Ecology and Conservation of Wood Snipe *Gallinago nemoricola* in Lauribina-Gosainkunda area, Lamtang National Park, Nepal

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Contents

Cover photograph: Habitat of Wood Snipe in Lauribina area showing dense dwarf rhododendron scrub and rocky outcrops and boulder strewn areas (Photo: Hari Basnet).

Report photographs: Hari Basnet except where otherwise mentioned.

SUMMARY

The Wood Snipe *Gallinago nemoricola* is listed as a globally 'Vulnerable' species due to small and declining populations. Loss of habitat in both breeding and wintering areas is considered a major causes behind these declines. Previously only one Wood Snipe study has been undertaken in Nepal, in Lamtang National Park (NP) in 2007. It identified Gosainkunda and Associated Lakes as an important breeding area. Through further field surveys in May and August 2019, we investigated Wood Snipe distribution, ecology and conservation threats in the Lauribina-Gosainkunda areas of Lamtang NP. Wood Snipe were recorded from nine stations out of 18 surveyed, with an estimated 19 different calling birds. Their habitat lies between 3,800-4,414m, comprising alpine pasture with dwarf rhododendron scrub and juniper, and areas strewn with rocks and boulders, and rocky outcrops. These rocky areas in the rhododendron scrub are perhaps the main locations selected for nesting but this remains unclear. Contrary to what was expected, most sites where snipe were observed lacked permanent marshy ground. Interviews with local people revealed that the Wood Snipe population may have declined in recent years. Although, heavy grazing by *Chauri* (yak-cow hybrids) in snipe habitat poses threats to breeding success (i.e. nest trampling and habitat degradation), conversely arthropod larvae in Chauri dung may provide a food source for snipe, as evidenced by feeding signs (bill probe marks) in dung. In addition to the field studies, we conducted several conservation awareness programmes with local people in Lamtang NP. At least 500 people (including school students and teachers) participated, during which we discussed the importance of conservation of Wood Snipe and the environment generally, and distributed Wood Snipe conservation posters. As the snipe appear closely associated with areas subject to Chauri grazing, capacity-building with herders to enable them to undertake some straight-forward monitoring was initiated, and steps made to develop them as 'Wood Snipe guardians' to help safeguard the species, in this perhaps one of the most important sites globally, for Wood Snipe.

BACKGROUND – the Wood Snipe

The Wood Snipe *Gallinago nemoricola* is globally Vulnerable-listed on the basis of its small and declining population (IUCN Redlist; BirdLife International 2020). The population size has been estimated at less than 10,000 mature individuals and declines are primarily thought due to widespread loss of habitat in both its upland breeding areas and lower elevation wintering grounds (BirdLife International 2020). In Nepal the breeding population is estimated at fewer than 100 individuals (Inskipp *et al.* 2016). However, this estimate is based on very limited survey data and *ad hoc* information received from a few birdwatchers that have visited breeding areas at the right time of year. It breeds locally in the Himalayas of NW and NE India, Nepal, Bhutan and SE Tibet, and central Sichuan and Yunnan in China. It winters at lower altitudes in the Himalayas and northern Vietnam, but has been recorded as an apparent vagrant in the hills of central and southern India, Sri Lanka, Bangladesh, Myanmar, N Thailand and Laos (Birdlife International 2020). Within Nepal, Wood Snipe are rare and sparsely distributed, breeding locally in April–June in the subalpine and alpine meadows with areas of mainly dwarf rhododendron scrub but with some juniper, rocky outcrops and boulder-strewn slopes, between about 3,650–4,520 m asl (Inskipp *et al*. 2016). In winter, from what is known, they frequent swampy ground in and at the edges of evergreen forest, marshy grassland and scrub, below 3,000m, and sometimes down to lowland plains (Khatiwada *et al.* 2010). Post-1990 Wood Snipe records in Nepal included Shey-Phoksundo National Park (NP), Sagarmatha NP, Lamtang NP, Makalu Barun NP and Kanchenjunga Conservation Area. Additionally, Chitwan NP and Bardia NP are lowland protected areas where it has been recorded in the non-breeding season (Inskipp *et al.* 2016). The first record of Wood Snipe in Lamtang NP was at Kyanjin in May 1979, with the first photographic evidence in Lamtang NP in May 1990 (Buckton & Morris 1993, Inskipp *et al.* 2016). Several records were reported subsequently by various birding tour groups. A single scientific survey in the Kyanjin area and Gosainkunda and Associated Lakes (GAL) of Lamtang NP conducted in 2007, recorded an estimated eight individuals (Katiwada *et al.* 2010, Inskipp *et al.* 2016).

Overgrazing by livestock primarily by domestic Cahauri (yak *Bos grunniens* x breeds of local hill cow *B. indicus*) and much human disturbance during the pilgrimage festival seasons in the breeding habitat has caused a degradation of habitat quality and has probably reduced breeding success (Khatiwada *et al.* 2010).Information regarding the species' ecology, both in breeding and wintering areas is sparse.Wood Snipe have been recorded in 13 localities in Nepal of which the GAL area is considered an important breeding area for them. However, detailed status and distribution data are lacking, uncertain or outdated, which hinders conservation and management efforts (Buckland *et al*. 2008).This survey also was a follow-up of that conducted in 2007 to update information regarding the population status, distribution and ecology of Wood Snipe in Lamtang NP.

