Breeding Biology of Rufous-Bellied Woodpecker (Dendrocopos hyperythrus) in Rudraprayag District (Kedarnath Wildlife Sanctuary, Western Himalayas), Uttarakhand, India

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Research Article

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Breeding Biology of Rufous-Bellied Woodpecker (*Dendrocopos hyperythrus*) in Rudraprayag District (Kedarnath Wildlife Sanctuary, Western Himalayas), Uttarakhand, India

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In the Indian subcontinent there is almost no scientific study about the breeding biology of Rufous-bellied woodpecker (RBW) (*Dendrocopos hyperythrus)*. Keeping this fact in view an attempt was made to understand the breeding biology of RBW during its breeding season from March 2018 to July 2020 in Kedarnath Wildlife Sanctuary (Western Himalayas), Uttarakhand. Results indicated that the breeding season of RBW extends from March to July. RBW is a primary cavity nester in which male woodpecker builds the nest on selected tree species such as Buransh (*Rhododendron arboreum*), Utis *(Alnus nepalensis)*, Kharsu (*Quercus semecarpifolia*), Akhrot (*Juglans regia*), and Moru (*Quercus floribunda*). The most preferred tree species to build cavity nest by the study species was Buransh (*Rhododendron arboreum*) (N =5). Twelve active nests were located on tree trunks and branches. A nest was found abandoned before completion by the pair due to conflict with Himalayan woodpecker (*Dendrocopos himalayensis*) which built the nest on the same tree (*Rhododendron arboreum)*. One egg was laid daily. The clutch size ranged from 2 to 3 with an average of 2.72 ± 0.12 eggs and the incubation period ranged between 16 to 18 days (Mean 16.72 ± 0.20 days). The average provisioning period was 25.81±0.36 days (Range 24 – 28 days). The average depth of the nest was found 29.5±6.67 cm (range 22 to 45 cm) and diameter of the cavity opening was 7.09±0.07 cm (Range 7.0 to 7.2 cm). Nests (N=12) were made at the height between 7 and 28 feet above ground with an average height of 19.08±6.08 feet. All the nesting sites were found between 1700-2579 m (ASL). Nests were excavated in all the directions except for North and northeast.

Keywords: Subcontinent, clutch, conflict, provisioning, excavated

Introduction

Woodpeckers are important component of the forest communities and play a vital role in the forest ecosystem. Being insectivorous, they help in controlling bark insects by altering the micro-climatic conditions on tree bark (Mc Cambridge and knight, 1972; Kroll and Fleet, 1979; Otvos,1979; Kroll et al., 1980; Mendel et al, 1984). These Species are susceptible to habitat changes and act as general indicator of forest biodiversity and specific indicator of forest bird species (Mikusinski et al., 2001). Habitat requirements and broad scale habitat relationships are poorly studied for many species of woodpeckers in India and particularly in Garhwal Himalays.

As primary cavity nesters, capable of excavating tree holes, woodpeckers provide nesting opportunity to a host of secondary hole-nesters that depend on old nest holes of woodpeckers or tree cavities (Short, 1979,1982).

By providing nest to the secondary cavity nesters such parakeets, tits, owlets etc. the woodpecker may interact with many species and play their role as keystone species (Smith 2006). The conservation of keystone species is particularly important, since a loss of these species can lead

to cascading negative effects in many other species from different taxonomic groups. It is believed that woodpeckers, as an insect eater have an important role in bio control and ultimately in restoration processes of natural habitat. It is a sap sucking species (G. Shahabuddin et al., 2018) (Image-1). These cavities aren't useful to the woodpeckers, birds such as owlets, tits, parakeets needs pre-existing cavities for their nests and often use woodpecker's cavity.

Breeding is an important phase in bird's life, as birds spend lot of time and energy in various breeding activities like nest site selection, nest building, incubation and provisioning of young. (Fargallo et al.2001, De León and Mínguez 2003,Mänd et al. 2003). Unfortunately there is no scientific data about the breeding biology of the woodpeckers of the Indian sub-continent in general and Himalayan region in particular. The breeding biology of avian species nesting in tree holes is well known for secondary cavity nesters, as these birds readily occupy nest boxes. For this reason, the breeding ecology of tit, flycatchers as well as the starlings have been well documented from many locations. Woodpeckers excavate their own nest holes. As a result, there is little data are available on their breeding ecology, as it is more difficult to locate and study their nests during each stage of development of the brood. Negligible reports on the breeding phenology, number of fledglings and breeding/nesting success of the woodpeckers occurring in India.

