

## Understanding Flyways and Hotspots of Migratory Birds in India

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### Abstract

Each year, across much of the Northern Hemisphere, a substantial number of bird species migrate southward for winter and return along established routes in spring. This natural phenomenon, known as bird migration, follows specific pathways termed migratory flyways. More than 2000 bird species globally engage in migration, with some undertaking shorter, longitudinal movements or local migrations. However, numerous migratory birds confront multiple threats, leading to declines in species diversity and populations worldwide. To safeguard migratory birds, global initiatives under the United Nations and multilateral treaties have been implemented. India, a participant in the Convention on Migratory Species, actively contributes to the conservation of migratory birds. The convention's appendices list 128 avian species, with 7 species in Appendix I, 103 in Appendix II, and 18 species appearing in both. The Central Asian Flyway, linking Eurasia and the Indian Ocean via India, serves as a critical route for over 180 migratory bird species, including some facing global endangerment. Research conducted in India provides valuable insights into migratory bird behaviors and their habitats.

**Keywords:** Migratory bird, species, climate change, flyway, conservation, zoology, science, multilateral treaty.

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### Introduction

Every year, as winter sets in across much of the Northern Hemisphere, numerous avian species migrate southward to spend the season in warmer climates. They return to their original habitats as spring arrives, marking a biannual movement known as bird migration. This global phenomenon involves over 2000 bird species, collectively referred to as migratory birds. These birds follow established routes, termed migratory flyways, navigating natural obstacles like the Mediterranean Sea, Caribbean Sea, and high-altitude Himalayan peaks. Most migratory birds are aquatic species, relying on terrestrial water bodies ranging from small ponds to large lakes and wetlands for wintering. However, these birds face significant threats due to human activities such as habitat destruction, pollution, climate change, illegal hunting, infrastructure development, and diseases.

Consequently, their species diversity and populations are declining worldwide. To address these challenges, international cooperation is crucial. Various conservation measures have been adopted through intergovernmental agreements and multilateral treaties such as the Convention on Migratory Species, Ramsar Convention, Convention for the Protection of Migratory Birds, State of the World's Birds, and Neotropical Migratory Bird Conservation Act. These initiatives aim to ensure the sustainability of migratory bird populations by fostering coordinated efforts across borders. Flyways serve as strategic frameworks for international collaboration, focusing attention on the specific needs and conservation priorities of migratory birds.

### Definition and Terminologies

The term 'migration' originates from the Latin word 'migrara', meaning movement from one place to another. Among birds, many species have evolved to undertake two-way seasonal journeys to access favorable conditions for food and shelter. As winter approaches in their native habitats, characterized by scarcity of food and harsh conditions like low temperatures and snowfall, birds migrate to warmer regions known as wintering grounds, where survival conditions are more conducive. With the onset of spring and favorable seasonal changes, they return to their breeding grounds. Notably, while not all bird species migrate, a majority exhibit seasonal movements of varying extents. This phenomenon, termed 'bird migration', encompasses several types categorized primarily by the season and distance of migration. Birds native to the northern hemisphere predominantly engage in latitudinal migration, traveling long distances from north to south and vice versa.

Species like the Northern Pintail (*Anas acuta*), Eurasian Teal (*Anas crecca*), and Bar-tailed Godwit (*Limosa lapponica*) are renowned for covering extensive distances. Conversely, some species migrate shorter latitudinal distances, such as from the Himalayas to peninsular India and back. Examples include the Indian Blue Robin (*Larvivora brunnea*) and Rusty-tailed Flycatcher (*Ficedula ruficauda*). Others, like the Verditer Flycatcher (*Eumyias thalassinus*) and Blue-capped Rock Thrush (*Monticola cinclorhyncha*), move from the Himalayas to the plains of India. Certain birds migrate over very short distances, such as the Himalayan Black Bulbul (*Hypsipetes leucocephalus*) and Blue Whistling Thrush (*Myophonus caeruleus*), where some individuals travel less than 100 km southwards, while others remain as residents in their breeding areas. Additionally, some birds engage in vagrant or irregular migration, where they move short distances in search of safety and food without a specific direction. Examples

include herons, Black Stork (*Ciconia nigra*), Glossy Ibis (*Plegadis falcinellus*), Spotted Eagle (*Aquila clanga*), and European Bee-eater (*Merops apiaster*). Less frequently, birds in the southern hemisphere also exhibit migration, such as cuckoos breeding in India and spending summers in Southeast Africa.

