BIRDS OF LADAKH: STATUS, THREATS AND CONSERVATION

A Dissertation for the Partial Fulfilment of Master Degree In
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(MEVP-011)

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DECLARATION

I declare that the work in this dissertation titled "**Birds of Ladakh: Status, Threats & Conservation**" submitted to Indira Gandhi National Open University (IGNOU) New Delhi. The information derived from literature has been acknowledged in the text and a list of references is provided.

This project is not submitted to any other university or institution for the award of any degree or diploma.

Place: PADMA GYALPO
Date:

ACKNOWLEDGEMENT

*I extend my heartfelt gratitude to my supervisor **Dr. Tsewang Namgail, Director, Snow Leopard Conservancy - India Trust** who guided me in every way possible to complete my dissertation. His scientific approach to research methods have been invaluable for the project work.*

Thanks also to my fellow birder friends who at a moment's notice were ready to explore the remotest corners of Ladakh to document birdlife. Their dedication and positive approach towards conservation of the fragile ecosystem of Ladakh has led me to take up conservation and educational outreach programs among the youth of Ladakh.

My sincere thanks also goes to the members of Wildlife Conservation and Birds Club of Ladakh, of which I'm also a proud member, for helping me with prior information about undocumented birdlife of Ladakh.

Lastly, I would like to acknowledge the unconditional support of my parents, who do not have any idea when I would leave the comfort of home and travel to the farthest corners of Ladakh to get a glimpse of a rare bird. As for them, I believe they have now got used to it.

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ABSTRACT

Ladakh, a high-altitude Union Territory state of India, boasts a rich avian diversity that has garnered attention from researchers and conservationists alike. This abstract delves into the current status of birds in Ladakh, highlighting both their ecological significance and the challenges they face.

The avifauna of Ladakh is characterised by its unique adaptation to extreme environments, with species such as the White-browed Tit Warbler *Leptopoecile sophiae*, Black-necked Crane *Grus nigricollis*, and Tibetan Snowcock *Tetraogallus tibetanus* thriving in harsh mountainous terrain. However, this biodiversity is increasingly threatened by human-induced pressures, including habitat loss due to infrastructure development, climate change impacts altering traditional habitats, and disturbances from tourism.

Conservation efforts in Ladakh have focused on several fronts. These include habitat restoration initiatives, community-based conservation programs involving local communities in bird monitoring and protection, and raising awareness among stakeholders about the importance of preserving bird habitats. The integration of traditional ecological knowledge with modern conservation strategies has proven instrumental in developing sustainable solutions.

Despite these efforts, challenges persist, necessitating continued research, collaboration among stakeholders, and innovative conservation approaches. This abstract underscores the urgency of safeguarding Ladakh's avian biodiversity and emphasises the importance of a holistic approach that balances conservation with sustainable development goals

INTRODUCTION

Ladakh, often referred to as "The Land of High Passes," is a region located in the northernmost part of India, primarily in the union territory of Ladakh. Nestled amidst the vast Himalayan and Karakoram mountain ranges

Geographically, Ladakh is located in the Trans- Himalayan Region and is bordered by the Karakoram mountain ranges to the north, the Zankar mountain ranges to the south and western most extension of the Tibetan Plateau to the east. The Ladakh mountains make up approximately 60% of the Trans Himalayan zone which envelops the Kargil valley, Zanskar valley, Leh, Nubra valley and Lahaul Spiti areas. These areas are characterised by dry slopes, rugged mountains and valleys with an altitudinal variation from about 2,500 metres (8,200 feet) in Nubra Valley to over 7,000m (23,000 feet) above sea level in the Karakoram Range. The remaining 40 % of the region is occupied by the Western most extension of the Tibetan Plateau. This includes the Aksai Chin area, Changthang plains, parts of Northern Sikkim and Spiti. These landscapes are characterised by High Altitude lakes, Marshes and bogs, Hotsprings, Dry alpine pastures and vast dry plains.The altitude of such landscapes are well over 4000m above sea level.

Since it is located on the border between the Palaearctic & the Indo Malayan Zoogeographic Zone, it bears characteristic avifauna of both the regions (Pfister 2004). The high-altitude desert terrain of Ladakh is home to a myriad of bird species, each adapted to the demanding conditions of this cold desert plateau. From soaring raptors to small passerines, Ladakh's avifauna represents a fascinating mixture of resident and migratory birds. Ladakh serves as a critical breeding ground for several globally endangered bird species, making it an essential area for avian conservation efforts. The intricate web of ecosystems, including high-altitude lakes, river valleys, and alpine meadows, provides a rich tapestry for a variety of birdlife to thrive.

It encompasses of high passes, steep slopes, deep valleys with small drainage system that forms a good many of marshes and lakes which provides an area for searching of food resources and breeding habitat for many resident and migratory faunal species like Black Neck Crane *Grus nigricollis*, Bar Headed Goose *Anser indicus*, Greylag Goose *Anser anser*, Great Crested Grebe *Podiceps cristatus* (Islam & Rehmani, 2004).

The regions on the north flank of the Himalayas — Dras, the Suru valley and Zangskar — experience heavy snowfall and remain virtually cut off from the rest of the country for several

months in the year. Summers are short, though they are long enough to grow crops in the lower reaches of the Suru valley. The summer weather is dry and pleasant. Temperature ranges are from -3 to 30 °C in summer and from -20 to 15 °C in winter. There is little moisture to temper the effects of rarefied air. Ladakh is a high altitude desert as the Himalayas create a rain shadow, denying entry to monsoon clouds. The main source of water is the winter snowfall on the mountains. Vegetation is sparse in Ladakh except along streambeds and wetlands, on high slopes, and in irrigated places (Bhat et al, 2010). The monsoon laden clouds settle most of the moisture in the clouds on the windward slopes and as time passes they traverse over Ladakh, the clouds lose moisture and hence the precipitation is very less.

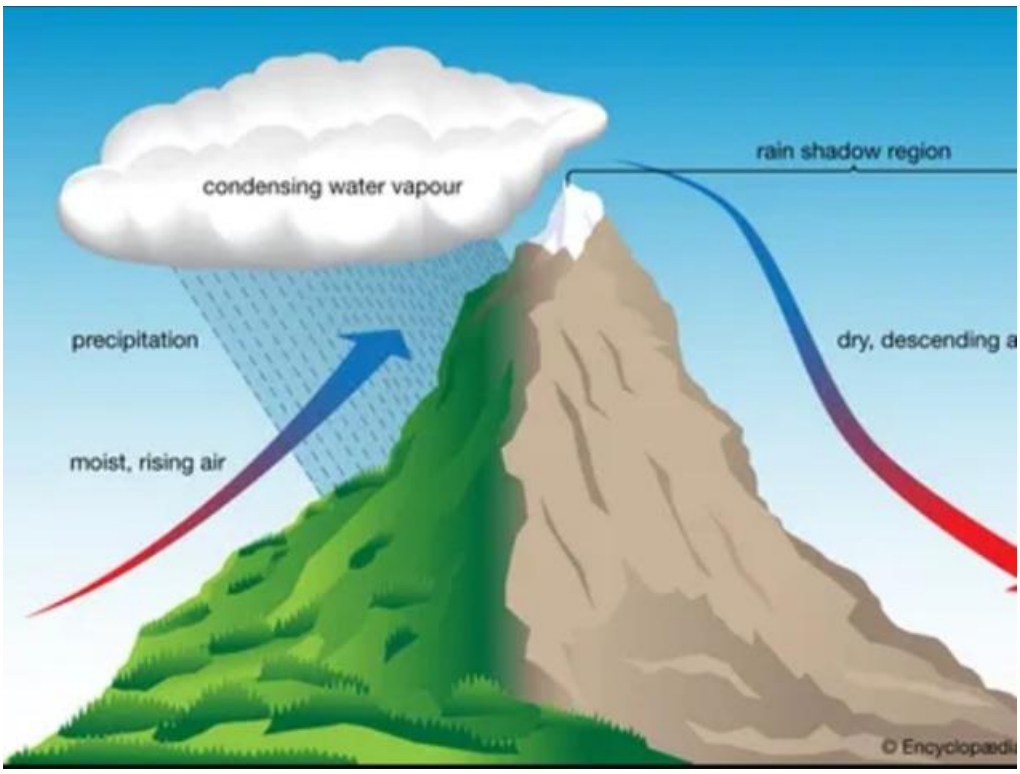


Figure 1.1 Windward and Leeward Side Source- Wikipedia

Birds, members of the class Aves, are a diverse group of warm-blooded vertebrates characterised by feathers, beaks, laying hard-shelled eggs, and having a high metabolic rate. Today there are slightly more than 10,000 species of living birds, according to the most commonly accepted classifications of worldwide avian diversity. Feathers are the most distinctive feature of birds and are unique to this class of animals. They provide insulation, enable flight, and often play a role in mating displays and camouflage. Instead of teeth, birds have beaks or bills, which are adapted to

their specific diets and feeding behaviours and breathe via a system of one-way air-flow, which permits more efficient capture of oxygen than the in-and-out breathing pattern of mammals. Birds are endothermic, meaning they regulate their body temperature internally, maintaining it at a relatively constant level even when external temperatures fluctuate. They have a lightweight skeleton with hollow bones, which aids in flight and are highly adapted to withstand the stresses of flight while keeping the overall body weight low.

Birds exhibit a remarkable diversity in size, shape, coloration, behaviour, and ecological niche. They inhabit virtually every terrestrial habitat, from polar regions to deserts, forests, grasslands, and urban environment. Many bird species undertake seasonal migrations, travelling thousands of kilometres between breeding and non-breeding grounds to take advantage of seasonal food resources and favourable breeding conditions. They play an essential role in ecosystems as predators, prey, pollinators, seed dispersers, and scavengers, Hence contributing in maintaining ecological balance and are indicators of environmental health.

India is one of the richest countries in the world in terms of biodiversity. It holds four of the biodiversity hotspots out of 36 biodiversity hotspots worldwide i.e. the Himalayas, the Western Ghats, the Indo Burma and the Sunderland, contributing 8.1 percent of the total global biodiversity. Among the 10,000 bird species known to science, India has recorded around 1371 and Ladakh has recorded 433 bird species (eBird,2024). Their beauty, behaviour, and ecological significance make them a subject of fascination and study for scientists and bird enthusiasts alike.

Studies on the birds of Ladakh started way back in the second half of the nineteenth century when the Tibetan Plateau was open to the outsiders. Many workers such as Hume (1873), Richmond (1895), Ward (1906, 1908), Ludlow (1920, 1950), Wathen (1923), Whistler (1935, 1936), Osmaston (1925, 1926, 1927 a & b, and 1930); Meinertzhagen (1927), LaPearson (1928 a & b), Sillem (1935), Koelz (1939), Biswas (1950), Vaurie (1972), Gole (1978, 1992), Williams and Delaney (1985, 1986), Delaney et al. (1982), Holmes et al. (1983), Holmes (1986), Naryan et a1. (1986), lamdar (1987), Mallon (1987), Akhtar (1990), Fily and Perennou (1990), Pfister (1997, 1998, 1999 and 2004), Singh and laypal (2001), Sangha et a1. (2003), Sanga and Naoroji (2005), Namgail (2005), etc. have explored the region for its avifauna (Tak et al. 2008).

Birds are observed on a daily basis by Birders all over the globe and most of them upload their sightings in the form of audio-visual documentation on citizen science platforms such as eBird website/App, iNaturalists etc. Such data helps scientists/researchers in studying bird behaviour, migration, habitat change as well as climate change. Birdwatchers and Naturalists in Leh Ladakh also upload their sightings on the citizen science platforms.

The bird species found in Ladakh can be broadly categorised into two main groups: resident birds and migratory birds. To ensure an organised and precise study of each species, additional subdivisions have been created within these categories. These subdivisions aim to streamline the analysis and examination of every avian species, making the study more accessible and comprehensive. By implementing these divisions, a more systematic approach can be taken towards the analysis and understanding of the diverse bird population in Ladakh (Gyalpo. P., & Giri. L. 2023).

1. **Resident** - These are those species which are recorded throughout the year and mostly breed in that same area.

a. **Altitudinal migrant**- These are also resident birds but they move across altitudinal gradients seasonally. During the spring season (March-April) some species move towards high altitude to breed and raise their young, while in the Autumn season (October-November) they come down to valley bottoms near Indus River to spend the Winter season. For example - White-winged Redstart *Phoenicurus erythrogastrus,* White-browed Tit-Warbler *Leptopoecile sophie* and Eurasian Wren *Troglodytes troglodytes.*

2. Migratory - Migratory birds can be described as those which take both long and short migrations annually. Migratory species are further classified as Passage migrants, Summer Visitors, Winter Visitors and Stragglers or Vagrants.

a. **Passage Migrant** – They are found only for a brief period of time as they use suitable habitats within ladakh as a stopover site during their migration period. They do so to forage and refuel their bodies to carry the migration further until they reach their destination. Some birds regularly use stopover sites to refuel whilst some species undergo non-stop migration to reach their destination. For example - Northern Wheatear *Oenanthe oenanthe* Black-tailed Godwit *Limosa limosa* and Greylag Goose *Anser anser.*

b. **Summer Visitors** -Those migratory species that are recorded in the region during summer months usually from April - September as they breed and raise their young ones within Ladakh. The foremost example of this category is the State Bird of Ladakh, the Black-necked Crane *Grus nigricollis.* Many species visit ladakh in summers to breed as the climatic condition becomes favourable to raise their young ones. The average summer temperature ranges between 15℃ to 30℃ across Kargil and Leh districts. Other examples are Mountain Chiffchaff *Phylloscopus*

sindianus, Eurasian Hobby *Falco subbuteo* and Bar-headed Goose *Anser indicus* which is also the highest flying bird in the world.

c. **Winter Visitors** - Such species visit ladakh during the cold and harsh winter season where the average temperature is mostly sub zero and in some places it can even drop down to -35℃. Despite such unbearable weather conditions some species spend their winter season in the region. For example - Black-throated Thrush *Turdus atrogularis,* Common Buzzard *Buteo buteo* and Eurasian Goshawk *Accipiter gentilis.*

d. Vagrant/Straggler – Any Species that is recorded irregularly in the region without past consecutive spotting. Unfavourable weather conditions such as strong wings, unexpected precipitation leads the birds astray from their usual migratory routes and are observed in unexpected places. For example - Fieldfare *Turdus pilaris,* Rough-legged Buzzard *Buteo lagopus* and Daurian Starling *Agropsar sturninus.* Nearly everyone on earth has seen and wondered about a bird, and this familiarity helps give birds their special inspirational power-birds capture our imagination and curiosity by simply being in our presence. Researchers over the years have harnessed this same accessibility of birds to answer questions in the laboratory and in the field with relative ease, especially compared with the challenges of studying most other animals. Dozens of principles in evolution, ecology, biogeography, behaviour, neurobiology, life history theory, natural resource management, and conservation biology have been-and continue to be-discovered and refined through studies of birds (Lovette,I.J & Fitzpatrick,J.W., 2016). Almost all the bird species that are recorded in Ladakh are those which use the Central-Asian Flyway migratory route to travel to and fro from the breeding grounds and to their non-breeding grounds.