OBJECTIVES

The project was divided into two sections: (1) fieldwork with the objective to gain more information regarding the population status, distribution and ecology of Wood Snipe in Lamtang NP; and (2) local conservation awareness programmes. Through these measures, the aim was thus to implement some conservation initiatives as a first step to reduce anthropogenic threats to Wood Snipe within Lamtang as a whole.

STUDY SITE AND METHODS

Study site: The study was carried out in six main areas of Lauribina-Gosainkunda in Lamtang NP: Lauribina (28.09206ºN, 85.38668ºS); Brana (28.09479ºN, 85.39234ºS); Buddha Mandir (28.08965ºN, 85.39262ºS); Gosainkunda and Bhairab Kunda (28.08271ºN, 85.41377ºS); Naukunda (28.06151ºN, 85.39188ºS); and Phedi (28.07051ºN, 85.43783ºS). GAL is a Ramsar Site which lies at between 4,054-4,620 m asl with an area of 1,030 ha including 54 ha of covered by 16 lakes (Mool *et al*. 2002). It is one of the world's highest freshwater lake systems and is located in the high Himalayan Palaearctic biogeographical region. The lakes are important sources of water for the famous Trisuli river of Nepal, and a major tributary of Narayani, one of the four major river systems of Nepal. The study site has religious associations for Hindus and Buddhists, and is a popular and spectacular hiking destination, reached by a short trek from Kathmandu. Thousands of Hindu and Buddhist pilgrims visit Gosainkunda during the festivals of Ganga Dasara and Janaipurnima (May and August each year). The zone is above the tree line and comprises mainly dwarf rhododendron scrub interspersed by rocky slopes, talus and alpine pasture. Vegetation of the pastures is dominated by sedges and grasses (e.g. *Carex* spp., *Kobresia* spp., *Poa* spp. and *Festuca* spp.), but with many herbs (families including Rosaceae, Primulaceae, Ranunculacea, Gentianaceae, Polygonaceae, Campanulaceae, Papaveracea, Crassulaceae and Scrophulariaceae). Within GAL area, as well as other Himalayan specialties, three species of globally threatened large mammals, Snow Leopard *Panthera uncia*, Red Panda *Ailurus fulgens* and Himalayan Musk Deer *Moschus leucogaster* occur.

Survey team: The survey team comprised six members, Hari Basnet, Mohan Bikram Shrestha, Romit (Kanchha) Tamang, Deelip Chand Thakuri, Tejab Pun and Dhiraj Chaudhary.

METHODS

Survey design

An International Centre for Integrated Mountain Development (ICIMOD) land use map (http://geoportal.icimod.org/) was used to identify potential Wood Snipe habitat on the basis of altitudinal range, plus a literature review of habitat preferences (including reports from the area) and suggestions by experts. The identified potential habitat was overlain with a grid of 500 x 500 m^2 squares. Within this, 63 full grid squares were present of which 30% were selected. Among these selected grids, 13 were randomly selected whilst five were purposely chosen in order to cover the area surveyed in 2007. In this way, in total 18 grid squares were chosen and covered during our study (Figure 1). A detailed working plan was made through consultations with local assistants and staff of Lamtang NP. The surveys were conducted within the Wood Snipe breeding season, 25 May 2019 to 10 June 2019, and in the post-breeding conducted, from 29 July to 10 August 2019. In May, 65 working days and in July/August, 68 working days were spent in the field conducting snipe call count surveys, sweep surveys and recording any additional sightings signs of presence (i.e. feathers, droppings, feeding signs and foot prints).