Keeping the above background in view, in this study an attempt was made to understand the breeding biology of Rufous-bellied woodpecker (*Dendrocopos hyperythrus*) in Rudraprayag (Western Himalayas).

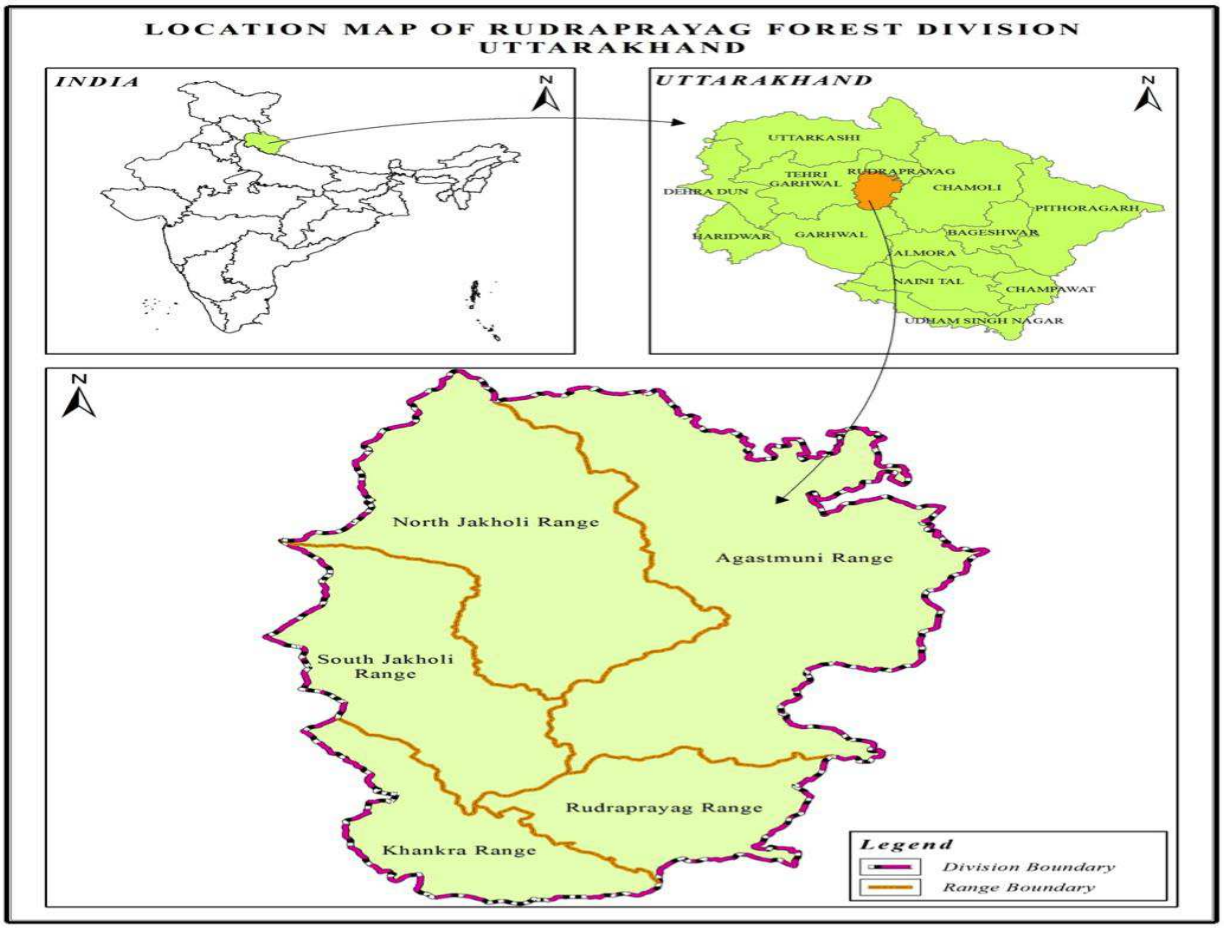
Rufous-bellied woodpecker is a medium sized woodpecker, male has red crown and nape while female has black crown and nape which are spotted with white. They often accompany mixed feeding flocks of insectivorous birds like Rufous sibia, Himalayan woodpecker, white throated laughing thrush etc. (personal observation). Usually forages in the upper forest storey on trunks and branches of large trees. Often feeds by probing and pecking at loose bark and in crevices, also bores holes into oak bark and drinks sap. It is a resident species of Himalayas from Pakistan, and Jammu and Kashmir east to Arunachal Pradesh, NE India and Bangladesh. Recorded mainly at an altitude ranging from 1000 m to 3400 m. breeding season of this species starts from February mid and terminate by the end of July.