The Central Asian Flyway covers a vast area, encompassing about 15 countries between the Arctic Ocean and the Indian Ocean. After leaving Siberia, the migratory birds in this flyway first cross the Altai Mountains, then the Gobi and Taklamakan Deserts and then the Tian Shan (Mountains). If migrating birds were to decide to circumvent these mountains that rise up to 6000m, then they could not benefit from the lush meadows and deciduous forests before they have to cross the Taklamakan Desert. After flying over this desert, they have to cross the Tibetan Plateau, after which loom the high Himalayas, straddling almost across the breadth of the flyway. The Himalayas stretch more than 2400 km between Namche Barwa in the east and Nanga Parbat in the west. The width of the Himalayas ranges from about 400 km in the west to about 150 km in the east. This young mountain range is bounded to the north by the vast Tibetan Plateau and to the south by the plains of rivers Indus, Ganges, Brahmaputra and Irrawaddy, but between these southern plains and the

Greater Himalaya and the Lesser Himalaya there is still another mountain range to be passed by the birds migrating south, namely the Siwalik Range, which runs for the entire length of the western and central Himalayas. Further to the west, the Himalayas merge into the Zanskar Range, the Ladakh Range, the Pir Panjal, the Karakoram, the Hindu Kush and the Pamirs. These far western mountain ranges include many peaks that are higher than 7000m and even 8000m. (Prins, H. T & Namgail,T. 2017). Most of the breeding birds of Ladakh are Palearctic or breed at high elevations in the mountains. There is a small proportion of Oriental species, and no bird is endemic to this region (Namgail. T., & Tov. Y. Y., 2009).

Objectives - To document the Avian Diversity of Ladakh.

- To make a complete checklist of Birds of Ladakh.
- To apply IUCN Red List criteria for the birds documented in Ladakh.
- To access the threat analysis of the birds of ladakh.

LITERATURE REVIEW

Holmes, R. P. (1986) Presents a compilation of Birds of Suru Valley in Kargil District. The breeding birds in the Suru River valley region were quite similar to the breeding birds in the upper Indus Valley. Migratory routes of Yellow-browed Warbler *Phylloscopus inornatus* are also discussed.

Mallon (1987) did research on the Avifauna of Indus River Valley and Zanskar River Valley and their tributaries in the winters from 1980-1984. He describes 84 species during the winters from December-February.

Pfister (2001) recorded birds in Ladakh from 1994-1997 in which he encountered a total species of 165 which accounts for 50% of the total known species. During the survey, he discovered eight new species following Pallid Scops Owl, Dunlin, Parasitic Jaeger, Greater Spotted Eagle, Cattle Egret, Black Drongo, Rusty Tailed Flycatcher and Dark sided Flycatcher.

Namgail (2005) Conducted a survey through Gya Miru wildlife Sanctuary particularly on the winter birds as winter birds receive less attention than summer visitors and migratory birds. He found out 30 bird species and also found out that the area has relatively higher diversity as the area is a transition zone between central Ladakh and Tibetan plateau.

Khan et al., (2008) in a study on Diurnal time budget of breeding Black –Necked Crane (Grus *nigricollis*) in Changthang, Ladakh, India, (2008) found out that feeding was most common accounting for 48.5 +- 1.3% (mean +- SE) of the crane's diurnal time budget and cranes spent maximum time in meadows as compared to other habitats.

Namgail, T., & Yom, T. Y., (2009). Studied the effects of body mass, status (resident or migratory) and diet on the breeding elevation range and timing of reproduction of the birds in the Trans-Himalayan region of Ladakh, northwestern India. They found most of the breeding birds of Ladakh are Palearctic or breed at high elevations in the mountains. There is a small proportion of Oriental species, and no bird was found endemic to the region.

Svensson, L., Grant, P. J., Mullarney, K. (2008). Their 2nd ed bird guide book focuses on the birds of Britain and Europe. Colour plates and illustrations are top notched and represent complex plumages of few birds which are tough to identify in the field.

Tak et al., (2009) conducted a survey on Birds of Ladakh and Analysis Of their status which confirmed the presence of total 310 Avifaunal species belonging to 150 genera, 6 subfamilies, 50 families and 16 Orders. Out of these 29 species have not been seen after 1960. Of the 310 species, 153 are non-passerines and the remaining 157 are passerines.

Bhat et al., (2010) studied the Avian Diversity of Ladakh Wetlands in which they checklisted 50 species of Aves birds found in the region between Hanley and Merak. They focused on the need for protection of threatened species of flora and fauna specially the Avifauna of Ladakh, focusing more on Black Necked Crane which is endemic to Ladakh and higher Himalayas.

Kareiva, P. M and M. Marvier., (2011). The authors focus in this textbook is first and foremost on protecting nature and especially Earth's biota. It also contains a heavy emphasis on highlighting strategies to better connect the practice of conservation with the needs and priorities of a growing human population.

Naoroji, R., & Sangha, H. S., (2011). They did a survey in Hanle, they recorded 122 species of birds and documented breeding of Upland Buzzard *Buteo hemilasius.* During the survey they noticed the landscape of Hanle changing fast resulting in habitat loss for the breeding birds in the Hanle marshes.

Muzika, Y., (2014) Visited western Qinghai, China, in 2012 and subsequently in 2013 to photograph birds which were identified as Sillem's Mountain Finch *Leucosticte sillemi* (Kazmierczak & Muzika 2012).He also surveyed similar areas near the Kunlun pass in search of the bird. He was the first to photograph Sillem's Mountain Finch in the wild and in Tibet. He suggests birders in Ladakh to explore similar habitats.

Delany et al., (2014) Recorded several rare bird species which were new to India. Their Bird trapping and ringing program at Thiksey Village yielded new insight into the migration pattern of birds in Ladakh. They were among the first researchers to explore the avi-fauna of birds in the winter season as well.

Pfister, O., (2014) In his book provides a complete inventory of all bird and mammal species in the Ladakh region. It describes and illustrates the numerous species of birds and mammals, including their local names, alternative names, habitat, behaviour, status, and distribution. A total of 305 bird species have been reported from the Ladakh region, of which 34 species have not been sighted after 1960.

Grimmett, R., Inskipp, C., Inskipp, T. (2016). This field guide comprises the birds found in India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan and the Maldives totalling at 1375 species. This field guide is one of the most reliable and trusted manuscript for identification of birds in the Indian Subcontinent.

Lovette,I.J & Fitzpatrick,J.W., (2016). Explains the various reasons to study birds and their ecology in detail and captivates the readers to dwelve deep into the wonderful birds of the world.

Fitzpatrick W. J., & Rodewald. D. A., (2016). They have comprehensively explained the need for Conservation efforts across the globe to preserve the habitats for survival of birds. From extinct birds to near extinct birds, steps necessary to protect them for future generation are also discussed.

The Cornell Lab of Ornithology *Handbook of Bird Biology*. (2016) Is from the renowned Cornell Lab of Ornithology and authored by a team of experts from around the world, the Handbook covers all aspects of avian diversity, behaviour, ecology, evolution, physiology, and conservation. Using examples drawn from birds found in every corner of the globe, it explores and distils the many scientific discoveries that have made birds one of our best known and best loved parts of our Natural ecosystem.

Prins, H.T., and Namgail, T., (2017) were the first to present information on the bird's exact migratory paths. Capitalising on knowledge generated through satellite telemetry, the authors describe the migratory routes of a multitude of birds flying over or skirting the Himalayas. The authors also show the different strategies used by birds to cope with physiological and climatic challenges during their migratory journey.

Freeman, B. G., Scholer, M. N., Ruiz-Gutierrez, V., et al. (2018). Suggests that Global warming is causing species to move to higher elevations as temperatures warm, and species that live only near mountaintops may run out of room. They also show High-elevation species shrink in range size and decline in abundance.

Shirihai, H., Svensson, L. (2018). Their comprehensive 2 volume book on birds of Western Palearctic is by far the best book on identification of birds in the region. Each and every bird mentioned is discussed in-depth about their plumage, call, distribution, field identification, similar species, moult pattern etc.

Samplonius, J. M., & Both, C. (2019). Reports on two mechanisms through which climate change may affect fatal interactions between two sympatric passerines, the resident great tit Parus major and the migratory pied flycatcher Ficedula hypoleuca, competing for nest sites.

Madge, S. (2020). Describes the Field identification, systematic history, subspecies, habitat, distribution, diet and foraging, sounds and vocal behaviour, breeding and Conservation status of Long-billed Bush Warbler *Locustella major.*

Abhinav *et al.,* (2021) in their findings on Status of Nauman's Thrush in India and its hybrids with dusky thrush found out that most of the Naumann'sThrush, hybrids were recorded above 1,500m asl. However, the records from Dehradun, west Bengal and Assam were all lower than 700m asl. All the records in India occurred between 60m and 3,300m. The record from UT Ladakh in 1982 was the first record of pure Naumann's Thrush.

S. Sharma., Wangmo, R., Rana, K. S., Visuddha, L., et al. 2021. Their maiden book reveals the updated checklists of Birds of Ladakh with a total of 378. The book was a collaborative venture to educate citizens of Ladakh about their biological wealth, and to promote conservation values.

Gyalpo, P., Stanba, A. T & Gasha, C. S., 2022. Photographed Hoemeyer's Great Grey Shrike *Lanius excubitor homeyeri* for the first time in Ladakh in 2020 on different locations within Central Ladakh. The subspecies *homeyeri* is also very rarely recorded throughout India.

Pandiyan, J., Poyamozhi, A., Mahboob, S., et al. (2022). Their studies showed that Waterbirds could be a good indicator of harmful metal levels in aquatic environments. Waterbirds' organs and tissues were tested for the presence of pollutants, such as metals. They found correlation between the metals of prey species and the tissues, kidneys, liver, and feathers of waterbirds.

Varagiya, D., Jethva, B., & Pandya, D. (2022). Studied 12 different waterbird species for heavy metal contamination. They found the highest concentration of lead was 4.56 ppm in Black-headed Gull (*Chroicocephalus ridibundus*) from Subhash Nagar similarly, Lesser Flamingo (*Phoeniconaias minor*), had the highest copper concentration (18.32 ppm).

Srinivasulu, C., (2022) Explains the scientific names of 1413 species of birds occurring or known to occur, in the Indian Subcontinent from Bangladesh, Bhutan, India, Maldives, Nepal and Sri Lanka.

Gyalpo. P., (2023). Describes the presence of Grasshopper Warbler and Booted Warbler from Eastern Ladakh and claims both the species to be a passage migrant. The author in his article also rejects the previous claim of Booted Warbler by another birder owing to misidentification.

Gyalpo et al., (2023) mentions the first occurrence of Pallas's Leaf Warbler *Phylloscopus proregulus* in the Indian Subcontinent. The authors also discuss in detail,similar species and features to eliminate the same. Their record was an addition to South Asian avifauna.

Gyalpo. P., & Giri. L. (2023) Describes the potential of wildlife tourism in Ladakh because of the prevalence of rare birds and mammals which could be found in Ladakh and also describes the status of birds in Ladakh with photographs.

SoIB (2023) Is a periodic assessment of the distribution range, trends in abundance, and conservation status for most of the bird species that regularly occur in India. It is a comprehensive, national-level assessment. This report points the way towards conservation of India's birds.

METHODS and METHODOLOGY

3.1 Study Area.

The Union Territory of Ladakh is located in the northernmost region of India, is a high-altitude desert area nestled within the Trans-Himalayan region. From a scientific research perspective, Ladakh offers a unique and challenging environment for studying various ecological processes, biodiversity, climate change impacts, and cultural adaptations. Ladakh is divided into two Districts namely Leh and Kargil. Leh is the capital of Ladakh with 45,110km² area and Kargil with 14,086 km². There are 2 Wildlife Sanctuaries and 1 National Park in Ladakh. The Changthang Wildlife Sanctuary is dominated by high altitude lakes such as Pangong Tso, Tso Moriri and Tso Kar Lake. Both Tso Moriri and Tso Kar lake are Ramsar sites given the diversity of wildlife it harbours. The Changthang Cold Desert Wildlife Sanctuary is spread across an area of approx 5,000 sq km and is the largest Wildlife Sanctuary in Ladakh while the Karakoram Wildlife Sanctuary is the smallest with 4,267 Sq Km. Hemis National Park in Ladakh is the largest national park in India, covering an area of 4,400 sq km. It harbours rare and elusive mammals such as the state animal of Ladakh- The Snow Leopard *Panthera uncia,* Tibetan Wolves *Canis lupus chanco,* Eurasian Lynx *Lynx lynx isabellinus,* Ladakh Urial *Ovis vignei* etc.

The study area was spread across a diverse habitat range present in Ladakh covering an Altitudinal range from lowest altitudinal village - Gurgurdho, Kargil at 2590 m asl till Khardungla at 5359m asl. Major Lakes such as Tsomoriri, Tsokar, Pangong lake, biodiversity rich ponds such as Shey Holy Fish Pond, Guphuks Pond were covered. Wetlands and Marshes such as Hanle Marshes, Tsokar Wetland Complex, Chuchot Marshes, Shey Marshes, Spituk Marshes, Puga marshes, Lal Pahari Marshes, Sato-kargyam Wetland Complex, Chushul Marshes, Nyoma marshes etc and Major Rivers such as Indus River, Suru river, Shyok river and glacier melt streams and rivulets. Alpine meadows, forested areas as well as cultivated areas.

3.2 Type of Habitats covered-

- Hanley Wetland Complex - Ragar marshes, Chukhil marshes, Jungdemo marshes, Buk-shado marshes.
- Tsokar Wetland Complex - Thukje marshes, Ponganua marshes, Tsokar Lake, Startsaphuk Freshwater Lake, Startsaphuk marshes, Tsokar Lake.

- Sato-Kargyam Wetland Complex - Chhibra Lake, Sato marshes, Barma marshes, Horong marshes, Chhibra marshes.

- Chushul Wetland Complex - Jamarding I & II marshes, Tso nyak marshes

- Marshes - Puga, Lal Pahri, Loma, Nyoma, Dungti, Shey, Chuchot, Spituk, Skara, Sindhu Ghat, Choglamsar, Shey manla, Damsna, Suru, Yaya Tso.

- Lakes & Ponds - Tsomoriri, Pangong, Yaya Tso, Shey Holy Fish Pond & Guphuks.

- Hot Springs - Chumathang & Puga

- Alpine Meadows - Wari-la base, Taglang-la base, Khardung-la base, Chang-la base, Polokongka la base, Shruray Lungpa, Hanu Gongma, Tharuk, Tangtse & Horong

- Pasture lands and RangeLands - Nuruchan, Puga, Polokongka, Igoo, Liktsey, Kungyam, Tukla, Himya, Khatpu, Tarchit, Tiri, Tsokar & Tuchik

- Rivers - Indus, Suru & Zanskar.

- Forests - Hemis Shukpachan Juniper & Sea Buckthorn *Hippophae rhamnoides* forested areas

- Plantations - Khaldo Bagh, Naga Bagh, Punguk Bagh, Manglay Forest Skara Bagh, Chushul Bagh, Nidder bagh, Nyoma bagh, Martselang Bagh & Chumathang bagh.