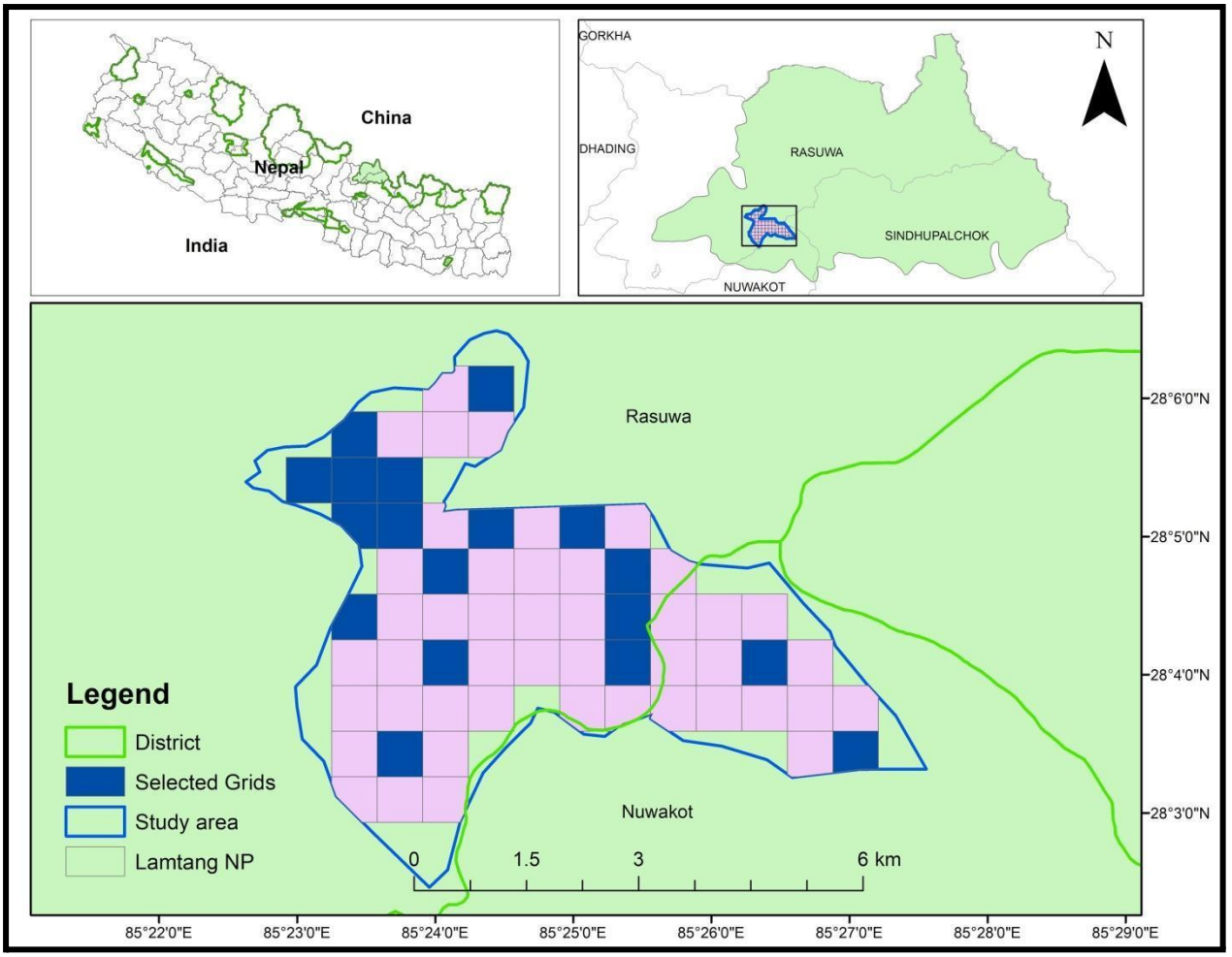

Figure 1. Study area showing the selected 500 x 500m squares for survey.

Information collection, desktop review and identification of stakeholders

A desktop review was undertaken to assist in location of call count stations as well as to identify new potential areas for the species. Xeno-canto (https://bit.ly/2Xui6zA, XC158568) and eBird (https://ebird.org/species/woosni1) data were assessed for more information concerning the probable peak breeding season (i.e. best time to survey) and types of call, duration/intensity of calling, time of day when calls heard and locations. Information about the project was circulated and a meeting held with Lamtang NP staff during World Wildlife Week (15 April 2019) at the village of Dhunche to identify potential project stakeholders. Moreover, suggestions from bird experts and researchers involved in the previous Wood Snipe study in 2007 were taken into consideration.

Dawn and dusk call count surveys

Dawn and dusk call count surveys were conducted from 04h30 to 0600h and 18h15 to 19h45 from a vantage point in each site. Site and vantage points were selected based on Key Informant Interviews (KII) with herders, and preliminary surveys. Each selected site was surveyed at least three times (dawn-dusk-dawn or dusk-dawn-dusk), avoiding periods of heavy rainfall or dense fog. In each session, observers were rotated and the number of calls and results were checked post-survey to avoid double counting by comparison of time and direction (compass bearing in relation to surveyor position) of the call. A total of 54 call

count surveys were made, 60% conducted during the dawn pariod. All drumming displays and chipping calls were noted (see also Sweep surveys, below). During the first 10 min the surveyor sat and waited for Wood Snipe to call naturally. If no call was heard, then a drumming or chipping playback call was broadcasted three times at 5 minute intervals in an attempt to stimulate birds to respond.

Sweep surveys

Snipes *Gallinago* spp. are generally one of the most difficult wader species to observe and count as birds are largely inconspicuous except when performing drumming display flights or making chipping calls (Hoodless *et al.* 2006) and may rest silently for long periods. Therefore, a sweep survey technique (post-breeding season) was used in an attempt to flush birds. Keeping a distance of about 10 m between each surveyor (i.e. a line of five people), areas of potentially suitable habitats were traversed. After the dawn and before the dusk survey, surveyors gathered at one station and carried out a sweep survey for 1.5-4 hours. Time, number, type of call and direction was recorded. All locations from where Wood Snipes were sighted/heard, plus feathers and feeding signs, were recorded using GPS.