Materials and method

Study Area

This study was conducted in Rudraprayag, Uttarakhand State, in the Western Himalayas. Rudraprayag in Garhwal Himalaya is well known for its rich biodiversity. KWLS was established in 1972 and is situated in the north-eastern part of the Garhwal Himalayas between 30°250 -30°410 N, 78°550 - 79°220 E (Map-1). The Sanctuary falls under the IUCN management Category IV (Managed Nature Reserve) in the bio geographical province 2.38.12 of Himalayan highlands. The highest summer temperature recorded was 25 °C and the lowest temperature was observed (−10 °C) during first half of January. When heavy snowfall is received in the upper region, this results in severe cold conditions. For about three months, following heavy snowfall in December, the sanctuary is snow-covered. KWLS is one of the largest protected areas with 97517.80 ha (25293.70 ha in 72224.10 ha in Rudraprayag district) in the Western Himalaya. The sanctuary lies in the upper catchment of the Alaknanda and Mandakini Rivers, which are major tributaries of Ganges. It is bordered by high mountain peaks, e.g. Kedarnath (6940 m), Mandani (6193 m) and Chaukhamba (7068 m) and harbors extensive alpine meadows, in particular Trijuginarayan, Kham, Mandani, Pandavshera, Manpai and

Bansinarayan in the north, and several dense broad leaved oak mixed forests stands in the south. The overall woodpecker abundance and species-richness are both greatly influenced by the abundance of large-sized trees.

