UNIT I

PAPER: AVIAN BIOLOGY

SUBJECT CODE-18KP1ZELZ1

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CLASS AVES

GENERAL CHARACTERS

1.Aves are **birds**.

2. The body is spindle shaped and it consists of four regions, namely a **head,** a **neck**, a **trunk, and** a **tail**.

3. Birds are **bipedal, feathered**, and **warm blooded** animals.

4. The **fore limbs** are modified into **wings**. Most of them can fly except flightless birds (e.g., Ostrich).

5. The **hind limbs** are adapted for **walking, perching, and swimming** and bear four, three and rarely two toes.

6. The birds has an **epidermal exoskeleton** in the form of **feathers, scales, claws,** and **beaks.**

7. The skin is dry and **skin glands** are absent.

8. **Preen glands** (oil or uropygium gland) are present at the base of tail.

9. The **upper** and **lower jaws** are modified into **beak** or bill. Beaks are modified into different forms for feeding- seed- crushing, fruit-scooping, flesh-tearing, nectar-sip-ping, wood-chiseling etc.

10. The **teeth** are **absent**.

11. **Legs** are modified for walking, hopping, grasping, perching, wading, and swimming. Legs bear horny epidermal scales.

12.The alimentary canal has the **crop and gizzard.** The crop stores and softens the food and gizzard helps in crushing and churning the food.

13. Respiration is by lungs. The lungs are provided with **air sacs**. Birds exhibit double respiration.

14. Voice is produced by a special organ, the **syrinx** (voice box).

15. The heart is **four-chambered**.

16. Right systemic arch alone present. **Left systemic arch** is **absent.**

17. RBC is **nucleated.**

18. Kidney is **metanephric**.

19. They have **cloaca**.

20. **Urinary bladder** is absent.

21 Birds excrete **uric acid**. Hence, they are called uricotelic animals.

22. Brain is better developed than that of reptiles, cerebrum, cerebellum, and optic lobes are quite large.

23. Birds have 12 pairs of cranial nerves.

24**. Pecten** is present in the eyes of birds. It gives nourishment to retina and it increases intensity of vision.

25. The ear contains single bone called **columella auris**.

26. The bones are **pneumatic** with air spaces to reduce weight.

27. The skull is **monocondylic** with a single occipital condyle.

28. The sternum is large, and it bears a keel for the attachment of flight muscles.

29. Exhibit sexual dimorphism.

30. Birds are **Oviparous.**

31. Produce **cleidoic eggs** (eggs with a shell).

32. The female has a single ovary (left) and a single oviduct

33. **Four embryonic membranes** (e.g chorion, amnion, allantois and yolk sac) are formed.

34. Fertilization is internal.

35. Birds exhibit **parental care**, courtship, nest building, **migration** and territorial behaviour.

36. The birds are the most beautiful among the animals.

FLIGHT ADAPTATION IN BIRDS

1.Spindle -shaped Body:
It offers minimum resistance to the wind.

2. Feathers:
They prevent loss of heat and helps to maintain a constant temperature.

3. Wings:
Fore-limbs are modified into wings, which helps during flight.

4. Beak:
Modified beaks help in the procurement of food and used for nest-building.

5. Neck and Head:
Mobile neck and head are particularly useful for feeding, nest building, offence, and defense.

6. Flight Muscles:
The flight muscles are highly developed in flying birds

7. Hind Limbs (Legs):
The feet are used for locomotion, offence, and defense. Well adapted for perching.

8. Endoskeleton:
Bones are pneumatic It makes body light weight.

9. Synsacrum: Plate like structure formed by the fusion of 14 vertebrae. It acts as a girder to support the entire weight of the bird.

10. Air Sacs:
Air sacs serve as reservoirs of air.

11. Warm-Bloodedness:
Birds are warm-blooded animals. The constant body temperature helps the birds to take flight at high altitudes in all seasons.

12. Circulatory System:
The circulatory system is highly adapted for carrying more oxygen.

13. Excretory system:
It is highly modified to reduce weight.

14. Brain:
Brain and eyes are well developed. Equilibrium is maintained by well-developed cerebellum of the brain.

15. Eyes: Power of eye is very high. Presence of pecten helps birds to see objects from extremely high altitudes.

16. Single Ovary: Absence of ovary and oviduct from one side leads to reduction of weight which is essential for flight.

BIRDS ARE GLORIFIED REPTILES

Aves are birds. They are the masters of air. They originated from reptiles in Mesozoic era. Birds are **defined** as

"warm blooded, bipedal, air –breathing, vertebrates with fore limbs modified into wings and non-glandular skin covered with feathers"

Feathers, wings, and beaks are the three important identifying features which make the birds distinct from other vertebrates. Both reptiles and birds resemble with each other in many features. Superior to reptiles but inferior to mammals in evolutionary scheme.