Interviews with the local people

Realizing the importance of the knowledge of the Chauri herders and their potential role in future Wood Snipe conservation work, Key Informant Interviews (KII) were conducted with nine herders as well as seven hotel/guest house owners between Chandanbari to Gosainkunda. Also, 22 informal interviews were conducted with local people along the Gosainkunda trekking route using a semi-structured questionnaire. This incorporated questions about historical/recent snipe presence, numbers of birds seen, snipe ecology, threats and their perception regarding conservation of the species. At the end of each interview, there was a general discussion about Wood Snipe and the potential local community role in its conservation.

Community Conservation Awareness Programme

Two community conservation awareness meetings and several focal group discussions were conducted at different hotels/guest houses in the study area during the survey period. Conservation awareness meetings and focus group discussions were started with a brief summary of the project followed by an introduction to the species, anthropogenic threats recorded in the past and current survey, and our role and responsibility to conserve Wood Snipe and other wildlife. A Wood Snipe poster including information on conservation importance, conservation challenges and potential conservation measures was distributed amongst stakeholders (e.g. hotel owners) and schools etc.

School Conservation Awareness Programme

This was originally intended to be conduct in Thulo Safrubesi village (28.142825°N, 85.360421°S) as nearby and local people reported seeing the Wood Snipe in the winter season in the their village environs. However, due to the small student numbers at the school here, the school awareness programme was carried out at Rasuwa Secondary School (higher numbers of students and teachers), situated in the buffer zone of Lamtang NP at Dunche, Rasuwa district. This is the (small) town nearest to the study area, the starting point of the Gosainkunda trek, and where the headquarters of Lamtang NP are situated. The programme lasted two hours. This involved students participation and learning ‘with fun’. Students were provided with a piece of paper and instructed to draw a picture (of nature, local animals and plants) but keep it secret. Students were then asked to unveil their drawings and place them on a white board. In the end, the board was filled with nature subjects representing a

'complete ecosystem'. The awareness team then discussed the habits of the animals, their habitats, threats and conservation.

Results dissemination

Project results were shared amongst the relevant park staff of Lamtang NP.

RESULTS AND DISCUSSION

Status and distribution

Wood Snipe were recorded at nine of the 18 survey stations, with an estimated 19 different calling birds. A total of 14 calling birds were recorded in the Lauribina area and five in the Gosainkunda area (Table 1, Figure 2). More were counted than in the 2007 Lauribina survey area (Khatiwada *et al.* 2010) probably for the simple reason as larger extent was covered here during our survey. Five different stations in the Lauribina area were included in the current study, as opposed to one station in the 2007 survey. Survey timings were also different (2007 surveys conducted throughout the day from 06h00 to18h00, we conducted dawn and dusk surveys only) thus a direct comparison is not possible. However, it is worth mentioning that the 2007 survey reported four Wood Snipe in the Naukunda and Lauribina (Khatiwada & Chaudhari 2008) where we also counted the same number of calls at these locations (and probably relating to four individuals). Information derived from KII and informal interviews with stakeholders reported the species occurrence over a wider area, and thus our survey poorly represents the whole potential habitat, so it is very likely that more breeding snipe are present. Locals reported the occurrence of Wood Snipe around their village (Thulo Saprubesi, 2,200m elevation) during the winter, feeding in swampy ground. Moreover, at the beginning of the breeding season, Wood Snipe have been heard and seen in the Fokrang area (2,900 m) where herders spend some time prior to their ascent to higher elevations with their Chauri. Similarly, hotel owners and herders at Chandanbari (3,300m) have reported frequently hearing Wood Snipe calls in their area during the breeding season. Additionally, a sheep herder from Yarsa Rural Municipality (RM) reported that he frequently heard calls whilst sheep herding in the Langu (above Yarsa RM) and Ujali (1 km from Naukunda) areas. Records of Wood Snipe from around Fokrang, Langu and Thulo Saprubesi during the non-breeding season or prior to the actual breeding season, indicates (as expected) that the species descends to lower elevation in winter, returning to higher elevation in the spring to breed. The breeding habitat remains under snow from October to March, hence wintering at lower elevations. In neighbouring Bhutan, Wood Snipe have been recorded between 1,800 -2,400 m during winter (Spierenburg 2005), and at 2,900 m in Phobjikha Valley on 23 April 2013 (Eaton & Duff 2013).