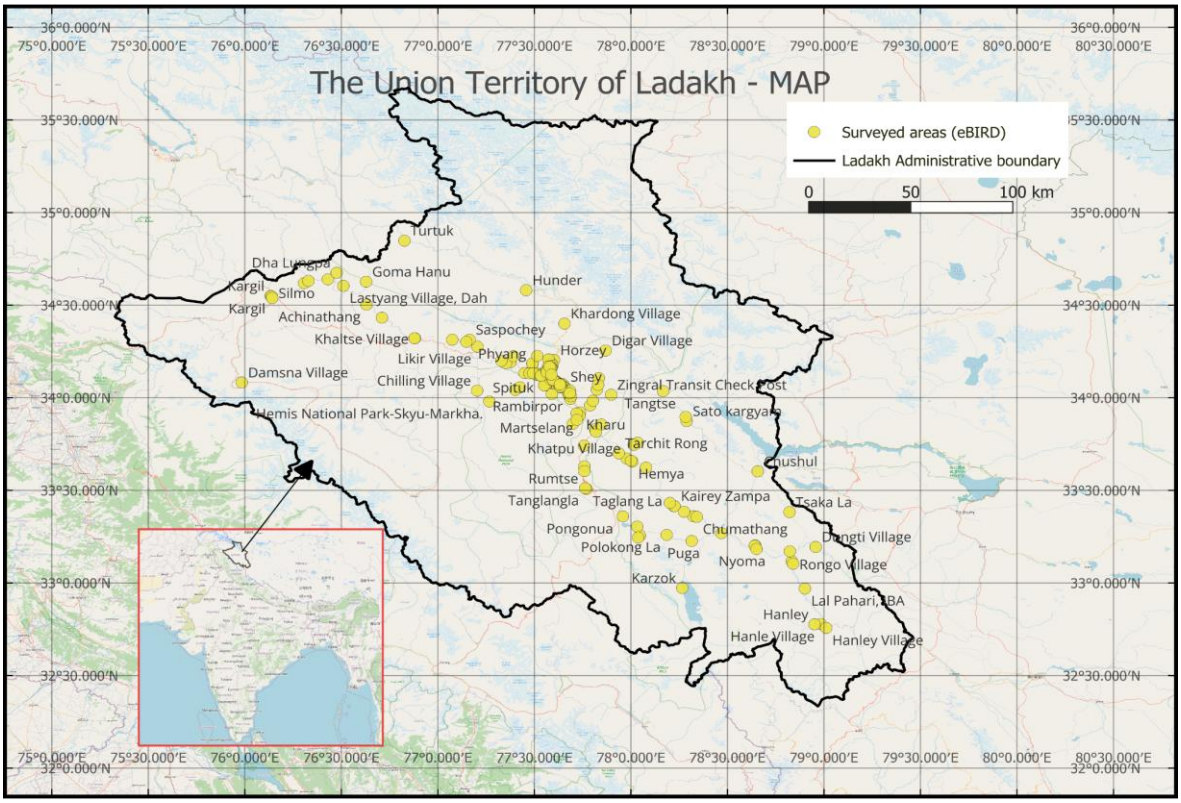


Figure 3.1 Study area map of Ladakh

The yellow dots in the Map represent the various locations across Ladakh where the author observed birds and uploaded at least one checklist in eBird website. Few villages near Line of Control (LoC) such as Gurgurdo, Dha Lungpa & Turtuk and few villages near Line of Actual Control (LAC) such as Chushul, Tsaka la and Dungti marshes.were also covered during the study period. This intensive survey across Ladakh was conducted from January 2022- April 2024 spanning for 848 days in total.

3.3 Observation Methods-

1. **Line Transect Method**- In this method, survey was carried along a predetermined route at a fixed pace and birds were observed and photographed by seeing them on either side of the route.
2. **Point Transect method**- With this method, birds were observed by standing at a particular vantage point for as long as an hour or more.
3. **Citizen Science Monitoring**- Citizen science monitoring involved the comprehensive usage of Cornell Lab of Ornithology websites such as eBird, Birds of the World (BOW), Merlin app to access the bird distribution, habitat preference of birds and time of occurrence in Ladakh. Birders and nature enthusiasts upload their sightings on this platform which is globally accessible for free to anyone. This approach greatly expands the spatial and temporal coverage of bird surveys and monitoring. Hence, this approach was the main method throughout the study period.

Checklists submitted in eBird have certain protocols/methods which are known as the core eBird Protocols. These are the basic types of checklists that apply to most birding activities.

(a) **Stationary**

- Your primary focus was birding
- You know the exact start and amount of time spent birding
- Your entire birding activity occurred at a single, fixed location
- You did not go more than approximately 100ft (30m) in any direction from the starting point of your checklist

(b) **Travelling**

- Your primary focus was birding
- You know the exact start and amount of time spent birding

- You went more than 100ft (30m) away from the starting point of your checklist
- You know the specific distance you travelled, or have estimated it to the best of your ability.

(c) **Incidental**

- Your primary focus was NOT birding
- You observed the bird unintentionally. A sudden spotting of bird while not primarily birding can be considered as Incidental Checklist.

(d) **Historical**

- Your primary focus was birding
- You know the date you went birding, but not the exact start time, duration, or distance travelled (or you know some of these, but not all three).

3.4 Diversity Analysis:

Diversity analysis in ecology refers to the study of the variety and distribution of species within a given ecosystem or community. It involves quantifying and interpreting patterns of species richness, evenness, and diversity to understand the structure and functioning of ecological systems.

Species Richness: Species richness refers to the total number of different species present in a defined area or sample. It provides a basic measure of biodiversity and can be determined through field surveys or data collection.

Species Evenness: Species evenness measures how evenly individuals are distributed among the different species in a community. A community with high evenness has a more equitable distribution of individuals among species, while a community with low evenness may be dominated by a few species.

Shannon's Diversity Index- This index estimates the diversity of species within a community.

$H = - \sum (p_i * \log p_i)$

Where $\sum$: Means sum

H: Shannon Diversity Index

P_i : The proportion of the entire community made up of species

n = No. of individuals in a given species

N = The total number of individuals in a community

The higher the value of H, the higher the diversity of species in a particular community. The lower the value of H, the lower the diversity, a value of H=0 shows a community has only one species.

Simpson's Index- It determines the biodiversity of a species depending upon the relative species abundance along with the total individual families present.

$$= \frac{\sum_i n_i (ni - 1)}{N(N-1)}$$

Where: $n_{i:}$ The number of organisms that belongs to species i

N: The total number of organisms

$\sum$: Sum

3.4 Materials and other aids used during the study period are as follows-

Camera - For documentation of the avi-fauna, mirrorless camera and super telephoto lens were used. Mirrorless camera Canon R7 and DSLR camera Canon 700D with Sigma 150-600mm F/5-6.3 DG OS HSM lens, Canon 18-55 mm and Canon 70-250mm lens were used. The zoom reach of the sigma 150-600mm significantly increased from 240-960mm when combined with an APS-C format camera, Thus increasing the reach and making the subject look a lot closer to the observer. This zoom range also helped study the bird behaviour from a far distance without disturbing the bird and its habitat.

Binoculars - Several types of binoculars were used to observe birds from far distances.

1. Solognac 100 series - 10x42
2. Solognac 900 series - 10x42
3. Bushnell - 10x42

Reference books/Online resources For Species Identification

Svensson, L., Grant, P. J., Mullarney, K. (2008). Collins Bird Guide (ed-2). United Kingdom: HarperCollins.

Grimmett, R., Inskipp, C., Inskipp, T. (2016). *Birds of the Indian Subcontinent*: India, Pakistan, Sri Lanka, Nepal, Bhutan, Bangladesh and the Maldives.

Shirihai, H., Svensson, L. (2018). Handbook of Western Palearctic Birds, Volume I &II: Passerines: Larks to Warblers - Flycatchers to Buntings.

The Cornell Lab of Ornithology Birds of the World https://birdsoftheworld.org

The Cornell Lab of Ornithology Birds of the World https://ebird.org

RESULT and DISCUSSIONS

During the study period, a vast amount of crucial data were gathered and uploaded on eBird website for access to all. Essential information which were decisive for the conclusion of status for various species of birds were obtained. Furthermore, many rare records as well as first records for Ladakh were also documented. For example - Bar-tailed Godwit *Limosa lapponica,* Black-faced Bunting *Emberiza spodocephala,* Oriental Pratincole *Glareola maldivarum* and Pallas's Leaf Warbler *Phylloscopus proregulus* (Gyalpo et al., 2023) were recorded for the first time in Ladakh and were new additions to the checklists of Ladakh. Some rare records includes Fieldfare *Turdus pilaris,* Naumann's Thrush *Turdus naumanni,* Rock Sparrow *Petronia petronia,* Greater white-fronted Goose *Anser albifrons,* Ruddy-breasted Crake *Porzana fusca,* Cinereous Vulture *Aegypius monachus* among many others. These significant records which are rare not only for Ladakh but for the whole India proves the fact that the landscape of Ladakh has huge potential to attract many more rare birds in the Trans-himalayan region. It can also be assumed that many rare birds do use ladakh as a stopover site during their migration and are not yet observed by birders and nature enthusiasts alike. Similarly many vagrant birds throughout all seasons could have been to Ladakh and have been missed by birders. The breeding species along the Suru and upper Indus valley are very similar. There is evidence that the common wintering species from the Indus valley also occur in the Suru valley: Guldenstadt's Redstart, Brown Accentor, Black-throated Thrush and Stoliczka's Tit-warbler have all been observed, and only Eastern Great Rosefinch *Carpodacus rubicilloides* has yet to be recorded from the Suru valley (Holmes, R. P., 1986). During the course of study, various threats to birds were observed and examined which are discussed in detail in the later part of the manuscript.Almost all the observations of birds were uploaded on the eBird platform and the results have been extracted from eBird data and collated into Tabular, Pie-chart, Column chart formats.

Table 4.1 -List of species observed and checklists completed

Year-Month	**Total no. of Birds Observed**	**Total no. of Checklists**
2022 (Jan-Dec)	216	265
2023 (Jan-Dec)	228	552
2024 (Jan-Apr)	102	179

Table 4.2- Year wise time spent and distance travelled while birdwatching across Ladakh

Year-Month	Total Time spent Birding	Total Distance Travelled while Birding

2022 (Jan-Dec)	199.25 Hours	249.18 Kms
2023 (Jan-Dec)	516.6 Hours	608.2 Kms
2024 (Jan-Apr)	228.4 Hours	226.27 Kms
Total	944.25 Hours	1,083.65 Kms

Table 4.3- eBird Protocol (Methods) used to observe birds

Year-Month	**eBird Protocols**			
	Travelling	Stationary	Incidental	Historical
2022 (Jan-Dec)	166	86	15	0
2023 (Jan-Dec)	372	172	2	0
2024 (Jan-Apr)	127	60	0	0
Total	665	318	17	0

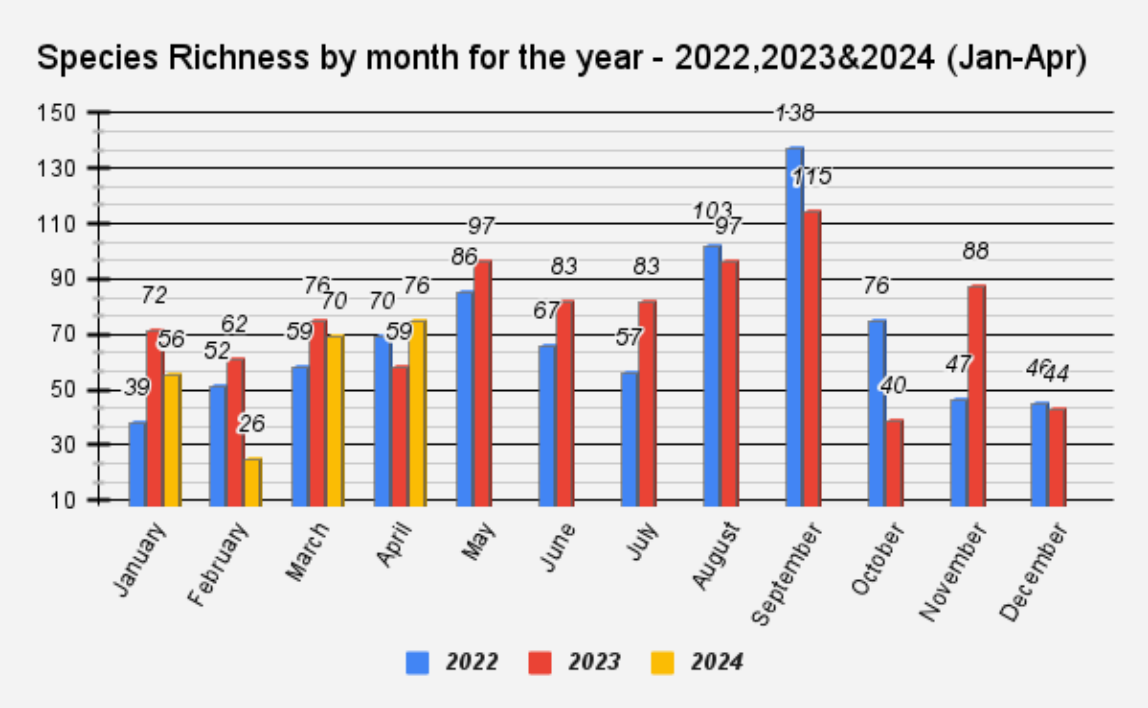
Table 4.4- Diversity Indices of Avifauna of Ladakh during the study period

Diversity Indices	2022 (Jan-Dec)	2023 (Jan-Dec)	2024 (Jan-Apr)
Species Richness	216 (50.34%)	228 (53.14%)	102 (23.77%)
Species Evenness	0.973	0.9836	0.953
Shanon Diversity Index	2.42	2.44	1.32
Simpson Diversity Index	0.0945	0.0888	0.2743

The species Richness was highest in the year 2023 with 228 species observed out of the total 429 species recorded within Ladakh. Same case is for the Species Evenness, Shannon Diversity Index. While the Simpson Diversity Index is highest for 2024 (Jan-Apr).

Figure - 4.1 - Species Richness of each month during the study period.

The species richness is highest for the month of August and September for 2022 & 2023 because the number of passage migrant birds overwhelm the resident species across ladakh. Such species spend the winter season in east-west coasts, mainland, other water bodies and forests across the Indian plains while few species spend their winter season in the South African plains. The Lowest species richness is in the month of December due to the cold winters that prevails in the Trans-Himalayan region of Ladakh.



An updated checklist of birds from Ladakh has been presented which includes 378 species, which includes various threat categories of IUCN - Critically Endangered 2, Endangered 5, Vulnerable 10, and Near Threatened 17 (Sharma, S., Wangmo, R., Rana, K. S., Visuddha, L., et al. 2021).

Since then a lot of species have been added (Gyalpo, P., Stanba. A. T., & Gasha. C. S., 2022), (Gyalpo, P., 2023), (Gyalpo, P., et al, 2023). A complete checklist of Birds of Ladakh has been compiled with latest additions. In Total, the Ladakh Checklist acknowledges 429 species belonging to 20 Orders and 64 families. Each species has been attributed their status in Ladakh - Resident, Migratory-Passage migrant, Vagrant and have also been assigned their IUCN conservation status.