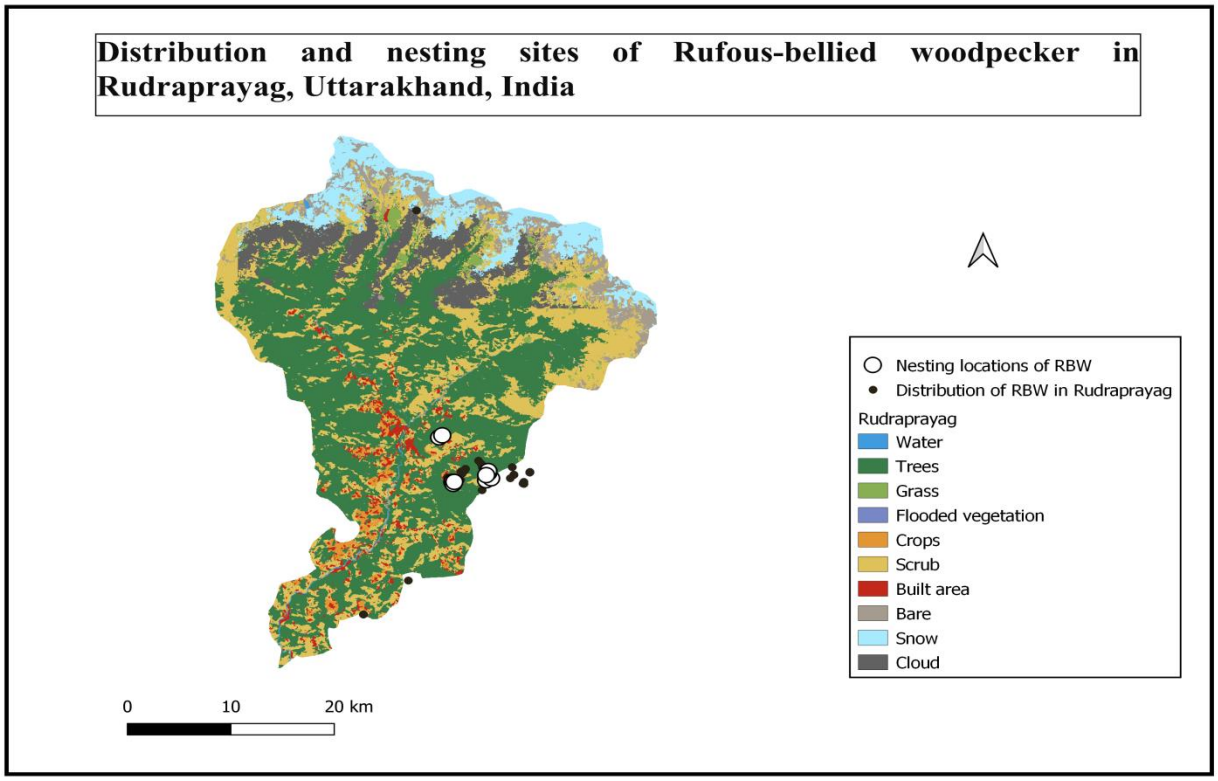


Map-1 Study area

Field data Collection

The study was conducted from February 2018 to July 2020. A preliminary field survey was conducted to mark the nests of Rufous-bellied woodpecker. At each site, the presence of Rufous-bellied woodpecker was confirmed by two observers by the point count method. It was observed that both males and females excavate many nests before the start of the breeding season and only a few are occupied by the pair for nesting purpose. The breeding season of the Rufous-bellied woodpecker starts from March mid and ends in July. Field observations were made from early morning (6:30 am to 11:30 am) till late evening (4:00 pm to 6:30 pm). We observed the activities of the breeding pair with the help of Nikon binoculars (10x50mm), Canon 70 D still image camera (100-400mm zoom lens) & LED camera (RC_51001715 7 mm 6 LED Endoscope Waterproof Inspection Borescope Camera) for the inspection of nest content, recording of drumming & calls were done by Marantz (model-PMD660) recorder and a Sennheiser microphone. We tried to mark trees with red-colored ribbons (Image-6). The number of tree cavities (occupied or unoccupied) was noted before the breeding season and the number of active nests that were occupied by the woodpeckers was also confirmed subsequently. The nest parameters (the entrance diameter, height from the ground, and depth of the nest cavity and nest

content), nest locations (Map-2) characteristics (tree species on which cavities were found), cavity status (occupied or unoccupied), and position of the nest from the ground, breeding parameters (clutch size, incubation period, nestling and fledging) and losses (eggs and nestlings) were recorded. The time span of the breeding season, egg-laying, incubation period, and numbers of hatchlings were also recorded. Tree cavities were measured using a collapsible ruler and a flashlight bulb, fixed with a flexible wire only after the nestlings fledged out from the nest. We have also pinpointed the locations of the nest and QGIS is used. The latest Land use and land change file is taken from ESRI 2020. Occurrence data of the studied species is taken from ebird.



Map-2 Distribution and nesting sites of RBW.

Recording of Acoustic signals/drumming- Different calls were recorded and analyzed using Avisoft SASLab Pro in the lab.

Statistical analysis:
The data of the breeding biology of Rufous-bellied woodpecker are presented in percentages and the data based upon the dimension of nest and eggs are presented in mean ± SD.

Occurrence data: We have taken occurrence data from ebird starting from the year January 2017 to December 2020 (Map-2).