The majority of calls were recorded from the NW-facing slope in the Lauribina area (Lauribina-Buddha Mandir and Brana) which lies between 3,900-4,300m on the Gosainkunda trekking route. Among all the calling stations, Kharka area (720m north of Buddha Mandir) was identified as an important site for Wood Snipe. Four calls (probably representing 4 individuals) were heard on the second day evening sessions at this location - the highest number of calls recorded from a single station. Four snipe were also flushed in different locations during sweep surveys, the first at 08h38 (2 August 2019), 560m east of Buddha Mandir (28.0865°N 85.3953°S; 4,327m). The habitat comprises scattered dwarf rhododendron, alpine grasses and boulders. The second and third were flushed on 4 August 2019 in the Kharka area (28.0892°N 85.3941°S, 4,193m and 28.0886°N 85.40158°S, 4,270m) at 12h16 and 17h29 while a fourth flushed at 07h32 1km north-east of Buddha

Mandir (28.0888°N 85.4014°S, 4,383m). All these sites were covered in dense rhododendron scrub with boulders. Additionally, two Chauri herders reported seeing a total of three Wood Snipe during our survey period. In May 2019, dawn calls were heard commencing from just before 05h00. At dusk calls were heard from 18h04 to 19h30. In the breeding season using broadcast of calls they could be induced to respond later in the morning or throughout the day, though their responses were very limited. In the post-breeding season, calls were heard at dawn as early as 04h21, with sporadic calling heard up to 05h21; dusk calling started at 19h16 and was heard to 19h35.

Table 1. Dawn and dusk call count survey in the study area.

Site No.	Latitude	Longitude	Elevation (m)	Site	Day 1	Day 2	Day 3
1	28.09171	85.38691	3,987	550m E of Maya Hotel	1	2	2
2	28.08722	85.39014	4,228	Buddha Mandir	3	3	3
3	28.08943	85.39813	4,288	720m NE of Buddha Mandir	2	2	1
4	28.08337	85.40578	4,346	Bhairab Kunda	1	1	0
5	28.07758	85.41794	4,414	E corner of Gosainkunda	2	2	2
6	28.0594	85.39285	4,347	Naukunda	2	2	2
7	28.08952	85.39574	4,201	Kharka	3	4	3
8	28.08901	85.38445	4,044	550m W of Buddha Mandir	2	2	2
9	28.09595	85.39007	3,894	Brana	1	1	1

