to about 900 m). Very common in monospecific flocks of 15–25 birds in this habitat. Never observed in mixed-species flocks. Seen always on stretch of track between Bulbulia and Ranijheel (c. 800 m) and also after Ranijheel on the track down to Firmbase (c. 450–900 m). One flock sighted on the uphill track from Burma nala crossing up to the MV road point at 38–39 mile in November 2006. A range-restricted species that appears to occur commonly in its habitat and one that has been reported regularly from the area.

Striped Laughingthrush *Garrulax virgatus*
A sighting of a single flock of birds on a forest track (c.1,300 m) on the north bank of the Dihing river near 77th Mile village, in December 2006. This report extends the known range of this species to the north.

Red-headed Laughingthrush *Garrulax erythrocephalum*
16 December 2008, between Mugaphi–1 and Mugaphi–2, temperate forest: a single bird seen, possibly more. 30 December 2008, 10h00 and 11h20, Musala–3: a flock of 5–6 birds in the undergrowth. First records.

Streak-throated Barwing *Actinodura waldeni*
17–18 December 2008, Mugaphi–2 (2,059 m): single species flocks of 5–6 birds seen, foraging in the canopy and on bark. 18–20 December 2008, Mugaphi–2: birds

observed in a mixed-feeding flock with Rusty-fronted Barwing, Maroon Oriole and Grey-sided Laughingthrush. Another mixed feeding flock with Rusty-fronted Barwing and Slender-billed Scimitar Babbler also included a few birds of this species.

Morphological variation. Several individuals differed appreciably from the four known subspecies of this species. These subspecies are *daflaensis* of South China and central Arunachal Pradesh, *waldeni* of north-east India and adjacent northern Myanmar, *poliotis* of the Chin Hills (western Myanmar) and *saturatior* of northern Myanmar and South China. Subspecies *daflaensis* has a whitish throat, breast and upper belly with dark streaks, *waldeni* and *poliotis* completely buffy-rufous underparts with brownish streaks and a brownish-grey head, and *saturatior* is similar to *waldeni* but purer grey on the head. All subspecies have relatively indistinct malar stripes.

Several of the individuals recorded by us (in Streak-throated Barwing flocks) had pale ash-grey foreheads, ash-grey ear-coverts with dark streaking posteriorly separated from a pale ashy throat, neck-sides and upper breast by a distinct dark grey-black malar stripe. These are characteristics shown by none of the subspecies of Streak-throated Barwing. A more comprehensive examination is required to determine whether these birds are juvenile Streak-throated Barwings or a different taxon entirely, given that the juvenile of this species is yet to be described.

Golden-breasted Fulvetta *Alcippe chrysotis*
Mugaphi–2 (2,059 m) for all records. 17 December 2008, 07h00: flock of 7–9 birds. 18 December 2008, 07h10: flock of 8–10 birds. 19 December 2008, 07h15: c.15 birds with Black-throated Parrotbills. 21 December 2008, 13h40: flock of 10–12 birds with single White-throated Fantail. Subspecies *albilineata* (narrow white crown-stripe). First records.

Streak-throated Fulvetta *Alcippe cinereiceps*
19 December 2008, 08h20, Mugaphi–2 (2,059 m): flock of four birds in bamboo undergrowth. Only the second record from the area (first in Ripley *et al.* 1991).

Grey Sibia *Heterophasia gracilis*
A single bird sighted at Hornbill camp (506 m) in January 2007. In Arunachal Pradesh, known previously from a single specimen from the Patkai Hills (Rasmussen & Anderton 2005), and not reported from Namdapha previously. This record is probably the lowest altitudinal report of this species, which is known to descend to 900 m in winter.

Fire-tailed Myzornis *Myzornis pyrrhoura*
30 December 2008, 11h40, Musala–3: single bird in bamboo midstorey in temperate forest (2,050 m). With Beautiful Sibias. Recorded by Ripley *et al.* (1991). Seen only once during the entire course of the survey.

White-tailed Nuthatch *Sitta himalayensis*
18 December 2008, 11h20, Mugaphi–2 (2,059 m): one bird seen. 19 December 2008, 12h00, Mugaphi–2: a single bird in a mixed-species flock with Yellow-throated and Rufous-winged Fulvettas, Golden Babbler, White-bellied Yuhina, Black-eared Shrike Babbler, Yellow-browed Tit and Yellow-cheeked Tit. First record.

Rusty-flanked Treecreeper *Certhia nipalensis*
17 December 2008, above Mugaphi–2 (c.2,800 m, rhododendron): a single bird seen. First record.

Brown-throated Treecreeper *Certhia discolor*
22 December 2008, 10h10, between Mugaphi–1 and Mugaphi–2 (c.2,000 m): single bird in a mixed-species flock with Golden Babbler, Rufous-winged Fulvetta, Black-faced Warbler, Grey-headed Canary Flycatcher, White-bellied Yuhina and other small warbler species. First record.

Wallcreeper *Tichodroma muraria*
A single bird seen at 65th Mile (750 m), MV Road in December 2007. Although not an unexpected winter visitor to the area, this is the first record of this species from Namdapha National Park.

Golden-crested Myna *Ampeliceps coronatus*
9 November 2008, Miao (200 m): a single flock of 10–12 birds, with roughly equal numbers of males and females. Range extension and first record, the prior records of this species from India being '...NE Cachar; one old record along Barak R (W Manipur), in lowlands and foothills' (Rasmussen & Anderton 2005).

Eyebrowed Thrush *Turdus obscurus*
26 December 2008, 14h00, between Vijaynagar and Hazulu (1,100 m): two birds feeding on berries in roadside vegetation. 27 December 2008, 08h15, Hazulu (1,005 m): about six birds in hedges bordering cultivation; two more seen in a garden at 09h00. 2–3 January 2009, Musala–1 (1,258 m): over 30 birds in hedges and fruiting trees in persimmon orchard. Common in roadside scrub and orchards near habitation. First records.

[Purple Cochoa *Cochoa purpurea*
18 December 2008, 10h20 and 12h10, Mugaphi–2 (2,059 m): on both occasions, heard singing continually for over 30 minutes. 20 December 2008, 15h00: call heard. No published records from the area previously, but known to occur and reported by birdwatchers (Japang Pansa, pers. comm.).]

White-browed Bush Robin *Tarsiger indicus*
9 December 2008, 06h00, Gachhile–1 (1,705 m): a single female bird in lake shore tangled undergrowth. The frog-like call was heard previous day at dusk (16h30). 17 December 2008, 09h50, above Mugaphi–2 (3,015 m, stunted rhododendron): a single female bird in undergrowth. 18–19 December 2008, Mugaphi–2 (2,059 m): one female found throughout the day on damp ground near water. 3 January 2009, 11h15, Musala–1 (1,258 m): calls heard. First records.

[Golden Bush Robin *Tarsiger chrysaeus*
3 January 2009, 09h30, Musala–1 (1,258 m): a single aural record in hedges in persimmon and pineapple cultivation. The first record of this species from the area.]

Blue-fronted Redstart *Phoenicurus frontalis*
8 December 2008, Gachhile–1 (1,705 m): a single male. First record for Namdapha National Park, and a winter range extension. 3 January 2009, 08h20, Musala–1 (1,258 m): single male in open second growth.

BLUE-FRONTED ROBIN *Cinclidium frontale*
21 December 2008, 13h55, Mugaphi–2 (2,059 m): single bird approached in response to taped call of Rusty-capped Fulvetta, with another individual calling some distance away. On playing the calls and songs of Blue-fronted Robin, the bird responded with a complex song incorporating vocalisations of Spotted Forktail, White-browed Bush Robin, White-browed Shortwing and White-gorgeted Flycatcher, all birds recorded almost daily at Mugaphi–2 in the immediate vicinity of the Blue-fronted Robin, indicating the latter as an excellent mimic. 1–2 January 2009, Musala–2: calls heard on both days. Previously recorded only by Athreya *et al.* (1997).

WHITE-GORGETED FLYCATCHER *Ficedula monileger*
Commonly seen singly or heard throughout the day at Mugaphi–2 (2,059 m) in bamboo undergrowth. The subspecies in this area is *leucops*. One sighting at Musala–2 on 1 January 2009.

VERDITER FLYCATCHER *Eumyias thalassinus*
27 December 2008, 08h15, Hazulu (1,005 m): a pair of birds in garden on edge of secondary forest. First record.

[PALE-CHINNED FLYCATCHER *Cyornis poliogenys*
12 January 2009, 16h30, Deban (342 m): song heard. First record.]

WHITE-TAILED FLYCATCHER *Cyornis concretus*
11 January 2009, 13h35, Hornbill (506 m): male in midstorey of evergreen forest in response to playback. No previously published records of this species from Namdapha.

GREEN-TAILED SUNBIRD *Aethopyga nipalensis*
18–19 December 2008, 09h00, Mugaphi–2 (2,059 m): a pair seen on the first occasion and a single male sighted on the second. Males also seen on 31 December 2008 and 1 January 2009 at Musala–2 (2,050 m). First records.

TIBETAN SISKIN *Serinus thibetanus*
A single sight record of 20–25 birds in flight near an alder *Alnus* stand upstream of Lashichilo on north bank of Noa-dihing river (79–80 mile area; c.900 m) in December 2006. First record.

GREY-HEADED BULLFINCH *Pyrrhula erythaca*
17 December 2008, 08h50, above Mugaphi–2 (2,760 m, rhododendron forest): a single male bird seen. First record.

GOLDEN-NAPED FINCH *Pyrrhoplectes epauletta*
16, 18 and 21 December 2008, 12h45, Mugaphi–2 (2,059 m): a single female in bamboo undergrowth seen on each day. A range extension for this resident species.

CHESTNUT BUNTING *Emberiza rutila*
27 December 2008, 08h20, Hazulu (1,005 m): a single male observed in a vegetable patch. Previously recorded only by Ripley *et al.* (1991).

BLACK-FACED BUNTING *Emberiza spodocephala*
A large flock seen in riverine grassland at Deban (342 m) in October 2005 by SD. 4 January 2009, 15h25, Gandhigram (1,000 m): two birds in hedge bordering paddy fields. First records.

DISCUSSION

Our findings indicate that the various habitats of Namdapha and its surrounding areas represent part of the ranges of globally threatened and uncommon species such as Blyth's Tragopan. The possible wintering of juvenile Black-necked Crane is potentially also significant, since the species is known to winter in only two other valleys in India, both in Arunachal Pradesh. Several other uncommon or restricted-range species occur here, including White-winged Duck, Ward's Trogon and Blue-fronted Robin. With almost 500 recorded species, this area is one of the most avifaunally diverse regions globally.

The results of our surveys and observations highlight the fact that the forests of Namdapha, especially those of higher elevations, still remain poorly known with respect to their avifauna. Several other species such as Blyth's Tragopan and Black-faced Warbler were observed for the first time. Common species such as Scaly-breasted Wren Babbler and Golden-breasted Fulvetta have not been reported despite collecting expeditions to the area about two decades ago. Given the recent spate of discoveries and rediscoveries from the state of Arunachal Pradesh (King & Donahue 2004, Athreya 2006), it is also likely that species remain to be discovered for the first time, not only from Namdapha, but also from other poorly explored areas in north-east India.

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APPENDIX 1
Details of locations referred to in the text

Location	Classification	Latitude	Longitude	Altitude	Habitats
Deban	National Park	27°29.82′N	96°23.40′E	342 m	Shingle river bank, evergreen forest, habitation
Hornbill	National Park	27°32.29′N	96°26.51′E	506 m	Primary evergreen forest
Bulbulia	National Park	27°52.59′N	96°44.13′E	640 m	Primary evergreen forest
Ranijheel	National Park	27°52.60′N	96°45.80′E	860 m	Primary evergreen forest
Rajajheel	National Park	27°32.73′N	96°29.37′E	887 m	Primary evergreen forest, bamboo
Musathi	National Park	27°50.03′N	96°52.30′E	624 m	Secondary evergreen forest
Firmbase	National Park	27°30.51′N	96°30.55′E	434 m	River bank, grassland, evergreen forest
65th Mile	National Park	27°23.99′N	96°46.63′E	750 m	River bank, lowland evergreen forest
Gachhile–1	National Park	27°22.13′N	96°44.87′E	1,705 m	Lake in temperate forest
Gachhile–2	National Park	27°22.87′N	96°45.04′E	1,476 m	Rattan-dominated evergreen forest
77 Mile	National Park	27°20.58′N	96°52.13′E	950 m	Primary and secondary evergreen forest
Lashichilo	National Park	27°20.18′N	96°52.13′E	950 m	Primary and secondary evergreen forest
Miao	Reserve Forest	27°30.23′N	96°11.16′E	200 m	Primary evergreen forest and secondary forest
Mugaphi–1	Unclassed State Forest	27°13.23′N	97°01.36′E	1,240 m	Primary evergreen forest
Mugaphi–2	Unclassed State Forest	27°14.26′N	97°02.20′E	2,059 m	Temperate forest with bamboo undergrowth
Musala–1	Habitation	27°18.58′N	96°54.68′E	1,258 m	Persimmon & orange orchard, secondary forest
Musala–2	Unclassed State Forest	27°19.44′N	96°55.56′E	1,801 m	Temperate mossy forest
Musala–3	Unclassed State Forest	27°19.74′N	96°56.03′E	2,050 m	Temperate forest with bamboo undergrowth
Shidiku	Habitation	27°17.85′N	96°53.00′E	1,000 m	Small lake with grass, marshland
Gandhigram	Habitation	27°11.17′N	96°54.72′E	1,000 m	Paddy stubble, marshland with tall grass
Hazulu	Habitation	27°12.43′N	96°57.44′E	1,050 m	Orchard, garden, secondary forest
Vijaynagar	Habitation	27°11.69′N	97°00.13′E	1,200 m	Abandoned *jhum* cultivation

APPENDIX 2
List of the birds of Namdapha National Park & adjoining areas, with *Lisu* vernacular names

Observers/authors: (1) Aparajita Datta, unpublished records (1997–2007), (2) Choudhury (1996), (3) Ghosh (1987), (4) Chatterjee & Chandiramani (1986), (5) Alström (1994), (6) Singh (1995), (7) Athreya *et al.* (1997), (8) Ripley *et al.* (1991), (9) Samant *et al.* (1995), (10), M. O. Anand & Rohit Naniwadekar, unpublished records (October 2006–January 2007), (11) Waite (2003), (12) Chatterjee (2004), (13) Umesh Srinivasan, unpublished records (winter 2007–2008), (14) Athreya (1996), (15) Umesh Srinivasan & Shashank Dalvi, unpublished records (winter 2008–2009), (16) Banerjee (2009), (17) Birand & Pawar (2004), (18) Bostock & Gardiner (1994), (19) Chatterjee & Chandiramani (1986), (20) Neog & Bhatt (1991), (21) Saha (1985), (22) Singh (1999), (23) Wadedekar (1993), (24) Chatterjee (2008).

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Hill Partridge *Arborophila torqueola*	*Doola*			+				+								+	+				+				+
Rufous-throated partridge *Arborophila rufogularis*	*Doola*	+		+							+		+	+		+					+				+
White-cheeked Partridge *Arborophila atrogularis*	*Doola*	+				?		+			+					+		+	+						+
Chestnut-breasted Partridge *Arborophila mandellii*	*Doola*															+									+
Mountain Bamboo Partridge *Bambusicola fytchii*	*Nye-kili*								+							+									
Blyth's Tragopan *Tragopan blythii*	*Nye-nee*															+									
[Himalayan Monal *Lophophorus impejanus*]																									+
Red Junglefowl *Gallus gallus*	*Mwe-aya*	+			+			+			+			+		+				+	+				+
Kalij Pheasant *Lophura leucomelanos*	*Nye-ju*	+		+	+	+		+			+	+		+	+	+	+		+	+	+				+
Grey Peacock Pheasant *Polyplectron bicalcaratum*	*Kookha*	+		+	+	+	+	+			+	+	+	+	+	+		+		+	+				+
Lesser Whistling-duck *Dendrocygna javanica*																	+				+				+

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Bar-headed Goose *Anser indicus*											+														
[Tundra Swan *Cygnus columbianus*]																?									
Whooper Swan *Cygnus cygnus*																							+		
Ruddy Shelduck *Tadorna ferruginea*	*Yibh*					+					+			+		+									+
White-winged Duck *Cairina scutulata*	*Yibh*		+					+	+		+			+		+					+				+
Gadwall *Anas strepera*	*Yibh*										+														
Eurasian Wigeon *Anas penelope*																+									
Spot-billed Duck *Anas poecilorhyncha*																+									
Common Teal *Anas crecca*				+																					+
Ferruginous Duck *Aythya nyroca*																+									
Common Goldeneye *Bucephala clangula*											+	+	+												+
Common Merganser *Mergus merganser*	*Yibh*	+	+	+		+	+	+			+	+			+	+	+	+		+	+			+	+
Little Grebe *Tachybaptus ruficollis*	*Yibh-dza-dza*	+									+					+									
Black Stork *Ciconia nigra*		+				+		+			+	+		+	+	+	+	+							+
Woolly-necked Stork *Ciconia episcopus*													+												
Black-necked Stork *Ephippiorhynchus asiaticus*																					+				
[Little Bittern *Ixobrychus minutus*]																									+
Cinnamon Bittern *Ixobrychus cinnamomeus*				+																					+
Striated Heron *Butorides striata*						+		+			+	+				+	+	+							+
Indian Pond Heron *Ardeola grayii*						+					+		+			+	+				+				+
Chinese Pond Heron *Ardeola bacchus*				+							+														+
Cattle Egret *Bubulcus ibis*																+	+								+
White-bellied Heron *Ardea insignis*	*Ajye-nye-gaga*	+	+			+		+			+	+	+	+		+									+
Goliath Heron *Ardea goliath*				+																					+
Great Egret *Casmerodius albus*	*Niche*			+		+																			+
Intermediate Egret *Mesophoyx intermedia*	*Niche*			+													+				+				+
Little Egret *Egretta garzetta*	*Niche*		+	+		+											+								+
Indian Cormorant *Phalacrocorax fuscicollis*																	+								+
Great Cormorant *Phalacrocorax carbo*	*Ngwa-dzo*	+	+	+	+		+	+			+	+	+	+	+	+	+	+		+	+				+
Collared Falconet *Microhierax caerulescens*										+							+								+
Pied Falconet *Microhierax melanoleucos*			+		+		+	+		+	+	+	+		+	+	+		+					+	+
Lesser Kestrel *Falco naumanni* (Please refer to text)																									
Common Kestrel *Falco tinnunculus*	*D-thh(g)*			+	+	+		+			+	+	+			+	+		+	+					+
Amur Falcon *Falco amurensis*			+							+	+														+
Merlin *Falco columbarius* (Please refer to text)																									
Eurasian Hobby *Falco subbuteo*						+													+						+
Oriental Hobby *Falco severus*										+	+								+	+	+				+
Peregrine Falcon *Falco peregrinus*					+			+	+	+			+	+						+	+				+
Osprey *Pandion haliaetus*	*Ngwa-dzo*							+			+			+											+
Jerdon's Baza *Aviceda jerdoni*				+						+	+					+									+
Black Baza *Aviceda leuphotes*										+								+			+				+
Oriental Honey-buzzard *Pernis ptilorhynchus*										+	+					+			+						+

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Black-winged Kite *Elanus caeruleus*						+				+											+				+
Black Kite *Milvus migrans*				+						+	+								+		+			+	+
Brahminy Kite *Haliastur indus*										+															+
White-tailed Eagle *Haliaeetus albicilla*	*Ngwa-dzo*	+				+	+	+			+					+									+
Lesser Fish Eagle *Ichthyophaga humilis*	*Ngwa-dzo*				+	+	+			+	+									+	+				+
Grey-headed Fish Eagle *Ichthyophaga ichthyaetus*		+			+						+			+											
Slender-billed Vulture *Gyps (indicus) tenuirostris*										+															+
Himalayan Griffon *Gyps himalayensis*										+															+
Eurasian Griffon *Gyps fulvus*										+															
Cinereous Vulture *Aegypius monachus*										+															+
Short-toed Snake Eagle *Circaetus gallicus*								+																	+
Crested Serpent Eagle *Spilornis cheela*	*Khwa-j-dz-pha*	+		+	+	+		+		+	+		+	+	+	+		+		+	+				+
Eurasian Marsh Harrier *Circus aeruginosus*				+						+															+
Hen Harrier *Circus cyaneus*	*D-thh(g)*	+									+		+			+									+
Pallid Harrier *Circus macrourus*											+														+
Pied Harrier *Circus melanoleucos*				+						+											+				+
Crested Goshawk *Accipiter trivirgatus*	*Dz-pha*	+						+		+	+					+			+						+
Shikra *Accipiter badius*	*Dz-pha*			+						+	+														+
Japanese Sparrowhawk *Accipiter gularis*	*Dz-pha*										+					+									
Besra *Accipiter virgatus*	*Dz-pha*			+						+	+														
Eurasian Sparrowhawk *Accipiter nisus*	*Dz-pha*			+				+		+			+												
Northern Goshawk *Accipiter gentilis*	*Dz-pha*									+															+
White-eyed Buzzard *Butastur teesa*		+								+	+			+		+									+
Common Buzzard *Buteo buteo*	*Dz-pha*									+						+									+
Long-legged Buzzard *Buteo rufinus*		+								+	+														+
Black Eagle *Ictinaetus malayensis*		+		+				+		+	+		+	+	+	+	+			+	+				+
Greater Spotted Eagle *Aquila clanga*														+							+				+
Steppe Eagle *Aquila nipalensis*											+														
[Golden Eagle *Aquila chrysaetos*]																									+
Bonelli's Eagle *Hieraaetus fasciatus*										+															+
Booted Eagle *Hieraaetus pennatus*										+															+
Rufous-bellied Eagle *Hieraaetus kienerii*		+				+		+		+	+				+	+									+
Changeable Hawk-eagle *Spizaetus cirrhatus*										+								+	+		+				+
Mountain Hawk-eagle *Spizaetus nipalensis*		+			+	+		+		+	+		+			+				+	+				+
Slaty-legged Crake *Rallina eurizonoides*																+									
Black-tailed Crake *Porzana bicolor*	*Ajye-nye-titi*															+									
Common Moorhen *Gallinula chloropus*				+												+					+				+
Common Coot *Fulica atra*																+									
Black-necked Crane *Grus nigricollis*																+					+				+
Ibisbill *Ibidorhyncha struthersii*		+	+	+		+		+			+		+								+				+
Northern Lapwing *Vanellus vanellus*		+				+					+			+		+									+

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
River Lapwing *Vanellus duvaucelii*		+	+	+		+		+			+	+			+	+	+	+			+			+	+
Red-wattled Lapwing *Vanellus indicus*		+		+		+		+			+		+	+		+			+		+				+
Pacific Golden Plover *Pluvialis fulva*								+																	
Long-billed Plover *Charadrius placidus*											+														+
Little Ringed Plover *Charadrius dubius*		?				+																			+
Greater Painted-snipe *Rostratula benghalensis*								+																	+
Eurasian Woodcock *Scolopax rusticola*				+																					
Wood Snipe *Gallinagó nemoricola*																+									
Pintail Snipe *Gallinago stenura*						+																			+
Common Snipe *Gallinago gallinago*						+										+									+
Common Greenshank *Tringa nebularia*				+		+																			+
Green Sandpiper *Tringa ochropus*	*Ajye-nye-titi*	+		+		+		+								+					+				+
[Wood Sandpiper *Tringa glareola*]																									+
Common Sandpiper *Actitis hypoleucos*	*Ajye-nye-titi*					+	+	+			+	+	+				+								+
Temminck's Stint *Calidris temminckii*						+																			+
Small Pratincole *Glareola lactea*						+																			+
Pallas's Gull *Larus ichthyaetus*			+			+	+																		+
Common Pigeon *Columba livia*	*Dupu*					+		+			+		+			+	+								+
Ashy Wood Pigeon *Columba pulchricollis*								+			+	+						+							+
Oriental Turtle Dove *Streptopelia orientalis*	*Dupu*			+				+			+					+					+				
Spotted Dove *Streptopelia chinensis*	*Dupu*	+		+	+	+		+			+	+	+	+	+	+	+	+	+	+	+	+			+
Barred Cuckoo Dove *Macropygia unchall*		+		+		+	+	+			+				+	+	+				+				+
Common Emerald Dove *Chalcophaps indica*	*Aghu-neechhi*	+		+	+	+		+			+	+	+	+	+	+	+		+	+	+	+			+
Orange-breasted Green Pigeon *Treron bicinctus*	*Aghu*	+		+												+					+				+
Pompadour Green Pigeon *Treron pompadora*	*Aghu*	+				+					+	+			+										+
Thick-billed Green Pigeon *Treron curvirostra*	*Aghu*			+							+								+		+				+
Pin-tailed Green Pigeon *Treron apicauda*	*Aghu-m-ka*	+		+	+	+	+	+			+	+	+	+	+	+		+	+	+	+	+			+
Wedge-tailed Green Pigeon *Treron sphenurus*	*Aghu*	+		+				+			+				+	+					+				+
Green Imperial Pigeon *Ducula aenea*	*Aghu-pha*			+	+								+							+	+				+
Mountain Imperial Pigeon *Ducula badia*	*Aghu-pha*	+		+				+			+	+	+	+		+	+	+	+			+			+
Vernal Hanging Parrot *Loriculus vernalis*																					+				+
[Grey-headed Parakeet *Psittacula finschii*]																									+
Blossom-headed Parakeet *Psittacula roseata*	*Aa-jji*							+													+				+
Red-breasted Parakeet *Psittacula alexandri*																					+				+
Large Hawk Cuckoo *Hierococcyx sparverioides*											+	+	+												+
Common Hawk Cuckoo *Hierococcyx varius*		+		+				+													+				+
Indian Cuckoo *Cuculus micropterus*	*Ts-p-l*			+												+					+				+

