

MYSTERIOUS MIGRATION OF BIRDS: A REVIEW

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Can you imagine, that the bird 'Arctic Tern' covers a distance of over 17,000 km every year? The Pacific Golden Plover birds cross the open sea with non-stop flights of at least 3200 km! And most species of Penguin are covering over 1000 km by swimming regularly! Isn't it mysterious?

In science, this mystery is well known as birds' migration. Nature lures human brains to reveal itself and man has become successful in many areas. But still, there are some hidden mysteries, in search of which, we, human beings are astonishing against the miracles of nature. The migration of birds is one such unrevealed mystery for nature lovers.

What is migration?

To move from one place to another is a differential symptom of living things. Most of the animals tend to migrate generally in particular periods, at some particular distances. Such movements of varied distances are made chiefly due to changes in food availability, habitat, and weather. Similar types of regular seasonal journeys are undertaken by many species of birds. Lands Borrough Thomson describes birds' migration as "changes of habitat periodically recurring and alternating in direction, which tend to secure optimal environmental conditions at all times." Alternating i.e. back and forth movement is a crucial feature of migration. The irregular and generally unidirectional movements are known as nomadism or invasions. However, there are some non-migratory birds; that are known as resident birds.

However, migration is not a new phenomenon. Surprisingly, the oldest observations of bird migration were noted by Hesiod, Homer, Herodotus, and others about 3000 years ago. The references to migration have also been found in the Bible. Aristotle noted the cranes traveled from Scythia to the Nile. He also suggested about the hibernation of swallows and other birds. Elliott Coues described hibernation in 1878. White storks found in Germany, embedded with African arrows gave early clues about migration.

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Reasons for migration

Although various factors like changes in food availability, habitat, and weather are responsible for migration, also the appropriate season for migration stimulates the internal and external reflexes in the birds. Sunlight has a significant impact on many physiological processes. Hence variation in day length is supposed to be one of the primary external stimuli. However, by manipulating the day length artificially in the laboratory provoked the stages of maturity of reproductive organs, suggestive of internal stimuli.

Generally, in summer the birds migrate toward the north for breeding and return in winter towards warmer regions of the south. Migration mainly provides energy to the birds. The extended day length in summer in the northern part serves as a platform for breeding birds and feeding their young ones. As the day length also has a significant effect on clutch size i.e. number of eggs, the extended daylight hours allow diurnal birds to produce larger clutches as compared to non-migratory species of birds in the same region. In autumn, when day length reduces, the birds return to the warmer regions for food.

Various patterns of migration

The migration itself is more interesting as we peep in its various facets. Many times, the bird has to change its locality due to local conditions only. These conditions may be heat, drought, or floods, which generally cause adverse effects on the availability of their food supply. In India, at the base of the foothills of the Himalayas, such seasonal changes are more common as compared to equatorial regions. In a bio-diverse country like India, where different seasons provide various types of food for birds, a local migration is common at such places. For example, the flowering season of certain plants lures nectarivorous birds like Sunbirds. Similarly, the ripening of certain fruits, and fluctuations in insect population will attract frugivorous birds like Bulbul and parakeet and insectivorous birds like Egret and oriole, respectively. The same bird may be found in summer at one locality and in winter or rainy season at different regions within the country. This periodical appearance is also known as local migration.

Even, not all the birds of the same species migrate necessarily. Only some of the population within a species may be migratory, this is known as partial migration. Surprisingly, sometimes the birds at higher latitudes tend to be migratory whereas, those at lower latitudes tend to be resident due to suitable wintering habitats. This type of migration is known as leap-frog migration. Different altitudes also provide variation in food availability and enable birds to migrate. Such altitudinal migration is common in the Himalayan region of India. At a

height of 5000 m (16400 ft.) on the Khumbu glacier of Mt. Everest, the skeletons of Pintail and Black-tailed Godwit found give clues about the altitude of migration. Not only this but the Bar-headed Geese also have been observed flying over 8000 m (29000 ft.) in the Himalayas. Sea birds migrate at low overwater and high altitudes when crossing the land. Exactly the opposite type of flying altitude is observed in land migratory birds. Most of the birds migrate in the range of 150 m (500 ft.) to 600 m (2000 ft.).

Different patterns of migration are also based on age groups and the sex of the bird. In the case of Chaffinches in Scandinavia, only females migrate and males stay as residents. Sometimes, a good breeding season is followed by a food source failure. Such circumstances cause irruptions in bird numbers. Many larger birds fly in flocks. It helps to reduce the energy stress. Most of the large birds fly in a V-formation.

It is observed that migratory birds return not only to the same general locality for breeding but also to the same nesting sites year after year. Even after covering a distance of 2000 km or more, the ringed Grey Wagtail was found to be returned at the same site in Mumbai on the same day. Isn't it mysterious?

How do birds find the route?

The phenomenon of navigating the migration route, although is a complex one, is itself an exciting and mysterious thing. Human beings have been engaged for years in solving this mysterious activity of birds. Generally, the adult males used to come first at their breeding ground in the spring. Adult females arrive later for breeding. However, in autumn, while returning, the adult birds both male and female follow the path led by young ones. Young ones act as forerunners of the flock. Isn't it really interesting that the young birds, which don't have an idea about the route and destination or any previous experience still reach to desired destination accomplishing the journey of thousands of miles? Instead of mortality through accidents and others, the birds reach with surprising accuracy, and this surplus the mystery of migration.

While searching for the roots of such mysterious migration, the primitive trait, which is inborn and inherited through several generations that have followed migration, may support the hypothetical base. The ability to navigate and orient themselves during the migration is the same as that of genetically fitted programs in birds along with learning.