SIL* - Status in Ladakh

R- Resident

R-AM- Resident and Altitudinal Migrant

M- Migratory

PM- Passage Migrant

SV - Summer Visitor

WV- Winter Visitor

V- Vagrant

IUCN Conservation Status

LC - Least Concern

NT - Near Threatened

VU - Vulnerable

EN - Endangered

CR - Critically Endangered

DD - Data Deficient

Table-4.5 - An updated and complete checklist of Birds of Ladakh as of April, 2024.

ORDER	FAMILY	COMMON NAME	SCIENTIFIC NAME	SIL*	IUCN
Anseriformes	Anatidae	Bar-headed Goose	*Anser indicus*	SV	LC
		Greylag Goose	*Anser anser*	PM	LC
		Greater White-fronted Goose	*Anser albifrons*	PM	LC
		Lesser White-fronted Goose	*Anser erythropus*	PM	LC
		Ruddy Shelduck	*Tadorna ferruginea*	R	LC
		Common Shelduck	*Tadorna tadorna*	PM	LC
		Garganey	*Spatula querquedula*	PM	LC

		Northern Shoveler	*Spatula clypeata*	PM	LC
		Gadwall	*Mareca strepera*	WV	LC
		Eurasian Wigeon	*Mareca penelope*	PM	LC
		Indian Spot billed Duck	*Anas poecilorhyncha*	V	LC
		Eastern Spot billed Duck	*Anas zonorhyncha*	V	LC
		Mallard	*Anas platyrhynchos*	R	LC
		Northern Pintail	*Anas acuta*	PM	LC
		Green-winged Teal	*Anas crecca*	WV	LC
		Red-crested Pochard	*Netta rufina*	SV	LC
		Common Pochard	*Aythya ferina*	PM	VU
		Ferruginous Pochard	*Aythya nyroca*	PM	NT
		Tufted Duck	*Aythya fuligula*	PM	LC
		Greater Scaup	*Aythya marila*	PM	LC
		Long-tailed Duck	*Clangula hyemalis*	V	VU
		Smew	*Mergellus albellus*	WV	LC

		Common merganser	*Mergus merganser*	R	LC
Galliformes	Phasianidae	Tibetan Partridge	*Perdix hodgsoniae*	R	LC
		Tibetan Snowcock	*Perdix hodgsoniae*	R	LC
		Himalayan Snowcock	*Tetraogallus himalayensis*	R	LC
		Common Quail	*Coturnix coturnix*	PM	LC
		Chukar Partridge	*Alectoris chukar*	R	LC
Podicipediformes	Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	PM	LC
		Red-necked Grebe	*Podiceps grisegena*	V	LC
		Great Crested Grebe	*Podiceps cristatus*	SV	LC
		Eared Grebe	*Podiceps nigricollis*	SV	LC
Columbiformes	Columbidae	Rock Pigeon	*Columba livia*	R	LC
		Hill Pigeon	*Columba rupestris*	R	LC
		Snow Pigeon	*Columba leuconota*	R	LC
		Yellow-eyed Pigeon	*Columba eversmanni*	V	VU
		Common Wood-Pigeon	*Columba palmubus*	V	LC
		Speckled Wood-Pigeon	*Columba hodgsonii*	V	LC

		European Turtle Dove	*Streptopelia turtur*	V	VU
		Oriental Turtle Dove	*Streptopelia orientalis*	SV	LC
		Eurasian Collared Dove	*Streptopelia decaocto*	PM	LC
		Red-collared Dove	*Streptopelia tranquebarica*	V	LC
		Spotted Dove	*Spilopelia chinensis*	PM	LC
		Laughing Dove	*Spilopelia senegalensis*	R	LC
		Yellow-footed Green Pigeon	*Treron phoenicopterus*	V	LC
Pterocliformes	Pteroclidae	Tibetan Sandgrouse	*syrrhaptes tibetanus*	R	LC
Cuculiformes	Cuculidae	Pied Cuckoo	*Clamator jacobinus*	PM	LC
		Asian Koel	*Eudynamys scolopaceus*	PM	LC
		Grey-bellied Cuckoo	*Cacomantis passerinus*	PM	LC
		Himalayan Cuckoo	*Cuculus saturatus*	V	LC
		Common Cuckoo	*Cuculus canorus*	SV	LC
Caprimulgiformes	Caprimulgidae	Eurasian Nightjar	*Caprimulgus europaeus*	V	LC

	Apodidae	White-throated Needletail	*Hirundapus caudacutus*	V	LC
		Alpine Swift	*Apus melba*	SV	LC
		Common Swift	*Apus apus*	SV	LC
		Blyth's Swift	*Apus pacificus*	PM	LC
		Little Swift	*Apus affinis*	V	LC
Gruiformes	Rallidae	Water Rail	*Rallus aquaticus*	WV	LC
		Corn Crake	*Crex crex*	PM	LC
		Spotted Crake	*Porzana porzana*	PM	LC
		Eurasian Moorhen	*Gallinula chloropus*	R	LC
		Eurasian Coot	*Fulica atra*	R	LC
		Grey-headed Swamphen	*Porphyrio poliocephalus*	PM	LC
		White breasted waterhen	*Amaurornis phoenicurus*	V	LC
		Ruddy-breasted Crake	*Zapornia fusca*	PM	LC
		Baillon's Crake	*Zapornia pusilla*	PM	LC
	Gruidae	Demoiselle Crane	*Grus Virgo*	PM	LC
		Siberian Crane	*Leucogeranus leucogeranus*	V	CR
		Black-necked Crane	*Grus nigricollis*	SV	NT

Charadriiformes	Burhinidae	Eurasian Thick-Knee	*Burhinus oedicnemus*	V	LC
	Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	PM	LC
		Pied Avocet	*Recurvirostra avosetta*	PM	LC
	Ibidorhynchidae	Ibisbill	*Ibidorhyncha struthersii*	R	LC
	Charadriidae	Black-bellied Plover	*Pluvialis squatarola*	PM	LC
		Pacific Golden Plover	*Pluvialis fulva*	PM	LC
		Common-ringed Plover	*Charadrius hiaticula*	PM	LC
		Little-ringed Plover	*Charadrius dubius*	SV	LC
		Northern Lapwing	*Vanellus vanellus*	PM	NT
		Red wattled lapwing	*Vanellus indicus*	V	LC
		Tibetan Sand-Plover	*Charadrius mongolus*	SV	LC
		Greater Sand-Plover	*Charadrius leschenaultii*	PM	LC
		Kentish Plover	*Charadrius alexandrinus*	PM	LC
	Rostratulidae	Greater-painted Snipe	*Rostratula benghalensis*	WV	LC

	Jacanidae	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	V	LC
	Scolopacidae	Whimbrel	*Numenius phaeopus*	PM	LC
		Eurasian Curlew	*Numenius arquata*	PM	NT
		Bar-tailed Godwit	*Limosa lapponica*	PM	NT
		Black-tailed Godwit	*Limosa limosa*	PM	LC
		Jack Snipe	*Lymnocryptes minimus*	V	LC
		Eurasian Woodcock	*Scolopax rusticola*	WV	LC
		Solitary Snipe	*Gallinago solitaria*	WV	LC
		Pin-tailed Snipe	*Gallinago stenura*	PM	LC
		Common Snipe	*Gallinago gallinago*	WV	LC
		Red-necked phalarope	*Phalaropus lobatus*	PM	LC
		Terek Sandpiper	*Xenus cinereus*	PM	LC
		Common Sandpiper	*Actitis hypoleucos*	PM	LC
		Green Sandpiper	*Tringa ochropus*	R	LC
		Marsh Sandpiper	*Tringa stagnatilis*	PM	LC
		Wood Sandpiper	*Tringa glareola*	PM	LC
		Common Redshank	*Tringa totanus*	SV	LC

		Spotted Redshank	*Tringa erythropus*	PM	LC
		Common Greenshank	*Tringa nebularia*	R	LC
		Ruddy Turnstone	*Arenaria interpres*	PM	LC
		Ruff	*Philomachus pugnax*	PM	LC
		Sharp-tailed Sandpiper	*Calidris acuminata*	V	VU
		Curlew Sandpiper	*Calidris ferruginea*	PM	NT
		Temminck's Stint	*Calidris temminckii*	PM	LC
		Long-toed Stint	*Calidris subminuta*	PM	LC
		Sanderling	*Calidris alba*	PM	LC
		Dunlin	*Calidris alpina*	PM	LC
		Little Stint	*Calidris minuta*	PM	LC
	Glareolidae	Oriental Pratincole	*Glareola maldivarum*	PM	LC
		Collared Pratincole	*Glareola pratincola*	PM	LC
	Stercorariidae	Parasitic Jaeger	*Stercorarius parasiticus*	V	LC
	Laridae	Little Gull	*Hydrocoloeus minutus*	V	LC
		Black-legged Kittiwake	*Rissa tridactyla*	V	VU
		Slender-billed gull	*Chroicocephalus genei*	PM	LC

		Black-headed Gull	*Chroicocephalus ridibundus*	PM	LC
		Brown-headed Gull	*Chroicocephalus brunnicephalus*	SV	LC
		Pallas's Gull	*Ichthyaetus ichthyaetus*	PM	LC
		Lesser Black-backed Gull	*Larus fuscus*	PM	LC
		Little Tern	*Sternula albifrons*	PM	LC
		Gull-billed Tern	*Gelochelidon nilotica*	PM	LC
		Whiskered Tern	*Chlidonias hybrida*	PM	LC
		Black Tern	*Chlidonias niger*	PM	LC
		White-winged Tern	*Chlidonias leucopterus*	PM	LC
		River Tern	*Sterna aurantica*	PM	VU
		Arctic Tern	*Sterna paradisaea*	V	LC
		Common Tern	*Sterna hirundo*	SV	LC
Ciconiiformes	Ciconiidae	Asian Openbill	*Anastomus oscitans*	V	LC
		Black Stork	*Ciconia nigra*	PM	LC
Suliformes	Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	PM	LC
		Little Cormorant	*Microcarbo niger*	V	LC
Pelecaniformes	Ardeidae	Great Bittern	*Botaurus stellaris*	WV	LC
		Little Bittern	*Ixobrychus minutes*	PM	LC

		Black-crowned Night heron	*Nycticorax nycticorax*	PM	LC
		Little Egret	*Egretta garzetta*	PM	LC
		Indian Pond-Heron	*Ardeola grayii*	PM	LC
		Eastern Cattle Egret	*Bubulcus coromandus*	V	LC
		Great Egret	*Ardea alba*	WV	LC
		Intermediate Egret	*Ardea intermedia*	V	LC
		Grey Heron	*Ardea cinerea*	WV	LC
		Purple Heron	*Ardea purpurea*	PM	LC
	Threskiornithidae	Glossy Ibis	*Plegadis falcinellus*	PM	LC
Accipitriformes	Pandionidae	Osprey	*Pandion haliaetus*	PM	LC
	Accipitridae	Black-winged Kite	*Elanus caeruleus*	V	LC
		Bearded Vulture	*Gypaetus barbatus*	R	NT
		Egyptian Vulture	*Neophron percnopterus*	V	EN
		Oriental Honey-buzzard	*Pernis ptilorhynchus*	PM	LC
		Cinereous Vulture	*Aegypius monachus*	PM	NT
		Himalayan Griffon	*Gyps himalayensis*	R	NT

		Short-toed Snake Eagle	*Ciraetus gallicus*	V	LC
		Mountain Hawk-Eagle	*Nisaetus nipalnesis*	V	LC
		Greater Spotted Eagle	*Clanga clanga*	PM	VU
		Booted Eagle	*Hieraaetus pennatus*	SV	LC
		Steppe Eagle	*Aquila nipalensis*	PM	EN
		Imperial Eagle	*Aquila heliacal*	V	LC
		Golden Eagle	*Aquila chrysaetos*	R	LC
		Western Marsh Harrier	*Circus aeruginosus*	PM	LC
		Hen Harrier	*Circus cyaneus*	WV	LC
		Pallid Harrier	*Circus macrourus*	PM	NT
		Montagu's Harrier	*Circus pygargus*	PM	LC
		Shikra	*Accipiter badius*	V	LC
		Eurasian Sparrowhawk	*Accipiter nisus*	R	LC
		Eurasian Goshawk	*Accipiter gentilis*	WV	LC
		Black Kite	*Milvus migrans*	PM	LC
		Red Kite	*Milvus milvus*	V	LC
		Pallas's Fish Eagle	*Haliaeetus pennatus*	PM	EN

		Rough-legged Hawk	*Buteo lagopus*	V	LC
		Common Buzzard	*Buteo buteo*	WV	LC
		Himalayan Buzzard	*Buteo refectus*	WV	LC
		long-legged Buzzard	*Buteo rufinus*	PM	LC
		Upland Buzzard	*Buteo hemilasius*	R	LC
Strigiformes	Strigidae	Eurasian Scops Owl	*Otus scops*	PM	LC
		Pallid Scops Owl	*Otus brucei*	PM	LC
		Eurasian Eagle Owl	*Bubo bubo*	R	LC
		Little Owl	*Athene noctua*	R	LC
		Long-eared Owl	*Asio otus*	SV	LC
		Short-eared Owl	*Asio flammeus*	PM	LC
Bucerotiformes	Upupidae	Eurasian Hoopoe	*Upupa epops*	SV	LC
Coraciiformes	Alcedinidae	Common Kingfisher	*Alcedo atthis*	PM	LC
		White-throated Kingfisher	*Halcyon smyrnensis*	V	LC
		Crested Kingfisher	*Megaceryle lugubris*	V	LC
		Pied Kingfisher	*Ceryle rudis*	V	LC

	Meropidae	Blue-Cheeked Bee-eater	*Merops persicus*	PM	LC
		European Bee-eater	*Merops apiaster*	PM	LC
		Chestnut-headed Bee-eater	*Merops leschenaulti*	V	LC
	Coraciidae	European Roller	*Coracias garrulus*	PM	LC
		Indian Roller	*Coracias benghalensis*	V	LC
		Oriental Dollarbird	*Eurystomus orientalis*	V	LC
Piciformes	Picidae	Eurasian Wryneck	*Jynx torquilla*	PM	LC
		Himalayan Woodpecker	*Dendrocopos himalayensis*	V	LC
		Scaly-bellied Woodpecker	*Picus squamatus*	R	LC
Falconiformes	Falconidae	Lesser Kestrel	*Falco naumanni*	PM	LC
		Eurasian Kestrel	*Falco tinnunculus*	SV	LC
		Amur Falcon	*Falco amurensis*	PM	LC
		Merlin	*Falco columbarius*	WV	LC
		Eurasian Hobby	*Falco subbuteo*	SV	LC
		Saker Falcon	*Falco cherrug*	R	EN
		Peregrine Falcon	*Falco peregrinus*	PM	LC
		Laggar Falcon	*Falco jugger*	V	NT