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Eurasian Cuckoo *Cuculus canorus*				+																					+
Plaintive Cuckoo *Cacomantis merulinus*						+																			+
Asian Emerald Cuckoo *Chrysococcyx maculatus*																					+				+
Drongo Cuckoo *Surniculus lugubris*		?												+				+	+						+
Asian Koel *Eudynamys scolopaceus*						+															+				+
Green-billed Malkoha *Phaenicophaeus tristis*		+		+		+					+	+	+					+							+
Greater Coucal *Centropus sinensis*				+			+							+							+				+
Lesser Coucal *Centropus bengalensis*		+		+				+			+	+	+	+			+								+
Oriental Bay Owl *Phodilus badius*																					+				+
Mountain Scops Owl *Otus spilocephalus*	*Kamta*	+		+		+	+	+					+	+							+	+			+
Collared Scops Owl *Otus bakkamoena*				+		+	+									+					+				+
[Eurasian Scops Owl *Otus scops*]																									+
Oriental Scops Owl *Otus sunia*						+																			
Eurasian Eagle Owl *Bubo bubo*																					+				
Spot-bellied Eagle Owl *Bubo nipalensis*														+							+				+
Brown Fish Owl *Ketupa zeylonensis*	*Ni-oola*			+							+														+
Tawny Fish Owl *Ketupa flavipes*	*Ni-oola*															+									
Brown Wood Owl *Strix leptogrammica*				+									+												+
Tawny Owl *Strix aluco*	*Bo-thli-l*							+								+									+
Collared Owlet *Glaucidium brodiei*	*Bada-chlu*	+		+		+		+					+	+		+		+			+	+			+
Asian Barred Owlet *Glaucidium cuculoides*	*Nye-bi-kh(uv)*	+		+	+	+	+	+			+	+	+	+		+	+	+		+	+				+
Jungle Owlet *Glaucidium radiatum*							+				+		+						+						+
Brown Hawk Owl *Ninox scutulata*													+												+
Hodgson's Frogmouth *Batrachostomus hodgsoni*			+		+						+					+				+	+				+
Great Eared Nightjar *Eurostopodus macrotis*	*Kwe-kwe*							+						+											+
Grey Nightjar *Caprimulgus indicus*	*Kwe-kwe*								+							+									+
Large-tailed Nightjar *Caprimulgus macrurus*	*Kwe-kwe*			+							+										+				+
Savanna Nightjar *Caprimulgus affinis*																					+				+
Himalayan Swiftlet *Collocalia brevirostris*	*Chaamay*					+	+	+								+			+		+				+
White-rumped Needletail *Zoonavena sylvatica*																	+								
White-throated Needletail *Hirundapus caudacutus*	*Chaamay*			+															+		+				+
Silver-backed Needletail *Hirundapus cochinchinensis*	*Chaamay*												+				+		+						+
Brown-backed Needletail *Hirundapus giganteus*	*Chaamay*													+			+		+						+
Asian Palm Swift *Cypsiurus balasiensis*	*Chaamay*			+		+							+			+			+		+				+
Alpine Swift *Tachymarptis melba*																					+				+
[Common Swift *Apus apus*]																					+				+
House Swift *Apus affinis*	*Chaamay*												+								+				+
Red-headed Trogon *Harpactes erythrocephalus*	*Gwasholo*	+		+	+	+	+	+			+	+	+	+	+	+	+	+	+	+	+	+			+

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Ward's Trogon *Harpactes wardi*	*Gwasholo-pha*															+					+				+
Indian Roller *Coracias benghalensis*		+		+		+					+	+	+		+						+				+
Oriental Dollarbird *Eurystomus orientalis*		+		+	+						+		+		+					+	+				+
Stork-billed Kingfisher *Halcyon capensis*											+				+						+				+
Ruddy Kingfisher *Halcyon coromanda*				+							+								+		+	+			+
White-throated Kingfisher *Halcyon smyrnensis*		+		+				+			+		+	+		+	+		+		+				+
Oriental Dwarf Kingfisher *Ceyx erithaca*				+							+										+	+			+
Blue-eared Kingfisher *Alcedo meninting*		+		+							+	+													+
Common Kingfisher *Alcedo atthis*		+		+		+		+			+					+	+				+				+
Blyth's Kingfisher *Alcedo hercules*				+				+							+	+		+	+			+			+
Crested Kingfisher *Megaceryle lugubris*	*Ngwa-dzo*	+		+		+	+	+			+	+	+	+	+	+	+	+							+
Pied Kingfisher *Ceryle rudis*	*Ajye-nye-titi*	+						+			+	+		+		+	+								+
Blue-bearded Bee-eater *Nyctyornis athertoni*		+		+		+	+				+	+	+	+	+	+	+	+	+		+				+
Green Bee-eater *Merops philippinus*				+																					+
Chestnut-headed Bee-eater *Merops leschenaulti*		+		+																	+				+
Common Hoopoe *Upupa epops*		+		+				+			+						+								+
Brown Hornbill *Anorrhinus tickelli*	*Ts-khu chhoopa*	+		+		+	+				+	+	+	+	+	+	+								+
Oriental Pied Hornbill *Anthracoceros albirostris*		+		+							+							+	+		+				+
Great Hornbill *Buceros bicornis*	*Ts-na*	+		+	+	+	+	+			+		+	+	+	+	+	+	+	+	+				+
Rufous-necked Hornbill *Aceros nipalensis*	*Michuti Ts-khu*	+		+	+	+	+	+			+	+	+	+	+	+	+	+	+		+			+	+
Wreathed Hornbill *Aceros undulatus*	*Ko-ko(v)*	+		+		+	+	+			+			+	+	+	+	+	+		+				+
Great Barbet *Megalaima virens*	*Alawoo*	+		+	+	+	+	+			+	+	+	+	+	+	+	+	+	+	+			+	+
Lineated Barbet *Megalaima lineata*		+				+	+				+		+								+				+
Golden-throated Barbet *Megalaima franklinii*	*Nye-kulu*	+			+	+		+			+					+				+	+				+
Blue-throated Barbet *Megalaima asiatica*	*Nye-kulu*	+		+		+		+			+	+	+	+	+	+	+	+	+		+			+	+
Blue-eared Barbet *Megalaima australis*	*Nye-kulu*	+									+	+		+		+	+				+				+
Coppersmith Barbet *Megalaima haemacephala*																								+	+
[Yellow-rumped Honeyguide *Indicator xanthonotus*]																									+
Speckled Piculet *Picumnus innominatus*		+		+	+	+		+			+			+		+				+	+	+			+
White-browed Piculet *Sasia ochracea*		+		+		+	+	+			+			+	+	+			+	+	+	+			+
Rufous-bellied Woodpecker *Dendrocopos hyperythrus*											+										+				+
Grey-capped Pygmy Woodpecker *Dendrocopos canicapillus*											+					+									
Fulvous-breasted Woodpecker *Dendrocopos macei*					+	+	+				+						+			+					+
[Crimson-breasted Woodpecker *Dendrocopos hyperythrus*]																									+
Darjeeling Woodpecker *Dendrocopos darjellensis*																+									

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Great Spotted Woodpecker *Dendrocopos major*																+									
Rufous Woodpecker *Celeus brachyurus*	*Chha-de*	+		+	+	+	+				+	+		+						+					+
Lesser Yellownape *Picus chlorolophus*	*Tanga*	+		+	+	+		+			+	+	+	+		+			+	+	+	+			+
Greater Yellownape *Picus flavinucha*	*Tanga*	+		+		+		+			+	+	+	+	+	+	+	+	+					+	+
Grey-headed Woodpecker *Picus canus*				+	+			+			+		+				+	+		+	+				+
Himalayan Goldenback *Dinopium shorii*											+	+									+				+
Common Goldenback *Dinopium javanense*											+														
Lesser Goldenback *Dinopium benghalense*											+						+		+					+	+
Greater Goldenback *Chrysocolaptes lucidus*					+						+		+			+		+		+	+			+	+
Pale-headed Woodpecker *Gecinulus grantia*	*Chha-de*	+		+		+		+			+			+			+		+			+			+
Bay Woodpecker *Blythipicus pyrrhotis*	*Chha-de*	+		+		+	+	+			+	+	+	+	+	+		+	+		+	+			+
Great Slaty Woodpecker *Mulleripicus pulverulentus*		+				+					+	+		+				+							+
Long-tailed Broadbill *Psarisomus dalhousiae*	*Dzach-nye, Nye-peeya*	+		+		+	+	+			+	+		+	+	+	+	+	+		+	+			+
Silver-breasted Broadbill *Serilophus lunatus*		+		+		+	+	+			+	+		+				+			+	+			+
Blue-naped Pitta *Pitta nipalensis*	*Doola choopa*	+		+				+			+				+	+			+		+				
Indian Pitta *Pitta brachyura*																					+				+
Large Woodshrike *Tephrodornis virgatus*	*Jala-tsumu*			+	+	+	+	+			+	+	+	+		+		+		+	+				+
Common Woodshrike *Tephrodornis pondicerianus*						+					+	+					+								+
Ashy Woodswallow *Artamus fuscus*				+	+						+						+		+		+				+
Common Iora *Aegithina tiphia*				+	+	+		+			+									+	+				+
[Marshall's Iora *Aegithina nigrolutea*]																									+
Large Cuckooshrike *Coracina macei*						+	+	+			+					+					+				+
Black-winged Cuckooshrike *Coracina melaschistos*						+		+			+			+		+		+	+						+
Small Minivet *Pericrocotus cinnamomeus*				+												+	+								+
Grey-chinned Minivet *Pericrocotus solaris*	*Solo-bibi, Nye-shishi*	+				+		+			+					+		+							+
Long-tailed Minivet *Pericrocotus ethologus*											+			+			+		+		+				+
Short-billed Minivet *Pericrocotus brevirostris*	*Solo-bibi, Nye-shishi*	+		+		+	+				+	+		+				+							+
Scarlet Minivet *Pericrocotus flammeus*	*Solo-bibi, Nye-shishi*	+		+	+	+		+			+	+	+	+		+	+	+	+	+	+			+	+
Bar-winged Flycatcher-shrike *Hemipus picatus*		+		+	+	+	+	+			+			+		+				+	+				+
Brown Shrike *Lanius cristatus*	*Jala*							+			+	+				+			+		+				+
Burmese Shrike *Lanius collurioides*	*Jala*										+														
Long-tailed Shrike *Lanius schach*	*Jala*			+		+		+			+		+	+	+	+					+				+
Grey-backed Shrike *Lanius tephronotus*	*Jala*	+		+	+	+		+			+	+	+	+	+	+	+		+	+	+			+	+
Eurasian Golden Oriole *Oriolus oriolus*																					+				+

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Black-hooded Oriole *Oriolus xanthornus*		+		+	+	+		+			+	+	+		+	+		+		+	+				+
Maroon Oriole *Oriolus traillii*	*Ata-lyuma*	+		+		+	+	+			+	+	+	+	+	+	+	+	+		+	+			+
Black Drongo *Dicrurus macrocercus*	*Chichi-m-kye*					+					+			+		+	+	+							+
Ashy Drongo *Dicrurus leucophaeus*	*Chichi-m-kye*	+		+		+		+			+	+	+	+	+	+	+		+		+			+	+
Crow-billed Drongo *Dicrurus annectans*	*Chichi-m-kye*			+							+						+		+		+	+			+
Bronzed Drongo *Dicrurus aeneus*	*Chichi-m-kye*	+		+	+		+	+			+	+	+	+	+			+	+	+	+	+		+	+
Lesser Racket-tailed Drongo *Dicrurus remifer*	*Chichi-wati*	+		+		+		+			+	+	+	+	+	+	+	+			+				+
Spangled Drongo *Dicrurus hottentottus*	*Chichi-m-kye*	+		+		+		+			+	+	+	+	+	+			+		+	+		+	+
Greater Racket-tailed Drongo *Dicrurus paradiseus*	*Chichi-wati*	+		+	+	+		+			+	+	+	+	+	+	+	+	+	+	+	+		+	+
Yellow-bellied Fantail *Rhipidura hypoxantha*	*Nye-mu-wala*	+		+		+		+			+	+	+	+	+	+	+	+			+			+	+
White-throated Fantail *Rhipidura albicollis*	*Nye-mu-wala*	+		+		+		+			+	+	+	+	+	+	+	+			+				+
Black-naped Monarch *Hypothymis azurea*																			+						+
Asian Paradise Flycatcher *Terpsiphone paradisi*		+		+							+										+	+			+
[Eurasian Jay *Garrulus glandarius*]																									+
[Yellow-billed Blue Magpie *Urocissa flavirostris*]																									+
Common Green Magpie *Cissa chinensis*	*Duchlu(gh)*	+		+		+		+			+	+	+	+	+	+	+	+			+				+
Rufous Treepie *Dendrocitta vagabunda*																									
Grey Treepie *Dendrocitta formosae*	*Kokilaka*	+		+		+		+			+	+	+	+	+	+	+	+	+		+	+		+	+
Collared Treepie *Dendrocitta frontalis*	*Kokilaka*	+		+	+		+	+			+			+	+	+		+	+	+		+			+
[Spotted Nutcracker *Nucifraga caryocatactes*]																									+
House Crow *Corvus splendens*																									+
Large-billed Crow *Corvus macrorhynchus*	*Aanay*	+		+		+		+			+	+	+	+	+	+				+	+			+	+
[Bohemian Waxwing *Bombycilla garrulus*]																									+
Great Tit *Parus major*					+															+	+				+
Green-backed Tit *Parus monticolus*		?		+				+			+					+	+				+				+
Yellow-cheeked Tit *Parus spilonotus*		+						+			+					+					+				+
Sultan Tit *Melanochlora sultanea*		+		+	+	+	+	+			+	+	+	+	+	+	+	+	+	+	+			+	+
Yellow-browed Tit *Sylviparus modestus*											+					+									+
Fire-capped Tit *Cephalopyrus flammiceps*											+														
Plain Martin *Riparia paludicola*				+		+	+	+			+	+	+												+
Sand Martin *Riparia riparia*																+									
[Pale Martin *Riparia diluta*]																									+
Barn Swallow *Hirundo rustica*				+		+		+			+										+				+
Red-rumped Swallow *Hirundo daurica*				+		+					+										+				+
[Asian House Martin *Delichon dasypus*]																									+
Nepal House Martin *Delichon nipalense*		+						+			+	+	+								+				+
[White-cheeked Tit *Aegithalos leucogenys*]																									+

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Black-throated Tit *Aegithalos concinnus*		+				+			+		+										+				+
[Jerdon's Bush Lark *Mirafra affinis*]																									+
Bengal Bushlark *Mirafra assamica*					+	+														+					+
Sand Lark *Calandrella raytal*						+					+														+
Oriental Skylark *Alauda gulgula*				+		+											+								+
[Zitting Cisticola *Cisticola juncidis*]																									+
Golden-headed Cisticola *Cisticola exilis*																					+				+
[Rufous-vented Prinia *Prinia burnesii*]																									+
Hill Prinia *Prinia atrogularis*	*Nye-sha-mukka*							+			+					+									+
Rufescent Prinia *Prinia rufescens*		+									+										+				+
Graceful Prinia *Prinia gracilis*																					+				
Yellow-bellied Prinia *Prinia flaviventris*	*Nye-sha-mukka*							+			+		+			+									+
Mountain Tailorbird *Orthotomus cucullatus*		+			+	+	+	+			+			+	+	+	+			+					+
Common Tailorbird *Orthotomus sutorius*						+		+								+					+				+
Dark-necked Tailorbird *Orthotomus atrogularis*											+					+	+								+
Crested Finchbill *Spizixos canifrons*											+														
Striated Bulbul *Pycnonotus striatus*	*Chadugyay*	+									+		+		+	+					+				+
Black-crested Bulbul *Pycnonotus melanicterus*		+		+	+			+			+		+			+	+			+	+				+
Red-whiskered Bulbul *Pycnonotus jocosus*	*Aa-gugu*	+		+		+		+			+		+	+	+	+		+	+		+	+			+
Red-vented Bulbul *Pycnonotus cafer*	*Aa-gugu-nene*	+		+	+	+		+			+		+	+	+	+	+	+	+	+	+	+			+
White-throated Bulbul *Alophoixus flaveolus*	*Nye-lama*	+		+	+	+		+			+	+	+	+	+	+	+	+	+	+	+	+			+
Olive Bulbul *Iole virescens*																			+						+
Mountain Bulbul *Ixos mcclellandii*		+		+				+			+				+	+					+				+
Ashy Bulbul *Hemixos flavala*	*Nye-da-di*	+		+	+	+		+			+	+	+	+	+	+	+	+	+	+	+			+	+
Black Bulbul *Hypsipetes leucocephalus*	*Chamtakye*	+		+	+	+		+			+	+	+	+	+	+			+	+	+				+
Striated Grassbird *Megalurus palustris*	*Chichi-pipi*				+	+		+			+		+		+	+				+	+				+
Chestnut-headed Tesia *Tesia castaneocoronata*		+				+		+			+	+	+			+	+	+			+				+
Slaty-bellied Tesia *Tesia olivea*		+		+	+	+	+	+			+	+	+	+		+	+	+		+					+
Grey-bellied Tesia *Tesia cyaniventer*		+				+	+					?					+	+			+				+
Pale-footed Bush Warbler *Cettia pallidipes*																			+						+
Brown-flanked Bush Warbler *Cettia fortipes*																+									
Yellow-bellied Bush Warbler *Cettia acanthizoides*																					+				+
Grey-sided Bush Warbler *Cettia brunnifrons*														+							+				+
Brown Bush Warbler *Bradypterus luteoventris*																	+								
Thick-billed Warbler *Acrocephalus aedon*				+												+									+
Paddyfield Warbler *Acrocephalus agricola*				+																					+
Blyth's Reed Warbler *Acrocephalus dumetorum*	*Aatse*															+									

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Dusky Warbler *Phylloscopus fuscatus*	*Nye-see*															+									
Tickell's Leaf Warbler *Phylloscopus affinis*	*Nye-see*															+	+								+
Buff-barred Warbler *Phylloscopus pulcher*	*Nye-see*															+									
Ashy-throated Warbler *Phylloscopus maculipennis*	*Nye-see*					+		+			+	+				+		+							+
Lemon-rumped Warbler *Phylloscopus chloronotus*	*Nye-see*	+				+	+				+					+					+				+
Yellow-browed Warbler *Phylloscopus inornatus*	*Nye-see*					+					+	+													+
Greenish Warbler *Phylloscopus trochiloides*																	+								+
Large-billed Leaf warbler *Phylloscopus magnirostris*	*Nye-see*			+		+	+				+					+	+					+			+
Eastern Crowned Warbler *Phylloscopus coronatus*	*Nye-see*	?														+									+
Blyth's Leaf warbler *Phylloscopus reguloides*	*Nye-see*					+	+	+			+		+	+		+									+
Yellow-vented Warbler *Phylloscopus cantator*	*Nye-see*	+			+	+					+		+	+			+	+	+	+					+
White-spectacled Warbler *Seicercus affinis*	*Nye-see*	+		+			+	+			+	+			+	+		+	+						+
[Green-crowned Warbler *Seicercus burkii*]												+	?				?								+
Whistler's Warbler *Seicercus whistleri*	*Nye-see*	+			+	+		+			+			+		+				+					+
Grey-hooded Warbler *Seicercus xanthoschistos*	*Nye-see*	+				+	+	+			+	+	+			+	+	+			+				+
Grey-cheeked Warbler *Seicercus poliogenys*	*Nye-see*	+				+		+			+	+	+			+		+			+				+
Chestnut-crowned Warbler *Seicercus castaniceps*	*Nye-see*					+		+			+	+	+	+		+	+	+			+				+
Broad-billed Warbler *Tickellia hodgsoni*	*Nye-see*	+				+					+	+	+	+		+	+								+
Rufous-faced Warbler *Abroscopus albogularis*	*Nye-see*	+		+		+	+	+			+	+	+	+		+	+	+	+		+				+
Black-faced Warbler *Abroscopus schisticeps*	*Nye-see*															+									
Yellow-bellied Warbler *Abroscopus superciliaris*	*Nye-see*	+				+	+	+			+		+	+		+	+		+		+				+
Spot-throated Babbler *Pellorneum albiventre*																					+				+
Marsh Babbler *Pellorneum palustre*																					+				+
Puff-throated Babbler *Pellorneum ruficeps*				+				+			+										+	+			+
Buff-breasted Babbler *Pellorneum tickelli*		+		+	+	+														+		+			+
Abbott's Babbler *Malacocincla abbotti*				+							?														+
Large Scimitar Babbler *Pomatorhinus hypoleucos*				+		+		+			+			+		+					+	+			+
[White-browed Scimitar Babbler *Pomatorhinus schisticeps*]												+													+
Streak-breasted Scimitar babbler *Pomatorhinus ruficollis*																+									
Red-billed Scimitar Babbler *Pomatorhinus ochraceiceps*				+				+			+	+	+	+		+		+	+		+				+
Coral-billed Scimitar Babbler *Pomatorhinus ferruginosus*					+			+	+		+	+		+	+	+	+	+		+	+				+

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Slender-billed Scimitar Babbler *Xiphirhynchus superciliaris*				+		+			+		+		+	+		+					+				+
Long-billed Wren Babbler *Rimator malacoptilus*									+							+									
Streaked Wren Babbler *Napothera brevicaudata*		+		+	+	+	+	+						+		+				+	+	+	+		+
Eyebrowed Wren Babbler *Napothera epilepidota*		+		+		+	+	+			+			+		+	+				+	+			+
Scaly-breasted Wren Babbler *Pnoepyga albiventer*											+					+									+
Pygmy Wren Babbler *Pnoepyga pusilla*					+	+	+	+			+	+	+	+		+	+	+		+					+
Bar-winged Wren Babbler *Spelaeornis troglodytoides*									+								+				+				+
Spotted Wren Babbler *Spelaeornis formosus*						+	+				+	+				+		+							+
Long-tailed Wren Babbler *Spelaeornis chocolatinus*									+							+									+
[Tawny-breasted Wren Babbler *Spelaeornis longicaudatus*]																					+				
Wedge-billed Wren Babbler *Sphenocichla humei*				+				+	+							+					+	+			+
Rueous-fronted Babbler *Stachyris rufifrons*						+					+														+
Rueous-capped Babbler *Stachyris ruficeps*		+			+						+					+				+	+				+
Golden Babbler *Stachyris chrysaea*		+		+		+	+	+			+	+	+	+	+	+			+		+	+			+
Grey-throated Babbler *Stachyris nigriceps*				+	+	+		+			+	+	+	+		+	+		+	+	+	+			+
Snowy-throated Babbler *Stachyris oglei*		+				+	+	+	+		+			+	+	+	+		+		+				+
Striped Tit Babbler *Macronous gularis*		+		+	+	+		+			+		+	+		+		+	+	+					+
Yellow-eyed Babbler *Chrysomma sinense*				+																					+
Striated Babbler *Turdoides earlei*								+																	+
Jungle Babbler *Turdoides striata*					+															+					+
White-crested Laughingthrush *Garrulax leucolophus*	*Nye-yophu*	+		+	+	+		+			+	+	+	+	+	+	+	+	+	+	+	+			+
Lesser Necklaced Laughingthrush *Garrulax monileger*	*Chemi-nye*	+		+		+	+	+			+	+	+	+	+	+		+	+	+	+	+			+
Greater Necklaced Laughingthrush *Garrulax pectoralis*	*Chemi-nye*	+		+	+	+	+	+			+	+	+	+		+	+	+			+				+
Striated Laughingthrush *Garrulax striatus*	*Nye-kula*	+		+							+			+		+					+				+
Chestnut-backed Laughingthrush *Garrulax nuchalis*					+															+	+				+
Yellow-throated Laughinghrush *Garrulax galbanus*															+										+
Rufous-vented Laughingthrush *Garrulax gularis*				+	+	+	+	+			+	+		+		+				+	+	+			+
Rueous-chinned Laughingthrush *Garrulax rufogularis*								+									+				+				+
[Spotted Laughingthrush *Garrulax ocellatus*]																									+
Grey-sided Laughingthrush *Garrulax caerulatus*	*Aga-chhu-nyu*	+							+		+					+					+				+
Rueous-necked Laughingthrush *Garrulax ruficollis*	*Chhu-nyu*	+		+	+	+		+			+		+	+		+		+		+	+				+