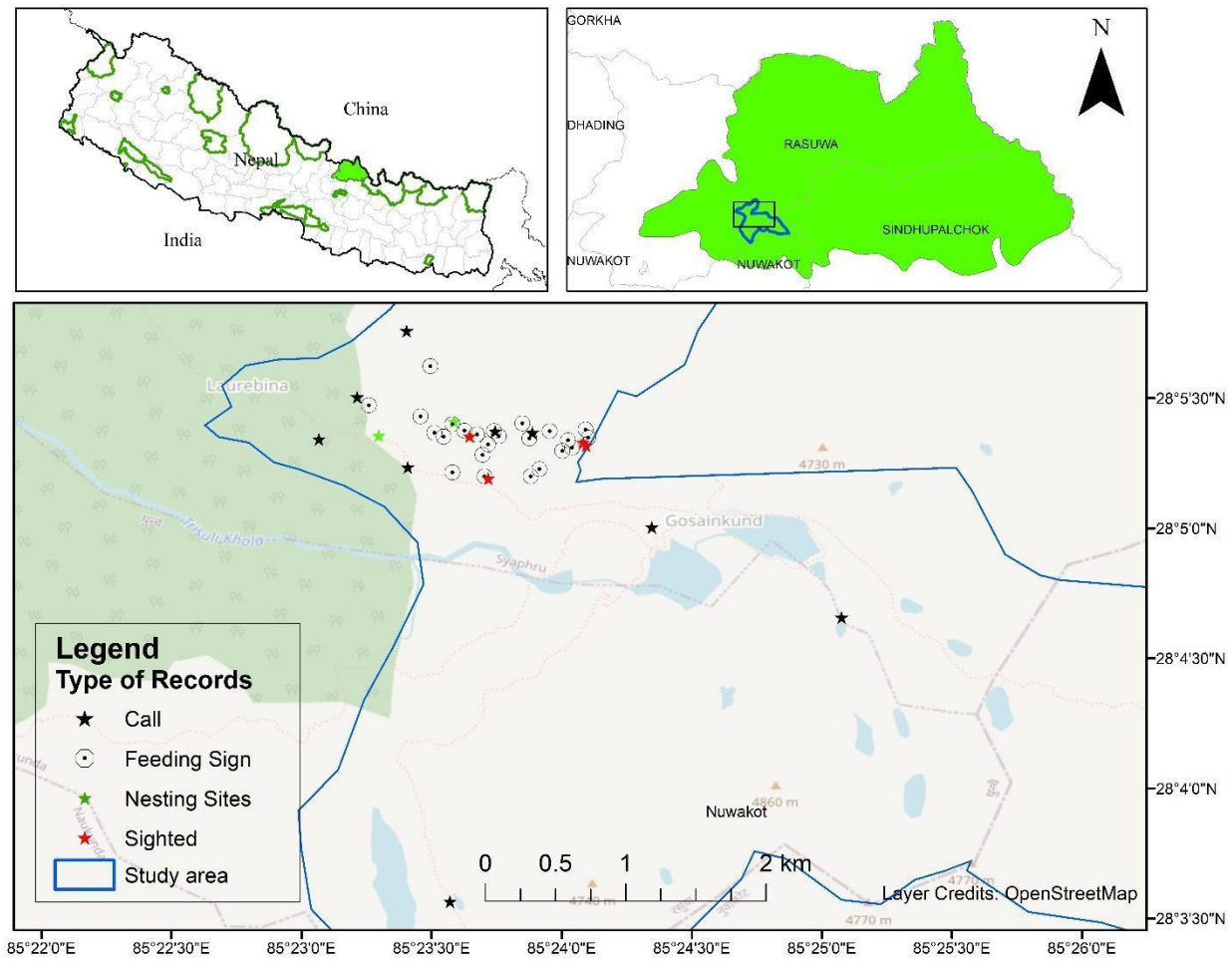

Figure 2. Distribution of Wood Snipe recorded in the study area.

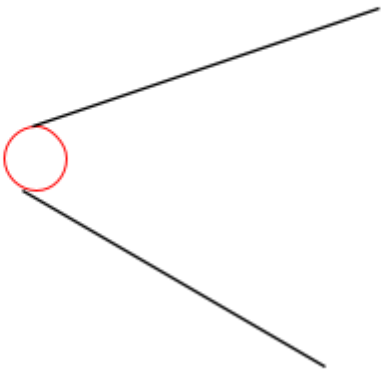

Plate 1. Wood Snipe, flushed from rhododendron scrub in flight, Kharka near Buddha Mandir, 2 August 2019. In all sighting, when flushed, birds produced a drumming sound and made an approximately 500m semi-circular flight before descending (Photo: Mohan Bikram Shrestha).

Habitat of Wood Snipe

In the Lauribina area, Wood Snipe were recorded between 3,800 to 4,414m in alpine pastures dominated mostly by Dwarf Rhododendron *Rhododendron anthopogon*, Pink Scaly Rhododendron *R. lepidotum* and Snow Rhododendron *R. nivale* along with juniper *Juniperus* spp., plus forbs and grasses. In the grid squares where snipe were recorded in the Lauribina area, there was an estimated greater than 70% vegetation cover, the rest comprising significant areas of rocks/boulders and rocky outcrops. Most occupied habitat lay on W- and NW-facing aspects on slopes of 30-45 degrees.

In most of the squares there was no permanent stream(s) or marshland, though monsoon rains and snow melt-water makes the whole breeding habitat wet. However, in Lauribina, a stream and a patch of marshland lie between the Maya Hotel and the Brana area where herders report regularly seeing snipe feeding in the marshland during September at sheep gathering time.

Plate 2. Habitat of Wood Snipe covered by dwarf rhododendron scrub and boulders, and grazing areas for Chauri; two Wood Snipe were flushed from this location.

Local people and Wood Snipe

Herders and some local people are very aware of Wood Snipe. They call it "*Tele Chip-chip"* (Tele: mud; Chip-chip- a way of feeding) '*feeding in the muddy area*' in the Tamang language. It was known among the local people due to: a) the species has a distinct call; b) it calls earlier in the morning and later in the evening than most other birds in the area (Himalayan Monal *Lophophorus impejanus* and Blood Pheasant *Ithagini scruentus* were also indicated as having distinct dawn call habits); c) it has a long beak making it fairly unmistakable when seen; and d) Wood Snipe share common habitat with Chauri and so herders frequently encounter them.

Among those subject to a Key Informant Interview (KII) i.e. Chauri herders and local hotel owners, 87% knew about the species when we used the local name *Tele Chip-chip*; 68% knew its call and 56% recognized the species in a photo, but their response was inconsistent/confused if photos of Wood Snipe and Eurasian Woodcock *Scolopax rusticola* were shown together. However, none indicated that they knew about its conservation status and none were aware of its Nepali (*Ban Chaha*) or English names. Among the KII, 77% of respondents suggested that the population is declining in the area based on less frequently heard calling and seen in recent years. The reason behind the decline is unknown, although around 40% of respondents blamed heavy snowfall in recent years. Similarly among the 29 other local people (i.e. not herders or hotel owners), 62% recognized the species correctly (using the local name) and 52% thought that species had declined in the past few years.

Plate 3. Heavy snowfall covers the whole area of potential snipe breeding habitat in the Lauribina area (April 2019). The snow remained for more than a month. Local people believe that heavy spring snowfall is one reason for declining numbers of Wood Snipe (Photo: Romit Tamang).

Relationship between Wood Snipe and Chauri grazing

Altogether 11 Chauri sheds were present in the Lauribina area. None were seen in GAL although temporary sheep sheds were present. Each Chauri shed holds an average of 35 Chauri, thus equivalent to approximately 385 animals (if sheds fully occupied) grazing potential Wood Snipe habitat in the Lauribina area. Here, Chauri reach the sheds around July and stay until September, enjoying seasonal grazing in the alpine pastureland. Most of the Chauri (and sheep) herders reported having frequently seen Wood Snipe, especially each morning and evening as they bring back animals to the sheds for milking and subsequently sending them back to the pastures. During this process, herders chase their stock to move them more quickly, which in the process sometimes flushes snipe, primarily from the rhododendron scrub.