Psittaciformes	Psittaculidae	Rose-ringed Parakeet	*Psittacula krameri*	V	LC
		Plum-headed Parakeet	*Psittacula cyanocephala*	V	LC
		Slaty-headed Parakeet	*Psittacula himalayana*	V	LC
Passeriformes	Campephagidae	Long-tailed Minivet	*Pericrocotus ethologus*	PM	LC
		Black-headed Cuckooshrike	*Lalage melanoptera*	V	LC
	Oriolidae	Eurasian Golden Oriole	*Oriolus oriolus*	V	LC
		Indian Golden Oriole	*Oriolus kundoo*	SV	LC
	Dicruridae	Black Drongo	*Dicrurus macrocercus*	PM	LC
		Ashy Drongo	*Dicrurus leucophaeus*	V	LC
	Monarchidae	Indian Paradise Flycatcher	*Terpsiphone paradisi*	PM	LC
	Laniidae	Red-backed Shrike	*Lanius collurio*	PM	LC
		Red-tailed Shrike	*Lanius phoenicuroides*	PM	LC
		Isabelline Shrike	*Lanius isabellinus*	PM	LC
		Brown Shrike	*Lanius cristatus*	PM	LC
		Bay backed Shrike	*Lanius vittatus*	PM	LC

		Long-tailed Shrike	*Lanius schach*	SV	LC
		Grey-backed Shrike	*Lanius tephronotus*	SV	LC
		Great Grey Shrike	*Lanius excubitor homeyeri*	V	LC
		Lesser Grey Shrike	*Lanius minor*	PM	LC
	Corvidae	Black-headed Jay	*Garrulus lanceolatus*	V	LC
		Eurasian Jay	*Garrulus glandarius*	V	LC
		Eurasian Magpie	*Pica pica*	R	LC
		Red-billed Chough	*Pyrrhocorax pyrrhocorax*	R	LC
		Yellow-billed Chough	*Pyrrhocorax graculus*	R	LC
		Eurasian Jackdaw	*Corvus monedula*	SV	LC
		House Crow	*Corvus splendens*	V	LC
		Rook	*Corvus frugilegus*	WV	LC
		Carrion Crow	*Corvus corone*	R	LC
		Hooded Crow	*Corvus cornix*	V	LC
		Large-billed Crow	*Corvus macrorhynchos*	R	LC
		Common Raven	*Corvus corax*	R	LC
	Paridae	Fire-capped Tit	*Cephaopyrus flammiceps*	PM	LC
		Coal Tit	*Periparus ater*	SV	LC

		Rufous-naped Tit	*Periparus rufonuchalis*	R	LC
		Ground Tit	*Pseudopodoces humilis*	R	LC
		Green-backed Tit	*Parus monticolus*	V	LC
		Cinereous Tit	*Parus cinereus*	R	LC
		White-crowned Penduline Tit	*Remiz coronatus*	V	LC
		Yellow-browed Tit	*Sylviparus modestus*	V	LC
	Alaudidae	Horned Lark	*Eremophila alpestris*	R-AM	LC
		Greater Short-toed Lark	*Calandrella brachydactyla*	PM	LC
		Mongolian Short toed Lark	*Calandrella dukhunensis*	PM	LC
		Hume's Lark	*Alauda acutirostris*	SV	LC
		Bimaculated Lark	*Melanocorypha bimaculata*	V	LC
		Tibetan Lark	*Melanocorypha maxima*	R	LC
		Eurasian Skylark	*Alauda arvensis*	SV	LC
		Oriental Skylark	*Alauda gulgula*	SV	LC
		Crested Lark	*Galerida cristata*	PM	LCC
		Asian Short-toed Lark	*Alaudala cheelensis*	V	LC

	Acrocephalidae	Booted Warbler	*Iduna caligata*	PM	LC
		Sykes's Warbler	*Iduna rama*	PM	LC
		Black-browed Reed Warbler	*Acrocephalus bistrigiceps*	PM	LC
		Sedge Warbler	*Acrocephalus schoenobaenus*	PM	LC
		Paddyfield Warbler	*Acrocephalus agricola*	PM	LC
		Blyth's Reed Warbler	*Acrocephalus dumetorum*	PM	LC
		Great Reed Warbler	*Acrocephalus arundinaceus*	PM	LC
		Clamorous Reed Warbler	*Acrocephalus stentoreus*	PM	LC
	Locustellidae	Common Grasshopper Warbler	*Locustella naevia*	PM	LC
		Long-billed Bush Warbler	*Locustella major*	SV	NT
	Hirundinidae	Grey-throated Martin	*Riparia chinensis*	PM	LC
		Bank Swallow	*Riparia riparia*	PM	LC
		Pale Martin	*Riparia diluta*	PM	LC
		Eurasian Crag Martin	*Ptyonoprogne rupestris*	SV	LC

		Barn Swallow	*Hirundo rustica*	SV	LC
		Wire-tailed Swallow	*Hirundo smithii*	PM	LC
		Northern House-Martin	*Delichon urbicum*	SV	LC
		Asian House-Martin	*Delichon dasypus*	PM	LC
		Red-rumped Swallow	*Cercropis daurica*	PM	LC
	Phylloscopidae	Wood Warbler	*Phylloscopus sibilatrix*	PM	LC
		Buff-barred Warbler	*Phylloscopus pulcher*	PM	LC
		Yellow-browed Warbler	*Phylloscopus inornatus*	PM	LC
		Hume's Warbler	*Phylloscopus humei*	SV	LC
		Brook's Leaf Warbler	*Phylloscopus subviridis*	PM	LC
		Pallas's Leaf Warbler	*Phylloscopus proregulus*	V	LC
		Lemon-rumped Warbler	*Phylloscopus chloronotus*	PM	LC
		Tytler's Leaf Warbler	*Phylloscopus tytleri*	SV	LC

		Sulphur-bellied Warbler	*Phylloscopus griseolus*	SV	LC
		Tickell's Leaf Warbler	*Phylloscopus affinis*	SV	LC
		Dusky Warbler	*Phylloscopus fuscatus*	PM	LC
		Mountain Chiffchaff	*Phylloscopus sindianus*	SV	LC
		Common Chiffchaff	*Phylloscopus collybita*	PM	LC
		Whistler's Warbler	*Phylloscopus whistleri*	V	LC
		Greenish Warbler	*Phylloscopus trochiloides*	SV	LC
		Large-billed Leaf Warbler	*Phylloscopus magnirostris*	PM	LC
		Western Crowned Warbler	*Phylloscopus occipitalis*	PM	LC
	Scotocercidae	Brownish-flanked Bush Warbler	*Horornis fortipes*	V	LC
	Aegithalidae	White-browed Tit-Warbler	*Leptopoecile sophiae*	R-AM	LC
	Sylviidae	Garden Warbler	*Sylvia borin*	PM	LC
		Barred Warbler	*Curruca nisoria*	PM	LC
		Lesser Whitethroat	*Curruca curruca*	SV	LC
		Greater Whitethroat	*Curruca communis*	PM	LC

	Leiothrichidae	Streaked Laughingthrush	*Trochalopteron lineatum*	R	LC
		Variegated Laughingthrush	*Trochalopteron variegatum*	V	LC
	Regulidae	Goldcrest	*Regulus regulus*	PM	LC
	Tichodromidae	Wallcreeper	*Tichodroma muraria*	R	LC
	Certhiidae	Bar-tailed Treecreeper	*Certhia himalayana*	PM	LC
	Troglodytidae	Eurasian Wren	*Troglodytes troglodytes*	R-AM	LC
	Cinclidae	White-throated Dipper	*Cinclus cinclus*	R	LC
		Brown Dipper	*Cinclus pallasii*	R	LC
	Sturnidae	European Starling	*Sturnus vulgaris*	PM	LC
		Rosy Starling	*Pastor roseus*	PM	LC
		Daurian Starling	*Agropsar sturninus*	V	LC
		Indian Pied Starling	*Gracupica contra*	V	LC
		Brahminy Starling	*Sturnia pagodarum*	PM	LC
		Chestnut-tailed Starling	*Sturnia malabarica*	V	LC
	Turdidae	Grandala	*Grandala coelicolor*	V	LC
		Scaly Thrush	*Zoothera dauma*	PM	LC

		Scaly Thrush	*Zoothera dauma*	PM	LC
		Mistle Thrush	*Turdus viscivorus*	PM	LC
		Song Thrush	*Turdus philomelos*	V	LC
		Tickell's Thrush	*Turdus unicolor*	SV	LC
		Eurasian Blackbird	*Turdus merula*	V	LC
		Tibetan Blackbird	*Turdus maximus*	WV	LC
		Fieldfare	*Turdus pilaris*	V	LC
		Eyebrowed Thrush	*Turdus obscurus*	V	LC
		Chestnut Thrush	*Turdus rubrocanus*	V	LC
		Black-throated Thrush	*Turdus atrogularis*	WV	LC
		Red-throated Thrush	*Turdus ruficollis*	WV	LC
		Dusky Thrush	*Turdus eunomus*	WV	LC
		Naumann's Thrush	*Turdus naumanni*	WV	LC
	Muscicapidae	Dark-sided Flycatcher	*Muscicapa sibirica*	PM	LC
		Asian Brown Flycatcher	*Muscicapa dauurica*	V	LC
		Spotted Flycatcher	*Muscicapa straita*	PM	LC

		Rufous-tailed Scrub Robin	*Cercotrichas galactotes*	V	LC
		Oriental Magpie-Robin	*Copsychus saularis*	V	LC
		Rufous-bellied Niltava	*Niltava sundara*	WV	LC
		Bluethroat	*Luscinia svecica*	SV	LC
		Blue Whistling Thrush	*Myophonus caeruleus*	R-AM	LC
		Little Forktail	*Enicurus Scouleri*	R	LC
		Spotted Forktail	*Enicurus maculatus*	V	LC
		Siberian Rubythroat	*Calliope calliope*	PM	LC
		Himalayan Rubythroat	*Calliope pectoralis*	PM	LC
		Chinese Rubythroat	*Calliope tschebaiewi*	SV	LC
		Himalayan Bluetail	*Tarsiger cyanurus*	PM	LC
		Rusty-tailed Flycatcher	*Muscicapa ruficauda*	V	LC
		Taiga Flycatcher	*Ficedula albicilla*	PM	LC
		Red-breasted Flycatcher	*Ficedula parva*	PM	LC
		Blue-fronted Redstart	*Phoenicurus frontalis*	SV	LC
		Plumbeous Redstart	*Phoenicurus fuliginosus*	WV	LC

		Rufous-backed Redstart	*Phoenicurus erythronotus*	V	LC
		White-capped Redstart	*Phoenicurus leucocephalus*	WV	LC
		Common Redstart	*Phoenicurus phoenicurus*	PM	LC
		White-winged Redstart	*Phoenicurus erythrogastrus*	R-AM	LC
		Black Redstart	*Phoenicurus ochruros*	SV	LC
		Rufous-tailed Rock Thrush	*Monticola saxatilis*	PM	LC
		Blue Rock Thrush	*Monticola solitarius*	SV	LC
		Whinchat	*Saxicola rubetra*	V	LC
		Siberian Stonechat	*Saxicola maurus*	PM	LC
		Pied Bushchat	*Saxicola caprata*	PM	LC
		Northern Wheatear	*Oenanthe oenanthe*	PM	LC
		Isabelline Wheatear	*Oenanthe isabellina*	PM	LC
		Desert Wheatear	*Oenanthe deserti*	SV	LC
		Pied Wheatear	*Oenanthe pleschanka*	SV	LC
		Variable Wheatear	*Oenanthe picata*	SV	LC
		Hume's Wheatear	*Oenanthe alboniger*	V	LC
	Bombycillidae	Bohemian Waxwing	*Bombycilla garrulus*	V	LC

	Prunellidae	Alpine Accentor	*Prunella collaris*	R-AM	LC
		Altai Accentor	*Prunella himalayana*	V	LC
		Robin Accentor	*Prunella rubeculoides*	R-AM	LC
		Rufous-breasted Accentor	*Prunella strophiata*	R	LC
		Brown Accentor	*Prunella fulvescens*	R-AM	LC
		Black-throated Accentor	*Prunella atrogularis*	R-AM	LC
	Passeridae	House Sparrow	*Passer domesticus*	R	LC
		Spanish Sparrow	*Passer hispaniolensis*	V	LC
		Russet Sparrow	*Passer cinnamomeus*	V	LC
		Eurasian Tree Sparrow	*Passer montanus*	SV	LC
		Yellow-throated Sparrow	*Gymnoris xanthocollis*	V	LC
		Rock Sparrow	*Petronia petronia*	V	LC
		Black-winged Snowfinch	*Montifringilla adamsi*	R	LC
		White-rumped Snowfinch	*Onychostruthus taczanowskii*	SV	LC
		Rufous-necked Snowfinch	*Pyrgilauda ruficollis*	V	LC

		Blanford's Snowfinch	*Pyrgilauda blanfordi*	SV	LC
	Motacillidae	Forest Wagtail	*Dendronanthus indicus*	V	LC
		Gray Wagtail	*Motacilla cinerea*	R-AM	LC
		Western Yellow Wagtail	*Motacilla flava*	PM	LC
		Citrine Wagtail	*Motacilla citreola*	SV	LC
		White-browed Wagtail	*Motacilla maderaspatensis*	V	LC
		White Wagtail	*Motacilla alba*	SV	LC
		Richard's Pipit	*Anthus richardi*	PM	LC
		Paddyfield Pipit	*Anthus rufulus*	V	LC
		Long-billed Pipit	*Anthus similis*	PM	LC
		Blyth's Pipit	*Anthus godlewskii*	PM	LC
		Meadow Pipit	*Anthus pratensis*	PM	LC
		Rosy Pipit	*Anthus roseatus*	PM	LC
		Tree Pipit	*Anthus trivialis*	PM	LC
		Olive-backed Pipit	*Anthus hodgsoni*	PM	LC
		Red-Throated Pipit	*Anthus cervinus*	PM	LC
		Water-Pipit	*Anthus spinoletta*	WV	LC

		Buff-bellied Pipit	*Anthus rubescens*	WV	LC
	Fringillidae	Common Chaffinch	*Fringilla coelebs*	WV	LC
		Brambling	*Fringilla montifringilla*	WV	LC
		White-winged Grosbeak	*Mycerobas carnipes*	WV	LC
		Black and Yellow Grosbeak	*Mycerobas icterioides*	V	LC
		Common Rosefinch	*Carpodacus erythrinus*	SV	LC
		Blyth's Rosefinch	*Carpodacus grandis*	R-AM	LC
		Pink Browed Rosefinch	*Carpodacus rodochroa*	V	LC
		Pale Rosefinch	*Carpodacus stoliczkae*	SV	LC
		Sillem's Rosefinch	*Carpodacus sillemi*	R	DD
		Streaked Rosefinch	*Carpodacus rubicilloides*	R-AM	LC
		Great Rosefinch	*Carpodacus rubicilla*	R-AM	LC
		Red-fronted Rosefinch	*Carpodacus puniceus*	SV	LC
		Himalayan White-browed Rosefinch	*Carpodacus thura*	WV	LC
		Crimson-winged Finch	*Rhodopechys sanguineus*	V	LC