The change in day length triggers the hormonal reflex in birds, which can be seen with higher activity or restlessness in cage-raised birds. Also before the migration period, birds show increased fat deposition in the body, which is suggestive of energy storage for migration.

Even in caged birds during the migration period, a preferential flight direction is seen, which is roughly the same direction of migration shown by wild birds.

Various natural navigators are supposed to guide the path of migratory birds. Day-flying migrants use Sun-compass by manufacturing their course from the angle made between the sun and the earth, at the proper time. In the case of nocturnal migrants, the constellations of stars act as guides. Along with major visual landmarks and olfactory cues, the ability to detect magnetic fields by birds equally contributes to mapping the path. Young birds in their first migration, fly in the correct direction by using the earth's magnetic field. However, they don't have any idea about stopover points. The innate ability and earned experience help to find electromagnetic fields to recognize the habitats and make mental maps. The study about the migration of raptors like ospreys and honey buzzards, with satellite tracking, has shown that older individuals are better at correcting wind drift. Recently, researchers have found a neural connection between the eye and 'cluster n' part of the forebrain, which is active during migrational orientation. This is suggestive of the ability of birds to see the magnetic field of the earth.

Problems in migration

The migratory journey is not that easy, but full of risks, barriers, and problems for the birds. Instead of high stress, the birds are at risk of predation. This predation risk is the same with diurnal and nocturnal migrants. The bird Elenora's falcon feeds its young one with southbound nocturnal passerine migrants. During migration, birds have to stop at some stopover points for refueling them, which also enhances the predation risk. Many smaller insectivorous birds like hummingbirds and flycatchers migrate large distances usually at night to minimize predation and avoid overheating. Again the nocturnal migration at the cost of loss of sleep, affects the migrant's journey. The large broad-winged birds like vultures, eagles, buzzards, and storks rely on thermal columns of rising hot air to enable them to soar to migrate in the daytime. Since the thermals only form over the land, these birds are unable to maintain their active flight for long distances and have to face great difficulty in crossing large water bodies. Similarly, the water birds have difficulty crossing large landscapes. Environmental fluctuations provoke food scarcity which may be harmful. Sometimes, differential wind conditions may cause detours. Various parasites and pathogens causing harm to the immune status of birds can not be neglected at the same time.

Ecological effects of migration

Migration of species from one place to another is not a mere matter of movement; it also favors the movement of ectoparasites like ticks and lice. Such ectoparasites are not only harmful to birds but also serve as hosts for many vectors like micro-organisms, raising the question about human health. Many times, some viruses (e.g. West Nile virus) are maintained in birds without any lethal effects. Since migratory birds act as carriers for various infections e.g. global spread of avian influenza, which is dreadful to domestic as well as pet birds. Migrants also have an important role in the dispersion of plants and plankton. As per the genetic aspects, migration changes the gene and genotypic frequencies of the population.

Techniques to study migration

Migrating birds initiated human curiosity, which in turn developed into various techniques regarding migratory behavior study. Ringing is the oldest method used to know the migration patterns in birds. Some other techniques like color marking, the use of radar, satellite tracking, and stable hydrogen isotopes are also used. Various efforts to study orientation behavior have been carried out for many years. Emlen funnel is a circular cage with the top covered by glass or wire. The screen is set up so that the sky should be visible. The behavior of the bird inside Emlen's cage is studied by analyzing the distribution marks left on the wall of the cage by the bird.

Conservation

Increased human encroachment in the natural habitats of many not only the migratory birds but also in general, have raised the question of the existence of wild flora and fauna. Habitat destruction, hunting, fragmentation, illegal trades, poisoning, emerging diseases, and climatic changes have threatened the species.

Conservation of forests and grassland to agriculture, monoculture plantations in natural forests, grazing and woodcutting pressures, etc. have declined the quality and quantity of habitat. This tragedy is not only with the terrestrial species but also for aquatic and semi-aquatic species. Diversion of surface and groundwater, drying up of streams and other water bodies, siltation, and pollution from pesticides and chemical effluents have threatened the survival of migratory birds.

Various countries have accepted and adopted conservation measures co-operatively, as the migratory birds cross political boundaries, to protect migratory birds. E.g. Migratory Bird Treaty Act- 1918 of U.S. and African Eurasian migratory water birds agreement.

Man-made structures like power lines, wind farms; offshore oil rigs, and hunting along migratory routes have severely affected migrants. The migration of a huge flock of billions of passenger pigeons (*Ectopistes migratorius*), 1.6 km wide and 500 km long, passing in the sky now becomes history. This bird has gone extinct already. Let's hope that the sky will not experience this event again.

The biodiverse land of India is also one of the destinations for migratory birds. 13% of the world's bird species are found in India. Even though more than 1200 species of birds, India is the largest country containing rare and threatened species. More than 500 protected areas and 35 areas especially established for bird protection. Along with grasslands, India has potential wetlands and marshes like Ramsar sites, which have international importance due to waterfowl. Many migratory birds unfortunately are getting added to the threatened list. 12 species are facing extinction threat as 'critically endangered'. Siberian crane is one of them. Keoladeo National Park, Rajasthan is the site of fidelity for Siberian cranes. But it was seen last time in 2002 in this park. When the roots of this declination were traced out, it was observed that there was severe hunting along the migratory route, particularly in Afghanistan and central Asia.

Besides the legal efforts like bird sanctuary, some areas in the country are protected by people and have also served as breeding tracts for many migrants. Vedanthangal (Tamilnadu), Nelapattan (Andhra Pradesh), Kokkelabelur (Karnataka), and Navegoan bandh (Maharashtra) are a few of them.

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