Results:
Twenty cavities were excavated by the RBW during the study period on different tree species like Buransh (Rhododendron arboreum), Utis (*Alnus nepalensis*), Kharsu (*Quercus*

semecarpifolia), Akhrot (*Juglans regia*), and Moru (*Quercus floribunda*) (table 1). Most preferred tree species for nest building were Rhododendron arboretum (N=5) and *Juglan regia* (N=3). All the tree species selected for nest building were close to the small patch of grassland. All the nest sites were found between 1700-2579 m (ASL). Height of the nest varied between 7 and 28 feet above ground. Nests frequently located by inspecting all approachable snags. Nest cavities are completed in 4 to 6 weeks, and chips will be more abundant as excavation proceeds. The average nest height was 19.08±6.08 feet. The depth of tree cavities ranged between 22 and 45 cm with an average of 29.5±6.67 cm. The entrance diameter of the nests was between 7.0 and 7.2 cm with a mean of 7.09±0.07 cm. Nests were excavated in all the directions, but 50 % of the nests (N=6) were either east or South-East facing.

Out of twenty cavities excavated, only 12 cavities were used for the nest building by the RBW. The RBW excavated 8, 7 and 5 tree cavities during 2018, 2019 and 2020 respectively. Out of twelve nest built, 11 nests were successful to raise the young, while one pair built the nest but abandoned before egg laying due to the conflict/fight with Himalayan woodpecker. We also tried to pin point the locations in a map (Map-2). The mapping was done in QGIS and land use file is taken from ESRI and is of year 2020.

Drumming and acoustic signals: Different parameter of the calls/drumming were analyzed in this study the phrase length of the call in sec spacing of beats within a single drum (interval between beats) .The phrase length ranged between 0.1 sec and 22.4 sec, average length of pause between two drumming was 0.3 sec . The minimum and maximum frequencies of drumming sound were 3.6± 4.1 kHz (Fig 1). Two calls were alarm calls with phrase lengths of 0-10.2 sec and 1.4-15.7 sec, average pause length between the alarms calls was 1.18sec and 0.25sec. The minimum and maximum frequencies of alarm calls sound were 3.4±4.2kHz, 5.0 ±5.6kHz respectively with an average of 4.2 ± 4.9 kHz. The normal calls delivered by RBW male with an average of minimum and maximum frequency of 3.1 ± 3.9 kHz with maximum phrase length of 0-35.5 sec long having average gap of 1.8sec. RBW produced drumming sound probably to attract mate and repel the enemies. An individual can drum and tap at different speed depending upon the situation, generally drumming is seen at very high speed when female is around.