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Spot-breasted Laughingthrush *Garrulax merulinus*				+												+					+	+			+
Streaked Laughingthrush *Garrulax lineatus*		+			+						+								+	+					+
Striped Laughingthrush *Garrulax virgatus*		+									+														+
Blue-winged Laughingthrush *Garrulax squamatus*				+		+		+	+							+									+
Scaly Laughingthrush *Garrulax subunicolor*	*Aga-chhu-nyu*				+											+				+					+
Black-faced Laughingthrush *Garrulax affinis*	*Aga-chhu-nyu*				+											+				+					+
Chestnut-crowned Laughingthrush *Garrulax erythrocephalus*	*Aga-chhu-nyu*															+	+				+				+
Red-faced Liocichla *Liocichla phoenicea*	*Aga-chhu-nyu*				+						+		+	+		+				+	+				+
Silver-eared Mesia *Leiothrix argentauris*	*Solo-nye*	+		+	+	+	+	+			+	+	+	+	+	+	+	+		+	+	+			+
Red-billed Leiothrix *Leiothrix lutea*	*Solo-nye*	+		+				+			+	+		+		+		+	+		+				+
[Cutia *Cutia nipalensis*]																									+
Black-headed Shrike Babbler *Pteruthius rufiventer*													+								+				+
White-browed Shrike Babbler *Pteruthius flaviscapis*	*S-dz-nye*					+	+	+			+	+	+	+	+	+	+								+
Green Shrike Babbler *Pteruthius xanthochlorus*		+						+				+				+									+
Black-eared Shrike Babbler *Pteruthius melanotis*		+				+		+			+			+		+		+			+				+
White-hooded Babbler *Gampsorhynchus rufulus*		+				+	+	+			+			+	+	+	+	+	+						+
Rusty-fronted Barwing *Actinodura egertoni*					+	+	+	+			+			+	+	+	+			+	+				+
Hoary-throated Barwing *Actinodura nipalensis*																	+								
Streak-throated Barwing *Actinodura waldeni*																+									
Blue-winged Minla *Minla cyanouroptera*				+		+		+			+		+	+		+					+	+			+
Chestnut-tailed Minla *Minla strigula*				+												+									+
Red-tailed Minla *Minla ignotincta*		+		+		+	+	+			+	+	+	+	+	+	+	+			+				+
Golden-breasted Fulvetta *Alcippe chrysotis*																+									+
Yellow-throated Fulvetta *Alcippe cinerea*		+		+				+			+					+					+				+
Rufous-winged Fulvetta *Alcippe castaneceps*		+		+		+	+	+			+			+		+					+				+
White-browed Fulvetta *Alcippe vinipectus*									+		+					+					+				+
Brown-throated Fulvetta *Alcippe ludlowi*									+																+
Streak-throated Fulvetta *Alcippe cinereiceps*									+							+					+				+
Rufous-throated Fulvetta *Alcippe rufogularis*		+				+	+	+			+		+	+	+	+		+	+		+	+			+
Rusty-capped Fulvetta *Alcippe dubia*				+												+					+				+
[Brown-cheeked Fulvetta *Alcippe poioicephala*]																									+

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Nepal Fulvetta *Alcippe nipalensis*	*Titi-nye*	+		+		+		+			+		+	+	+	+	+	+	+		+	+			+
Rufous-backed Sibia *Heterophasia annectans*	*Sigu-jala*	+		+		+	+	+			+		+	+		+	+	+	+		+				+
Rufous Sibia *Heterophasia capistrata*						+					+														+
Grey Sibia *Heterophasia gracilis*											+						+				+				+
Beautiful Sibia *Heterophasia pulchella*	*S-n-s-ne*	+		+		+	+	+					+			+					+	+			+
Long-tailed Sibia *Heterophasia picaoides*	*S-n-s-ne*	+				+	+	+			+		+	+	+	+	+	+	+		+			+	+
Striated Yuhina *Yuhina castaniceps*	*Mo-k-dudu*	+		+		+	+	+						+		+	+	+	+		+				+
White-naped Yuhina *Yuhina bakeri*	*Mo-k-dudu*	+		+		+		+			+		+	+		+			+		+	+			+
Whiskred Yuhina *Yuhina flavicollis*	*Mo-k-dudu*	+		+		+		+			+	+	+	+	+	+	+		+		+				+
Stripe-throated Yuhina *Yuhina gularis*	*Mo-k-dudu*	+									+	+		+		+					+				+
Rufous-vented Yuhina *Yuhina occipitalis*	*Mo-k-dudu*			+												+					+				+
Black-chinned Yuhina *Yuhina nigrimenta*	*Mo-k-dudu*	+		+		+		+			+	+	+	+		+		+	+		+				+
White-bellied Yuhina *Yuhina* [*Erpornis*] *zantholeuca*	*Mo-k-dudu*	+		+		+	+	+			+	+	+	+		+		+			+				+
[Black-breasted Parrotbill *Paradoxornis flavirostris*]																									+
Spot-breasted Parrotbill *Paradoxornis guttaticollis*																					+				+
Black-throated Parrotbill *Paradoxornis nipalensis*	*Matsili*	+		+				+			+	+		+		+					+				+
Lesser Rufous-headed Parrotbill *Paradoxornis atrosuperciliaris*		+		+		+		+			+			+		+	+		+		+				+
Greater Rufous-headed Parrotbill *Paradoxornis ruficeps*		+		+			+	+			+		+	+	+	+			+		+	+			+
Grey-headed Parrotbill *Paradoxornis gularis*		+				+	+	+			+			+					+						+
Fire-tailed Myzornis *Myzornis pyrrhoura*									+							+									
Oriental White-eye *Zosterops palpebrosus*						+					+		+			+	+				+				+
Asian Fairy Bluebird *Irena puella*		+		+		+	+	+			+	+		+		+	+			+	+				+
Chestnut-bellied Nuthatch *Sitta castanea*		+			+	+		+			+	+	+	+		+	+	+	+	+	+			+	+
White-tailed Nuthatch *Sitta himalayensis*																+	+				+				+
Velvet-fronted Nuthatch *Sitta frontalis*						+	+				+														+
Beautiful Nuthatch *Sitta formosa*		+				+	+	+			+	+	+	+	+	+					+				+
Wallcreeper *Tichodroma muraria*											+														+
Rusty-flanked Treecreeper *Certhia nipalensis*											+					+									+
Brown-throated Treecreeper *Certhia discolor*					+											+				+					+
Spot-winged Starling *Saroglossa spiloptera*				+																					+
Golden-crested Myna *Ampeliceps coronatus*				+												+									+
Common Hill Myna *Gracula religiosa*	*Moova-nye*	+		+	+	+		+			+	+		+	+	+	+	+		+	+			+	+
White-vented Myna *Acridotheres cinereus*	*Anni-khi-nye*	+							+				+	+		+	+								+
Jungle Myna *Acridotheres fuscus*	*Anni-khi-nye*	+		+	+	+		+			+	+	+	+		+				+	+				+

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Bank Myna *Acridotheres ginginianus*																					+				+
Common Myna *Acridotheres tristis*		+		+		+		+			+		+			+	+				+				+
Asian Pied Starling *Sturnus contra*				+	+															+	+				+
Chestnut-tailed Starling *Sturnus malabaricus*		+		+	+	+							+							+					+
Brahminy Starling *Sturnus pagodarum*				+																	+				+
Blue Whistling Thrush *Myophonus caeruleus*	*Chhugga*	+		+	+	+		+			+	+	+	+	+	+	+	+	+	+	+	+		+	+
Siberian Thrush *Zoothera sibirica*																			+						+
Plain-backed Thrush *Zoothera mollissima*	*Aghu-s-s*	+		+		+		+								+									+
Long-tailed Thrush *Zoothera dixoni*								+													+				+
Scaly Thrush *Zoothera dauma*				+		+	+	+					+								+				+
Dark-sided Thrush *Zoothera marginata*		+		+		+		+			+											+			+
Black-breasted Thrush *Turdus dissimilis*	*Aghu-s-s*			+				+								+					+				+
White-collared Blackbird *Turdus albocinctus*													+								+				+
Grey-winged Blackbird *Turdus boulboul*		+						+								+									+
Chestnut Thrush *Turdus rubrocanus*											+	+			+										+
Eyebrowed Thrush *Turdus obscurus*	*Aghu-s-s*															+					+				+
Dark-throated Thrush *Turdus ruficollis*													+		+										+
Purple Cochoa *Cochoa purpurea*																+									
Green Cochoa *Cochoa viridis*	*Wa-nye-gilay*	+						+			+	+	+	+		+			+						+
Rusty-bellied Shortwing *Brachypteryx hyperythra*				+				+	+												+				+
Lesser Shortwing *Brachypteryx leucophris*		+			+	+		+								+				+					+
White-browed Shortwing *Brachypteryx montana*				+				+								+					+				+
[Siberian Rubythroat *Luscinia calliope*]																									+
White-tailed Rubythroat *Luscinia pectoralis*		+																							
White-browed Bush Robin *Tarsiger indicus*																+					+				+
Rufous-bellied Bush Robin *Tarsiger hyperythrus*								+																	+
Orange-flanked Bush Robin *Tarsiger cyanurus*				+		+	+	+						+	+						+				
Golden Bush-robin *Tarsiger chrysaeus*																+									
Oriental Magpie Robin *Copsychus saularis*	*Nye-gilay*	+		+	+	+		+			+				+	+	+			+	+				+
White-rumped Shama *Copsychus malabaricus*				+							+		+			+					+				+
Black Redstart *Phoenicurus ochruros*																					+				+
Hodgson's Redstart *Phoenicurus hodgsoni*		+		+				+			+			+		+					+				+
Daurian Redstart *Phoenicurus auroreus*					+			+			+			+	+	+				+	+				
Blue-fronted Redstart *Phoenicurus frontalis*																+									+
Plumbeous Water Redstart *Rhyacornis fuliginosa*	*Thr-thr*	+		+		+		+			+	+	+	+	+	+	+				+			+	+

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
White-capped Water Redstart *Chaimarrornis leucocephalus*	*Ati-yudi*	+		+		+		+			+	+	+	+	+	+	+	+			+			+	+
White-tailed Robin *Myiomela leucura*				+		+	+	+			+		+	+	+	+	+	+			+	+			+
Blue-fronted Robin *Cinclidium frontale*								+	+							+									+
Little Forktail *Enicurus scouleri*	*Ajye-nye-gilay*	+				+					+		+		+	+	+	+			+			+	+
Black-backed Forktail *Enicurus immaculatus*	*Ajye-nye-gilay*	+									+				+	+	+				+				+
Slaty-backed Forktail *Enicurus schistaceus*	*Ajye-nye-gilay*	+		+		+		+			+	+	+	+	+	+	+	+	+	+		+		+	+
White-crowned Forktail *Enicurus leschenaulti*	*Ajye-nye-gilay*	+		+	+	+	+	+			+		+	+	+		+	+			+				+
Spotted Forktail *Enicurus maculatus*	*Ajye-nye-gilay*	+		+							+	+		+	+	+	+	+			+				+
Common Stonechat *Saxicola torquatus*	*Pabf-nye*	+				+		+			+		+			+	+				+				+
Grey Bushchat *Saxicola ferreus*								+			+		+				+								+
Blue Rock Thrush *Monticola solitarius*		+				+		+			+					+	+								+
Chestnut-bellied Rock Thrush *Monticola rufiventris*								+			+				+	+					+				+
Blue-capped Rock Thrush *Monticola cinclorhynchus*		+		+																	+				+
[Slaty-backed Flycatcher *Ficedula hodgsonii*]																									+
Rufous-gorgeted Flycatcher *Ficedula strophiata*	*Chichilaka*			+		+	+	+			+			+		+		+			+				+
Red-throated Flycatcher *Ficedula parva*		+		+		+					+								+		+	+			+
White-gorgeted Flycatcher *Ficedula monileger*	*Chichilaka*			+							+	+				+	+				+				+
Snowy-browed Flycatcher *Ficedula hyperythra*	*Chichilaka*					+	+	+			+		+	+		+	+				+				+
Little Pied Flycatcher *Ficedula westermanni*	*Chichilaka*					+					+	+				+	+								+
Ultramarine Flycatcher *Ficedula superciliaris*	*Chichilaka*					+																			+
Slaty-blue Flycatcher *Ficedula tricolor*	*Chichilaka*					+					+	+				+									+
Sapphire Flycatcher *Ficedula sapphira*	*Chichilaka*			+		+					+					+					+	+			+
Verditer Flycatcher *Eumyias thalassinus*	*Nye-neechhi*										+					+									+
Pale Blue Flycatcher *Cyornis unicolor*	*Chichilaka*					+	+	+								+			+						+
[White-bellied Blue Flycatcher *Cyornis pallipes*]																									+
Pale-chinned Flycatcher *Cyornis pohogenys*																+									+
Hill Blue Flycatcher *Cyornis banyumas*				+															+		+	+			+
[Tickell's Blue Flycatcher *Cyornis tickelliae*]																									+
Blue-throated Flycatcher *Cyornis rubeculoides*				+																	+	+			+
White-tailed Flycatcher *Cyornis concretus*																+									+
Rufous-bellied Niltava *Niltava sundara*	*Chichilaka*			+	+	+		+			+		+	+		+	+	+		+	+	+		+	+

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Large Niltava *Niltava grandis*	*Chichilaka*			+	+	+	+	+					+	+		+				+	+				+
Small Niltava *Niltava macgrigoriae*	*Chichilaka*			+		+		+			+		+	+		+	+	+			+	+			+
Pygmy Blue Flycatcher *Muscicapella hodgsoni*						+	+	+					+			+	+	+							+
Grey-headed Canary Flycatcher *Culicicapa ceylonensis*		+		+		+	+	+			+	+	+	+	+	+	+	+	+		+				+
[White-throated Dipper *Cinclus cinclus*]																									+
Brown Dipper *Cinclus pallasii*		+		+		+		+			+	+	+		+	+	+	+						+	+
Blue-winged Leafbird *Chloropsis cochinchinensis*	*Lama-chh-nye*	+				+	+	+			+	+			+	+	+								+
Golden-fronted Leafbird *Chloropsis aurifrons*	*Lama-clil-nye*	+									+	+	+					+	+		+				+
Orange-bellied Leafbird *Chloropsis hardwickii*	*Lama-chh-nye*	+		+	+	+		+			+		+	+	+	+	+	+	+	+	+			+	+
Thick-billed Flowerpecker *Dicaeum agile*																					+				+
Yellow-vented Flowerpecker *Dicaeum chrysorrheum*		+																							
Yellow-bellied Flowerpecker *Dicaeum melanoxanthum*						+																			+
Plain Flowerpecker *Dicaeum concolor*																			+		+				+
Fire-breasted Flowerpecker *Dicaeum ignipectus*		+						+			+					+		+						+
Scarlet-backed Flowerpecker *Dicaeum cruentatum*		+									+														
Purple Sunbird *Nectarinia asiatica*											+	+									+				+
[Mrs Gould's Sunbird *Aethopyga gouldiae*]																									+
Green-tailed Sunbird *Aethopyga nipalensis*				+												+									+
Black-throated Sunbird *Aethopyga saturata*	*Tsanamaaphi*	+		+	+	+	+	+			+	+	+	+	+	+	+	+	+	+	+	+			+
Crimson Sunbird *Aethopyga siparaja*				+																	+				+
Fire-tailed Sunbird *Aethopyga ignicauda*																					+				+
Little Spiderhunter *Arachnothera longirostris*		+		+	+											+	+		+	+	+	+			+
Streaked Spiderhunter *Arachnothera magna*	*Yaama-chhili*	+		+	+	+		+			+	+	+	+	+	+	+	+	+	+	+	+			+
House Sparrow *Passer domesticus*						+					+														+
Russet Sparrow *Passer rutilans*				+																					+
Eurasian Tree Sparrow *Passer montanus*		+		+	+	+		+			+		+	+	+	+				+	+				+
Streaked Weaver *Ploceus manyar*																					+				+
Baya Weaver *Ploceus philippinus*																					+				+
White-rumped Munia *Lonchura striata*	*Nye-dili*	+		+		+		+			+					+			+		+				
Scaly-breasted Munia *Lonchura punctulata*	*Nye-dili*							+								+					+				+
Black-headed Munia *Lonchura malacca*	*Nye-dili*							+																	+
Forest Wagtail *Dendronanthus indicus*				+																	+				+
Yellow Wagtail *Motacilla flava*				+							+										+				+
Citrine Wagtail *Motacilla citreola*				+															+						+
Grey Wagtail *Motacilla cinerea*		+				+		+			+			+											+

English Name	*Lisu name*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
White Wagtail *Motacilla alba*		+		+		+		+			+	+	+	+		+	+		+		+			+	+
White-browed Wagtail *Motacilla maderaspatensis*													+								+				+
Paddyfield Pipit *Anthus rufulus*						+															+				+
Blyth's Pipit *Anthus godlewskii*																	+								
Tawny Pipit *Anthus campestris*											+														+
Tree Pipit *Anthus trivialis*		+																							
Olive-backed Pipit *Anthus hodgsoni*	*Yee-dz(uv)*	+		+	+	+		+			+	+	+	+	+	+	+		+	+	+				+
Rosy Pipit *Anthus roseatus*	*Yee-dz(uv)*					+										+									+
Tibetan Siskin *Serinus thibetanus*											+														
Plain Mountain Finch *Leucosticte nemoricola*				+																					
Dark-breasted Rosefinch *Carpodacus nipalensis*				+				+						+											+
Common Rosefinch *Carpodacus erythrinus*																					+				+
[Spot-winged Rosefinch *Carpodacus rodopeplus*]																									+
[Crimson-browed Finch *Propyrrhula subhimachala*]																									+
Scarlet Finch *Haematospiza sipahi*				+				+													+	+			+
Red Crossbill *Loxia curvirostra*																					+				+
Grey-headed Bullfinch *Pyrrhula erythaca*																+									+
Golden-naped Finch *Pyrrhoplectes epauletta*																+									+
Little Bunting *Emberiza pusilla*				+			+	+			+					+					+				+
Chestnut Bunting *Emberiza rutila*									+							+					+				
Black-eaced Bunting *Emberiza spodocephala*																+									

Rapid decline of the Bearded Vulture *Gypaetus barbatus* in Upper Mustang, Nepal

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We assessed the status of the Bearded Vulture *Gypaetus barbatus* between 2002 and 2008 in Upper Mustang, Nepal. Regular monitoring of four transect lines indicate a rapid decline of the species over the study period, with the number of individuals recorded per day and per kilometre falling by 73% and 80%, respectively. The use of the veterinary drug diclofenac could lie behind this decline, as the species's range overlaps with those of other vulture species known to be affected by diclofenac. A regular monitoring programme to assess the status of Bearded Vulture population is urgently needed, along with assessment of its population trends over a wider area. If ongoing declines on a wider geographic scale are observed, then the conservation status of this species should be reassessed.

INTRODUCTION

The Bearded Vulture or Lammergeier *Gypaetus barbatus* is a territorial cliff-nesting accipitrid vulture whose diet mainly consists of bone remains from wild and domestic ungulates (Hiraldo *et al.* 1979, Margalida *et al.* 2007). Its range in Asia includes the mountains of Afghanistan, Baluchistan, Tibetan Plateau, Mongolia and throughout the Himalayas from the extreme north-west across to Arunachal of India in east (Kaul & Ahmed 1992, Ferguson-Lees & Christie 2001). In addition, it occurs in the mountainous regions of Europe, North Africa, East Africa and southern Africa (Brown 1997, Margalida *et al.* 2003, Hirzel *et al.* 2004, Gil *et al.* 2009).

Although the Bearded Vulture is threatened within its range in Europe, the species is listed as Least Concern by BirdLife International owing to its common occurrence in other areas of the world (BirdLife International 2009). The Bearded Vulture is a resident species in Nepal (Grimmett *et al.* 2000), which holds one of the largest populations in the world (Gil *et al.* 2009). It is recorded in almost all protected areas in the country's mountains (IUCN Nepal 2008) and its status there has been described as 'fairly common to common' (Grimmett *et al.* 2000) including at our study area, Upper Mustang (Suwal 2003).

Owing to catastrophic population declines of three resident *Gyps* vulture (White-rumped *G. bengalensis*, Indian *G. indicus* and Slender-billed Vultures *G. tenuirostris*) in South Asia in the last decade, these species, once very common in the region, are all now classified as Critically Endangered (BirdLife International 2001, Green *et al.* 2006). The use of veterinary diclofenac is the major reason for the decline (Oaks *et al.* 2004). Diclofenac is a non-steroidal anti-inflammatory (NSAID) drug commonly used to treat pain and inflammation in livestock in India, Pakistan and Nepal (Green *et al.* 2004, Shultz *et al.* 2004). It is not known whether diclofenac is affecting other vulture species and scavenging birds in the region. However, numbers of Red-headed Vultures *Sarcogyps calvus* and Egyptian Vultures *Neophron percnopterus* have also recently undergone rapid declines in India (Cuthbert *et al.* 2006a). Evidence from studies suggests that, in addition to diclofenac, vultures and other scavenging birds are susceptible to a range of other NSAIDs (Cuthbert *et al.* 2006b). Acharya *et al.* (2009) described the rapid decline of Himalayan Griffon *Gyps himalayensis* over the period 2002–2005 in the high Himalaya region of Nepal. Bearded Vultures share the same habitat with other vultures, although their status has not been studied in Nepal until now. This study aims to fill these gaps and explore the situation and trends of Bearded Vulture populations in Upper Mustang, Nepal.

STUDY AREA

Upper Mustang (28°50′23″N 83°47′38″E to 29°11′56″N 83°59′21″E), with an area of 2,667 km^2, covers the northern half of Mustang District (Ale 2002) (Fig. 1). The northern border of the study area extends up to the Tibetan border, an autonomous region of the People's Republic of China. The area contains seven Village Development Committees (VDCs)—Chuksang, Ghemi, Charang, Lomanthang, Chosyar, Chunup and Surkahang—and includes 33 Buddhist settlements with a total population of about 6,100 people (Shah 2001). Local people depend on seasonal livestock farming, agriculture and winter trade for their livelihoods.

The Upper Mustang area (including the Upper Kaligandaki valley) is located in the arid, trans-Himalayan zone, which receives 132 mm of rain per year. This unique marginal land lies between the east and west Himalayan Tibetan Plateau, within the Hindu Kush. The area is known to be rich in globally significant flora and fauna owing to the steep geophysical topography of the area, and is recognised as a biodiversity hotspot by Conservation International (under the Eastern Himalayan Landscape) (Biodiversity Hotspots 2009).

METHODS

Bearded Vultures were surveyed along predetermined walked transects for 24, 22, 22 and 17 days in 2002, 2004, 2005 and 2008, respectively, during July and August. The transects were along the main trails used by local people in the area, to ensure easy demarcation for future monitoring. All vultures identified within 500 m on both sides of the transect line were recorded. Vultures observed beyond 500 m in each survey year were ignored. Distances were determined by visual estimation, a distance of 500 m being marked out on the ground prior to each survey to familiarise the observer with the observation distance. The linear distance of transects covered per day

varied depending on settlement, altitude and climate. The transects were walked between 08h00 and 17h00 (roughly 7 hours/day) of each survey day.

The possibility of repeated counting of the same individuals on the same day and subsequent days cannot be ruled out. However, error due to this bias should not affect the estimated trends, because similar biases were present in all study years, although fewer birds in subsequent years may result in fewer repeat counts. More survey days were covered in the first year (2002) than in the following years (2004, 2005 and 2008). Results are presented on a per day and per kilometre basis.

Four transects, totalling 188 km in length, were covered in all four survey years. These were located as follows: Transect 1, north–south from Jomsom to Lomanthang via Nichung (89 km); Transect 2, Lomanthang to Samjung and back (18 km); Transect 3, Lomanthang to Jomsom (64 km); and Transect 4, east–west from Lomanthang to Yara and back (17 km). Ordinary least squares regressions were fitted against the natural logarithm of numbers for each transect and for the total combined counts (Table 1). The estimated annual multiplicative rate of increase (D) was estimated from the fitted regression line.

All the pharmaceutical veterinary product information was obtained from three shops located in villages (Jomsom, Kobhang and Marpha) and the Livestock Development Centre in the district headquarters.

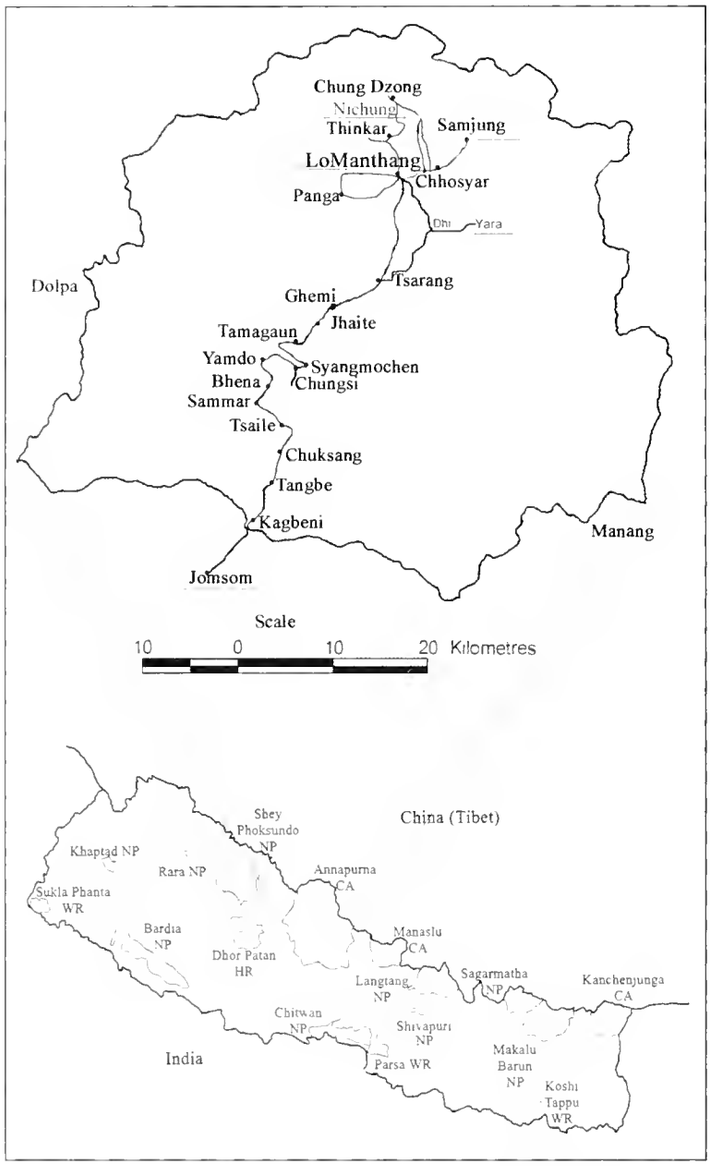

Figure 1. Map showing the Bearded Vulture study area. Texts with underline are the major location from where either transect started or ended. Source: Baral & Heinen 2007, NTNC/ACAP.