Tropical birds may migrate during the rainy season to outer tropics for breeding and return to central tropics afterward. Marine avian species, such as the Arctic Tern (*Sterna paradisaea*), undertake extensive migrations, with some traveling up to 22,500 km from northern temperate regions to Antarctic zones along the Atlantic. The Bar-headed Goose (*Anser indicus*), one of the highest-flying birds, winters in various wetlands of India. Certain species display longitudinal migration, moving from east to west and vice versa. Examples include the Starlings (*Sturnus vulgaris*), which migrate from East Europe to the Atlantic coast, and the Hooded Pitta (*Pitta sordida*), found in Eastern and Southeast Asia but migrating to the Himalayan foothills during summer months. Some researchers categorize the daily movements of birds as 'daily migration'. Based on the time of travel, migratory birds are further classified into diurnal migrants, which travel during the day, and nocturnal migrants, which travel at night.

### **Problematic Features**

Birds encounter various threats during migration, ranging from natural phenomena like thunderstorms, sandstorms, diseases, and predation, to human-induced activities such as wind farms, pollution, oil spills, radiation, artificial lights, habitat degradation, and hunting. These factors collectively contribute to the declining populations of many migratory bird species. In India, several significant challenges affect migratory birds:

- **Fishing activities:** Local communities around wetlands often engage in fishing, which disturbs birds and causes them distress.
- **Human disturbance:** Herders and visitors frequently traverse the areas adjacent to wetlands with their livestock, leading to overgrazing and disturbance to birds. This grazing also accelerates soil erosion in the surrounding lands, increasing sedimentation in lakes.
- **Agricultural expansion:** Surrounding areas of wetlands are sometimes encroached upon for agriculture, resulting in the removal of natural vegetation cover. Water from lakes is often diverted for irrigation purposes in these fields.

The local residents often harvest aquatic reeds from wetland areas, which leads to degradation of the habitat. Conversely, certain plants such as *Ipomoea carnea* and *Eichhornia crassipes* proliferate rapidly, reducing the available surface area for many migratory birds. Species like *Eichhornia crassipes*, *Lemna perpusilla*, *Marsilea quadrifolia*, and *Wolffia globosa* are known as dominant surface-covering plants, forming dense green mats on the water's surface. Illegal hunting of migratory birds by local poachers is another concern, although efforts by forest officials typically prevent such activities.

Pollution poses a significant threat as wetlands are delicate ecosystems with limited self-cleaning capabilities. Plastic waste such as water bottles, wrappers, and bags are frequently discarded near wetland banks, contributing to pollution. Residents living nearby often dispose of waste in or near wetlands, further contaminating the water and surroundings. Recent research has shown that nocturnally migrating passerines are particularly susceptible to the effects of light pollution. These issues highlight the complex environmental pressures that migratory birds face during their journeys, necessitating concerted conservation efforts to mitigate their impact and ensure the survival of these species.

### **International Frameworks**

Several international strategies have been implemented under the auspices of the United Nations to conserve migratory birds and their habitats:

- **Convention on Migratory Species (CMS):** This United Nations treaty, also known as the Bonn Convention, was established to facilitate global collaboration for the conservation and sustainable use of migratory animals, their habitats, and migration routes. Signed in Bonn, West Germany in 1979 and effective from 1983, it currently includes 133 member countries. CMS focuses primarily on migratory birds, which constitute a significant portion of migratory animals. The convention's appendices categorize species based on their conservation status: Appendix I lists migratory species threatened with extinction, while Appendix II includes species that benefit from international cooperation. In India, 128 avian species are listed in these appendices, with 7 in Appendix I, 103 in Appendix II, and 18 in both.
- **World Migratory Bird Day (WMBD):** Initiated in 2006 by the Secretariat of the Agreement on the Conservation of African-Eurasian Migratory Waterbirds in collaboration with CMS, WMBD serves as an annual awareness campaign advocating for the conservation of migratory birds and their habitats globally. This day promotes public engagement through activities such as bird festivals, awareness events, exhibitions, and bird-watching excursions. Originally inspired by 'International Migratory Bird Day' in the United States, WMBD has expanded to include celebrations twice a year, on the second Saturday of May and October.
- **Convention on Wetlands (Ramsar Convention):** Established in Ramsar, Iran in 1971 and effective from 1975, this treaty aims to ensure the wise use and conservation of wetland habitats worldwide. Wetlands are critical ecosystems, providing various essential services such as freshwater supply, biodiversity conservation, flood control, and climate change mitigation. Parties to

the convention commit to designating at least one wetland site within their territory as a 'Ramsar Site', recognized internationally for their ecological significance. India currently hosts 75 Ramsar Sites, with Tamil Nadu holding the largest number, 14.

These international frameworks and initiatives underscore the importance of coordinated efforts at a global level to safeguard migratory birds and their habitats from diverse threats and challenges.

### **Strategies by the Indian Government**

India is actively engaged in international agreements concerning environmental and biodiversity conservation under the auspices of IUCN. The country plays a pivotal role in nature conservation efforts, particularly in safeguarding migratory birds and their wetland habitats. The Government of India, through the Ministry of Environment, Forest and Climate Change (MoEFCC), has implemented extensive measures and programs for this purpose. India is a party to the Convention on Biological Diversity (CBD), with MoEFCC serving as the key ministry responsible for its implementation. India has been acknowledged globally for its leadership in biodiversity conservation, having developed and enforced robust legal and policy frameworks. Under the CBD, India has ratified two key protocols: the Cartagena Protocol on Biosafety and the Nagoya Protocol on Access and Benefit Sharing.

Additionally, India became a member of the Ramsar Convention, known as the Convention on Wetlands, in February 1982. Currently, India has designated 75 wetlands, covering a total area of 13,26,677 hectares, under the List of Wetlands of International Importance, including five sites added during the fiscal year 2020-2021. India has also taken significant steps in conserving migratory birds, particularly those along the Central Asian Flyway, through the implementation of the National Action Plan for Conservation of Migratory Birds and their Habitats. The primary objective of this plan is to halt the decline in migratory bird populations by 2027. Over the years, numerous research projects conducted by various organizations and institutions across India have contributed valuable insights into migratory bird ecology and conservation in the region.

### **Understanding Flyways and Hotspots**

Migratory birds follow established, though somewhat flexible, routes during their seasonal movements. Globally recognized pathways connect the northern and southern hemispheres, guiding millions of waterbirds annually to their wintering and breeding grounds. Typically, these birds travel along a north-south axis to spend their non-breeding winter season in more favorable conditions. The primary driving force behind their route selection is to minimize the energy expenditure associated with migration. However, other factors such as weather patterns, available resources along the way, and geographic features of their destination also influence their path. Migrants often navigate using landmarks such as mountain ranges, rivers, coastlines, and watercourses, while avoiding large bodies of water and high-altitude mountains.

This results in similar species with comparable biological and ecological needs sharing common migration routes known as "flyways." Globally, there are 2,274 migratory species utilizing these flyways. Interestingly, not all migration routes strictly adhere to a north-south axis. For instance, in the southern hemisphere, migratory movements can be influenced by rainfall patterns, resulting in less latitudinal movements compared to northern migrants. Many species utilize only sections of these flyways, while others, such as the Whimbrel, Ruddy Turnstone, and Sanderling, cover the entire extent of a flyway. The International Wader Study Group identifies eight major multi-species flyways, including the Central Asian Flyway that spans from Arctic breeding grounds in Siberia to wintering areas in West Asia, India, and the Maldives. This flyway supports over 180 migratory bird species, including several globally threatened or near-threatened species like the critically endangered White-bellied Heron and Northern Bald Ibis, the endangered Greater Adjutant Stork, the vulnerable Lesser Adjutant Stork and Black-necked Crane, and the near-threatened Lesser Flamingo and Pygmy Cormorant.