Though detailed studies of Wood Snipe feeding habits and diet are yet to be done, it is said that they feed upon worms, small aquatic insects, grubs and also seeds (Collar *et al*. 2001). Our study identified at least 36 locations in Lauribina area where apparent feeding signs (bill probing and footprints) in Chauri dung was recorded (Plate 1). This indicates that they may

feed upon arthropod larvae present in the dung. Several species of flies and coleopteran were noted laying eggs on/in dung piles, these hatch and develop into larvae. These larvae may be an important source of protein for both adult snipe and their chicks during the breeding season. Possible feeding signs were observed in deposits of dung of at least 1-week old, or older but many holes were attributed to emergence holes of dung beetles. During our survey, a herder at Kharka saw a snipe feeding around dung heaps at 07h25, the bird hiding in rhododendron scrub as he approached. Locals have also seen Wood Snipe feeding on piles of drying dung in the Chauri sheds themselves in the early winter where many grubs/insect larvae are found. At this time, Chauri are moved to the lower elevation, thus higher areas are mostly free of disturbance. Feeding on dung beetles has been recorded for Wilson's Snipe *G. delicata*, 21.7% of the total volume of their food containing beetles including dung beetles (White & Harris 1966), while Sperry (1940) found that 15.4% of food contained coleopteran remnants. Moreover, Gichuki & Gichuki (2006) recorded African Snipe *G. nigripennis* spending considerable parts of the day feeding in isolated puddles and patches of livestock dung in cattle enclosures.

Plate 4. Dipteran flies feeding and laying eggs on Chauri dung (left) and dung beetle (Scarabaeidae) larvae extracted from dung.

Plate 5. Feeding signs of Wood Snipe - bill probes in and footprints on dung (left) and Himalayan Monal (right), in Chauri dung.

Nest sites

The current survey identified two possible nest locations as indicated by a concentration of a large number of feathers with piles of droppings, both situated in drier areas under boulders covered by rhododendron scrub. But these might perhaps relate to predation events (and not nests); we recorded many Large-billed Crows *Corvus macrorhynchos* and Siberian Weasels *Mustela sibirica* in the area, both are potential snipe egg/chick predators, and weasels could take adults. Based on studies of Common Snipe *G. gallinago* (Green 1988), among 105 nests failures, 60% were destroyed by predators and 19% were trampled by livestock. Similarly, nest studies of Common and Great Snipe *G. media* (in Belarus) found that 83% of nests of Common Snipe and 70% of those of Great Snipe failed (Ferrand 2006). This suggests a high rate of nest predation in *Gallinago* species generally and the situation may be similar in Wood Snipe. Further studies would be needed to deduce this.

The area surrounding our possible nest sites were covered in more than 70% rhododendron scrub. Although no definite record of a Wood Snipe nest or its eggs are described, other *Gallinago* spp. prefer to nest (a neat cup of compressed vegetation) in dense vegetation, e.g. of grasses and rushes (Green *et al*. 1990, Hsu & Severinghaus 2011). Chauri herders reported seeing a snipe nest (4 years previously) next to boulders in rhododendron scrub, without any nesting material, that contained three white eggs – however snipe eggs are not white but grey-brown with darker blotches, thus such reports cannot be relied upon. Likewise, around Forkang and Chandanbari (below 3,300 m), locals reported having seen nests in cavities of Blue Pine *Pinus wallichiana* at ground-level but this needs to be verified and we consider these unlikely to refer to Wood Snipe nests. Ali and Ripley (1987) report an old observation purportedly describing a Wood Snipe nest in pine forest between 1,700-1,850m but indicate perhaps not in fact attributable to the species.

Plate 5. Feathers collected from a potential nesting sites (left), and droppings (uncertain if snipe) with a feather at Lauribina.

Threats

During the pre-breeding season Wood Snipe habitats in the Lauribina area are free from livestock, but herds arrive in July each year and remain until September. During this time, up to 385 Chauri range over about 360ha of alpine pasture which may detrimentally affect the breeding success of Wood Snipe due to overgrazing (reduced nesting cover) and nest

trampling. Chauri grazing intensity was high (as indicated by cropped vegetation, dung presence and trampling) over what we considered to be potential Wood Snipe breeding habitat within our survey area. A previous study found 37.5% of nests and 75% of clutches of Common Snipe were destroyed by grazing cattle in Belarus (Ferrand 2006), thus nest trampling by livestock is probably a potential threat to Wood Snipe. However, Wood Snipe also probably benefit from Chauri presence as they may feed on arthropods in their dung.