RESULTS

During the surveys a total of 67, 49, 21 and 13 Bearded Vulture were recorded in the years 2002, 2004, 2005 and 2008, respectively (Table 1). In 2002, 2.79 birds were recorded per day and 0.35 birds in a km^2 area. Similarly, in 2004, 2.23 birds were recorded per day and 0.26 birds in a km^2 area. This fell to 0.95 birds per day and 0.11 birds per km^2 in 2005. The decline of birds continued in 2008, with records of just 0.76 birds per day and 0.07 birds per km^2 (Table 1). Between 2002 and 2008, the number of Bearded Vultures recorded per day and per kilometre declined by 73% and 80 %, respectively. Of the four main transects statistically significant declines over the period 2002–2008 were observed in Transect 1 and in Transect 4, with declines of 96% and 64%, respectively. A statistically significant decline was observed for the total numbers of birds along on all four transects combined, with an estimated multiplicative decline rate of 25.0% a year (Table 1).

During the study, 47 agro-veterinary pharmaceutical products were recorded in local shops and the District Livestock Development Centre. Among the most commonly displayed products were anti-helminthic medicines (six compounds for treating internal and three

Table 1. Total numbers of Bearded Vulture recorded in four different transects of Upper Mustang, Nepal, and total numbers for all transects combined along with estimated birds/day and birds/km^2. Regression statistics indicate the F value, degrees of freedom and P value, with the estimated annual multiplicative rate of decline (D) from the fitted regression line.

Year	Number of days surveyed	Total number recorded along transect	Birds/day in transect	Birds/km^2 in transect	Transect 1	Transect 2	Transect 3	Transect 4
2002	24	67	2.79	0.35	45	11	3	8
2004	22	49	2.23	0.26	35	4	4	6
2005	22	21	0.95	0.11	13	0	3	5
2008	17	13	0.76	0.07	2	4	4	3
Regression statistics	–	$18.86_{1,2}$ $P < 0.05$	$9.48_{1,2}$ $P = 0.091$	$17.14_{1,2}$ $P = 0.053$	$27.93_{1,2}$ $P < 0.05$	$1.33_{1,1}$ $P = 0.454$	$1.00_{1,2}$ $P = 0.423$	$982.5_{1,2}$ $P < 0.01$
D	–	*25.0%*	*20.6%*	*24.6%*	*42.1%*	*13.5%*	*+3.9%*	*15.2%*

for external parasites), antibiotics (6), and antiseptics (3). During the period of observation only one veterinary painkiller and anti-inflammatory drug for the treatment of livestock was found, the NSAID Voviram bolus, which contains sodium diclofenac as the active ingredient.

DISCUSSION

The investigation was limited by its study period (2002–2008) and was based only in Upper Mustang, so extrapolation of the population trend for the whole country is difficult. However, it is alarming that a substantial decline (73%) of the species was found in the survey in this remote region of the Himalayas. Surveys of Bearded Vultures from an adjacent area of Nepal (two villages are overlapped) in 1995 recorded 76 Bearded Vultures at a rate of 0.38 birds/km² and 5.1 birds/day (Gil *et al.* 2009). These records are similar to those observed in the first year of this study in 2002 (Table 1), suggesting that this frequency of occurrence is more typical than the low rates observed by the end of our study.

Veterinary pharmaceutical medicines are commonly available in the Mustang district. One of them is diclofenac, but as noted above some other NSAIDs are also harmful to vultures. The Himalayan Griffon and Bearded Vulture were found to be sharing habitat and roosting sites in China (Katzner *et al.* 2004). Our team also observed sharing of roosting sites by these two species outside the study area (28°39′24.9″N 83°39′53.6″E in Kunjo VDC, 2,500 m a.s.l. in 2005). Bearded Vultures are primarily bone-eaters, so it is unlikely they feed on the carcass as well (Xirouchakis & Nikolakakis 2002, Margalida *et al.* 2007). However, with the collapse of resident *Gyps* vultures and decline in Himalayan Griffons from the same area (Acharya *et al.* 2009) it is possible that Bearded Vultures are now able to access and feed on soft tissues from which previously they would have been excluded. It is not known if diclofenac residues remain within bones of treated animals, although residues of diclofenac are known to be passed into feathers and hair (N. Richards pers. comm.). Although the Bearded Vulture is mainly a resident and non-migratory species (Grimmett *et al.* 2000, Besten 2004), it has been observed flying with other vulture species near the carcass of an Ox *Bos indicus* in a lowland area of Nepal (Chansu, Sildujure VDC, Kaski, 1,100 m a.s.l., in 2001; RA pers. obs.). In addition to this, it was also recorded 305 m. a.s.l. at Mugling, Nepal (Fleming *et al.* 1984) and near sea level in Gujarat (Thakker 2005). The movements of Bearded Vultures depend on food availability (Xirouchakis & Nikolakakis 2002) and they feed in close proximity with lowland vultures when sharing food with them; hence, diclofenac could be one of the reasons for its decline.

Along with diclofenac, other toxic substances (fungicides, herbicides and pesticides) could have similar or compounding effects on the decline of the Bearded Vulture population in the area. It has already been observed that poisoning was the principal reason for non-natural mortality during the steep decline of the population of Bearded Vulture in Europe (Hiraldo *et al.* 1979, Margalida *et al.* 2008). In addition, virtually all local people within the study area believe that Bearded Vulture intestines make an effective treatment for diarrhoea. The practice is also common in Tibet (Ghyacho Bista, local homeopathy doctor in Upper Mustang, pers. comm.). Similarly, in Mustang it is believed that anyone who takes chicks from the nest of a vulture becomes more prosperous. Such beliefs suggest that exploitation of this bird may still occur in this area and in Tibet. Understanding the extent of this additional threat is a priority.

In Europe and Africa, Bearded Vultures have declined massively in the last two decades (Ferguson-Lees & Christie 2001), with the European Alps most prominently affected by these declines. Shooting and climatic variability were considered the most significant causes (Mingozzi & Esteve 1997, Hirzel *et al.* 2004, Margalida *et al.* 2008). Different intentional and unintentional poisoning practices were the most problematic factors in the conservation of Bearded Vultures in Europe during 1955–2002 (Margalida *et al.* 2008). The species is recovering with the help of an international reintroduction project (after introduction in 1986) (Mingozzi & Esteve 1997, Margalida *et al.* 2003, Hirzel *et al.* 2004). The rate of recovery was 5% per annum in the Spanish Pyrenees (Margalida *et al.* 2003). The restoration practices for Bearded Vulture in the European Alps were very expensive, costing about €1 million for every young bred and reared in captivity until the moment of the release (Frey 1998). Such a programme would be a huge undertaking within Nepal, although vulture conservation breeding centres have been established in the country in order to safeguard the Nepal's critically endangered *Gyps* vultures.

Further monitoring and understanding the cause of the decline are the next crucial steps for determining conservation actions for the Bearded Vulture in Nepal. If these declines are in fact found in any other areas of Nepal and throughout the Himalayan region, then the conservation status of the Bearded Vulture would need to be urgently reassessed. Furthermore, immediate steps should be taken to conserve it, in case it follows the same course as *Gyps* vultures in South Asia. Regular investigation of the population is essential in the long term to determine the real status of the species throughout its range.

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The taxonomic status of Rufous-rumped Grassbird *Graminicola bengalensis*, with comments on its distribution and status

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We examine the taxonomic status of the three taxa of Rufous-rumped Grassbird *Graminicola bengalensis* based on a combination of morphology, mitochondrial DNA and vocalisations. We find *sinicus* and *striatus* to be extremely similar in morphology, and that *sinicus* and *bengalensis* exhibit morphological, vocal and genetic differences (due to the lack of modern records of *striatus* it was not possible to include that taxon for vocal and genetic analysis). We propose that *sinicus* be treated as a synonym of *striatus* (the latter has priority) and that there are probably species level differences between *striatus* (s.s.) and *bengalensis*.

INTRODUCTION

The Rufous-rumped Grassbird *Graminicola bengalensis* is a grassland specialist endemic to Asia. It has been found in three main, mostly disjunct, areas: northern Indian subcontinent; south-east China (including Hainan island) and northern Vietnam; and south-east Myanmar (Tenasserim) and nearby parts of Thailand (Lekagul & Round 1991, Dickinson 2003, Collar & Robson 2007). Three subspecies are currently recognised: *G. b. bengalensis* Jerdon, 1863 (hereafter *bengalensis*) in India, Bangladesh and Nepal; *G. b. striatus* Styan, 1892 (hereafter *striatus*) in Myanmar, Thailand, Vietnam and Hainan island; and *G. b. sinicus* Stresemann, 1923 (hereafter *sinicus*) in China, having been recorded in Guangdong and Guangxi provinces and Hong Kong (Cheng 1987, Carey *et al.* 2001, Dickinson 2003, Collar & Robson 2007). Although long treated as a warbler, recent molecular work has shown it to be a babbler (Alström *et al.* 2006, Gelang *et al.* 2009), more specifically placed in a clade referred to as Pellorneinae that includes e.g. *Alcippe*, *Pellorneum*, *Turdinus*, *Napothera* and *Gampsorhynchus* (Gelang *et al.* 2009). It is currently treated as Near Threatened as it is thought to be suffering substantial long-term habitat losses due to drainage, overgrazing and conversion of its grassland and wetland habitats (BirdLife International 2001).

In this paper we discuss differences in morphology, mitochondrial DNA and vocalisations between different populations of *Graminicola bengalensis* and review the taxonomic relationships between the different taxa. We were able to review morphological differences of all three taxa by examining museum specimens, but were unable to obtain genetic vocal data for *striatus* as there are no modern records of this taxon. We also summarise what is currently known regarding distribution and numerical status (Appendix).

MATERIAL AND METHODS

Morphology

Specimens of *Graminicola bengalensis* were examined at the Natural History Museum, Tring, UK (BMNH) and the Museum für Naturkunde, Berlin, Germany (ZMB). (The collection at the Institute for Zoology, Chinese Academy of Science, proved to hold no *Graminicola bengalensis* specimens.) The specimens examined comprised 13 *striatus*, three *sinicus* (including the holotype), and 51 *bengalensis*. In addition, biometric data collected from two *sinicus* trapped for ringing in Hong Kong were included. The following measurements were taken: length of wing (maximum chord), tail and bill (to skull), bill width and bill depth (at proximal edge of nostrils). Wing and tail measurements were recorded to the nearest 0.5 mm, bill measurements to the nearest 0.1 mm using digital vernier callipers. All measurements from specimens were taken by PJL. Wear to the rectrices and remiges was recorded separately using the following categories: none, slight, moderate or heavy. Plumage differences were assessed, with particular consideration given to those attributable to age, condition and wear. Statistics were calculated in Excel (Microsoft Inc.).

DNA extraction and sequencing

Total genomic DNA was extracted from blood or feathers from two specimens each of *bengalensis* and *sinicus* (*striatus* was not examined). Amplification and sequencing was done as in Olsson *et al.* (2005), except that products were purified using EZNA cycle pure kit (Omega bio-tek) and sequencing was done by Macrogen Inc.

Distance analysis

Sequences were aligned in MegAlign 4.03 in the DNAstar package (DNAstar Inc.), which also calculated uncorrected p distance. We also calculated distances under the HKY model (Hasegawa *et al.* 1985) which was the best-fit model according to the Akaike Information Criterion (Akaike 1973) in the same way as in Olsson *et al.* (2005).

Vocalisations

Analysis of vocalisations was carried out based on recordings of *bengalensis* made by Paul Holt at Chitwan, Nepal, and at Kaziranga National Park, Assam, India, and of one individual *sinicus* by GJC in Hong Kong, People's Republic of China. It was not possible to obtain recordings of *striatus*. Vocalisations were recorded using HHB PDR 1000 DAT recorder and a Telinga Pro 5 in the case of *bengalensis* and HHB Portadisc MDP 500 and Telinga Pro 5 in the case of *sinicus*. Spectrograms were prepared using Raven Pro 1.3.

Table 1. Means of length, maximum and minimum frequencies and frequency range of three song strophes each of one *sinicus* and one *bengalensis*.

	1	2	3	Mean	SD
sinicus					
length (secs)	1.11	1.17	1.22	1.17	0.06
max freq. (kHz)	4.80	4.64	4.48	4.64	0.16
min freq. (kHz)	1.80	2.00	2.00	1.93	0.12
frequency range (kHz)	3.00	2.64	2.48	2.71	0.27
bengalensis					
length (secs)	1.36	1.40	1.47	1.41	0.06
max freq. (kHz)	4.42	4.55	4.64	4.54	0.11
min freq. (kHz)	1.57	1.52	1.59	1.56	0.04
frequency range (kHz)	2.85	3.03	3.05	2.98	0.11

RESULTS

Morphological differences

Plumage differences between all three taxa are detailed in Table 2. We found *striatus* and *sinicus* to be extremely similar, with the only consistent difference being the slightly narrower pale fringes to the mantle feathering in *sinicus*. However, *bengalensis* is readily separable from both *striatus* and *sinicus* by having broader pale fringes to the tips of all the rectrices, and blacker and more extensive streaking on the mantle and crown, with white rather than rufous fringes to these feathers. This results in *bengalensis* being much more contrasting above than both *striatus* and *sinicus*. It should be noted that these differences are less apparent in birds in very fresh plumage, as all three taxa exhibit rufous fringes to the upperparts and a rufous wash to the underparts. In such plumage the most obvious difference between *bengalensis* and *striatus*/*sinicus* is the width of the pale tips to the rectrices. However, the rufous fringes above abrade very rapidly and these fringes are not apparent in skins with even slight wear.

Biometrics of males and females are not significantly different in any taxon, except bill length in *bengalensis*, which differs between the sexes (two-sample heteroscedastic t-test, p=0.017). The following measurements of both sexes combined are significantly different (two-sample heteroscedastic t-test): tail *striatus–sinicus* (p=0.038); bill depth *striatus–bengalensis* (p=0.00001) and *sinicus–bengalensis* (p=0.0016); bill width *striatus–bengalensis* (p=0.01) and *sinicus–bengalensis* (p=0.03). See Table 3. Differences in bill measurements are shown in Figure 1.

Genetic analysis

We obtained contiguous 1,076 base pair portions of the cytochrome *b* gene from two specimens each of *bengalensis* and *sinicus*. No frameshift mutations or stop codons that would indicate the accidental amplification of nuclear pseudogenes (e.g. Zhang & Hewitt 1996, Sorensen & Quinn 1998) were detected. The sequences are deposited in GenBank under the accession numbers HM628906 (Hong Kong), HM628907 (Hong Kong), HM628908 (Nepal) and DQ008480 (Nepal). Genetic distances are given in Table 4.

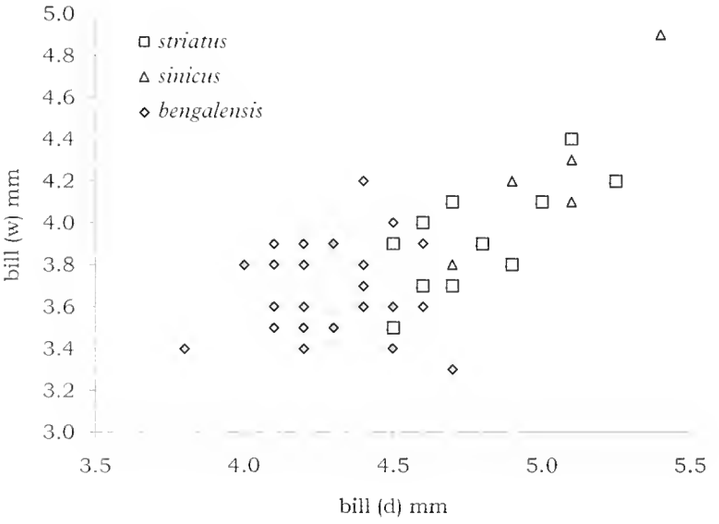

Figure 1. Scatterplot comparing bill width and depth (measured at proximal edge of nostrils) of *bengalensis*, *striatus* and *sinicus*.

Table 2. Plumage comparison of *bengalensis*, *striatus* and *sinicus*.

	bengalensis	***striatus***	***sinicus***
Crown	Striped buff and black; black stripes clearly broader than buff stripes. Black streaks prominent on forecrown	Striped rufous and blackish; blackish streaks narrower than rufous streaks. Blackish streaks becoming diffuse on forecrown	Striped rufous and blackish; blackish streaks narrower than rufous streaks. Blackish streaks becoming diffuse on forecrown
Nape and mantle	Nape with broad black centres and narrow white feather fringes, mantle with broad black feather centres and extensive narrow silver-white fringes; mantle predominantly black	Nape striped dark brown with grey to greyish buff fringes; stripes and paler fringes generally of even width. Mantle with broad dark brown to brownish-black feather centres with narrow rufous fringes	Nape striped dark brown with grey to greyish buff fringes; stripes and paler fringes generally of even width. Mantle with broad dark brown to brownish-black feather centres with narrow rufous fringes. Pale fringes less extensive than in *striatus*
Rump and uppertail-coverts	Extensive narrow blackish streaks, especially on upper tail coverts	Dark brown streaks on uppertail-coverts of some birds, largely unstreaked on rump and uppertail-coverts	Unstreaked on rump, dark brown streaks on uppertail-coverts
Flanks and undertail-coverts	Rufous	Rufous	Rufous
Tail	Upperside of central feathers grey-brown with prominent darker centre along entire length, broad white tips	Upperside of central feathers brown-grey with indistinct or no darker centre along length, narrow off-white tips	Upperside of central feathers brown-grey with indistinct or no darker centre along length, narrow off-white tips

Table 3. Biometrics of *bengalensis*, *striatus* and *sinicus*, given in the order mean, ± standard deviation, number (in parentheses). M: male; F: female; A: all. Significant differences (t-test, sexes combined) between *bengalensis* and the two others are indicated by asterisks: * P ≤0.05, ** P ≤0.01, *** P ≤0.001. The only significant difference between *sinicus* and *striatus* is tail length (*). † Only two sexed specimens, both females.

		Wing	Tail	Tarsus	Bill (to skull)	Bill depth	Bill width
bengalensis	A	59.67 ± 1.62(43)	78.36 ± 3.90(35)	24.58 ± 1.03(13)	16.06 ± 0.59(33)	4.26 ± 0.21(31)	3.68 ± 0.21(29)
	M	59.9 ± 1.58(13)	77.7 ± 5.26(12)	24.5 ± 0.83(4)	16.49 ± 0.50 (11)	4.31 ± 0.32(10)	3.52 ± 0.21(9)
	F	60.0 ± 2.27(8)	79.3 ± 2.17(5)	24.3 ± 1.41(3)	15.75 ± 0.63(8)	4.27 ± 0.18(6)	3.68 ± 0.13(5)
sinicus †	A	58.90 ± 2.07(5)	79.94 ± 2.87(5)	24.73 ± 0.99 (3)	16.46 ± 0.62(5)	5.04 ± 0.26 (5)**	4.26 ± 0.40(5)*
striatus	A	60.59 ± 1.81(11)	76.00 ± 2.93(9)	24. 07 ± 1.09(11)	16.12 ± 0.66(11)	4.79 ± 0.25(11)***	3.94 ± 0.26(11)**
	M	61.6 ± 1.85(5)	76.1 ± 1.65(4)	24.08 ± 1.20(5)	16.48 ± 0.44(5)	4.82 ± 0.13 (5)	3.92 ± 0.18(5)
	F	59.7 ± 1.57(5)	75.0 ± 3.83(4)	23.80 ± 0.99 (3)	15.70 ± 0.69(5)	4.79 ± 0.36 (5)	3.68 ± 0.34(5)

Table 4. Genetic distances between representatives of two populations of *Graminicola bengalensis*.

a. Genetic distances (%; uncorrected p).

	bengalensis Nepal 1	*bengalensis* Nepal 2	*sinicus* Hong Kong 1	*sinicus* Hong Kong 2
bengalensis Nepal 1	–			
bengalensis Nepal 2	0.1	–		
sinicus Hong Kong 1	2.6	2.5	–	
sinicus Hong Kong 2	2.6	2.5	0	–

b. Genetic distances (%) calculated under the HKY85 model.

	bengalensis Nepal 1	*bengalensis* Nepal 2	*sinicus* Hong Kong 1	*sinicus* Hong Kong 2
bengalensis Nepal 1	–			
bengalensis Nepal 2	0.1	–		
sinicus Hong Kong 1	2.7	2.6	–	
sinicus Hong Kong 2	2.7	2.6	0	–

Vocalisations

The taxon *sinicus*, at least, appears to utter song relatively infrequently, and only one recording was obtained in eight early morning and late afternoon visits to the breeding area over two breeding seasons. Despite this, the vocal repertoire of both taxa appears to be fairly wide, and includes a variety of moderately modulated, high-pitched and churring calls, at times recalling a shrike *Lanius*. However, what is considered to be the primary song for both taxa is a fairly rapid and musical, somewhat jaunty and rhythmic utterance that lacks any churring notes. While similar across the two taxa, the two songs are recognisably different (Figs. 2–3).

The initial notes of each strophe of *sinicus* are not recognisably distinct from the rest, while the initial note of each strophe in *bengalensis* is rather more distinct, being quieter and less musical, and there is a short gap before the rest of the strophe is uttered; overall, this imparts a more hesitant introduction. Each strophe ends with two very similar notes, which are usually terminally flat in pitch in *sinicus* but inflected in *bengalensis* (Figs. 2–3).

The mean length of the three strophes analysed for *sinicus* was shorter than the mean of the three strophes of *bengalensis* (Table 1). Peak frequency of *sinicus* averaged 4.64 kHz, while the minimum averaged 1.93 kHz; the equivalent values for *bengalensis* were 4.54 kHz and 1.56 kHz (Table 1). The song strophes of *sinicus* had a mean frequency range of approximately 2.71 kHz, while that of *bengalensis* was approximately 2.98 kHz (Table 1). This combination of longer strophes uttered more rapidly at a slightly higher pitch with an inflected termination in *bengalensis* creates a fairly distinctive difference between the two. Both *sinicus* and *striatus* utter similar harsh, churring calls when agitated or alarmed. However, those of *sinicus* (Fig. 4) tend to be slightly higher in pitch, usually as high as 4.5 kHz, whereas those of *bengalensis* (Fig. 5) generally do not exceed 4.0 kHz.

There appear to be distinct differences in the vocalisations of these two taxa and these may prove significant with a larger sample size.

Song flight

Song flight has been recorded in *bengalensis* breeding in Nepal by Baral *et al.* (2006), who noted that while singing

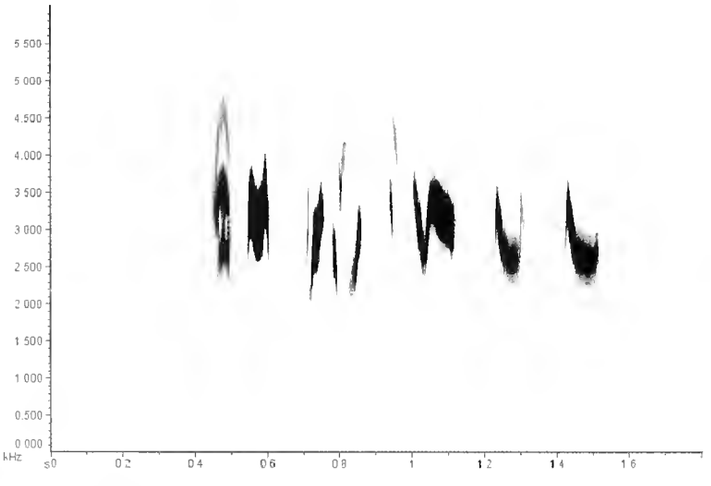

Figure 2. Song strophe of *sinicus*. 15 May 2008, Robin's Nest, New Territories, Hong Kong, China (Geoff Carey).

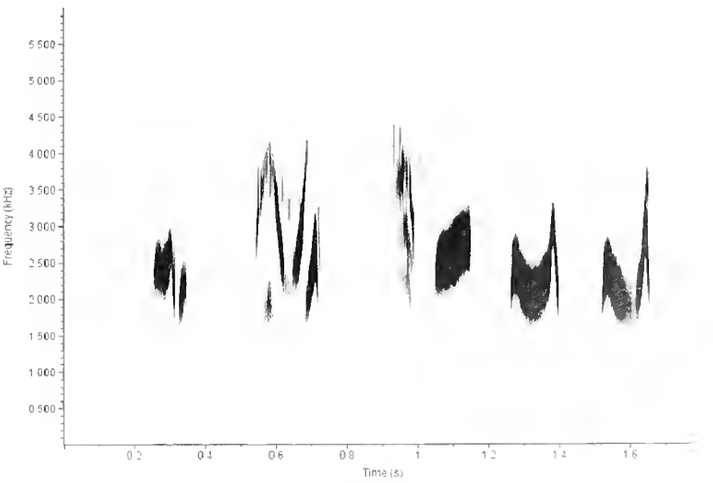

Figure 3. Song strophe of *bengalensis*. 17 March 2001, near Sauraha, Chitwan National Park, Nepal (Paul Holt).