		Black-headed Mountain Finch	*Leucosticte brandti*	R-AM	LC
		European Greenfinch	*Chloris chloris*	V	LC
		Yellow-breasted Greenfinch	*Chloris spinoides*	WV	LC
		Twite	*Linaria flavirostris*	R	LC
		Eurasian Linnet	*Linaria cannabina*	V	LC
		Red Crossbill	*Loxia curvirostra*	V	LC
		European Goldfinch	*Carduelis carduelis*	R	LC
		Fire-fronted Serin	*Serinus pusillus*	R	LC
		Eurasian Siskin	*Spinus spinus*	V	LC
	Emberizidae	Red-headed Bunting	*Emberiza bruniceps*	PM	LC
		Chestnut-earned Bunting	*Emberiza rutila*	PM	LC
		Rock Bunting	*Emberiza cia*	R	LC
		Godlewski's Bunting	*Emberiza godlewskii*	V	LC
		White-capped Bunting	*Emberiza stewarti*	SV	LC
		Yellowhammer	*Emberiza citrinella*	WV	LC

		Pine Bunting	*Emberiza leucocephalus*	WV	LC
		Gray-necked Bunting	*Emberiza buchanani*	PM	LC
		Ortolan Bunting	*Emberiza hortulana*	PM	LC
		Reed Bunting	*Emberiza schoeniclus*	PM	LC
		Little Bunting	*Emberiza pusilla*	PM	LC
		Rustic Bunting	*Emberiza rustica*	PM	VU
		Black-faced Bunting	*Emberiza spodocephala*	V	LC

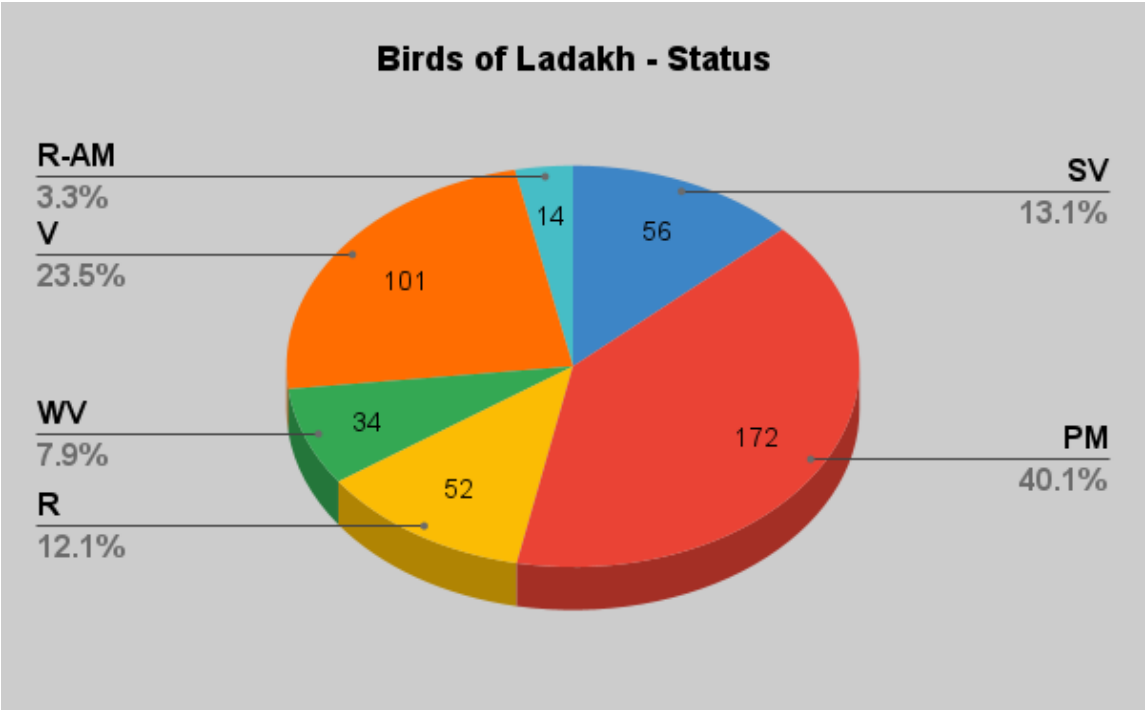


Figure 4.2 - No. of Birds assigned with their respective status. It is interesting to note that passage migrant birds makeup the most numerous species in the checklist of birds. It is because most bird species breed near arctic Russia, Mongolia, Tibet and Siberian areas. These countries are located North of India and since ladakh is the northernmost state in India, the wintering birds cross Ladakh and reach their breeding areas. The same pattern can be seen in the autumn season when those birds migrate back into the Indian peninsula to spend the winter season.

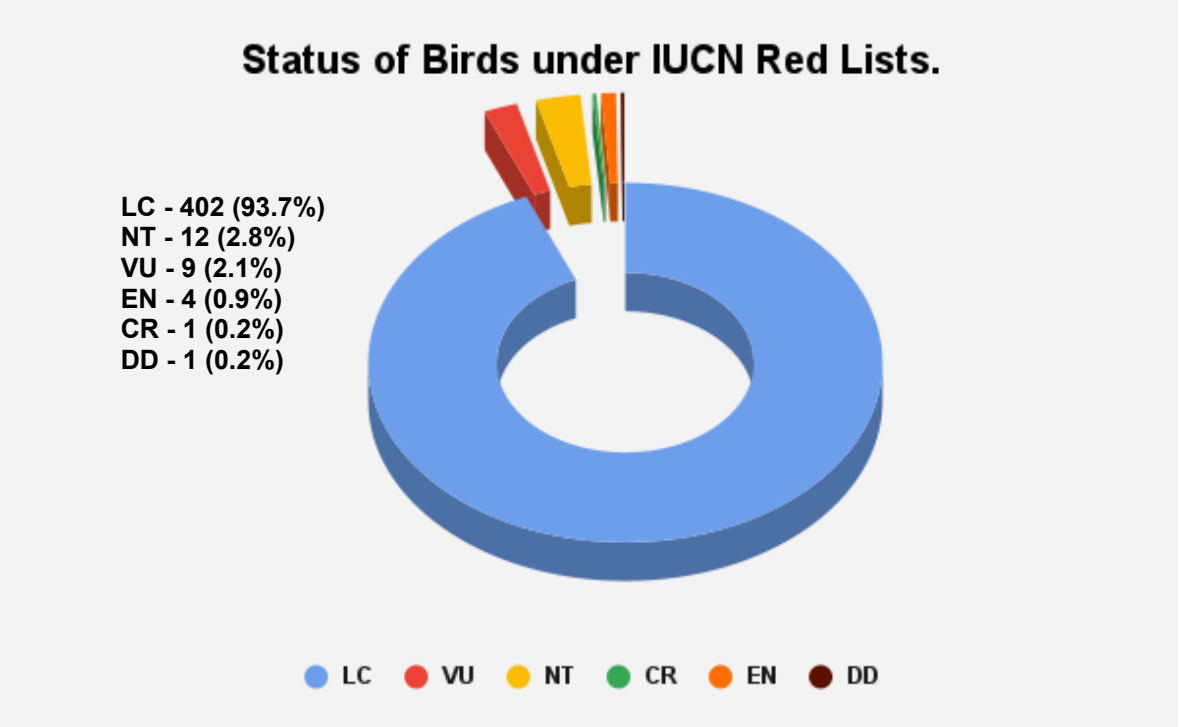


Figure 4.3 - It shows the birds listed under the IUCN threat list. While the majority of bird species are categorised under Least Concern (LC), 27 species belong to either of the threatened categories. State bird of Ladakh - Black-necked Crane belongs to the Near threatened (NT) category. Another important species, the Long-billed bush warbler which has not been photographed from 1977 and was briefly seen in 2015 in Kargil is also a Near threatened species. This species was very common during the early 1900's and now it is on the verge of disappearance. Another bird, Sillem's Rosefinch is listed as Data Deficient (DD) because there's not enough data about the bird's behaviour and other major details regarding this species. The previously known records within the Indian boundary comes from a single specimen collected from the Aksai-Chin area where locals and the general public is not allowed to visit due to its close proximity to the Indo-China Border. At the western end of its assumed distribution, the high elevation areas of Ladakh, close to the Chinese border, are certainly worth exploring. For example, the high Shyok Valley is less than 100 km away from the type locality. Breeding is likely to occur between mid-June and August, as in other high-elevation passerines of the Tibetan plateau, with young birds fledging by the end of August. Trips during the summer months could therefore yield data on the bird's breeding biology, which is completely unknown at present (Muzika, Y., 2014).

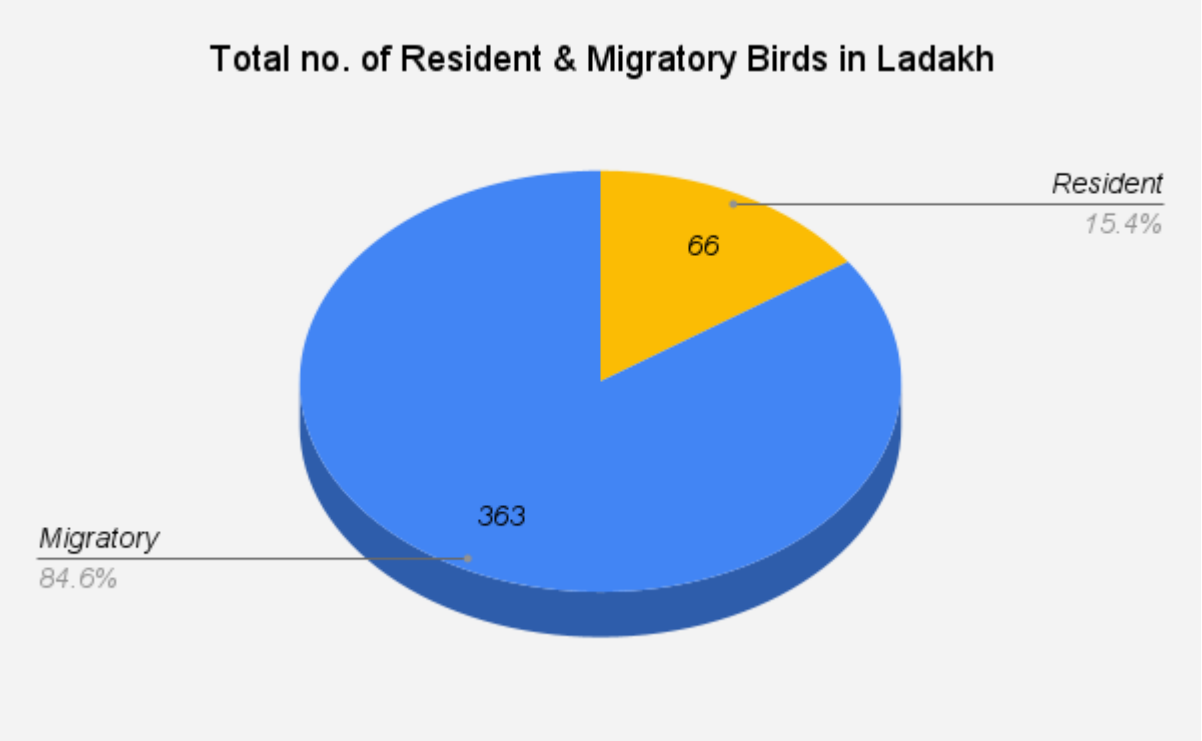


Figure 4.4 - This chart represents the total number of Resident species and the total number of Migratory species out of all the recorded species in Ladakh

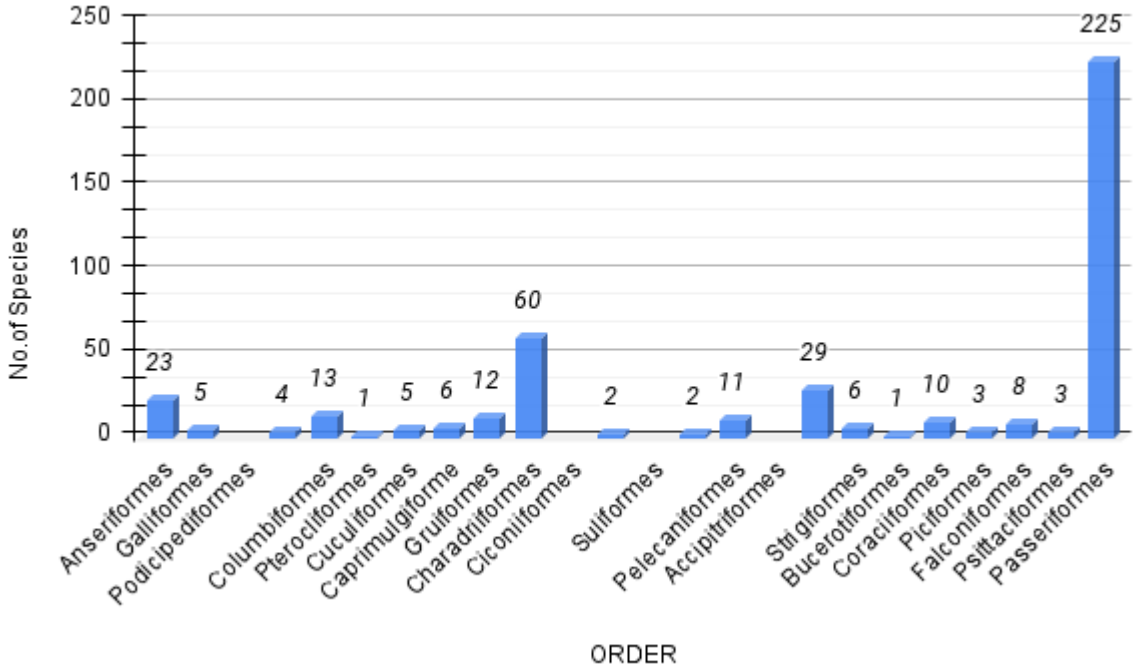


Figure 4.5- The figure represents the total no. of Individuals belonging to specific Order. It is safe to say that the majority of the birds recorded in Ladakh belong to the order - Passeriformes.

Status & Photographs of Birds under various above mentioned categories. (Figure 4.6-4.40)

From left to right. **Top Line -**

Fig. 4.6- Upland Buzzard *Buteo hemilasius* (Temminck & Schlegel, 1844).
Fig. 4.7- Ibisbill *Ibidorhyncha struthersii* (Vigors, 1831)

Middle Line -
Fig. 4.8- Eurasian Eagle Owl *Bubo bubo* (Linnaeus,1758)
Fig. 4.9- Tibetan Snowcock *Tetraogallus tibetanus* (Gould,1854)

Bottom Line -
Fig. 4.10- Eurasian Magpie *Pica pica* (Linnaeus,1758)
Fig. 4.11- White-throated Dipper *Cinclus cinclus* (Linnaeus,1758)

1. **Resident - Altitudinal Migrants**

From left to right **Top Line -**

Fig. 4.12- White-winged Redstart *Phoenicurus erythrogastrus* (Guldenstadt,1775)

Fig. 4.13- Great Rosefinch *Carpodacus rubicilla* (Guldenstadt,1775).

Middle Line -

Fig. 4.14- White-browed tit-warbler *Leptopoecile sophiae* (Severtsov,1873).

Fig. 4.15- Common Merganser *Mergus merganser* (Linnaeus,1758).

Bottom Line -

Fig. 4.16- Eurasian Wren *Troglodytes troglodytes* (Linnaeus,1758).