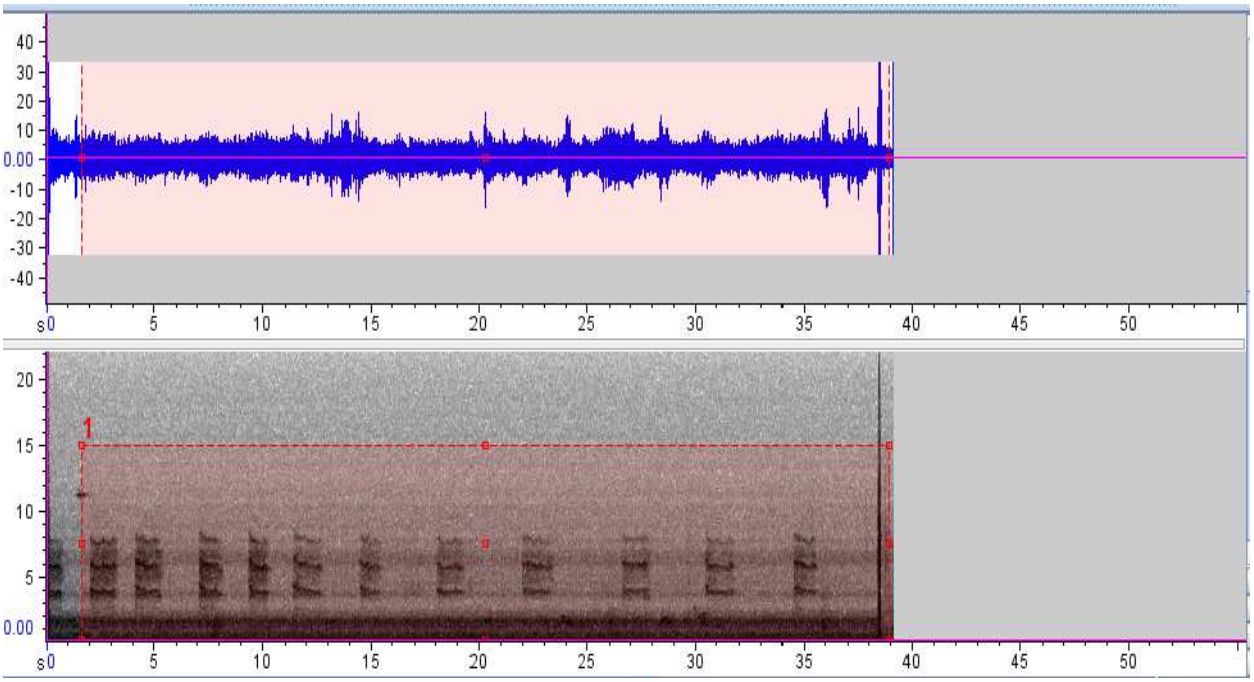


Fig 1 Spectrogram of **Rufous-Bellied Woodpecker** showing strokes of drumming roll

Table 1: List of tree species used for the nest building by RBW.

S. No.	Tree species	Nesting site (ASL) in meters	Nest cavity orientation	Height of the nest above ground (ft.)	Depth of cavity (cm)	Entrance diameter (cm)
1.	Juglan regia	1800	NW	20	23	7.1
2.	Juglan regia	2200	SE	25	28	7.1
3.	Rhododendron arboreum	2100	NW	15	30	7.2
4.	Quercus semecarpifolia	1700	W	20	30	7.1
5.	Rhododendron arboreum	1800	E	22	40	7.0
6.	Alnus nepalensis	2300	SW	24	45	7.2
7.	Rhododendron arboreum	2470	W	28	25	7.1
8.	Rhododendron arboreum	2500	SW	8	29	7.1
9.	Quercus floribunda	2320	E	13	28	7.0
10.	Lyonia ovalifolia	1906	SE	16	26	7.1
11.	Rhododendron arboreum	2560	E	25	28	7.1
12.	Juglan regia	2589	SE	13	22	7.0

	Mean ± SD			19.08±6.08	29.5±6.67	7.09±0.07

Provisioning of young:

Cavity Orientation: The examination of nesting cavity orientations shows that the local climatic conditions probably play a more important role in the position of the nest. The studied species usually prefer the direction where sunlight is direct on the nest. In most of the cases, bit tilted trees were preferred. The systematic use of a new cavity each year is seen throughout the study period. The preference of the tree is that is devoid of parasites as the young will stay in an enclosed space for around four weeks. The nest cavities where rainfall was too often, the pair used trees which have growth of *Trametes versicolor* (Image-5) which provided shade to the cavity opening so that water does not get inside the nest and also it helps to hide the nest. This mushroom species has a waxy surface like other mushrooms and is quite common in the trees of the study area.

Hatching success: The RBW laid a total of 31 eggs in all the nests observed during the study period. The mean clutch size of the 11 successful nests was 2.72±0.42 eggs (n=11) and ranged between 2-3 eggs (Image-7). Out of the total 31 eggs laid 24 eggs were hatched. The hatching success during the study period was 77.42%.

Fledgling Success: Out of a total of 24 eggs hatched only 21 were fledged successfully. The fledgling success was calculated 87.5% (Image-8)

Breeding success: Out of a total of 30 eggs laid only 21 young were fledged successfully from the nest resulting in 70% breeding success. Success or failure was based on the following criteria: A nest was considered as successful if young were observed fledged out from the nest or found within its surrounding area. The depth of the nest plays a major role in preventing the nest from predation. Predation rate was found higher in the nest with low depth. Most of the breeding losses were due to conflict with Himalayan woodpecker and common myna. The most common predators observed were common myna. Common myna was putting her head inside the nest to pull the chick out of the nest. The present study revealed that the RBW has higher breeding success and a low predation rate as compared to other cavity-nesting birds (Personal observation).