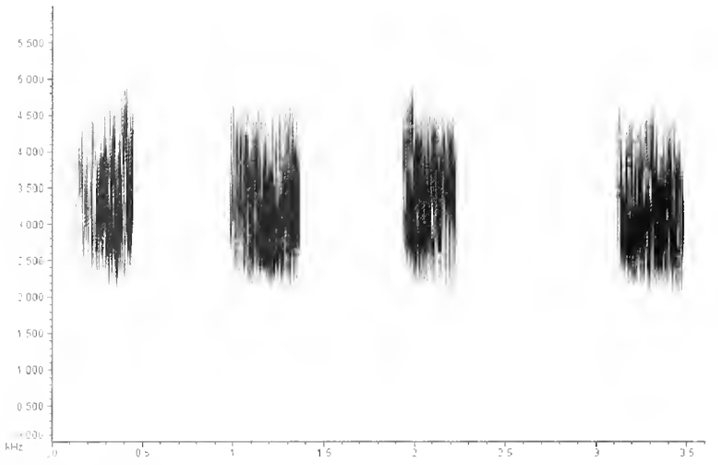

Figure 4. Harsh, churring calls of *sinicus* uttered when agitated or alarmed. 28 May 2008, Robin's Nest, New Territories, Hong Kong, China (Geoff Carey).

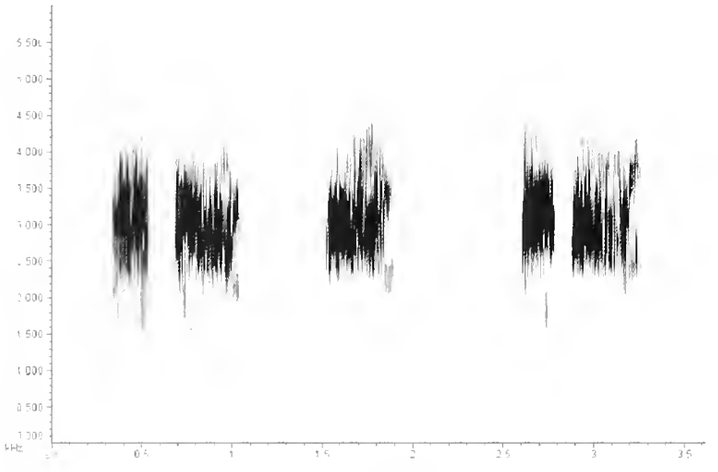

Figure 5. Harsh, churring calls of *bengalensis* uttered when agitated or alarmed. 23 March 1999, near Sauraha, Chitwan National Park, Nepal (Paul Holt).

birds usually remain well concealed, in the breeding season, they occasionally perform a short song flight to a height of about 3 m above grass height, which was not as elaborate as the flights of Striated Grassbird *Megalurus palustris* or Bristled Grassbird *Chaetornis striatus* (Baral 1997). In addition, a horizontal branch-to-branch flight with song emitted has also been recorded (HSB pers. obs.). In Hong Kong, China, *sinicus* invariably sings from patches of tall grass or from within dense vegetation and has never been noted in song flight either by us or by a number of Hong Kong birdwatchers we consulted.

DISCUSSION

Based on plumage characters and bill structure, *bengalensis* can be differentiated from both *sinicus* and *striatus*, while the latter two are only very subtly different. Of the biometrics reviewed we found that *bengalensis* has a significantly less deep and less wide bill than *striatus* and *sinicus*, while the latter two are very similar, with the only significant difference being in tail length.

When describing *sinicus*, Stresemann (1923) noted that it was larger than *bengalensis* and *striatus* (wing 62 mm) and was distinguished from either by the jet black rather than light brown feather-shafts to the breast feathers. The colour of upperparts, head and tail of *sinicus* were described as similar to *striatus*, while flanks and undertail-coverts were darker chestnut than *bengalensis*. Certainly, a wing of 62 mm is large for a Rufous-rumped Grassbird; however, it is within the range for all three taxa. An examination of the type specimen of *sinicus* at the ZMB showed that it is in very fresh plumage (very slight wear on the primaries); as discussed above, birds of all three taxa are more similar morphologically when in very fresh plumage. However, a comparison of other specimens of both *striatus* and *sinicus*, particularly when birds in similar states of wear are compared, leads us to the conclusion that *sinicus* is morphologically very similar to *striatus* (Tables 1 and 2). Specimens of *striatus* from Thailand and Hainan, China (the latter being the type locality of *striatus*, although the type was not examined), and of *sinicus* from Guangdong and Hong Kong, China, were examined, and no consistent morphological differences from these locations were detected. There is a recent record from western Guangxi (see Appendix) that is not ascribed to taxon and which lies within a gap in the published distribution of *striatus* and *sinicus*. This may suggest that *striatus* and *sinicus* formerly had continuous ranges and that any differences are merely part of a (subtle) cline. Based on these findings we prefer to treat *sinicus* as a junior synonym of *striatus*. The genetic distances between *bengalensis* and *sinicus* indicate that these two taxa have been evolving as separate evolutionary lineages for 1.24–1.50 million years, assuming 1.8–2.1% divergence per million years. The validity of the '2% rule' has been questioned (Garcia-Moreno 2004, Lovette 2004, Ho *et al.* 2005, Penny 2005), but Weir & Schluter (2008) showed that molecular evolution occurred in an approximately clock-like manner through time across a variety of bird lineages, and that a divergence of 2.1% per million years seems a reasonable approximation in the absence of calibration points.

With the caveat of the small sample size analysed for this work, vocalisations of *sinicus* and *bengalensis* appear to differ, providing further support to the significance of these separate evolutionary lineages.

CONCLUSIONS

We found that *sinicus* shows only very minor differences from *striatus* in terms of morphology (genetic and vocal differences were not possible to determine due to a lack of modern records from within the range of *striatus*). We recommend that *sinicus* is synonymised with *striatus* (*striatus* predates *sinicus* by 31 years).

We further found that *bengalensis* and *striatus* (including '*sinicus*') can be separated morphologically, genetically and, potentially, vocally. There also appear to be behavioural differences in that the song flight has only been recorded in *bengalensis*. We note that further research is required into the extent of the vocal and behavioural differences discussed above, but conclude that the available information indicates that *bengalensis* and *striatus* are better treated as specifically distinct.

We propose the following English names, both of which are taken from the country in which the type specimens were collected:

- Indian Grassbird *Graminicola bengalensis* Jerdon, 1863
- Chinese Grassbird *Graminicola striatus* Styan, 1892

Rufous-rumped Grassbird *Graminicola bengalensis* (*sensu lato*) is considered Near Threatened (BirdLife 2001); if the treatment proposed above is adopted then it seems likely that one or both of *bengalensis* and *striatus* warrant a higher threat status. The current distribution and status of both are summarised in the Appendix.

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APPENDIX
Current distribution and status of *Graminicola bengalensis* and *G. striatus*

Obtaining population estimates is problematic, and a number of authors comment along the lines that *Graminicola* is under-recorded or difficult to detect due to its skulking nature. However, it is also possible that it is rarely recorded at certain sites as it is present in very low densities. Baral *et al.* (2006) found it to be very vocal (and thus more easily detected) when occurring at relatively high densities; this is in stark contrast to the (low density) populations in Hong Kong which vocalise irregularly and are difficult to detect. It is to be expected that the species is more widespread than the records below suggest and observers are encouraged to search in areas of suitable habitat within the ranges of the two species.

Graminicola bengalensis

According to available data the core part of the range of *bengalensis* is Nepal, where important populations are found from Sukila Phanta in the west to Chitwan in the central region (Inskipp & Inskipp 1991). Baral *et al.* (2006) conducted a detailed study covering the status and distribution in Nepal. They found it to be a fairly common breeding resident within protected areas, especially in Sukila Phanta and Royal Chitwan National Park, but rare at Koshi Tappu and Bardia. It occurred in higher densities in open grasslands and in grasslands away from forests. At Bardia they noted that further surveys were required, as a brief visit in March 1998 coincided with heavy grass burning which may have biased the results; whilst in Koshi Tappu most of the suitable grassland habitat is degraded and lost. They concluded that the results of the study show that Nepal's lowland grasslands hold an internationally important part of the world population of *G. bengalensis*.

It is very rarely reported from India. It is known from several sites including Dudhwa National Park (Uttar Pradesh), and Dibru-Saikhowa (Assam). At the latter site it was 'rarely seen' (Allen 2002). Although Barau & Sharma (1999) state that it is occasionally seen at Kaziranga National Park, Robson (2007) notes that recent reports from protected areas in north-east India indicate a good population in this park. Singh *et al.* (1999) recorded it from D'Ering, the only records from Arunachal Pradesh.

In Bangladesh it has recently been recorded in low numbers in the north-east by Thompson & Johnson (2003) who noted that the 'only remaining suitable areas of wet grassland would appear to fringe some of the hoars in the north-east region...'; Collar & Robson (2007) note that it has disappeared from most of its range within Bangladesh due to habitat destruction.

There are six specimens from Bhutan ('Bhutan Duars') in BMNH. As Bhutan does not appear to be within the published range of *Graminicola bengalensis*, these specimens are of note.

Current population estimates **India**: Rarely reported and localised; population unknown but on current information considered to be low. **Bangladesh**: Rarely reported and localised, restricted to the north-east; population presumed to be very low. **Nepal**: Using a density estimate of 10 pairs/km^2, and area of potential grassland habitat based on site visits, verification from the maps and field experience, the population in Nepal is estimated to be approximately 2,000 pairs (HSB unpubl. data).

Graminicola striatus

In certain parts of its range it has suffered significant losses and is now thought to be extinct in both Thailand (last record 1923: Lekagul & Round 1991, Collar & Robson 2007) and Vietnam, where there is little if any suitable habitat remaining (BirdLife International 2001, P. D. Round and J. Eames pers. comm.). There are no modern records from Myanmar, despite recent extensive surveys of suitable habitat (J. Eames pers. comm.).

In China it has not been recorded from Hainan since 1899 and there are very few recent records away from Hong Kong. In Guangxi there has been one record since 1931, concerning one in Shiwandashan, south-west Guangxi, at 600 m, May 1997 (Lee *et al.* 2006, Lee Kwok Shing *in litt.*). There are two older records from Guangdong: one undated (at the South China Institute of Endangered Animals: R. W. Lewthwaite pers. comm.), the other from 1917 (Stresemann 1923). There is one recent record of two at 900 m at Wutongshan, Shenzhen, on 17 May 2001 (Lee Kwok Shing *in litt.*). In Hong Kong it is considered to be a scarce grassland specialist breeding at 200–800 m (Carey *et al.* 2001).

Current population estimates **Myanmar**: No modern records, population presumed to be very low. **Thailand**: No modern records; presumed extinct. **Vietnam**: No modern records; presumed extinct. **China**: Recent widespread surveys of many sites with suitable habitat in Guangdong, Guangxi and Hainan provinces have generated single records each in Guangxi and Guangdong (Lee *et al.* 2006, Lee Kwok Shing *in litt.*). The population level in these areas is presumed to be low, although it seems likely that there are numerous other sites at which birds remain to be discovered. In Hong Kong it is restricted as a breeding species to grasslands at 200–800 m, and during a territory-wide breeding bird survey during 1993–1996 it was recorded in 13 1 km squares out of a total of 1,220 1 km squares surveyed (present in 0.1% of squares) (Carey *et al.* 2001). The stronghold appears to be the Tai Mo Shan massif, where it was found in four 1 km squares during the survey. Even in optimum breeding habitat, however, it occurs at low densities (estimated to be 1–2 pairs per km^2), and it is likely that the Hong Kong population is not large. During a census of wintering birds during 2001/2002 to 2004/2005 a total of 18 individuals were recorded in 10 1 km squares (Hong Kong Birdwatching Society unpublished data). Based on a review of historical data at each breeding site (Leader in prep.), it is estimated that the Hong Kong population is in the region of 50–100 pairs. Although this species was only formally identified in Hong Kong in 1978 it is thought to have been present since at least 1957 (Melville & Chalmers 1984). Recent visits to Tai Mo Shan and Robin's Nest in Hong Kong indicate that regeneration of shrubland, tree planting and grazing by feral cattle are reducing the area of suitable breeding habitat for this species. A Hong Kong-wide study mapping terrestrial habitats found that the area of grassland decreased from 25,752 ha in 2003 to 21,572 ha in 2004 (Scott Wilson 2005); during the same period the area of shrubby grassland (i.e. the next successional stage) increased from 14,332 to 24,674 ha, which the study attributed to a genuine increase in the size of the habitat. Regeneration of shrubland and tree planting are also thought to be issues at other grassland sites in Hong Kong, Guangdong and Guangxi.

Agta bird names: an ethno-ornithological survey in the Northern Sierra Madre Natural Park, Philippines

JAN VAN DER PLOEG and MERLIJN VAN WEERD

Interviews with six Agta guides during fieldwork in 2006 and 2008, involving joint observations of birds in the wild and examination of illustrations, generated 110 Agta names of bird species in the Northern Sierra Madre Natural Park in northern Luzon, Philippines. Indigenous knowledge of birds is not limited to economically important species, as is often assumed. Agta hunters are familiar with most discernible species. Secretive, silent and montane birds are largely unknown.

INTRODUCTION

Ethno-ornithology, the study of people's knowledge about birds, can enhance the design of effective conservation interventions and advance scientific knowledge, particularly of enigmatic forest birds in the tropics (Berkes 1999). Nowhere is this more urgent than in the Philippines, where an exceptional high number of endemic birds face unprecedented threats (Collar *et al.* 1999). There is however little information on the ornithological knowledge and taxonomic classifications of the indigenous peoples of the Philippines. In this paper we document the bird names of the Agta, the indigenous people of the northern Sierra Madre on Luzon.

The Agta are the descendants of Australoid people who arrived in the Philippine archipelago 35,000 years ago. In contemporary Philippine society the Agta form a distinct cultural group, mainly because of their characteristic physical features and their hunter-gatherer lifestyle (Griffin & Estioko-Griffin 1985). The Agta largely depend on forest, freshwater and marine resources that are bartered with lowland communities for rice and other consumer goods. However, environmental degradation, changing consumption and production patterns, and the loss of control over their ancestral lands, threaten the Agta's way of life (Headland 1986, Minter 2010).

The Northern Sierra Madre Natural Park (NSMNP) is the largest protected area of the Philippines, with a total area of 359,486 ha (Mallari *et al.* 2001) and 294 bird species, 30% endemic to the Philippines, recorded there (van Weerd 2002). NSMNP is one of the last strongholds on Luzon for 20 globally threatened bird species, including the Critically Endangered Isabela Oriole *Oriolus isabellae* and Philippine Eagle *Pithecophaga jefferyi*. Logging, agricultural encroachment, hunting and the conversion of wetlands represent serious threats to the avifauna of NSMNP (NORDECO & DENR 1998), which remains a 'paper park': law enforcement is virtually non-existent. Government plans for infrastructural development and mining could have a severe impact on the biodiversity of the protected area and the livelihoods of the Agta.

Around 1,800 Agta live in or directly adjacent to NSMNP (Minter 2010). They speak two different Negrito languages: Palanan-Divilacan Agta and Disabungan-Dipagsanghan Agta (Headland 2003). Most Agta in the park also speak Ilocano, the *lingua franca* of northern Luzon, or Tagalog, the Philippine national language. In some areas they also use Ibanag, Paranan, Kalinga or Itawis to communicate with neighbouring farming communities. Nowadays the Agta form a small minority in NSMNP: 22,000 people live inside the park and another 33,000 in villages directly adjacent to its western boundary. Most of these people are subsistence farmers who settled in the Sierra Madre forest frontier in search of land.

METHODS

From 14 to 29 March 2006 we visited several sites along the Pacific Coast of the municipality of Palanan. We surveyed limestone forest around the Magsinarao Caves in Diguyo (16°56′N 122°27′E), ultrabasic forest on the Digollorin Plateau (16°52′N 122°26′E) and lowland forest at Diadiadin Creek in Divinisa (16°48′N 122°24′E). From 12 to 24 September 2008, we conducted a biodiversity survey in the Palanan River Valley, upstream of *sitio* Dipagsangan. We surveyed lowland dipterocarp forest at Dipinantahikan (16°53′N 122°20′E), and mid-elevation forest at Pinakdatdatin ti Bulayo (16°51′N 122°18′E). In each site we stayed three nights and three days to make an inventory of the avifauna.

During the surveys we were accompanied by six Agta guides: Estaniel Prado (around 50 years old) from Dipagsangan; Bawi Donato (70), Jaime Salazar (45) and Osbel Cabaldo (60) from Dikente, and Rabidong Alonso (60) and Moning Molina (50) from Diddadungan. These men are experienced hunters who are familiar with the topography and the species of the surveys sites. In the rainy season (June to January) Agta men in Palanan make regular trips to their hunting grounds, which are usually located within a day's reach of their settlements (Minter 2010).

To obtain Agta vernacular birds names we showed A4-size colour photographs (Philippine Bird Photography Forum 2009) and drawings (Kennedy *et al.* 2000) of 202 bird species of Luzon to our guides and asked them to identify them. There are concerns about the reliability of this pile-sorting method, as illiterate hunter-gatherers in tropical forests mainly identify birds by size, voice, behaviour and posture—characteristics that are absent in a two-dimensional picture (Diamond & Bishop 1999). We therefore validated the bird names recorded during the interviews with field observations and mist-netting. Early morning and late afternoon we walked a 5 km transect with an Agta guide. When a bird was observed or heard we asked and recorded the Agta name. In addition we asked our Agta guides to identify the birds caught in mist-nets, which enabled us to cross-check species names. In the Congo basin this combination of ecological and anthropological research methods has successfully been

used to record bird names of Mbuti hunter-gatherers (Ichikawa 1998).

Our respondents readily admitted ignorance when they did not know a bird name and frequently corrected each other, which, following Blurton Jones & Konner (1998), suggests that our records are reliable. We complemented our results with the 71 Agta bird names recorded by the DENR/Birdlife survey in the Sierra Madre in 1991 (Danielsen *et al.* 1994), during which researchers showed plates from duPont (1982) to several Agta hunters in Dinapigue and recorded their Agta name.

RESULTS AND DISCUSSION

Table 1 presents 110 Agta bird names that were recorded during field observations, mist-netting and interviews; for simplicity we confine the scientific names of species to this table. Agta bird names are spelt phonetically.

Fifteen Agta bird names overlap with Tagalog bird names (Kennedy *et al.* 2000): Philippine Duck (*Papan*), Darter (*Kasilem*), Rufous Night Heron (*Bakaw*), Blue-breasted Quail (*Pekpekao*), Buff-banded Rail (*Tekleng*), Pompadour Green Pigeon (*Punay*), Green Imperial Pigeon (*Balud*), Emerald Dove (*Batu-Batu*), Philippine Hanging Parrot (*Colasisi*), Philippine Hawk Owl (*Bukao*), White-throated Kingfisher (*Salaksak*), Luzon Hornbill (*Tahiktik*), Rufous Hornbill (*Kalao*), Whiskered Pitta (*Kong-Kong*) and Slender-billed Crow (*Wak-Wak*). Only two species overlap with Ilocano bird names (Vanoverbergh 1928): Oriental Honey-buzzard (*Kali*) and Coleto (*Takling*). A plausible explanation is that the Agta in Palanan have adopted the names of conspicuous species from their neighbouring Tagalog farming communities. Two names are derived from Spanish: Philippine Eagle (*Aguila*) and the introduced Crested Myna (*Martinez*).

In the forest Agta hunters mainly identify species on sound. Many Agta bird names are onomatopoeic. *Pitupi* (Plaintive Cuckoo), *Tuao* (Asian Koel), *Bukao* (Philippine Hawk Owl), *Tonguitok* (Coppersmith Barbet), *Wik-Wik* (Bar-bellied Cuckooshrike), *Sina-Cacao* (Balicassiao), *Pato-Dilao* (Black-naped Oriole), *Bales-Gugu* (Philippine Fairy Bluebird), *Wak-Wak* (Slender-billed Crow), and

Table 1. Agta names for the birds of the Northern Sierra Madre Natural Park. An asterisk (*) indicates not recorded in our surveys, and Agta name from Danielsen *et al.* (1994).

Species	Agta name
Little Grebe *Tachybaptus ruficollis*	*Talingting*
Shearwaters (seabirds in general)	*Paltaw / Liawe*
Great Cormorant *Phalacrocorax carbo*	*Dagalsim*
Darter *Anhinga melanogaster*	*Kasilem*
Herons (Great-billed, Grey, Purple)	*Dahilog*
Egrets (Great, Intermediate, Little, Cattle)	*Uduk*
Pacific Reef Egret *Egretta sacra*	*Tugak*
Night Herons (Rufous, Black-crowned)	*Bakaw*
Ducks	*Papan*
Osprey *Pandion haliaetus* White-bellied Sea Eagle *Haliaeetus leucogaster* Grey-headed Fish Eagle *Ichthyophaga ichthyaetus*	*Bagnig*
Oriental Honey-buzzard *Pernis ptilorhynchus*	*Kali**
Brahminy Kite *Haliastur Indus*	*Dialambog*
Eastern Marsh Harrier *Circus spilonotus*	*Buko**
Pied Harrier *Circus melanoleucos*	*Tagaw**
Grey-faced Buzzard *Butastur indicus*	*Salikap*
Philippine Serpent Eagle *Spilornis holospilus*	*Kulizagwag*
Philippine Eagle *Pithecophaga jefferyi*	*Aguila*
Philippine Falconet *Microhierax erythrogenys*	*Banggak*
Red Junglefowl *Gallus gallus*	*Italon*
Tabon Scrubfowl *Megapodius cumingii*	*Ocong*
Quails and Buttonquails	*Pekpekao*
Rails	*Tangiok*
Plain Bush-hen *Amaurornis olivaceus* Buff-banded Rail *Gallirallus philippensis* Barred Rail *Gallirallus torquatus*	*Tekleng*
Watercock *Gallicrex cinerea*	*Tungtung*
Plovers (shorebirds in general)	*Balalang*
Common Sandpiper *Actitis hypoleucos*	*Tabalalan*
Greater Painted-snipe *Rostratula benghalensis*	*Tahadag*
Snipes	*Tardak*
Gulls	*Bitaw*
Terns	*Salikap*
Pompadour Green Pigeon *Treron pompadora* Pink-necked Green Pigeon *Treron vernans*	*Punay*
White-eared Brown Dove *Phapitreron leucotis* Amethyst Brown Dove *Phapitreron amethystinus*	*Laguiden*
Flame-breasted Fruit Dove *Ptilinopus marchei* Yellow-breasted Fruit Dove *Ptilinopus occipitalis*	*Hogam*
Cream-bellied Fruit Dove *Ptilinopus merrilli* Black-chinned Fruit Dove *Ptilinopus leclancheri*	*Biholi*
Pink-bellied Imperial Pigeon *Ducula poliocephala* Green Imperial Pigeon *Ducula aenea*	*Balud*
Metallic Pigeon *Columba vitiensis*	*Dugem*
Reddish Cuckoo Dove *Macropygia phasianella*	*Lupupu*
Island Collared Dove *Streptopelia bitorquata* Spotted Dove *Streptopelia chinensis*	*Lopo*
Emerald Dove *Chalcophaps indica*	*Batu-Batu*
Luzon Bleeding-heart *Gallicolumba luzonica*	*Lagba-an*
Guaiabero *Bolbopsittacus lunulatus*	*Guhingab*
Blue-naped Parrot *Tanygnathus lucionensis* Blue-backed Parrot *Tanygnathus sumatranus*	*Uret*
Green Racquet-tail *Prioniturus luconensis* Montane Racquet-tail *Prioniturus montanus*	*Mambag*
Colasisi *Loriculus philippensis*	*Colasisi*
Cuckoos	*Petpet*
Plaintive Cuckoo *Cacomantis merulinus*	*Pitupi*
Asian Koel *Eudynamys scolopacea*	*Tuao*
Scale-feathered Malkoha *Phaenicophaeus cumingi* Red-crested Malkoha *Phaenicophaeus superciliosus*	*Sekat*
Philippine Coucal *Centropus viridis*	*Saleng-Gagu*
Rufous Coucal *Centropus unirufus*	*Talamsig*
Philippine Scops Owl *Otus megalotis*	*Siok*
Philippine Eagle Owl *Bubo philippensis*	*Bulayo*
Philippine Hawk Owl *Ninox philippensis*	*Bukao*

Table 1 ... continued.