Fig. 4.17- Blue-Whistling Thrush *Myophonus caeruleus* (Scopoli,1786).

2. Migratory - Summer Visitors (Breeding)






From left to right **Top Line -**

Fig. 4.18- Black-necked Crane *Grus nigricollis* (Przevalski,1876).

Fig. 4.19- Bluethroat *Luscinia svecica* (Linnaeus,1758).

Middle Line -

Fig. 4.20- Mountain Chiffchaff *Phylloscopus sindianus* (W.E.Brooks,1872).

Fig. 4.21- White-capped Bunting *Emberiza stewartii* (Blyth,1854).

Bottom Line -

Fig. 4.22- Bar-headed Goose *Anser indicus* (Latham,1790).

Fig. 4.23- Eurasian Hobby *Falco subbuteo* (Linnaeus,1758).

3. Migratory - Passage Migrants






From left to right **Top Line –**

Fig. 4.24- Short-eared Owl *Asio flammeus* (Pontoppidan,1763).
Fig. 4.25- Spotted Flycatcher *Muscicapa striata* (Pallas,1764).

Middle Line -
Fig. 4.26- Isabelline Wheatear *Oenanthe isabellina* (Temminck,1829).
Fig. 4.27- Demoiselle Crane *Grus vigo* (Linnaeus,1758).

Bottom Line -
Fig. 4.28- Greylag Goose *Anser anser* (Linnaeus,1758).
Fig. 4.29- Whiskered Tern *Chlidonias hybrida* (Pallas,1811).

4. Migratory - Winter Visitors (non-breeding)

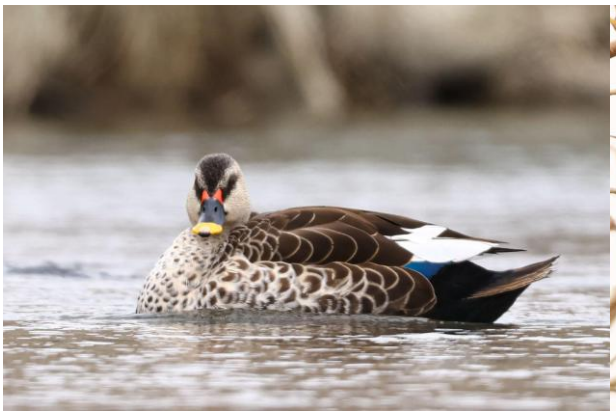
From left to right **Top Line -**

Fig. 4.30- Black-throated Thrush *Turdus atrogularis* (Jarocki,1819).
Fig. 4.31- Eurasian Goshawk *Accipiter gentilis* (Linnaeus,1758).

Middle Line -
Fig. 4.32- Common Buzzard *Buteo buteo* (Linnaeus,1758).
Fig. 4.33- Solitary Snipe *Gallinago solitaria* (Hodgson,1831).
Bottom Line -
Fig. 4.34- Red-throated Thrush *Turdus ruficollis* (Pallas,1776).
Fig. 4.35- Gadwall *Mareca strepara* (Linnaeus,1758).

1. **Migratory - Vagrants/Stragglers**






From left to right **Top Line –**

Fig. 4.36- Pallas's Leaf Warbler *Phylloscopus proregulus* (Pallas,1811).

Fig. 4.37- Fieldfare *Turdus pilaris* (Linnaeus,1758).

Middle Line -

Fig. 4.38- Indian Spot-billed Duck *Anas poecilorhyncha* (J.R.Froster,1781).

Fig. 4.39- Yellow footed Green Pigeon *Treron phoenicopterus* (Latham,1790).

Bottom Line -

Fig. 4.40- Red Crossbill *Loxia curvirostra* (Linnaeus,1758).

Fig. 4.41- Brook's Leaf Warbler *Phylloscopus subviridis* (W.E.Brooks,1872).

THREATS

Birds in Ladakh face several threats, primarily due to human activities and environmental changes. Most of the habitable land in Ladakh is an Open type ecosystem which represents a wide range of open habitats such as grasslands, marshes, alpine meadows, semi-arid landscapes, and deserts, but also human-created ecosystems like croplands, grazing lands, and fallow lands. They are characterised by a long and continued history of human use, by livestock grazers, farmers and others, resulting in a number of novel ecosystems and bird communities that have coexisted with people. Birds of these habitats also face many direct threats to survival, including those from energy infrastructure such as power lines and wind turbines. Ground-nesting birds, characteristic of open habitats, are vulnerable to predation by free-ranging dogs and other human-subsidised predators.(SoIB,2023).

Although birds in Ladakh do not face threats from infrastructure developments such as high rise buildings or wind mills, since no such developmental activities are prevalent in Ladakh due to its unique geographic conditions. However, Human induced effects such as habitat destruction, off-roading, water pollution, menace of feral dogs and electrocution are among the major threats observed for the birds. Photo documentation is also provided from Figure 5 (A) to 5 (S).

These major threats for birds can be broadly described under the following categories.

5.1 Habitat Loss & Degradation

Most landscapes are not managed for conservation, but are still vital for the persistence and health of many migratory as well as resident birds of Ladakh. Hotspot areas such as Shey manla, Chuchot Marshes, Shey Marshes are not a protected area in Ladakh but are highly valuable areas for many migratory birds as well as resident birds.These habitats also provide shelter, food, and protection from predators. A safe habitat offers a variety of food sources, such as insects, seeds, fruits, and nectar, that birds need for energy and nutrition. It also provides suitable foraging areas where birds can search for food without excessive competition or risk of predation. Many migratory bird species, who rely on safe stopover sites along their migratory routes, need a safe environment for replenishing energy reserves during migration.

There are several stopover sites in Ladakh which provide a suitable place for migratory birds. Chuchot marshes, Spituk marshes, Shey manla, Shey holy fish pond, Guphuks lake and vegetation alongside Indus river are one of the main areas in central Ladakh while as Tsokar wetland complex, Hanley wetland complex, Chushul wetland complex, Pangong Lake and Tso Moriri Lake are

important stopover sites in eastern Ladakh. These habitats face a number of threats ranging from infrastructure development to land reclamation. They are mostly threatened by unplanned construction of commercial buildings such as Hotels, Guest houses and construction of roads. Land expansion for agricultural purposes is minimal and hence does not cause a major disturbance to the immediate ecosystem especially in eastern Ladakh where the average altitude is 4000 m asl. However, reclamation of wetlands for housing, unplanned construction of pucca roads eventually cut off the water supply to marshes. This leads to drying up of one side of the marshes while the other half is flooded with accumulation of water. The prime nesting sites of endangered bird species are also threatened by unintentional land use change. Such cases of birds stuck in fences, drying up of marshes and alternate land use change have been predominantly observed in various places in Changthang region. Many wildlife lovers have reported such incidents and have posted them on the popular facebook group 'Wildlife of Ladakh'

During the course of the study period a number of scenarios were observed that led to destruction of habitat in Chuchot marshes (See Pic- (A) and Shey Holy Fish Pond (See pic- (C.

In Kargil district the main bird species affected by habitat destruction and land use for agriculture is the Long-billed Bush Warbler *Locustella major*. The global distribution ranges from NW Himalaya in N Pakistan (Khagan Valley and Gilgit) and NW India (NE Kashmir, Ladakh, Zaskar). The winter range is unknown, presumably at lower altitudes in NW India and N Pakistan. It seems likely that this species' habitat has been degraded by changes in agricultural practices, overgrazing (especially by goats) and the cutting of scrub for firewood. A thorough investigation into its current status is urgently required (Madge, S. 2020).

There are several stopover sites in Ladakh which provide a suitable place for migratory birds. Chuchot marshes, Spituk marshes, Shey manla, Shey holy fish pond, Guphuks lake and vegetation alongside Indus river are one of the main areas in central Ladakh while as Tsokar wetland complex, Hanley wetland complex, Chushul wetland complex, Pangong Lake and Tso Moriri Lake are important stopover sites in eastern Ladakh. These habitats face a number of threats ranging from infrastructure development to land reclamation. They are mostly threatened by unplanned construction of commercial buildings such as Hotels, Guest houses and construction of roads. Land expansion for agricultural purposes is minimal and hence does not cause a major disturbance to the immediate ecosystem especially in eastern Ladakh where the average altitude is 4000 m asl. However, reclamation of wetlands for housing, unplanned construction of pucca roads eventually

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Pic-(B) - Narrow water channels have been diverged to private fisheries farms alongside erection of fences at Chuchot marshes.

Pic-(D) - A juvenile of a Black-necked Crane stuck in the fence. *Pic Credit - konchok Phunchok/FB.'Wildlife of Ladakh'. August,2018.*

5.2 Climate Change -

Rising temperatures and changing precipitation patterns can lead to shifts in vegetation types and the availability of suitable habitats for birds. This can force birds to migrate to new areas or result in habitat fragmentation, making it harder for them to find suitable nesting sites and food sources. Climate change can affect the timing and routes of bird migrations. Warmer temperatures can cause birds to migrate earlier or delay their migrations, disrupting established migration patterns. Changes in the availability of food along migration routes can also impact bird populations. Climate change also affects bird survival and reproduction through the disruption of species interactions by phenological mismatches and range shifts. Mismatches in seasonal timing (of migration, breeding, emergence) between birds and their prey can reduce survival and reproduction and also lead to fatal competition with other species (Samplonius, J. M., & Both, C. 2019). Climate change can influence the distribution and prevalence of diseases that affect birds. Warmer temperatures can create more favourable conditions for disease vectors such as mosquitoes, which can transmit diseases to birds. More frequent and intense extreme weather events, such as storms and heatwaves, can directly impact bird populations by causing habitat destruction, mortality, and disruptions to food availability.

It has been observed that few bird species inhabiting the plain areas of the Indian-Subcontinent have been spotted several times in Ladakh which might indicate the effect of climate change. Largely non-migratory bird species such as Red-wattled Lapwing *Vanellus indicus* (See pic-(F), Eastern Cattle Egret *Bubulcus coromandus* and House Crow *Corvus splendens* have been observed multiple times in recent years throughout the summer season. Till date there are no breeding records of these birds in Ladakh and hence it may indicate that they were drawn into ladakh because of temperature rise in their usual breeding places or less likely range extension of these species. The Ibisbill *Ibidorhyncha struthersii* is a resident bird species which breeds and lays their eggs on the shores of the Indus river. In the summer of 2023, due to unusually warmer temperatures the Indus river was flooded with high water levels. In consequence the Ibisbill with its young ones were restricted to a small area making their survival chances grim (See pic-(F). However, climate change poses a threat to high-elevation bird species as favourable conditions shrink at mountain summits, potentially causing local extinctions (Freeman, B. G., Scholer, M. N., Ruiz-Gutierrez, V., et al, 2018).


(E)


(F)

5.3 Electrocution -

Electrocution of birds in Ladakh has also been observed during the study period wherein two such species were observed In the Hanley wetland complex, an adult Eurasian Hobby *Falco subbuteo* (See pic - (G) was seen falling on the ground just after landing on an electric pole. Similarly, in the Gompa village near Leh city, a single Eurasian Eagle Owl's tarsus was seen holding onto the electric pole while the rest of the body was not to be seen(See pic - (H). Most probably the body got detached from the leg and fell on the ground where dogs might have eaten the rest. On close examination of the tarsus revealed that the feathers were burnt out and turned black. Further supporting the hypothesis. On 19th May, 2021 a photo of a dead Black-necked Crane was posted on Fb group 'Wildlife of Ladakh' by Mr. Lobzang Visuddha stating the cause of death by electrocution.(See pic - (I)


(G)


(H)


(I)

5.4 Environmental Pollution -

The scientific literature is clear about the strong connection between environmental pollution and reduced wild vertebrate populations. However, relationships between pollutant exposure and reduced reproduction or survival have been established for only a few species. This is particularly true in India where toxicology studies on wild species are still very limited. While specific linkages between heavy metals and bird mortality are difficult to draw, a recent review found heavy metal contamination in a large number of bird species across Asia (Varagiya, D., Jethva, B., & Pandya, D. 2022).

Environmental pollution can have profound effects on bird populations, affecting their health, behaviour, reproduction, and overall survival. Birds can be exposed to pollutants such as heavy metals (e.g., lead, mercury), pesticides, industrial chemicals, and plastic debris through contaminated food and water sources. These pollutants can accumulate in their bodies over time, leading to health problems and reduced reproductive success. Pollution can also degrade habitats essential for bird survival, such as wetlands, rivers, and forests. Chemical runoff from agricultural fields, and urban pollution can all contribute to habitat degradation, making it more challenging for birds to find suitable nesting sites, food, and clean water. Lack of a proper garbage disposal facility has led to accumulation of trash in marshes and in streams. These garbage mostly include plastic waste which disintegrates into smaller pieces. Birds could easily mistake small plastics as their food and may ingest (See pic (K). Apart from plastic being their food, some birds are also reported to get trapped in plastic wastes. Ropes and wires in garbage get entangled onto the birds legs, restricting their movements which may lead to their demise (See pic (J).*Pic credit - Tashi Chotak Lonchey.* In the summer months of 2022, a Geothermal power plant was set up at Puga Hot Spring area. The area is an important habitat for birds as well as other animals. Because of this setup, the nearby hot spring water was filled with heavy metals and other toxic chemicals which not only harmed the nearby ecosystem but the same stream also ended up in the main Indus River. Thus, causing immense harm to the aquatic biodiversity as well as the agricultural fields where water of the Indus river was the main source of irrigation. This setup was met with huge protests and dissatisfaction from wildlife lovers across ladakh. Their joint effort in preserving the area led to the shutting off of the Puga Geothermal power plant. This step led by the local wildlife lovers helped protect the Puga hot spring area from being destroyed completely.


(J)


(K)

5.5 Feral Dogs -

Birds that make their nests on ground usually face a multitude of challenges in open habitats. Horned Lark *Eremophila alpestris,* Tibetan Lark, Hume's Lark and the near threatened Black-necked Crane *Grus nigricollis.* Threats from trampling upon by unsuspecting cattles, predation of chicks and eggs by feral dogs are a usual case during the breeding season. Feral dogs attacking, chasing and eating the eggs and chicks of Black-necked Cranes have been well documented with photography and videography in the Hanle Wetland Complex. Constant harassment by feral dogs can cause significant stress to birds, affecting their behaviour, reproductive success, and overall health. It can disrupt their feeding, nesting, and roosting activities, leading to decreased survival rates. In some cases, feral dogs may pose a direct threat of predation to ground-nesting birds, their eggs, and chicks. This can contribute to declines in bird populations, especially for species vulnerable to predation. Over the course of the past 10 years, the population of the state bird of Ladakh - Black-necked Crane have decreased significantly due to the predation of their chicks and eggs by feral dogs(See pic- N&O). Feral dogs in Ladakh not only pose threats to birds but for every other wild animal. They have been documented killing the State animal of Ladakh - The Snow Leopard *Panthera uncia* , Eurasian Lynx *Lynx lynx isabellinus,* Tibetan Wolf *Canis lupus chanco,* Himalayan Marmot *Marmota himalayana* and other small mammals. The menace of feral dogs is well documented throughout India and a small place like ladakh is no exception. In Ladakh, many migratory birds have been prey to these free ranging dogs at some IBA'S (Important Bird Areas) and important stopover sites across ladakh.