Table 2- Showing mean and Standard deviation of different parameters of breeding

S.No	Nesting tree	Clutch size	Incubatio period	Eggs hatched	Provisioning period	No. of youngs

						fledged
1	Juglan regia	3	17	2	25	2
2	Juglan regia	2	16	2	24	2
3	Rhododendron arboreum	3	17	2	25	1
4	Quercus semecarpifolia	3	15	3	26	2
5	Rhododendron arboreum	2	17	1	25	1
6	Alnus nepalensis	3	17	3	28	3
7	Rhododendron arboreum	3	17	2	26	2
8	Rhododendron arboreum	3	18	3	26	2
9	Quercus floribunda	3	17	2	27	2
10	Lyonia ovalifolia	3	16	2	24	2
11	Rhododendron arboreum	3	17	2	28	2
Mean		2.82	16.73	2.18	25.82	1.91
SD		0.40	0.79	0. 60	1.40	0. 54

Discussion

Cavity nesting species comprise a major component of many forest communities. About 10% of all birds and many other vertebrates use cavities in trees for nesting or roosting and these species use either cavities that are excavated or holes formed by the natural decay process (Cockle et al. 2011). Cavity nesting species in forest ecosystems constitute a structured wildlife community that interacts through the creation of, and competition for, nest sites. Cavity-nesting species in forest ecosystems constitute a structured wildlife community that interacts through the creation of and competition for nest sites. In order to conserve the population of cavity-nesting birds, particularly keystone species such as woodpeckers, proper information about their breeding is required. Our study suggested that twenty cavities were excavated by the RBW during the study period on different tree species and the most preferred tree species is *Rhododendron arboreum*. In this respect, we estimated a very low predation rate or just one predation with Himalayan woodpecker because of the same habitat they share and same tree preference for nest making. Cavity-nesting birds are known for their relatively high probability of nesting success (Martin and Li 1992). Different calls were recorded during the study, which includes drumming also called rapping, tatting, and tattooing, drumming may be species-specific (Lawrence 1967). Nesting locations of the woodpecker were located by listening to drumming and vocalization of the birds. Drumming is a loud, rhythmic series of sounds produced when a woodpecker hammers its bill in split-second repetitions against a resonating object. Drumming is never produced when the substrate is being altered for feeding or nest building and is thus defined as a signal or display behavior (Lawrence 1967). Locations of nest trees were pinpointed (Map-2) by observing the movements of the woodpecker. The heights of the cavities follow an increasing gradient from 8ft to 28ft. Several hypotheses for the function of drumming have been proposed; the best supported include territory announcement and maintenance, mate attraction, pair bond maintenance, and individual localization (Short 1982, Wilkins and Ritchison 1999). Systematic use of a new cavity every year is found. The need of the site devoid of parasites as the young will stay in an enclosed space for around four weeks. This hypothesis, proposed by Short (1979), also emphasizes the advantage of excavating entrance holes with a diameter as close as possible to the size of the bird, to reduce the risk of parasitism. Rufous-bellied woodpecker's acoustic signals reached a peak in mid-Feb to mid-March, which is also the breeding season of this species. Cavity-nesting birds are known for their relatively high probability of nesting success (Martin and Li 1992). A nestling period of about four weeks (26-28) is observed. Nestlings are fed frequently throughout the day. Food items are primarily beetles, moths, caterpillars, millipedes, and unidentified larvae. The rate of feeding although the sample size of nests monitored is quite less to conduct a comprehensive analysis, these data provide general demographic information and can inform future RBW's research.

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Image-1

Image-2

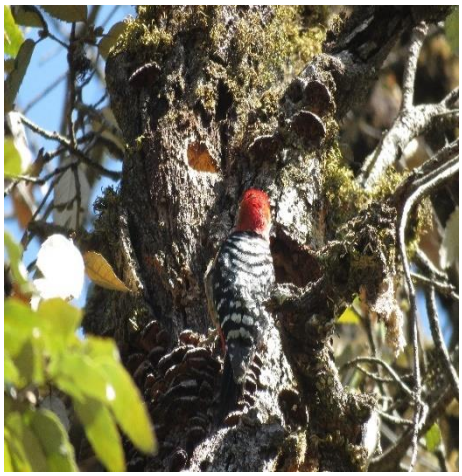

Image-3

Image-4

Image-5

Image-6

Image-7

Image-8