Species	Agta name
Philippine Frogmouth *Batrachostomus septimus*	*Tuker*
Nightjars	*Tagao*
Swiftlets	*Talawen*
Whiskered Swiftlet *Hemiprocne comata*	*Gahutitid*
Philippine Trogon *Harpactes ardens*	*Amaladawon*
Dollarbird *Eurystomus orientalis*	*Kasak-Kasak*
Common Kingfisher *Alcedo atthis*	*Soksok*
Indigo-banded Kingfisher *Alcedo cyanopectus* Philippine Dwarf Kingfisher *Ceyx melanurus*	*Darwen*
Stork-billed Kingfisher *Pelargopsis capensis*	*Batao*
White-throated Kingfisher *Malcyon smyrnensis* White-collared Kingfisher *Halcyon chloris*	*Salaksak*
Spotted Kingfisher *Actenoides lindsayi*	*Sulpayat**
Blue-throated Bee-eater *Merops viridis* Blue-tailed-Bee-eater *Merops philippinus*	*Leplew*
Luzon Hornbill *Penelopides manillae*	*Taliktik*
Rufous Hornbill *Buceros hydrocorax*	*Kalaw*
Coppersmith Barbet *Megalaima haemacephala*	*Tonguitok*
Woodpeckers	*Kamambitel*
Red-bellied Pitta *Pitta erythrogaster* Whiskered Pitta *Pitta kochi*	*Kong-Kong*
Hooded Pitta *Pitta sordida*	*Busaswet*
Pacific Swallow *Hirundo tahitica*	*Kalawen*
Bar-bellied Cuckooshrike *Coracina striata*	*Wik-Wik*
Blackish Cuckooshrike *Coracina coerulescens*	*Rok-Rok*
Yellow-vented Bulbul *Pycnonotus goiavier*	*Pageg-Pak*
Yellow-wattled Bulbul *Pycnonotus urostictus*	*Pogyuk*
Philippine Bulbul *Hypsipetes philippinus*	*Patet*
Balicassiao *Dicrurus balicassius*	*Sina-Cacao*
Black-naped Oriole *Oriolus chinensis*	*Pato-Dilao*
Philippine Fairy Bluebird *Irena cyanogaster*	*Bales-Gugu*
Slender-billed Crow *Corvus enca* Large-billed Crow *Corvus macrorhynchos*	*Wak-Wak*
Elegant Tit *Parus elegans*	*Amalaplosan*
Sulphur-billed Nuthatch *Sitta oenochlamys*	*Balteo*
Golden-crowned Babbler *Stachyris dennistouni*	*Patit*
Oriental Magpie Robin *Copsychus saularis*	*Palal*
White-browed Shama *Copsychus luzoniensis*	*Hegihow*
Arctic Warbler *Phylloscopus borealis* Lemon-throated Leaf Warbler *Phylloscopus cebuensis*	*Tiger*
Tawny Grassbird *Megalurus timoriensis*	*Rouset-Rouset*
Philippine Tailorbird *Orthotomus castaneiceps*	*Bernang*
Cisticolas	*Sarsit**
Mangrove Blue Flycatcher *Cyornis rufigastra*	*Bangak*
Blue-headed Fantail *Rhipidura cyaniceps*	*Baltay*
Pied Fantail *Rhipidura javanica*	*Mangatiklan**
Rufous Paradise-flycatcher *Terpsiphone cinnamomea*	*Pitokan*
Japanese Paradise-flycatcher *Terpsiphone atrocaudata*	*Dislag**
Black-naped Monarch *Hypothymis azurea*	*Bonseswet*
Grey Wagtail *Motacilla cinera*	*Palansasiwan*
White Wagtail *Motacilla alba*	*Nagbiyakas**
Richard's Pipit *Anthus novaseelandiae*	*Routak-Routak*
White-breasted Woodswallow *Artamus leucorynchus*	*Macolewlew*
Shrikes	*Rek-Rek*
Coleto *Sarcops calvus*	*Takling*
Crested Myna *Acridotheres cristatellus*	*Martinez*
Sunbirds	*Tilad-Tilad*
Flowerpeckers	*Boboyan*
Orange-bellied Flowerpecker *Dicaeum trigonostigma*	*Bukidong**
White-eyes	*Bubonsalag**
Eurasian Tree Sparrow *Passer montanus*	*Trompon**
Green-faced Parrotfinch *Erythrura viridifacies*	*Tragui*
Munias	*Dignas*

Rek-Rek (Brown Shrike) are clear examples of vernacular names that describe the distinctive sound of the species.

Pigeons (Columbidae) are the most important prey species for Agta hunters. Pompadour Green Pigeon and Pink-necked Green Pigeon are both called *Punay*. Agta hunters mimic the calls of White-eared and Amethyst Brown Doves (both *Laguiden*) to lure them within shooting range. They consider Cream-bellied Fruit Dove (*Biholi*) an indicator species for relatively undisturbed forest. Yellow-breasted Fruit Dove is called *Hogam*, but hunters mention another *Hogam* species restricted to montane forest, probably Flame-breasted Fruit Dove. Common Emerald Dove is called *Batu-Batu*; *batu* means stone, and the Agta claim they find stones in the gizzard when butchering this species. The Agta are familiar with Black-chinned Fruit Dove (also called *Biholi* because it has red feet) and Pink-bellied Imperial Pigeon and Green Imperial Pigeon (both called *Baliud*), but say that these species do not occur on the eastern side of the Sierra Madre. They do not know Pied Imperial Pigeon *Ducula bicolor*, and it has probably never occurred along the coast of NSMNP. Island Collared Dove and Spotted Dove are seen as female and male of a single species, *Lopo*. A similar cognitive construction is made for Long-tailed Shrike and Brown Shrike (*Rek-Rek*) as male and female of a single species.

Hunters catch live Red Junglefowl (*Italon*) with rattan traps to crossbreed the species with domestic chickens. They say they also regularly catch Red-bellied Pitta (*Kong-Kong*) in traps. Feathers of both Luzon and Rufous Hornbills are used for arrows. Rufous Hornbill (*Kalao*) casques from NSMNP are traded to middlemen to be sold as traditional medicine or tourist souvenirs in Ifugao province. Agta children regularly shoot bulbuls and other small birds with catapults for fun and for food. The Agta distinguish three bulbul species: *Pageg-Pak* (Yellow-vented), *Pogyuk* (Yellow-wattled) and *Patet* (Philippine).

They distinguish three swiftlet species, called *Talawen*. Swiftlet nests are an important commodity for the Agta (Minter 2010). Nests of Island Swiftlet, Glossy Swiftlet and Pygmy Swiftlet are collected from limestone caves during the dry season (March–June), cleaned and sold to traders. Swiftlet nests are the most profitable non-timber forest product in NSMNP. There are no specific harvest

regulations and some Agta are concerned about the sustainability of the swiftlet nest trade.

The Agta shoot Philippine Serpent Eagle (*Kuliwagwag*) and Brahminy Kite (*Dialambog*) with air-guns or home-made match-guns, as they occasionally attack domestic chickens; but tradition prescribes that only 'guilty birds', individuals that have actually attacked chicken, can be shot. Philippine Eagle (*Aguila*) is very seldom seen by Agta hunters, who say the species 'lives in a big tree high in the mountains', suggesting it is confined to montane forest in the northern Sierra Madre; they know it is protected by law. Munias (*Dignas*) and Green-faced Parrotfinch (*Tragui*) are also considered pests as they feed on upland rice, and are caught with fish-nets.

Indigenous knowledge of birds is not limited to edible or pest species, as is popularly assumed. Prominent species in mixed flocks in lowland forest are well known to the Agta, such as Elegant Tit (*Amalaplosan*), Sulphur-billed Nuthatch (*Baltco*), White-browed Shama (*Hegihow*), Blue-headed Fantail (*Baltay*) and Black-naped Monarch (*Bouseswet*). The Agta identify seven kingfisher species. Two different 'classes' of *Darwen* occur respectively in agricultural areas (Indigo-banded Kingfisher) and the forest (Philippine Dwarf Kingfisher). The Stork-billed Kingfisher is known as *Batao* and is said to occur along large rivers. Common and Spotted Kingfishers are respectively known as *Soksok* and *Sulpayat*. Two different *Salaksak* occur in agricultural areas: White-throated and White-collared Kingfisher. The *Salaksak* announces the arrival of visitors (van Alphen 1999).

Several other birds play a prominent role in Agta culture. It is said that two mythical birds created the world and gave birth to its first people: these creator-gods are embodied in *Uduk* (Egret) and *Wak-Wak* (Crow) (Minter 2010). A folktale describes the plight of the *Takling*: in a competition the Coleto flew higher than all other birds, but blinded by his success flew so high that the sun burned his face. Scale-feathered Malkoha (*Sekat*) is considered an omen for hunting success. Philippine Eagle Owl (*Bulayo*) is associated with ancestral spirits. Evil spirits (*anito*) sometimes take the form of a nightjar (*Tagao*) and make people sick.

A distinctive feature of Agta taxonomy is that species are often classified simply at family or genus level: all woodpeckers (Picidae) for example are called *Kamambitel*. Sometimes the classification is based on a shared behavioural trait and appearance: all piscivorous raptors are *Bagnig*. Within these general categories the Agta distinguish different 'classes' (i.e. species). There are thus three classes of *Bagnig* (White-bellied Sea Eagle, Grey-headed Fish Eagle and Osprey). Important prey species that look very similar, such as White-eared and Amethyst Brown Dove (both *Laguiden*), as well as less obvious species, such as flowerpeckers (Dicaeidae) (*Boboyan*) and sunbirds (Nectariniidae) (*Tilad-Tilad*), are lumped, but in the case of sunbirds Agta tell apart several species based on habitat: Olive-backed is found in agricultural areas along the coast whereas Metallic-winged occurs only in lowland forest.

Our informants misidentified several species. Jerdon's Baza *Aviceda jerdoni* was identified from a photograph as *Kuliwagwag* (Philippine Serpent Eagle), Besra *Accipiter virgatus* as *Bukao* (Philippine Hawk Owl), Rufous-bellied Eagle *Hieraaetus kienerii* as *Bagnig*, Spotted Imperial Pigeon *Ducula carola* as *Biholi* (fruit dove), Bukidnon Woodcock *Scolopax bukidnonensis* as *Tardak* (Common Snipe), White-browed Jungle Flycatcher *Rhinomyias insignis* as *Hegihow* (White-browed Shama), Asian Glossy Starling *Aplonis panayensis* as *Sina-Cacao* (Balicassiao), and Buzzing Flowerpecker *Dicaeum hypoleucum* as *Bernang* (Philippine Tailorbird). These mistakes are easily explicable: the photographs and drawings of these species closely resemble each other. We think that our respondents would have correctly identified these species in the field. Only a few species that we jointly observed in the field were misidentified: Citrine Canary Flycatcher *Culicicapa helianthea* was identified as *Amalaplosan* (Elegant Tit), Golden-bellied Gerygone *Gerygone sulphurea* as *Boboyan* (flowerpecker), and Green-backed Whistler *Pachycephala albiventris* and Chestnut-faced Babbler *Stachyris whiteheadi* as *Patet* (Philippine Bulbul).

Agta do not have names for most montane species, such as Luzon Scops Owl *Otus longicornis*, White-browed Shortwing *Brachypteryx montana*, White-cheeked Bullfinch *Pyrrhula leucogenis* and Tawny-breasted Parrotfinch *Erythrura hyperythra*. High-altitude forest in NSMNP is difficult to access and Agta seldom hunt and gather above 800 m. Inconspicuous, silent and shy species such as White-fronted Tit *Parus semilarvatus*, Rabor's Babbler *Napothera rabori*, Luzon Striped Babbler *Stachyris striata*, Ashy Thrush *Zoothera cinerea*, Long-tailed Bush Warbler *Bradypterus caudatus*, Blue-breasted Flycatcher *Cyornis herioti*, Furtive Flycatcher *Ficedula disposita* and Striped Flowerpecker *Dicaeum aeruginosum*, and rare migrants such as Siberian Rubythroat *Luscinia calliope*, Scaly Thrush *Zoothera dauma* and Chestnut-cheeked Starling *Sturnus philippensis*, were not known to our informants.

According to our guides the Tabon Scrubfowl (*Ocong*) has been exterminated along the coast of NSMNP. Darter (*Kasilem*) has not been recorded in the Sierra Madre (van Weerd & van der Ploeg 2004) but our informants claim they still occasionally see the species along rivers. Agta are unfamiliar with Philippine Cockatoo *Cacatua haematuropygia*, substantiating the assumption that the species never occurred in the northern Sierra Madre (Poulsen 1995). The Agta in Palanan also do not know Isabela Oriole, which suggests that the distribution of this Critically Endangered species is limited to the western foothills of the Sierra Madre (van Weerd & Hutchinson 2004). The Agta say that the two racquet-tail species in the northern Sierra Madre (lumped as *Mambag*) only occur on the western side of the Sierra Madre. That the Agta have a name for Blue-naped Parrot or Blue-backed Parrot (*Uret*) is remarkable, as these species have not been recorded in NSMNP. The Agta are unfamiliar with Spot-billed Pelican *Pelecanus philippensis*, Black-faced Spoonbill *Platalea minor* and Sarus Crane *Grus antigone*, which indicates that these species have been absent in NSMNP for a long time (van Weerd & van der Ploeg 2004). Our respondents did not recognise drawings of Oriental Stork *Ciconia stormi* or Woolly-necked Stork *C. episcopus*, suggesting that these two species are rare vagrants (Danielsen *et al.* 1994).

The Agta are thus familiar with most discernible species in NSMNP, while secretive and montane species are much less known. This ethno-ornithological knowledge can be effectively tapped to derive new insights on the spatial and temporal distribution of several globally threatened birds (Johannes 1993), monitor biodiversity in the protected area (Danielsen *et al.* 2000), or refine conservation

interventions (Sheil & Lawrence 2004). The interest of Agta hunters in birds, the cultural values of many bird species and traditional conservation ethics can provide a sound basis for conservation action. In theory the Agta have an important say in the management of NSMNP: 11 out of 36 members of the Protected Area Management Board are Agta representatives. In practice, however, the participation of the Agta in decision-making is limited and park regulations are not enforced on the ground, with detrimental consequences for biodiversity and the welfare of Agta communities.

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A new breeding site of the Critically Endangered Chinese Crested Tern *Sterna bernsteini* in the Wuzhishan Archipelago, eastern China

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Chinese Crested Tern *Sterna bernsteini* is listed as a Critically Endangered species by IUCN and BirdLife International (IUCN 2008, BirdLife International 2008). For over a century it was known only from a few specimens collected before 1937 and several unconfirmed sight records, until in June 2000 eight adults were discovered in the Matzu archipelago in eastern China (Liang *et al.* 2000, BirdLife International 2001). It was believed to breed along eastern coast of China and winter in the South China Sea. In August 2004, another breeding colony of 10–20 adults was discovered among 4,000 Great Crested Terns *Sterna bergii* in the Jiushan archipelago in Zhejiang province, eastern China, which is situated about 430 km north of the Matzu archipelago (Chen *et al.* 2005). An action plan for the species was published by the Convention on Migratory Species in 2008 (Chan *et al.* 2008), one of its major points being the need to discover whether other breeding populations or sites exist. In fact, during the breeding seasons of 2003 to 2007 several surveys were undertaken for this purpose within the potential breeding range of Chinese Crested Tern along the Zhejiang coast, as well as monitoring of breeding seabirds at Jiushan Nature Reserve, Wuzhishan Nature Reserve and other important seabird breeding sites in Zhejiang. The results suggested that the Matzu and Jiushan colonies were probably the only two extant breeding populations of the species, and that its global population was at a critical level with fewer than 50 individuals. However, in May 2008 we detected a new breeding colony of Chinese Crested Tern in the Wuzhishan archipelago.

Zhejiang province is situated in the central part of eastern China, with 3,061 islands larger than 500 m^2 in size, accounting for 43.9% of the total number of islands in China. The Wuzhishan archipelago is located in the mouth of Hangzhou bay on the north-west coast of Zhejiang (Fig. 1). It contains seven uninhabited islands, most of which are less than 2 ha in size and lower than 30 m in elevation. The main vegetation on these islands consists of deciduous shrubs including *Mallotus japonica*, *Pueraria lobata*, *Albizia kalkora* and *Rubus parvifolius*. As several seabirds, including Black-tailed Gull *Larus crassirostris* and the Vulnerable Chinese Egret *Egretta eulophotes*, breed in large colonies there, the Wuzhishan Archipelago Bird Provincial Natural Reserve was created by the Zhejiang government in 2001 (Wang *et al.* 2008). The Jiushan archipelago on the central Zhejiang coast is also covered by a provincial natural reserve created in 2003, where the second breeding colony of Chinese Crested Tern was discovered in 2004 and rediscovered in 2007 (Chen *et al.* 2005, 2009). Breeding attempts by the species at Jiushan in these two years failed because of egg collection by local fishermen (compounded in 2004 by typhoons). The Yushan archipelago is located just 65 km south of the Jiushan archipelago. Since Great Crested Terns and other seabirds have been recorded breeding at Yushan it was considered to be the potential breeding site for the Chinese Crested Tern (Chen *et al.* 2009).

To undertake surveys and monitoring, we used boats belonging to nature reserves or hired fishing boats. When a seabird breeding colony was found we took pictures and landed on the island to confirm the species present, population sizes and breeding status. At the end of May 2008, when we monitored breeding seabirds in the Wuzhishan archipelago in Zhoushan, we detected a breeding colony of Great Crested Tern on two adjacent islands. We anchored our boat 80 m away from the breeding islands. After the colony settled down, we checked it with binoculars and took photos. By these means we confirmed that the Chinese Crested Tern was present and evaluated numbers in the colony. From then on we visited the islands about every three days until the end of August when the birds dispersed. In order to determine that the Chinese Crested Terns at Wuzhishan had not simply moved from the colony in the Jiushan archipelago, we also carried out monitoring on breeding seabirds in the latter area over the same period. In the 2009 breeding season, Chinese Crested Tern was again recorded breeding in the Wuzhishan archipelago. From May to August we continued the monitoring and surveys in the Wuzhishan, Jiushan and also Yushan archipelagos.

In 2008, Great Crested Terns were recorded arriving Wuzhishan in late May. In early June, birds began to assemble and laid eggs at two nearby islands (0.5 km apart): Yaqueshan and Wumaoshan. On 25 June, we landed on these islands and confirmed 315 pairs of Great Crested Tern and one pair of Chinese Crested Tern breeding on Yaqueshan, and 166 pairs of Great Crested Tern and one pair of Chinese Crested Tern breeding on Wumaoshan. Each of the two pairs of Chinese Crested Tern and most of the Great Crested Terns successfully reared one fledgling during this breeding season, and left the Wuzhishan archipelago in late August. However, no Chinese Crested Terns or Great Crested Terns were recorded at Jiushan Archipelago during this breeding season.

In 2009, Great Crested Terns were again first recorded in late May in the Wuzhishan archipelago, and again Chinese Crested Terns were identified in the colony. On 15 June, one pair of Chinese Crested Terns was documented breeding alone on Wumaoshan, with another pair and a helper breeding alongside 460 pairs of Greater Crested Terns on Mantoushan island, which is 240 m from Wumaoshan, and which also held some 60 pairs of Chinese Egret, 40 pairs of Little Egret *Egretta garzetta* and 50 pairs of Black-tailed Gull. The only seabirds

breeding on Yaqueshan in 2009 were 30 pairs of Black-tailed Gull. Why the mixed breeding colony shifted islands between years is unknown. The two pairs of Chinese Crested Terns and most Great Crested Terns successfully bred in 2009 and duly left in late August, but there was still no Chinese Crested Terns or Great Crested Terns recorded in the Jiushan or Yushan archipelagos.

Does the finding of breeding Chinese Crested Tern in the Wuzhishan archipelago indicate a new breeding population or simply a new breeding site? We believe it indicates the latter, because (1) we have carried out long-term monitoring on breeding seabirds in the Wuzhishan archipelago since 2002, and only small breeding colonies (no more than 20 adults) of Great Crested Terns were recorded before the appearance of this large mixed breeding colony of Chinese Crested Terns and Great Crested Terns; (2) no breeding Chinese Crested Terns or Great Crested Terns were recorded in the Jiushan or adjacent Yushan archipelagos after the large mixed breeding colony occurred at Wuzhishan; and (3) the first occurrence of large breeding colonies of Great Crested Terns at Wuzhishan was actually in early August 2007 (Wang *et al.* 2008), following the breeding failure and abandonment of the colony at Jiushan in early July (Chen *et al.* 2009).

As a breeding site for Chinese Crested Terns Wuzhishan has some advantages over Jiushan. First, the nature reserve of Wuzhishan was created earlier than at Jiushan, so local people there have greater predisposition to bird conservation than in Jiushan. In recent years, breeding seabirds at Jiushan still suffered occasional egg poaching, which has seldom happened at Wuzhishan in recent years. Second, Wuzhishan is smaller in area and number of islands, and the breeding islands are closer, so it is easier to monitor and patrol. Third, fishery activities around Wuzhishan are less frequent than in Jiushan, resulting in less disturbance and food shortage. Even so, as the breeding site of a Critically Endangered species, Wuzhishan also has some disadvantages. First, as a provincial nature reserve it only has one full time staff member and one boat, insufficient for the conservation of the terns. Second, it is a sight-seeing venue known as 'the bird islands', so every summer tourists visit to watch birds, which causes disturbance.

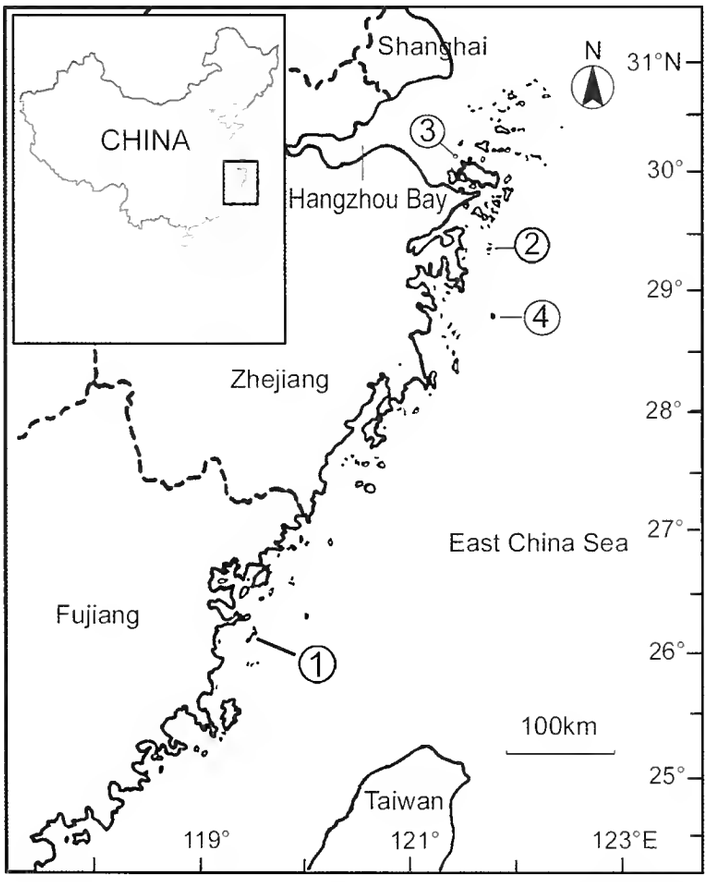

Figure 1. The study area for the Chinese Crested Tern along Zhejiang coast, east China. (1) Matzu archipelago, (2) Jiushan archipelago, (3) Wuzhishan archipelago, (4) Yushan archipelago.

Even though many surveys have been conducted since the Chinese Crested Tern was rediscovered in 2000 (Sun *et al.* 2003, Jiang *et al.* 2005, Zhang *et al.* 2006, Chen *et al.* 2009), these are still the only two breeding populations documented. The Matzu population consisted of fewer than eight adults until 2007, when after several years of rigorous conservation it began to increase and reached 20 adults in 2008 (Nownews 2008, Chen *et al.* 2009). Data from 2009 have not yet been released, but 17 adults were sighted in May at the Minjiang estuary, an important habitat for breeding seabirds in the Matzu archipelago. In contrast, the situation in Zhejiang is not so promising. In 2004 the population of Chinese Crested Tern was 10–20 adults, but as noted above breeding completely failed (Chen *et al.* 2009); in 2007 only eight adults were present and again there was total reproductive failure. After moving to Wuzhishan the population has consisted of only four adults. The maintenance of the Zhejiang population is clearly very important, however. Although we still have no idea about the age of first breeding in Chinese Crested Tern, Crawford *et al.* (2002) showed that it is three years in most Great Crested Terns, and according to our studies Chinese Crested Tern generally lays one egg each season. Successful breeding in 2008 and 2009 is encouraging for the Zhejiang population, but it has reached a critically low level, and recovery will take a long time.

In summary, we now know of two breeding populations of Chinese Crested Tern, three breeding sites and four important areas (the Matzu, Jiushan and Wuzhishan archipelagos and the Minjiang estuary). Of these, only Matzu is properly protected. The importance of the other three areas must be addressed with more resources allocated for better monitoring and management, both of the species and of the general environment, particularly at Wuzhishan and any additional breeding grounds discovered in the future. Egg collection and disturbance at the tern colonies should be strictly prohibited. Meanwhile, conservation awareness and education work targeted at both local government and the fishermen and restaurants are important and urgent. Recently a monitoring and education progamme on the Chinese Crested Tern along the Zhejiang and Fujian coast was initiated by BirdLife Asia Division and Hong Kong Bird Watching Society working with Zhejiang Wildbird Society and Fujian Birdwatching Society.