(L)


(M)


(N)


(O)

5.6 Other Threats -

Off-roading by Tourists in Pangong Lake and in various locations have been documented recently and have sparked public outrage. Some of the culprits have been nabbed and fined due to the concerns raised by the general public of Ladakh. Disturbances to wildlife in pristine places by off-roading is becoming a common phenomenon. A Tourist car stuck at Tsokar Lake (Ramsar site). (See pic -(Q). Disturbances created by human presence can also be regarded as a threat to the bird species. To enjoy the short summer season in Ladakh, many locals throng the marshes and riverside to enjoy. This leads to playing loud music and throwing away plastic wastes. Such scenarios are common in the summer season especially in Chuchot marshes (See pic (P&R), Hanle marshes and pangong lake areas. Fishing in the Indus and its tributaries also affect the nearby bird population. It was observed that the fishermen lay nets and hooks on the shoreline where many shorebirds make their nests. Birds like Little ringed Plover *Charadrius dubius* and the Ibisbill make their nest on the shore line making their eggs vulnerable from trampling upon by cattles & fishermen. In the vast plateau of Changthang landscape, the birds also face threats from the pashmina goats and sheeps which the nomads herd them in hundreds. Such huge herds when moving across the plateau in search of food will definitely create an atmosphere of destruction for the ground nesting birds. The increasing domestic livestock population has not only driven wildlife out of prime habitat, but

also led to overgrazing of pastures, resulting in wind erosion and desertification. The Rebo today have ceased to practise rotational grazing and are only partially nomadic, having permanent summer camps in prime pastureland, thereby creating additional pressure on the land. Domestic livestock are now invading areas that are not their 'natural' habitat, such as marshes and shallow ponds, as in these areas the vegetation is comparatively still intact. At Hanle and Lal Pahari, domestic livestock have been observed grazing on rushes in knee-deep water creating pressure on the breeding Black necked Crane, Brahminy Shelduck, Bar-headed Goose and other wetland breeding species (Naoroji, R., & Sangha, H. S., 2011).

Pets and other animals that accompany human presence add another layer of threat. Domestic cats and free ranging cats affect birds directly through predation and indirectly by creating a 'landscape of fear'. Pic- (S) - A domestic cat with a kill of Eurasian Magpie.


(P)


(Q)


(R)


(S)

CONSERVATION

Birds provide crucial ecosystem services in maintaining healthy and diverse ecological systems and processes throughout the world. For example, by eating or catching fruits, seeds, and nuts, birds provide an environmental courier service promoting dispersal, gene flow, and colonisation opportunities for thousands of species of plants in all kinds of forests and shrublands. (Fitzpatrick W. J., & Rodewald. D. A., 2016). Birds also serve human economic interests by controlling insect populations.

To accomplish lasting conservation in the real world is not easy. Conservation is a time-consuming, long term, effort requiring many steps, most of which are social, political, and economic. Birds are a good indicator of overall biodiversity in most terrestrial habitats. Habitat is the essential requirement for the conservation of any species, community, or ecosystem. Because habitat loss and degradation are the leading causes of avian population declines worldwide, efforts to protect or restore habitat will always be the cornerstones of conservation solutions for most species. Almost everywhere on earth, habitats experience continuing human influences, either directly or indirectly and Ladakh is no exception. Many important bird areas need urgent intervention to preserve the habitat. Hence, to protect the hotspot areas from habitat loss, pollution, feral dog menace and other threats should be a prime conservation effort.

Population monitoring is essential for bird conservation, because it provides data for detecting population declines, setting priorities, and measuring the success of management practices. Bird watchers and ornithologists have led the way in the explosion of citizen science, and bird monitoring projects involving volunteers are being carried out all over the world. Through involvement in these projects , legions of amateur bird enthusiasts now contribute crucial information of direct relevance to conservation while simultaneously having fun and enriching their lives. In recent years the most accessible, powerful, and informative global citizen science project involving birds is eBird (https://ebird.org), an internet based global database managed by the Cornell Lab of Ornithology (Sullivan et al.2014). Tens of thousands of eBird participants from around the world now regularly submit checklists that specify species, numbers, location, date, time of day, and minutes of effort during the observation period. However, in Ladakh there are only a few regular eBird users who submit their checklist on a daily basis but still the data is important to understand the status and distribution of the birds in Ladakh.

Every individual can help promote bird conservation by exercising vigilance (such as noticing and reporting violations of wetlands or a threat to an endangered species) and Political activism in elections that supports conservation of biodiversity. Promoting and participating in local environmental education helps broaden the community of people who grasp the importance of conserving birds and biodiversity. Because humans are more likely to protect what they understand and love, all possible forms of environmental education - via books, media, museums, nature centres, and classroom curricula will be even more crucial in future than they are today. Most people who are passionate about birds and conservation can identify the mentors who helped spark their initial interest in the natural world, sometimes even with just a single event or outing during childhood. Conservation will endure only if each generation contributes, and one of the best ways to help the next generation embrace the need to conserve birds and habitat is to share one's own knowledge and passion with today's children. Birds have an influential standing in our efforts to conserve the natural world. Birds serve as a flagships for imperilled habitats and ecosystems, and as early warning systems for environmental toxins or other destructive forces Conservation efforts focussed on birds often help preserve many other less conspicuous organisms. And owing to their charisma and popularity with humans, birds can help inspire all of us towards being better stewards of natural systems and biodiversity. Conservation of important stopover sites across Ladakh such as wetlands and marshes can boost species richness and diversity during migration season immensely. Wildlife Conservation and Birds Club of Ladakh (WCBCL) is a NGO that is based in Ladakh and since its inception in the year 2012, the members of the club have significantly contributed for the welfare of habitat. Noteworthy efforts include - Publish of book 'A comprehensive account of the Birds of Ladakh-Commentary, Notes and Field Guide', educating and creating awareness to the general public of ladakh about the wildlife of ladakh and its importance in maintaining the ecological balance, taking conservation steps by acting as the first responder to any animal casualty. Apart from these activities, WCBCL also participates in various International and National level Bird Count days like Global Big Bird Count(GBBC), Wild Bird Count day, Himalayan Bird Count day and uploads the crucial sightings on the popular citizen science platform eBird.

Habitats under threats such as Chuchot marshes, Shey manla, Shey Holy Fish Pond, Hanley marshes, Pangong Lake, Damsna Wetland and Rangdum Marshes needs to be considered of highest priority for conservation both by local NGOs and Dept. of Wildlife Protection UT Ladakh.

CONCLUSION

The study on Birds of Ladakh- Status, Threats and Conservation revealed the overall situation of birds across ladakh. A total of 216 species were recorded in the year 2022, 228 species in the year 2023 and 102 species in the year 2024 from the month of January till April. A huge number amounting to a total of 996 complete checklists were made within the study period revealing crucial data regarding the status of birds in Ladakh. The total species recorded in India is around 1374 (eBird,2024). The avifaunal diversity in Ladakh accounts to 31% of the total recorded birds in India. Among the 429 species reported from Ladakh, 27 species are listed under IUCN Red list. This accounts to 6.2% of the total species from Ladakh. Almost all of these threatened species are migratory and pass through ladakh utilising the important stopover sites as a safe haven during their annual migratory journey. Hence, the preservation of these important stopover places throughout Ladakh can help minimise the deaths of birds crossing the high mountain ranges, it can boost the species diversity and richness, it will keep in check the insect population among other ecological benefits.

Various categories of threats have been discussed in detail to understand the magnitude of their negative effect on the survival of bird species. Among which habitat loss constitutes the major threat. This is true not only for Ladakh region but across the globe where many habitat specialised birds have been driven to extinction due to habitat loss. Govt. officials and policy makers must acknowledge the importance of birds in any ecosystem and make policies in a sustainable way so as to pave the way for necessary developmental activities without sidelining the importance of a healthy environment.

Future researchers and birders should properly explore Zanskar and Kargil areas where only few birders are present. The area may reveal interesting results and will definitely aid in understanding more about species distribution.

REFERENCES

1. Abhinav, C., Kuriakose, J., Delany, S., Denby, C., Clement, P., Pathak, J., Rathore, S. D., Gyalpo, P., and Panwar, R. (2022). "Status of Naumann's Thrush *Turdus naumanni* and its hybrids with Dusky Thrush *T. naumanni x T. eunomus* in India." *Indian BIRDS* 18 (4): 99-106.

2. Bhat, H., Mahapatra, D. M., Boominathan, M., Rao, S., & Ramachandra, T. V. (2010). Avian diversity of Ladakh wetlands. Bangalore: *ENERGY and Wetlands Research Group, Centre for Ecological Sciences, Indian Institute of Science*, 1-5.

3. Delany et al., (2014). The Southampton University Ladakh Expeditions 1976–1982: Full details of nine species previously unrecorded in India and four second records. *Indian BIRDS* (9) 1-13.

4. Fitzpatrick W. J., & Rodewald. D. A., (2016). The Handbook of Bird Biology (Pp. 629). In: *Bird Conservation.* United Kingdom: Wiley & Sons, Limited.

5. Freeman, B. G., Scholer, M. N., Ruiz-Gutierrez, V., et al. (2018). Climate change causes upslope shifts and mountaintop extirpations in a tropical bird community. *Proceedings of the National Academy of Sciences* 115 (47), 11982-11987.

6. Grimmett, R., Inskipp, C., Inskipp, T. (2016). *Birds of the Indian Subcontinent: India, Pakistan,Sri Lanka, Nepal, Bhutan, Bangladesh and the Maldives.* United Kingdom:Bloomsbury Publishing. Pp. 7-528.

7. Gyalpo, P., Stanba. A. T., & Gasha. C. S., (2022). Homeyer's Great Grey Shrike Lanius excubitor homeyeri in Ladakh. *Indian BIRDS* 18 (2): 55-56.

8. Gyalpo, P., (2023). Status of the Grasshopper Warbler Locustella naevia and the Booted Warbler Iduna caligata in the Union Territory of Ladakh, India. *Indian BIRDS* 19 (3): 93-94.

9. Gyalpo, P., et al., 2023. The Pallas's Leaf Warbler Phylloscopus proregulus from Ladakh, India: An addition to the South Asian avifauna. *Indian BIRDS* 19 (3): 78-81.

10. Gyalpo, P., & Giri. L., 2023. Avi-Faunal Diversity of Ladakh as a Key to Unlocking Wildlife Tourism Potential. *Hima Paryavaran* 31(2) – 37(2): 6-10.

11. Gyalpo, P., 2023. Website URL: https://ebird.org/ (accessed on 15th March, 2024).

12. Holmes, R. P. (1986). The Avifauna of the Suru River Valley, Ladakh. *Forktail* 2: 21-41.

13. IUCN (2023). The IUCN Red List of Threatened Species. Version 2022-2. https://www.iucnredlist.org/ (accessed on 15th March, 2024).

14. Kareiva, P. M and M. Marvier. 2011. *Conservation Science: Balancing the Needs of People and Nature*. Roberts and Company, Greenwood Village, CO.

15. Lovette,I.J & Fitzpatrick,J.W., (2016). The Handbook of Bird Biology (Pp.3). In: *Why Study Birds.* United Kingdom: Wiley & Sons, Limited.

16. Madge, S. (2020). Long-billed Bush Warbler (Locustella major), version 1.0. In Birds of the World (J. del Hoyo, A. Elliott, J. Sargatal, D. A. Christie, and E. de Juana, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.lbbwar1.01(accessed on 10th February, 2024).

17. Mallon, D. P., 1987. The Winter Birds of Ladakh. *Forktail* 3: 21-41.

18. Muzika, Y., (2014). Sillem's Mountain Finch Leucosticte sillemi Revisited. *BirdingASIA* 21: 28-33.

19. Namgail, T., 2005. Winter birds of the Gya-Miru Wildlife Sanctuary, Ladakh, Jammu and Kashmir, India. *Indian BIRDS* 1(2), 26-28.

20. Namgail, T., & Yom-Tov, Y., (2009). Elevational range and timing of breeding in the birds of Ladakh: the effects of body mass, status and diet. *Journal of Ornithology* 150, 505-510.

21. Naoroji, R., & Sangha, H. S., 2011. Threats to habitat and wildlife in Changthang and Rupshu areas of Ladakh: a case study at Hanle. *Indian BIRDS* 7 (1): 2–6.

22. Khan, A., Chandan, P., Takpa, J., Hussain, S. A., Rattan, R., Jamwal, P. S., & Ahmad, T. (2014). Diurnal time budget of breeding Black-necked Crane (*Grus nigricollis*) in Changthang, Ladakh, India. *Zoological Research*, 35, 158.

23. Pandiyan, J., Poyamozhi, A., Mahboob, S., et al. (2022). Assessment of the Toxic Effects of Heavy Metals on Waterbirds and Their Prey Species in Freshwater Habitats. Toxics 10 (11), 641.

24. Pfister, O., 2001. Birds recorded during visits to Ladakh, India, from 1994 to 1997. Forktail, 81-90.

25. Pfister, O. (2014). Birds and Mammals of Ladakh: (Oxford India Paperbacks). India: Oxford University Press India. Pp. i-xxi, 1-361.

26. Prins, H.T., and Namgail, T., (2017). *Bird Migration Across the Himalayas – Wetland Functioning Amidst Mountains and Glaciers*. United Kingdom: Cambridge University Press. Pp. i-xv, 1-440.

27. Samplonius, J. M., & Both, C. (2019). Climate change may affect fatal competition between two bird species. *Current Biology* 29 (2), 327-331.

28. S. Sharma., Wangmo, R., Rana, K. S., Visuddha, L., et al. (2021). *A Comprehensive account of the Birds of Ladakh - Commentary, Notes and Field Guide*. G. B. Pant- NIHE, WCBCL & Department of Wildlife Protection, Union Territory of Ladakh: Walnut Publication. Pp. i-x, 1-353.

29. Shirihai, H., Svensson, L. (2018). *Handbook of Western Palearctic Birds, Volume I &II: Passerines: Larks to Warblers - Flycatchers to Buntings*. United Kingdom: Bloomsbury Publishing.

30. SoIB 2023. *State of India's Birds, 2023: Range, trends and conservation status*. The SoIB Partnership. Pp.119.

31. Srinivasulu, C. (2022). *Birds of the Indian Subcontinent & their Scientific Names Explained*. India: Walnut Publication. Pp. i-x, 1-638.

32. Svensson, L., Grant, P. J., Mullarney, K. (2008). *Collins Bird Guide. 2nd ed*. United Kingdom: HarperCollins. Pp. 9-445.

33. Tak, P. C., Sharma, D. K., Thakur, M. L., & Saikia, U. (2009). Birds of Ladakh and Analysis of their Status. *Records of the Zoological Survey of India*, *109*(2), 27–53.
34. The Cornell Lab of Ornithology *Handbook of Bird Biology*. (2016). United Kingdom: Wiley & Sons, Limited. Pp. i-xii, 1-716.

35. Varagiya, D., Jethva, B., & Pandya, D. 2022. Feather heavy metal contamination in various species of waterbirds from Asia: a review. *Environmental Monitoring and Assessment* 194 (1), 26.