India's diverse array of water bodies, including inland and coastal wetlands, marsh areas, and ponds, serves as a significant attraction for migratory birds. These habitats range from high-altitude lakes like Tso Moriri, Pangong Tso, Tso Kar, and Chandratol in the trans-Himalayan region to coastal wetlands encompassing salt marshes, lagoons, mangrove swamps, and various types of marshes and depressions. These wetlands are renowned for their high primary productivity, which supports a large diversity of bird species. Many of these sites have been designated as 'Wetlands of International Importance' due to their exceptional ecosystems and significant conservation values. Currently, India boasts a total of 1243 wetlands, including 75 Ramsar wetlands, 115 significant wetlands, and 1053 other recognized wetlands. India became a signatory to the Ramsar Convention, also known as the Convention on Wetlands, on February 1, 1982. The Ramsar sites in India cover a total area of 13,266.77 square kilometers, making India the leading country in South Asia and the third in Asia in terms of Ramsar site coverage.

Most of these sites are concentrated in the north-western Himalayas and the Gangetic plains. Notable wetlands that attract large numbers of winter migratory birds include Pong Dam in Himachal Pradesh, Asan Conservation Reserve in Uttarakhand, Wular Lake in Jammu & Kashmir, Tso Kar Wetland Complex in Ladakh, Harike Lake in Punjab, Bhindawas Wildlife Sanctuary and

Sultanpur National Park in Haryana, Sur Sarovar Bird Sanctuary in Uttar Pradesh, Keoladeo National Park and Sambhar Lake in Rajasthan, Bhoj Wetland in Madhya Pradesh, Kabartal Wetland in Bihar, Deepor Beel in Assam, Loktak Lake in Manipur, Bhitarkanika Mangroves and Hirakud Reservoir in Odisha, East Kolkata Wetlands and Sunderbans Wetland in West Bengal, Kolleru Lake in Andhra Pradesh, Point Calimere Bird Sanctuary and Pichavaram Mangrove in Tamil Nadu, Ashtamudi Wetland and Sasthamkotta Lake in Kerala, Nanda Lake in Goa, Thane Creek in Maharashtra, Nalsarovar Bird Sanctuary, Khijadia Wildlife Sanctuary, and Wadhvana Wetland in Gujarat. Additionally, numerous bird sanctuaries across India with wetland habitats, such as Patna Bird Sanctuary, Nawabganj Bird Sanctuary, Lakh Bahosi Sanctuary, and Sandi Bird Sanctuary in Uttar Pradesh; Kanwar Lake Bird Sanctuary in Bihar; Khichan Bird Sanctuary; Pulicat Lake at the Tamil Nadu-Andhra Pradesh border; D'Ering Wildlife Sanctuary in Arunachal Pradesh; Rann of Kutch in Gujarat; and Kumarakom Bird Sanctuary in Kerala, are known for hosting significant populations of migratory birds.

### Let Us Conclude

Studies indicate that India holds significant importance as a destination for migratory birds in South Asia, largely due to its diverse range of wetlands, spanning from coastal areas to inland lakes and reservoirs. Key wetland locations such as Pong Dam, Asan Barrage, Harike Barrage, and marshy depressions and waterlogged areas in the Gangetic plains not only host a substantial number of migratory birds but also serve as crucial stopover points for passage migrants continuing further southwards. India actively participates in several United Nations treaties aimed at conserving water birds, making substantial contributions toward the conservation of migratory birds and their habitats. This effort is coordinated through nationwide implementation of various programs under the auspices of the Ministry of Environment, Forest, and Climate Change.

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