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Confirmation of Long-billed Wren Babbler *Rimator malacoptilus* in Nepal

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A morning bird walk in east Nepal on 3 June 2009 produced a striking brown bird, subsequently identified as Long-billed Wren Babbler *Rimator malacoptilus*, at c.1,770 m on the north slope of Chitre Danda (= Chitre Ridge) (GPS coordinates: c.200 m east of 27°31.880′N 87°02.824′E) in the Sankhuwa Khola watershed, c.1 km south-west of Sikidim village, Bala Village Development Committee, Sankhuwasabha District. The area is located in Makalu-Barun Buffer Zone (MBBZ), which adjoins Makalu-Barun National Park (MBNP) to the south and east.

The bird was observed on two occasions and heard several times from 08h32 to 08h42. It appeared suddenly in a dim gap in the centre of a trailside thicket c.0.5 m from the periphery, and was initially observed for c.1 minute from a distance of 2.5 m using 10×42 binoculars. The bird then disappeared to a hidden perch in dense tangles, estimated by its singing (*per* Grimmett *et al.* 1998) to be 4–5 m away. After 3–4 minutes the bird returned silently and unobtrusively to its initial perch for longer (3–4 minutes) views.

When first observed more or less laterally in dim light, dorsal plumage characters were clearly evident. The most immediate and striking feature was a long dark grey, slightly decurved bill (approximately the length of the head), giving the bird a top-heavy appearance. The brown upperparts were finely streaked with pale brown from the top of the head into the mantle. The uppertail, rump and wings were uniform brown, with no sign of spotting, streaking or barring. When the bird turned further to the side a stubby undertail was seen to be rufescent-brown, the brightest brown in the plumage. A dark moustachial stripe and indistinct malar stripe (Grimmett *et al.* 1998) went unnoticed before the bird flew away.

On return to its perch the bird was viewed for a second time through binoculars and by field assistant Birendra Rai. A more ventral aspect clearly showed most of its underparts. The throat appeared whitish; the centre of

the belly pale, tinged yellowish (buffy) and streaked heavily with wide long shafts of medium brown, which may also be rendered as thin pale buffy streaks against a brown background. Within 1 minute the bird puffed out its belly feathers, then preened itself for 2–3 minutes. The pale streaking on the belly was distinctly broader when the bird was preening. The vent was not seen well, owing mostly to the dim light and angle of view, but appeared to be darkish. The legs were not seen. The dorsal plumage appeared to be the same as when initially noted but a relatively pale face and indistinct moustachial stripe were evident when the bird turned its head while preening.

Mention of rufous coloration in the plumage is limited by Grimmett *et al.* (1998) to a rufous-brown vent and undertail-coverts, and by Collar (2006) to rusty-rufous thighs and vent. Collar & Robson (2007) state that the upperwing and tail are plain brown with a rufescent tinge, the face more rufescent and the rump slightly chestnut. Ali & Ripley (1987) detail even more rufescence: breast and abdomen pale rufescent-brown, flanks rufescent-brown and undertail-coverts ferruginous. Dim light surrounding the bird on Chitre Danda and observation angles likely obscured visibility of rufescence in the dorsal plumage (if present).

Otherwise, however, the observed set of plumage characters are entirely consistent with those reported by Ali & Ripley (1987), Grimmett *et al.* (1998) and Collar & Robson (2007) for Long-billed Wren Babbler and are exclusive to that species. In addition, its larger size compared with *Pnoepyga* wren babblers, fluffier appearance of underparts, behaviour, vocalisations and habitat further support this identification. Long-billed Wren Babbler was recently split into three species based on morphological affinities (Collar 2006). The population in north-west Tonkin was elevated to White-throated Wren Babbler *R. pasquieri* and the particularly disjunct population in western Sumatra to Sumatran Wren Babbler *R. albostriatus*.

When first sighted, the bird seemed curious about my presence. After a few seconds it gave a rattling, churry alarm call several times. Alarm calls are reported as *prurr prurr prrit* or a quickly repeated *ker-wicket ker wicket* (Grimmett *et al.* 1998). One to two minutes later a whistled, fairly loud *pee-uh* call was heard four times at intervals of a few seconds. Heard (only?) at close range, the trailing *uh* was much softer and shorter. P. Morris in Grimmett *et al.* (1998) reported the song as a series of short clear bell-like whistles: *pee*, repeated every 3–4 seconds. Collar & Robson (2007) render the song as a short (0.4-second) clear whistle *chiiuuh* or *fyeéér*, smoothly falling in pitch but gaining in volume and given every 2–10 seconds. The bird did not respond to my imitations of its *pee-uh* call, and after 3–4 minutes of close-range observations it disappeared silently and unobtrusively through thickets. Ali & Ripley (1987) neatly summarise the general behaviour of the species: 'a great skulker; though fearless and allowing a very close approach, it excels in keeping unseen and it is extremely difficult to follow its movements for more than a brief instant'.

The habitat at the site was a somewhat open ravine of dense tangled thickets (shrubs with cascading lianas and dead branches), *ningalo* (*Arundinaria* sp.), scattered *malingo* (*Arundinaria* sp.), and tall herbaceous ground cover of nettles, fern and *Eupatorium* sp., set in dense subtropical mixed broadleaf forest on steep slopes with a dense understorey. Nearby trees were fairly tall with mossy trunks and limbs, and lianas were profuse on forest-edge trees, but few epiphytes. *Hibiscus* sp. was prevalent in the area as a short tree and shrub. The patch of shrubs and thickets apparently was formed by succession of an old landslip or, less likely, from tree cutting (>5?) years ago (no stumps were discernible). The weather was clear and calm and the temperature was c.24°C in the shade.

Long-billed Wren Babbler is distributed mainly as a scarce resident in the eastern Himalayas of India and Bhutan (Ali & Ripley 1987, Collar & Robson 2007) but has been reported in recent years from China in north-western Yunnan (Collar & Robson 2007), and several localities in northern Myanmar: Pyepat ridge somewhere between 1,675 m and 2,135 m in the N'Mai Hka drainage (Smythies 1949, 2001), Shinshanku in February 2001 (J. Rappole in press), Naung Mung in March 2001 or March 2004 (S. Renner *in litt.* 2010) and Namdudong at c.1,830 m on 31 January 2007 (J. W. Duckworth *in litt.* 2010).

On the subcontinent, the ecological requirements, breeding and behaviour of Long-billed Wren Babbler are poorly known. It is a rare resident at moderate elevations (c.1,500 m) in Sikkim, favouring dense scrub in disturbed forests and abandoned clearings (Ali 1962). In Bhutan and the Indian Himalayas (Miri Hills of Northeast Frontier Agency; Kasi, Cacar and Mizo Hills of Assam; Manipur), the species is scarce, residing in forest undergrowth and dense scrub in steep broken country at 900–2,700 m (Ali & Ripley 1987). The substantial range in altitude allows for the possibility that the species undertakes seasonal movements (Cox & Sherpa 1998).

A specimen of Long-billed Wren Babbler without locality data was obtained by B. Hodgson in the mid-nineteenth century while he was stationed at Darjeeling, India (Inskipp & Inskipp 1991). The skin was included in his second collection of Nepalese birds, but a catalogue he subsequently annotated suggests that skins of several species known from the eastern Himalayas probably came from India (Cocker & Inskipp 1988). This information led Grimmett *et al.* (2000) to exclude Long-billed Wren Babbler from their field guide to the birds of Nepal.

A sighting of a single Long-billed Wren Babbler was verbally reported by my field assistant, Chundak Sherpa, who was close by me while trekking on 20 April 1995 c.3 km north of Punggum village at 3,260 m on Zattara Danda along the western border of MBNP (Cox & Sherpa 1998). Details of the record are repeated here owing to the obscurity of the original publication: a single issue of a defunct regional journal. Sherpa was afforded a brief unobscured and unaided observation of a small brown stubby-tailed bird perched on a mossy boulder c.5 m off a crestline trail on a rugged ridge in dense mixed rhododendron forest, amongst clumps of dense bamboo undergrowth (mostly dead from recent flowering), ferns and boulders. He tried to alert me to its presence, but the bird flew away silently before I could view it (Cox & Sherpa 1998). Sherpa reported that the bird resembled Scaly-breasted Wren Babbler *Pnoepyga pusilla* and Pygmy Wren Babbler *P. albiventer*, with which he was familiar, but differed strikingly by a long decurved bill, approximately the length of the head. Also, unlike those two species, the upper back was prominently streaked with pale brown. The underparts were not discernible from Sherpa's angle of view except for a whitish throat. The bird appeared more rounded and puffed out compared to the two

Phoepyga species, but the short wings and weak short flight near the ground were very similar (Cox & Sherpa 1998).

Taken together, the observed characters were considered diagnostic by the authors and the editor of *Ibisbill*. However, objections raised by subcontinental bird authorities regarding the observer as a non-ornithologist, the record's particularly important status as a new species for Nepal, its unusually high altitude and relatively far western location in Nepal (c.125 km from the border with Sikkim) have resulted in the record remaining unaccepted.

My new record from Chitre Danda c.105 km from the Sikkim border confirms Long-billed Wren Babbler for Nepal, probably as a resident. Chitre Danda harbours an unusually dense and seemingly bird-species rich tract of moist temperate and subtropical forests in Nepal. J. Bland (*in litt.* 2004) assessed the diversity and habitat associations of birds along a gradient of forest disturbance on Chitre Danda from 1992 to 1995 and recorded 230 species within 2 km of Chitre village. The remoteness of the area and wet conditions caused by proximity to high mountains have limited conversion for agriculture and grazing, especially on north slopes. Subtropical forests in particular retain a dense understorey that is generally lacking in this forest type elsewhere in Nepal (pers. obs.). Similarly intact tracts may exist, however, in poorly explored upper reaches of the Arun and Tamur watersheds. These areas may contain suitable habitat for Long-billed Wren Babbler and, as at Chitre Danda, additional Eastern Himalaya species collected by Hodgson and initially listed as coming from Nepal.

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We are sorry to report the death of Jack Cox between the acceptance and publication of this note. Pdfs are available from mail@orientalbirdclub.org.

Radio-frequency chaff in a nest of Pacific Swift *Apus pacificus*

CHANG-YONG CHOI, HYUN-YOUNG NAM and JONG-GIL PARK

Swifts are aerial birds with highly specialised morphology for aerial foraging habits and high speed flight (del Hoyo *et al.* 1999). They require open areas with adequate concentrations of aerial plankton, which consists of a wide variety of insects and arachnids (Chantler & Driessens 1995, del Hoyo *et al.* 1999). During the breeding season, not only their food but also nesting materials are typically collected from airborne detritus (del Hoyo *et al.* 1999).

Among the four species of swift reported from Korea, Pacific Swift *Apus pacificus* is the most common, being an abundant summer visitor to coastal areas and islands of the Peninsula (Lee *et al.* 2000, Choi *et al.* 2009), but little is known about its breeding biology and nest materials owing to the limited accessibility of its nests on cliffs. On 10 July 2008, just after the fledging of two young swifts, we collected the nest of a Pacific Swift (*A. p. pacificus*) in a horizontal crevice of a sheer coastal cliff exposing sedimentary rock layers on Chilbaldo Islet (34°47′N 125°47′E), Jeonnam province, Republic of Korea. The height of the nest and cliff were 50 m and 125 m above sea

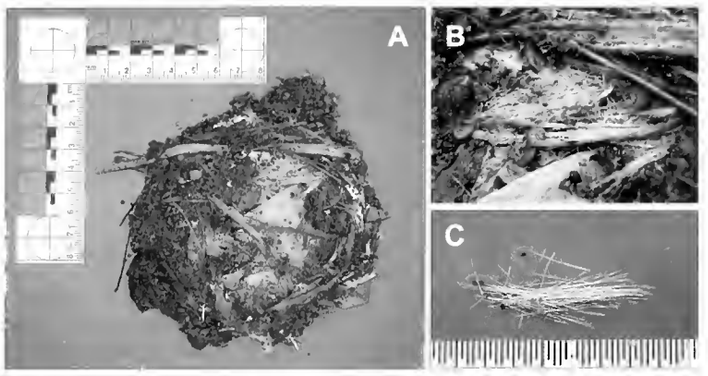

Figure 1. (A) Bottom view of the nest of a Pacific Swift *Apus pacificus* collected on Chilbaldo Islet, Jeonnam Province, Korea (10 July 2008). (B) Chaff fibres among herbaceous plants in the nest. (C) Chaff fibres separated from the nest (unit: mm).

level, respectively. The nest was mainly composed of herbaceous plants (approximately 40% by volume), plastic bags (40%), other birds' feathers and the other materials (10%), and a clump or mat of silver-coloured fibres (10%). On close examination, the fibres were identified as glass fibres derived from radio-frequency (RF) chaff (hereafter chaff).

Chaff is a defensive countermeasure designed to reflect radar waves and to obscure target equipment from radar tracking sources (Arfsten *et al.* 2002, 2004). Chaff consists of almost microscopically thin aluminum-coated glass fibres that can be released into the atmosphere in great densities (Lee 2000, Wilson *et al.* 2002, Arfsten *et al.* 2004). Although the chaff is sometimes used for scientific experiments (Lee 2000), it is released mainly for military purposes by ships, ground vehicles and aircraft (Hullar *et al.* 1999, Arfsten *et al.* 2002, 2004, Wilson *et al.* 2002). Owing to the extremely light mass of a chaff fibre (0.56×10^{-5} g/fibre; Lee 2000), the fibres can remain suspended in air anywhere from 10 minutes to 10 hours according to the atmospheric conditions, and they can travel considerable distances from the release point (Arfsten *et al.* 2002). With a clear sky and slightly unstable atmospheric conditions, one chaff release experiment (460 g of chaff with 82,000,000 fibres) revealed that wind and thermodynamic effects spread fibres horizontally over 40 km in the course of 2 hours (Lee 2000). Some chaff plumes containing c.900 g of fibres have been reported to drift over 270 km from the point of release (Arfsten *et al.* 2002).

Hullar et al. (1999) estimated that the U.S. Air Force dispenses about 500 tons of chaff per year both in the USA and elsewhere. In spite of its massive use for military training and increased concerns on the accumulation of aluminium, chaff releases are not suggested to have significant effects on ecosystem functioning in either terrestrial or aquatic environments to date (Hullar *et al.* 1999, Arfsten *et al.* 2002, Wilson *et al.* 2002) owing to its low deposition rate (1.0 g/ha/yr in US military operating areas: Hullar *et al.* 1999). There is no available estimate of the annual gross release of radio-frequency chaff through military activities and scientific experiments in the Republic of Korea, but it is clear that the chaff fibres drift around breeding colonies of swifts in Korea.

It is unsure whether the chaff is beneficial for breeding swifts as a new source of nest material, because the risk of exposure for swifts through ingestion or persistent contact has never been examined. In this report, we confirmed that the drifting chaff fibres were used as nesting materials by the breeding Pacific Swift in Korea. Although there were some records of chaff in the nests of swifts in Europe during World War II (Perrins 2009), to our knowledge this is the first report of the occurrence of chaff in a nest of the Pacific Swift.

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A population of Lemon-bellied White-eye *Zosterops chloris* from the south-eastern peninsula of Sulawesi

D. J. KELLY, N. M. MARPLES and H. A. SINGER

The recent publication of a review of the taxonomy and distribution of the family Zosteropidae (van Balen 2008) has allowed us to reassess the importance of data collected during an expedition to the south-eastern region of Sulawesi (Sulawesi Tenggara) in 2007. Current literature suggests (Dickinson 2003) or states (van Balen 2008) that the Lemon-bellied White-eye *Zosterops chloris*, although present in various other parts of Sulawesi (race *mentoris* in the north-central part of the island, *intermedius* in the south and east), is absent from the south-eastern peninsula. The race *intermedius* is also known from Muna, Buton (or Butung) and Kabaena, and *Z. c. flavissimus*, separated from Buton by a sea barrier of 46 km, is known from the Wakatobi (or Tukangbesi) islands (van Balen 2008).

Our expedition was focused on collecting data for an island biogeographic study. Having gathered information on the Wakatobi birds (*Z. chloris flavissimus*) and Buton birds (presumably *Z. c. intermedius*), we sought to compare these populations with those of mainland Sulawesi. For 12 days in August 2007 we were based in the coastal village of Rumbarumba (4°25′S 122°48′E) on the tip of the south-eastern peninsula adjacent to Buton. We used fine-mesh North Ronaldsay mist-nets to trap the birds, concentrating our efforts in the mornings and evenings but moving our nets from one site to another each day, as local birds quickly learned to avoid them. Some of the sites were near to the coast and others were further inland. All sites were within a 10 km² area centred on Rumbarumba. We recorded wing length (maximum chord), tarsus length ('minimum tarsus': Redfern & Clark 2001), bill to skull, total head length (HB; also known as 'head plus bill length': Redfern & Clark 2001), tail length, bill depth and weight of all birds (Svensson 1992). To avoid the risk of mismatch due to measurement style, we only compared specimens measured by a single recorder (NMM).

During the 12 days we stayed at Rumbarumba we caught eight *Z. chloris* and 40 Pale-bellied White-eye *Z. consobrinorum*, the latter of which van Balen (2008) indicates as the only representative of the white-eyes to be recorded from this peninsula in recent years. As we were catching so few *Z. chloris*, we used a local recording of *Z. chloris* song to attract birds to the nets for the last three days. Even so, this only improved our catch at coastal sites; we caught no *Z. chloris* at the inland sites around Rumbarumba, leading us to suspect that the species may be a coastal specialist on the south-eastern peninsula.

We found that the biometrics of the eight Rumbarumba birds, all measured by NMM, were very similar to those of the five birds measured by NMM from the sample of 20 that were trapped on Buton in 1999–2007. These data are presented in Table 1, along with the results from comparative tests to indicate differences between the populations. Mann-Whitney U tests were used for between-population comparisons, as datasets were non-parametric owing to the relatively small samples.

Table 1. A comparison of biometrics (± standard deviation) from *Z. chloris* trapped at Rumbarumba, Sulawesi (n = 8), and adjacent Buton island (n = 5). HB stands for head plus bill length; NS indicates a non-significant result.

	Rumbarumba	Buton	Mann-Whitney U test
wing (mm)	58.9 ± 0.7	58.1 ± 1.6	NS
tarsus (mm)	17.3 ± 0.7	17.1 ± 0.1	NS
HB (mm)	29.4 ± 0.4	29.8 ± 0.6	NS
bill (mm)	14.8 ± 0.3	14.9 ± 0.9	NS
depth (mm)	2.9 ± 0.1	3.0 ± 0.0	NS
tail (mm)	40.9 ± 1.5	41.8 ± 1.1	NS
weight (g)	11.0 ± 0.4	11.2 ± 0.2	NS

The physical appearances of the birds at Rumbarumba and on Buton were also similar (photographs have been submitted with this note), so we assume that these two populations belong to the same subspecies (currently *Z. chloris intermedius*). However, as we have no data on *Z. chloris intermedius* from the southern or eastern peninsulas, we cannot comment on their similarity to the birds we found on the south-eastern arm. Moreover, as we have not ascertained the range of the *intermedius* population on the south-eastern arm, we do not know if it is reproductively separated from the southern arm (distance by sea is c. 160 km) or the eastern arm (distance to divergence of eastern arm from central Sulawesi: >250 km). On the other hand, we note that, since *Z. chloris intermedius* lives in sympatry with *Z. anomalus* on the southern arm, with *Z. consobrinorum* on the south-eastern arm and with *Z. montanus* and *Z. atrifrons* in the east of Sulawesi (van Balen 2008), it is possible that these three subpopulations may currently be exposed to different competitive pressures; competition between congeneric species may result in character displacement (Brown & Wilson 1956). It would be interesting to compare plumages and biometrics from these subpopulations of *intermedius* in order to determine whether indeed character displacement is evident.

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First record of Demoiselle Crane *Grus virgo* for the Philippines

CARL H. OLIVEROS and CYNTHIA ADELINE A. LAYUSA

On a trip to Calayan Island in northern Philippines in May 2009, we received information that a grey heron-like bird was being held captive by a local resident. On 22 September 2009 on a subsequent trip to the island we visited the residence of Conrado Duerme in Tugod, Barangay Centro II (19°16.0′N 121°28.1′E) and found a crane foraging around his backyard. The bird was less than 1 m tall, had an overall grey body, black head and neck, white crown, white stripe behind eyes with plumes extending beyond the head, and red-orange iris, which are unmistakable characteristics of Demoiselle Crane *Grus virgo*. Photographs and video of the crane were taken on that day and on 30 September 2009 (one photograph being submitted with this note).

The crane was first seen in July 2008 foraging in Mr Duerme's rice field with two other cranes. Mr. Duerme captured the crane with the use of a snare attached to a long stick. The two other cranes flew away and were not sighted again. Mr Duerme initially clipped the wing feathers of the captured bird but allowed them to grow back after some time. Since then, the bird has been observed to fly around Mr Duerme's rice field but it has always returned to his backyard, where it remains at the time of writing (C. Duerme verbally September 2009).

Demoiselle Crane breeds across Europe and Asia. The East Asian population winters in India but rare visitors have been recorded in Japan (Meine & Archibald 1996). The date the bird was captured on Calayan Island is unusual and may indicate that the cranes were very early migrants or overwintering birds or that the captor may have recalled the date of capture incorrectly. No rings or any identifying marks were found on the bird and we are unaware of reports of Demoiselle Cranes escaping from captive populations in nearby areas. Thus, the Demoiselle Crane found on Calayan Island is likely to be wild in origin, and we assume that the two birds found with it were of the same species. This record from the Philippines is the southernmost observation of the species in East Asia. Sarus Crane *Grus antigone* is the only crane species previously known to occur in the Philippines but it may have been extirpated in the country (Kennedy *et al.* 2000).

The occurrence of vagrant birds in the small typhoon-prone islands north of Luzon is quite usual. Recent vagrants in the area include Cinereous Vulture *Aegypius monachus* on Batan Island, Pied Cuckoo *Clamator jacobinus* on Dalupiri Island, Orange-flanked Bush Robin *Tarsiger cyanurus* and the mainland Asian subspecies of Variable Dwarf Kingfisher *Ceyx erithacus erithacus* on Calayan Island (van der Ploeg & Minter 2004, Allen *et al.* 2006, Oliveros *et al.* 2008).

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First nesting record of Red-rumped Swallow *Hirundo daurica* in South-East Asia

JOHN D. PILGRIM and ANDREW W. TORDOFF

Red-rumped Swallow *Hirundo daurica* is a widespread and fairly common species, breeding across southern Europe, north and central Africa, the Middle East, the Indian Subcontinent, southern Siberia, southern and eastern Tibet, much of China, the Korean peninsula, and Japan, wintering largely within this range (Turner & Rose 1989). Although known to nest as close to Vietnam as south-west Yunnan (Meyer de Schauensee 1984), it has apparently not been previously recorded nesting in South-East Asia (Robson 2008).

While passing through Dau Cau village, Duc Hong commune, Trung Khanh district, about 8 km south of Trung Khanh town, Cao Bang province, East Tonkin, Vietnam, on 23 April 2009, we noted an unusual nest on a building. The nest was a domed shape with a long tubular entrance, and was fixed to the underside of a ledge built to keep the rain out of a window below. Recognising this mud nest as belonging to a hirundine but not being familiar with similar nests from northern Vietnam, we stopped to identify the species that had built it. We soon observed Red-rumped Swallows finishing construction of the nest with mud from a streambank very nearby. A photograph of the nest was taken and submitted as evidence along with this note.

The birds were identified as Red-rumped Swallow of the subspecies *japonica* owing to their small size, narrow streaking on the underparts, and near-complete rufous nuchal collars. The closely related Striated Swallow *H. striolata*, sometimes even considered conspecific, probably breeds in West Tonkin, Vietnam, and occurs across northernmost Vietnam in winter (Robson 2008), but was not seen during this trip. The relevant subspecies, *H. s. mayri*, is more similar to Red-rumped Swallow than the boldly streaked *H. s. stanfordi* resident in central and southern Vietnam, but still differs in the same features.

Although Red-rumped Swallows were quite frequently seen in the area, no further similar nests were seen that day or next day in Trung Khanh district. Another nest was, however, noted on 26 April 2009 in Quoc Toan commune, Tra Linh district, Cao Bang province, close to the junction between provincial road 205 and National Highway 3.

This second nest was similarly constructed under a wide ledge above a window. This architectural feature is not typical of traditional building styles in rural Cao Bang province but may be becoming commoner as an increasing number of houses are built out of concrete, reflecting changes in wealth and taste. We speculate that this continuing trend may facilitate a southwards spread of nesting Red-rumped Swallow into northern Vietnam.

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Cronism by the Shikra *Accipiter badius*

SWATI KITTUR and K. S. GOPI SUNDAR

Cannibalism (eating a member of the same species), cainism (eating a sibling) and cronism (eating an offspring) are recorded in raptor populations worldwide (Polis 1981, Dios 2003). However, very few observations of such intraspecific predation by Indian raptors exist, rare exceptions being in Ishtiaq & Rahmani (2000) and Rana & Prakash (2003). Here we report and discuss an instance of cronism by a common accipiter species, the Shikra *Accipiter badius*.