According to Khatiwada *et al*. (2010), tourism (hiking) is considered a potential threat to Wood Snipe. Although habitat in Lauribina is located along a popular trekking route, our observations suggest that there were no significant impacts upon Wood Snipe as most trekkers keep to the trails, and those that do wander off have little or no impact, as so few do so. However, we identified threats associated with the Pilgrimage festival (*Janaipurnima*) when high volumes of people visit and temporary tea houses and shelters are constructed to provide accommodation for pilgrims. Around 24 shelters were constructed at Buddha Mandir which we also identified as the best (in terms of numbers) Wood Snipe breeding site. Each shelter is lined with grasses (to insulate from the cold and damp ground) collected from potential snipe nesting areas. One person involved in shelter construction reported seeing an adult snipe with two chicks hiding amongst the grasses and rhododendron scrub while collecting dry grass for such a shelter (P. Tamang *in litt*. 2019).

Conservation Awareness Programmes

A thousand *Wood Snipe Conservation* posters were produced. Literature personality and culture expert Mr. Satya Mohan Joshi promoted the poster on Environment Day 2019, this event attended by at least 2,000 people. Key informant interviews and a project briefing was conducted with staff of Lamtang NP during 2019 Wildlife Week. Posters were distributed and displayed in hotels/guesthouses along the Dhunche-Goshainkunda trekking route. Informal discussions were undertaken with Chauri herders and a total of 29 people in Lauribina (1 August) and Gosainkunda (3 August) 2019. Information was collated, followed by sharing of this and discussions regarding e.g. nature conservation, herders' potential roles in Wood Snipe conservation and the possibility of Wood Snipe based eco-tourism similar to that promoted for Red Panda, in Lamtang.

A 2-hour long school awareness programme in Rasuwa secondary school, Dhunche was conducted on 7 August 2019. A total of 40 students of grade 8 were acquainted with Wood Snipe – this particular bird was not known to the students before this. Four teachers were also present thus they would be able to help disseminate the information to other students of higher and lower grades afterwards. Students were provided with information about Wood Snipe ecology and habitats, and a framed Wood Snipe Conservation poster was given to the school.

All the results and recommendation from the research were shared among the staff of Lamtang National Park on 7 August 2019.

Conclusions and recommendations

The majority of habitat occupied by Wood Snipe within the areas we surveyed was within the Lauribina area (Lauribina-Brana-Buddha Mandir) rather than Gosainkunda. The snipe population is almost certainly more than 19 individuals taking into account all of the potential areas not covered, especially in the lower belt of the Lauribina area. There appears to be a correlation between Wood Snipe habitat use, especially for foraging, and presence of Chauri. Thus a survey of Wood Snipe within the Chauri alpine grazing zone (in part using camera traps due to its crepuscular nature and long observation times required) would be useful. Moreover, surveys at lower elevations during the winter season are required to elucidating movements. Such studies would be greatly benefited by use of advance technologies, e.g. satellite tagging, but it is acknowledged that catching birds in order to fit such devices would be very difficult.

The pilgrimage festivals in the Gosainkunda area (i.e. high levels of human disturbance) coupled with limited conservation awareness among the local people pose some threats to Wood Snipe on their breeding grounds. Thus ongoing conservation education programmes, capacity building activities and livelihood support of herders to inspire them to be 'Wood Snipe guardians', are recommended.

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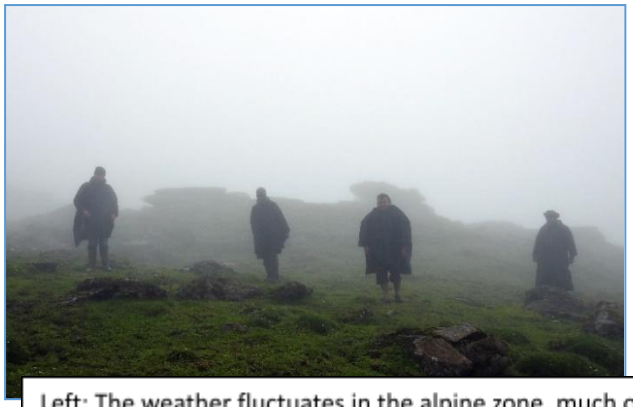
Appendix 1. Additional photographs

Left: Wood Snipe Conservation poster was released during the World Environment day in front of at least 2,000 people; Right: Group photo after result dissemination among the staff of Lamtang National Park.

Right: Door-to-door conservation awareness in the Chauri Shed and Right: Community conservation awareness in the Gosainkunda area (4442m asl).

Group photo with the participant involving school awareness programme.




Left: The weather fluctuates in the alpine zone, much of the survey time it was covered by fog, here doing a sweep survey; Right: Heavy snowfall in the Gosainkunda area during the field work in the Phedi area.


Left: Chauri around a Chauri-shed in the morning for milking purposes; Right: Chauri feeding on the breeding grounds of Wood Snipe.

Expedition team in the pre-breeding season (Mohan, Dhiraj, Hari, Deelip and Romit).

and Lauribina pasture area dominated by rhododendron scrub, rocky outcrops and boulders (i.e. habitat of Wood Snipe).

Left: Brana pasture area with Langtang Lurung and Langtang Ri in background, Right: Buddha Mandir and Lauribina area pasture land, the area is dominated by rhododendron scrub and rock boulders (the habitat of Wood Snipe).