We observed a territorial Shikra pair at Mandakini Enclave, New Delhi, from December 2008. Adults were

seen incubating eggs first on 11 April 2009 in a nest in a eucalyptus tree, and subsequently four newly hatched chicks were seen on 7 May 2009. On 18 May 2009, the female adult (told by her yellow eyes) brought a five-striped palm squirrel *Funambulus palmarum* to the nest and fed pieces of the squirrel to all four chicks. The following evening there was a dust storm that damaged the nest. The next day, only one chick could be seen in the nest and a male Shikra (told by his red eyes) was seen feeding on one of the chicks near the nest. The female called loudly as the chick was being eaten, and the male flew to the nest tree after eating the chick. This suggested that the male in question was the chick's parent. It was not clear if the chick had been killed by the male or had died during the storm and was subsequently eaten, but we think the latter more probable. The other two missing chicks were not found; since they had not yet fledged, they had clearly been killed during or after the storm. The surviving chick fledged from the nest on 29 May 2009, and continued to use the damaged nest infrequently until 2 June 2009.

Cannibalism by raptors in any form is thought to be rare and incidental to brood reduction (Mock 1984). It may however be deliberate in response to reduced food resources (Roulin *et al.* 1999). During our observations, the area near the Shikra nest had good populations of squirrels and birds, and resources did not appear limiting. Instead, inclement weather appears to have killed the chick. This therefore appears to have been a case of weather-induced chick mortality leading to cronism. While weather-induced mortality of chicks has been documented in other raptor populations (Dawson & Bortolotti 2000), cronism (or scavenging) following such deaths appears to be rare (Moss 1979). Cronism by raptors appears to be far commoner following fratricide (siblings killing each other: Ingram 1959). Published observations of Shikra at the nest are restricted to two nests (Naoroji 2006), and more work is needed on the species to assess if cronism is commoner than suggested by the literature.

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The song of the Dulit Frogmouth *Batrachostomus harterti*

DENNIS YONG and BEN KING

Smythies (1960) stated that 'frogmouths seem to be incapable of making any sound'. At that time, however, few ornithologists, let alone birders, had ever seen an Asian frogmouth and practically nothing was known about them. Joe T. Marshall, Jr., did extensive nocturnal fieldwork in South-East Asia in the 1960s and 1970s, making the first tape-recordings of the Asian frogmouths, which he published in his paper and 33⅓ LP record (Marshall 1978). Subsequently, all the other Asian frogmouths have been tape-recorded except for Dulit Frogmouth *Batrachostomus harterti*, and they have proved to be among the most vocal of nocturnal birds.

In early September 2004, we spent a week in the Kelabit Uplands of north-eastern Sarawak, Borneo, in an attempt to find and tape-record the Dulit Frogmouth. At c.1,060 m, about 04h00 on 4 September 2004, we heard a loud, trumpeting *whooooooaaah* which we both knew instantly was the frogmouth. Fortunately, the bird called again and we got a good recording (see Fig. 1)

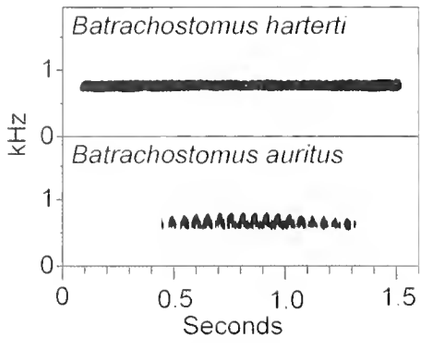

Figure 1. Sonograms of songs of Dulit Frogmouth *Batrachostomus harterti* and Large Frogmouth *B. auritus*. The song of Dulit (recorded by BK at an undisclosed site in the Kelabit Uplands, Sarawak, 4 September 2004) is a loud trumpeting monotone, *whooooooaaah*, quite distinct from the rapid, sonorous, hollow tremolo, *whowhowhowhowhowhowhoooo*, of Large, which is reminiscent of some *Strix* spp. owls (example here recorded by BK at 60 m c.1 km from headquarters of Gunung Mulu National Park, Sarawak, on 31 March 1978).

as well as good views at about 15 m with 10× binoculars. The following morning we obtained more recordings.

Altogether we tape-recorded eight song-bouts consisting of 1–8 notes each, as well as several other calls uttered in response to song playback. The spacing between songs in a bout was 0.98–2.7 seconds, with most spaces in the lower end of this range, and the few longer spaces at the end of a bout. We heard two birds close at hand, which we presume were a pair, one of which we saw. A third bird was heard in the distance.

The frogmouth was identified by a combination of size, voice, altitude and locality. First, the large size eliminated all the known Asian frogmouths except Dulit and Large *B. auritus*. Second, the two of us have heard a total of around 25 individuals of Large Frogmouth in Borneo, Sumatra and Peninsular Malaysia, and have never heard a vocalisation like this one; further, the birds uttered the vocalisation without apparent provocation, suggesting that it was the song and thus comparable to the known song of Large Frogmouth. Third, the known altitudinal range of Dulit Frogmouth is 300–1,200 m (Smythies & Davison 1999), while Large Frogmouth has been found only in lowland forests in Borneo ('lowlands ... below the steepland boundary': Smythies & Davison 1999), and it is also known only from lowland forests in Sumatra (van Marle & Voous 1988, MacKinnon & Phillipps 1993) and the Malay Peninsula (Wells 1999). Fourth, the Dulit Frogmouth has been collected in the Kelabit Uplands while the Large Frogmouth has not. All this does not prove beyond every doubt that the bird we tape-recorded and observed was a Dulit Frogmouth, but the evidence is highly indicative. A voucher specimen of a tape-recorded individual is, however, desirable.

Smythies (1960) pictured both Dulit and Large Frogmouths and some differences in the two birds can be seen in the paintings. However, BK looked at specimens of the latter and found that extensive plumage variation covered all the differences (and more) seen in the Smythies plates. AMNH has no specimens of Dulit Frogmouth. It may be that vocalisations and perhaps altitude will turn out to be the only way to distinguish these two species in the field.

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Notes on the roost sites of the Sulawesi Masked Owl *Tyto rosenbergii*

JAMES A. FITZSIMONS

The ecology of most of Sulawesi's owl species is poorly known (Bishop 1989, Holmes & Phillipps 1996, Bruce 1999, Marks *et al.* 1999, Debus 2002, 2009, König & Weick 2008). The recent discovery of new species (Rasmussen 1999, Indrawan & Somadikarta 2004), limited distributional details on rare or cryptic species (e.g. Mauro & Drijvers 2000) and only recent publication of basic ecological information on widespread and common species highlight this point. This note provides some details on the roosting (and potential breeding)

ecology of the Sulawesi Masked Owl *Tyto rosenbergii*. The Sulawesi Masked Owl is endemic to Sulawesi where it is widespread but uncommon (Coates & Bishop 1997). It occurs in a range of habitats from lightly wooded cultivation, tall dead trees in open country, grassland, rainforest, forest edge and coconut plantations, and occasionally around villages and urban areas (Coates & Bishop 1997, König & Weick 2008).

Roosting and breeding sites for a few *Tyto* species worldwide are well known, such as the Barn Owl complex (formerly *Tyto alba*) (Bruce 1999). However, Bruce (1999: 51) suggested that nothing is known of this aspect of the ecology of species within the masked owls (other than the Australian Masked Owl *Tyto novaehollandiae*), although he also notes that 'it seems likely that all members of this closely related group will have similar habits [to the Australian Masked Owl]'. Holmes & Phillipps (1996: 35) suggest the Sulawesi Masked Owl 'probably roosts by day in large trees...'. Both Bruce (1999) and König & Weick (2008) state that no breeding details for this species are described. Thus König & Weick (2008) suggested that the Sulawesi Masked Owl needs intensive study as nearly all aspects of its life are unknown. Here I provide some details of roost and breeding sites based on personal observations of the Sulawesi Masked Owls, discussions with park rangers and guides and reviewing published literature and unpublished birdwatching trip reports.

On 14 July 2009, as part of a guided birdwatching tour of Tangkoko-Duasudara Nature Reserve and surrounds, in north-east Sulawesi, I was taken by boat to view a known roost site of a Sulawesi Masked Owl. The site was a sea cave located north-east of the village of Batu Putih (1°35′11″N 125°09′28″E) on the tip of a short peninsula facing east. A single bird was present, awake and at times preening and viewed for 10 minutes. The cave itself was c.10 m above sea level with an opening c.3×5 m. The owl was partially sheltering behind a boulder but not far (<1 m) from the cave entrance. Many pellets, bones and excreta were evident both on the cave floor and spilling onto ledges below, indicating significant use of this roost site. Indeed the species is known to have occupied this cave from at least April 2006 and has been documented as present in all years since (see Table 1). In seven of these observations a pair of owls was observed using the cave, potentially indicating breeding. However, three trip reports have indicated the bird(s) were not always present or at least not on view when the site was visited. Elsewhere, Bruce (1999) also described food items from regurgitated pellets, presumed to be from Sulawesi Masked Owl, collected from a cave in Sulawesi (location not described).

On 18 July 2009 at the park headquarters of Bogani Nani Wartabone National Park at Toraut (0°34′N 123°54′E), I was shown the site of a recent Sulawesi Masked Owl roost by guide Idjong Datunsolang. It was a large tree located on the edge of the rainforest behind the park headquarters. Although the bird could not be located during the day it was heard at night.

Previously published papers and unpublished trip reports outline use of a variety of different tree structures for roosting and potentially breeding. Most documented observations are from Toraut. Rozendaal & Dekker (1989) found a pair to frequent tall dead trees in open country in the Toraut base camp area in March 1985. Luijendijk (1997) found '3 at a nest' opposite the park headquarters in September 1997, but provided no further details. Ahlman (1999) provided a map indicating the location of a tall tree where Sulawesi Masked Owls were nesting (to the front of the headquarters on the river side). Maher & Gregory (2000) and Hoff (2000) found a Sulawesi Masked Owl perched in a tree near the Toraut lodge.

Interestingly, Fletcher (1998) described an instance of breeding by what he considered to be Minahassa Masked Owl *T. inexpectata* in Bogani Nani Wartabone National Park at Toraut. He observed two adults and a juvenile c.25 m up a strangler fig, roosting and presumably nesting within. Mauro & Drijvers (2000) queried Fletcher's (1998) identification and suggested his observations were of a Sulawesi Masked Owl; in the only other documented breeding of Minahassa Masked Owl, Coates & Bishop (1997) cited van Marle (1940) apparently finding a pair nesting in a hole of a *Elmerilla ovalis* tree. Andrew & Bishop (1990) reported a Minahassa Masked Owl being flushed from a roost in 'disturbed riverine forest with patches of bamboo', also at Bogani Nani Wartabone National Park. Mauro & Drijvers (2000) also suggested this record be considered tentative as it could refer to Sulawesi Masked Owl. Away from Bogani Nani Wartabone National Park, Ericsson & de Win (2009) noted a daytime roost for Sulawesi Masked Owl was discovered in a tree hole at Tangkoko, while Coomans de Ruiter & Maurenbrecher (1948) found the species to be roosting in a coconut tree in south Sulawesi over a number of days.

Table 1. Number of Sulawesi Masked Owls present at a sea cave off Tangkoko-Duasudara Nature Reserve, north Sulawesi.

Year	Date (where specified)	No. of individuals	Source
2006	14 April	2	Gregory & Ford (2006)
2006	26 July	2	Westdean (2006)
2006	2 September	2	Lagerqvist (2006)
2006	September	2	Watson (2006)
2006	September	1	Farrow (2006a)
2006	September–October	1	Farrow (2006b)
2007	July–August	2	Hutchinson (2007)
2007	September	2	Morris & Demeulemeester (2007)
2007	September–October	1	Farrow (2007)
2008	22 August	1	Collaerts (2008)
2008	29 August	1	Pettersson (2008)
2008	September	2	Hutchinson (2008a)
2008	September	0	Hutchinson (2008b)
2008	September–October	0	Farrow (2008)
2008	1–3 November	1	Milton (2008)*
2009	14 July	1	Fitzsimons – observation described above
2009	September–October	1	Farrow & Robson (2009)
2009	11 October	0	Ericsson (2009)

*On a tree on the cliff next to the cave

On the Australian mainland, the relatively well studied Australian Masked Owl *Tyto novaehollandiae novaehollandiae* roosts in both hollow trees and caves, and less commonly in dense foliage (e.g. Debus 1993, Peake *et al.* 1993, Debus & Rose 1994, Higgins 1999), although Kavanagh (2002) found it in south-eastern Australia to roost only inside hollow trees and among dense foliage of tall subcanopy trees. Bell & Mooney (2002) found Tasmanian Masked Owls *T. n. castanops* to roost on external surfaces of trees and shrubs, with a preference for dense foliage (44% of the time), holes in cliffs (37%), buildings and man-made structures (17%) and tree hollows (3%).

The various tree hollow, cave and thick foliage roost sites used by the Sulawesi Masked Owl supports Bruce's (1999) supposition that Wallacean masked owls have similar roosting (and potentially breeding) habits to those of the Australian Masked Owl. If the latter actually nests in caves it would seem to do so only rarely (see Debus 1993, Higgins 1999). However, Higgins (1999) reports that Australian Masked Owl pairs roost together only rarely and when they do this is likely to be during courtship and nesting. Australian Masked Owls can also exhibit high nest-site fidelity (Kavanagh 1996, 2002, Kavanagh & Murray 1996, Hollands 2008), a trait potentially evident in the Sulawesi Masked Owl, as indicated by the cliff-roosting Tangkoko pair between at least 2006 and 2008. Further observations by ornithologists and birdwatchers to the Tangkoko cave site on any signs of breeding activity would be important.

The Tangkoko cave roost site contains the remains of many pellets. Although access to the site may be difficult via boat due to the nature of the cliff face, collection and analysis of this pellet material (without disturbing the roosting bird/s) could provide a better insight into the diet and broader ecology of this poorly known species.

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Removal of Pink-rumped Rosefinch *Carpodacus eos* from the Thai avifaunal list

PHILIP D. ROUND, PAUL J. LEADER and SURACHIT WAENGSOTHORN

The Pink-rumped Rosefinch *Carpodacus eos* is distributed in eastern Qinghai and western Sichuan, China, where it breeds at altitudes of c.4,000–5,000 m. It is also recorded from northern Yunnan and eastern Xizang, although there is incomplete concordance among different authors in delimiting both total range and the limits of the breeding and wintering areas (Cheng 1987, Clement *et al.* 1993, MacKinnon & Phillipps 2000, Dickinson 2003).

The species was added to the list of Thai birds by McClure (1969) on the basis of a female specimen collected at Ban Mae Kah (*sic*), Mae Taeng, Chiang Mai (CTNRC 53-1963) on 25 October 1968. The collecting location is read off the Royal Thai Survey Department 1:50,000 map sheet (Sheet no. 4747 II, Series L7017), as Ban Mae Ka, 19°08′N 98°56′E, elevation c.350 m. It lies approximately 2 km north-west of Mae Taeng district town.

The specimen is stored in the Centre for Thai National Reference Collections (CTNRC), Environment and Resources Department, Thailand Institute of Scientific and Technological Research, Bangkok. It bears the label *Carpodacus eos gery*. (The name '*gery*' has no basis in the published literature and may possibly result from a transcription error from the field label—a misread transcription of '*C. ery*', as an abbreviation of *C. erythrinus*, perhaps?) The measurements recorded on the label are wing 75.4; tail 58.0; culmen 5.7 and gape 6.2, although during our examination the wing measured 77 mm (maximum chord) and the tail 51.5 mm (Table 1).

This apparent Pink-rumped Rosefinch record was subsequently listed in Lekagul & Cronin (1974), King *et al.* (1975), Lekagul & Round (1991) and Robson (2000, 2002). The identification of the specimen was always

potentially questionable, however, as McClure's report never stated how it was arrived at, nor how females of the closely similar Beautiful Rosefinch *C. pulcherrimus* could be excluded.

At the request of PDR, PJL carried digital images of CTNRC 53-1963 for comparison with specimens of other rosefinches in The Natural History Museum, Tring (hereafter BMNH) in order to verify its identification.

Plumage

The specimen immediately stood out from a series of 18 brown-plumaged Common Rosefinches in the CTNRC collection in being markedly smaller, whiter and more heavily streaked on the underparts. It had blacker, more precise streaks on throat and breast (compared with browner, blurred streaks in all brown-plumaged *C. erythrinus* in the CTNRC collection). It showed two prominent whitish wing-bars formed by broad tips to the median coverts and greater coverts, and the median coverts showed prominent pointed black feather centres. The rump and upper tail-coverts were unstreaked.

Female specimens of both Pink-rumped and Beautiful Rosefinches examined in BMNH both showed bold black centres to the feathers of the crown and upperparts, giving them a prominently streaked appearance. In contrast, the streaking on the upperparts of CTNRC 53-1963 was much less contrasting, browner, more blurred and less bold, and closely similar to that of most Common Rosefinches. The pointed dark centres and sharply demarcated white tips to the median coverts of CTNRC 53-1963, although different from any CTNRC specimens of Common Rosefinches, also resembled some Common Rosefinches in BMNH. It differed from both Pink-rumped and Beautiful Rosefinch specimens, the median coverts of which both showed dark grey centres and a thin off-white fringe to the outer web.

Both Pink-rumped and Beautiful Rosefinches are heavily black-streaked on the entire underparts including the undertail-coverts. While CTNRC 53-1963 shows clear black streaks on a whitish ground-colour on the throat and breast, the lower belly and undertail-coverts are unmarked whitish. CTNRC 53-1963 was more strongly streaked on the throat and breast than any Common Rosefinch examined, although some approached CTNRC 53-1963 in distinctness of the breast-streaking. In particular, CTNRC 53-1963 resembles the juvenile *C. erythrinus roseatus* illustrated in Rasmussen & Anderton (2005).

Measurements and structure

An examination (PDR) and photographs (PJL) of the specimen readily indicated that it was neither Pink-rumped nor Beautiful Rosefinch based on its larger and more convex bill (the bill is smaller, with an almost straight culmen in both Pink-rumped and Beautiful Rosefinch); long primary projection; and proportionately longer wings and shorter tail (Table 1). These differences were confirmed when the photographs were compared directly with specimens of all three species at BMNH.

Table 1. Wing and tail measurements of rosefinches *Carpodacus* spp. (wing measured to nearest 0.5 mm with a wing-rule, tail to nearest 0.1 mm with dial callipers).

Taxon	n	Wing length	Tail length	Wing:tail ratio
C. erythrinus ssp.	29	78–91 (x̄= 83.0±2.70)	50.2–59.0 (x̄= 54.8±2.48)	1.36–1.67
C. p. pulcherrimus	8	73–83 (x̄= 77.8±3.15)	57–66 (x̄= 61.8±3.06)	1.17–1.33
C. eos	4	70.0–74.0	58.0–62.0	1.12–1.21
CTNRC 53-1963		77.0	51.5	1.5

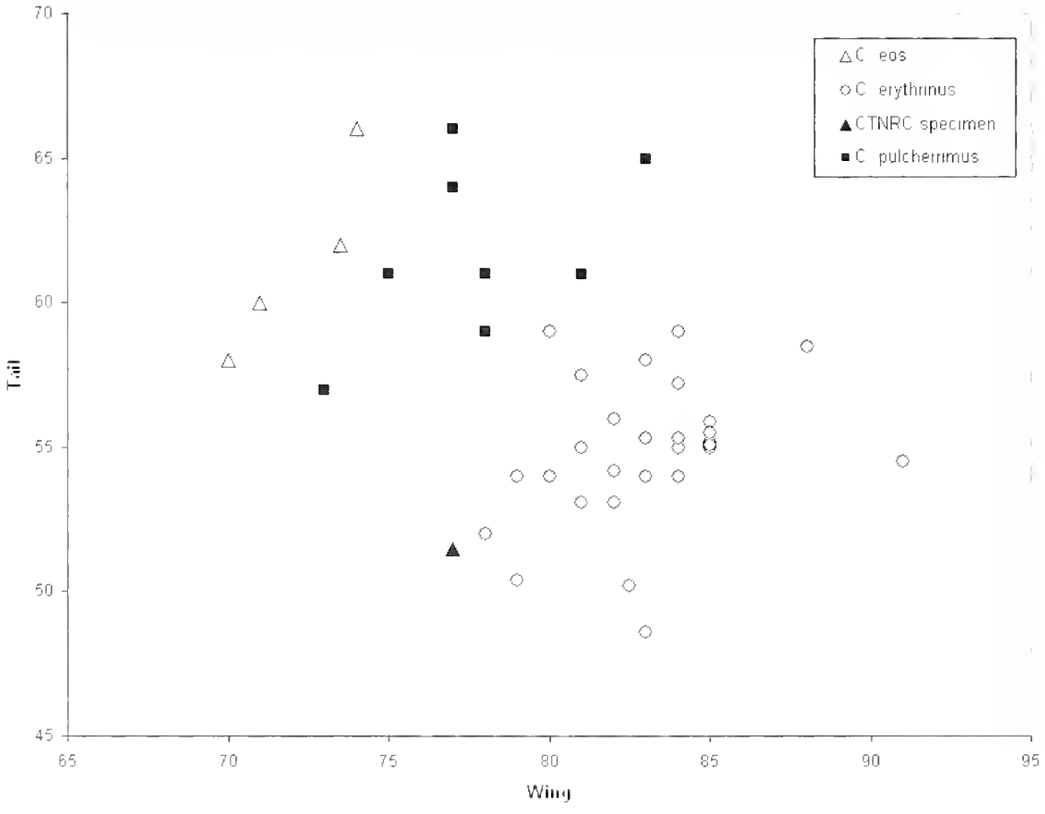

Figure 1. Scattergram of wing and tail measurements for *Carpodacus eos*, *C. p. pulcherrimus* and *C. erythrinus*, based on data in Table 1.

A scattergram of wing length against tail length (Fig. 1) indicates clearly that CTNRC 53-1963 clusters with Common Rosefinch, rather than with either Pink-rumped or Beautiful Rosefinch. The wing:tail ratio was 1.5. This compares with a ratio of 1.36–1.67 for other Common Rosefinch examined (n = 29); 1.18–1.21 for the short-winged, relatively long-tailed Pink-rumped Rosefinch (n = 4) and 1.17–1.33 (n = 8) for nominate Pink-rumped Rosefinch which is somewhat intermediate.

Conclusion

The addition of Pink-rumped Rosefinch to the Thai faunal list on the basis of specimen CTNRC 53-1963 cannot be sustained. The specimen instead appears to be a small, well-marked example of Common Rosefinch. Its size and stronger markings, distinguishing it from other Common Rosefinch in CTNRC, are doubtless the reason why the record remain unquestioned for so long; nevertheless, CTNRC 53-1963 remains a closer fit to Common Rosefinch than any other rosefinch of the region.

Speculation as to the subspecific identity of this specimen is outside the scope of this note and, in view of the great variability of Common Rosefinches, may not be possible to resolve. Both *C. e. erythrinus* and *C. e. roseatus* are listed for Thailand by Deignan (1963), and the range of variation in *C. e. roseatus*, in particular, should be examined. Additionally, females of the north-east Siberian race *C. e. grebnitskii* are said to be 'darker, greyer and browner, and more heavily streaked' (Vaurie 1959) and might be a better fit. Indeed, P. R. Sweet (*in litt.*) thought the photographs of the specimen were a good match for *C. e. grebnitskii*.

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A correction to Penhallurick & Robson (2009)

JOHN PENHALLURICK

Penhallurick & Robson (2009) published a revision of the parrotbills (Aves, Timaliidae) in which they assigned the former *Paradoxornis paradoxus* Three-toed Parrotbill and *Paradoxornis unicolor* Brown Parrotbill to the genus *Hemirhynchus* Hodgson, 1843, in the belief that the latter was a new name for *Heteromorpha* Hodgson,1843, not (i.e. preoccupied by) *Heteromorpha* Heubner, 1822 [Lepidoptera]; and thus that the type of *Hemirhynchus* was *Heteromorpha unicolor* Hodgson, 1843. This was erroneous, and the responsibility for the error lies entirely with me.

In fact in Blyth (1843: 1007) we read: '*Note to* p.933. Mr. Hodgson now suggests the name *Hemirhynchus* in lieu of *Temnoris*'. Since *Temnoris* Hodgson, 1841 is itself

a new name for *Suthora* Hodgson, 1837, the type of both *Temnoris* and *Hemirhynchus* is *Suthora nipalensis* Hodgson, 1837. Also, since Blyth did not report Hodgson's comment verbatim within quotation marks, the authorship of the name should be attributed to Blyth. Thus the citation for *Hemirhynchus* should be: *Hemirhynchus* Blyth (ex Hodgson), 1843, *Journal of the Asiatic Society of Bengal*, 12, Pt.2, p.1007. New name for *Temnoris* Hodgson, 1841; hence the type is *Suthora nipalensis* Hodgson, 1837.

Hemirhynchus should be included in the synonymy of *Suthora* Hodgson, 1837, and cannot be used as proposed. That means that the correct generic name for *Cholornis paradoxa* J. Verreaux, 1870, and *Heteromorpha unicolor* Hodgson, 1843 should be the oldest available, in this case: *Cholornis* J. Verreaux, 1870, *Nouvelles Archives de la Musée d'Histoire Naturelle*, Paris, 6, p. 35. Type, by original designation, *Cholornis paradoxa* J. Verreaux, 1870. Thus the names of the Three-toed and Brown Parrotbills should be, respectively:

- *Cholornis paradoxa* J. Verreaux, 1870, **Three-toed Parrotbill**.
  Cholornis paradoxa paradoxa
  Cholornis paradoxa taipaiensis (Cheng, Lo and Chao, 1973)
- *Cholornis unicolor* (Hodgson, 1843), **Brown Parrotbill**.

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Thanks to Steven Gregory for pointing out to me the error involving *Hemirhynchus* in the 2009 paper.

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