Huxley stated that 'birds are glorified reptiles'

The birds originated from reptiles. They retain many reptilian characters on their body. However, birds maintain advanced characters over reptiles.

The following reasons justify the fact that birds are glorified reptiles:

1.**Feathers** of birds are homologous to **epidermal scales** of reptiles.

2. The skull as a **single occipital condyle** in both.

3. Birds have **air sacs** in the lungs like that of Chamaeleon.

4. Heart is **4 chambered**. In crocodile also, heart is 4 chambered.
(Reptilia heart is 3 chambered -2 auricles & incompletely divided ventricle).

5. Eyes contain a **pecten** both in birds and crocodiles.

6. In both, middle ear contains a single bone the **columella auris**. It is a bony or cartilaginous rod connecting the tympanic membrane with the inner ear and transmitting sound.

7. Both are **uricotelic animals**. Uricotelic organisms are the organisms which excrete nitrogenous waste substances in the form of uric acid, e.g., Lizard and birds.

8. They are **oviparous.** Oviparous are animals that lay their eggs, with little or no other embryonic development within the mother (after their eggs after laying them) E.g., frogs, snakes, lizards, hens, and duck.

9. They produce **Cleidoic, Megalecithal and telolecithal eggs.**

> ***CLEIDOIC EGGS*** *are the egg enclosed by the shell or membrane and reduces the exchange of gases (terrestrial adaptation).*
>
> ***MEGALECITHAL*** *are eggs contains large amount of yolk (On the Basis of the distribution of yolk).*
>
> ***TELOLECITHAL*** *: refers to the uneven distribution of yolk in the cytoplasm of ovums. The yolk is concentrated at one pole of the egg.*

10. Cleavage is **meroblastic** (Incomplete) and **discoidal** (disc alone divides).

11. Embryo develops an **amnion** in both groups. The innermost membrane that encloses the embryo of a mammal, bird, or reptile.

12. **Archaeopteryx**, the fossil bird exhibits a mixture of reptilian and avian characters.

Birds are glorified (advanced) over reptiles by the following reasons:

1. Birds **fly** in air

2. Fore limbs are modified into **wings.**

3. They are **warm blooded**.

4. **Flight muscles** are well developed.

5. A **keel** is present in the sternum (Breastbone). It is boat shaped. It lies on mid ventral line. On the ventral side has a median triangular ridge called keel.

6. Bones are **pneumatic.**

*Birds have **pneumatic** bones which are hollow bones and contain air cell that leads to increasing their buoyancy and help them in flight.*

7. A **synsacrum** is present in the vertebral column.

It is a compound structure of the sacrum of birds formed by the fusion of 14 vertebrae.
It strengthens the vertebral column.
It makes trunk region rigid and flexible.
Both reptiles and birds have 12 pairs of cranial nerves.

8. **Syrinx** is present for melodious sounds.

Syrinx, the vocal organ of birds, located at the base of the windpipe (trachea), where the trachea divides into the bronchi (tubes that connect the trachea with the lungs).

9. **Parental care** is well developed.

A superficial examination reveals that a bird appears much different from reptile. But a close examination reveals that a bird is nothing, but a reptile clothed with feathers. Because of its feathers, it conquered the air. Hence the birds are described as **glorified reptiles.**

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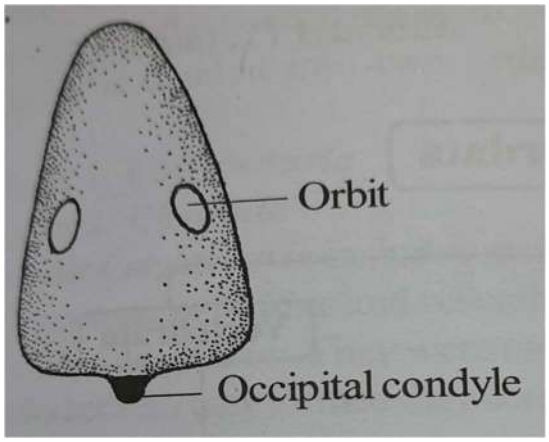

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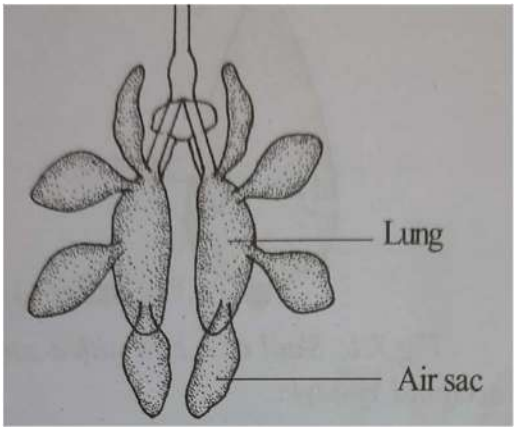

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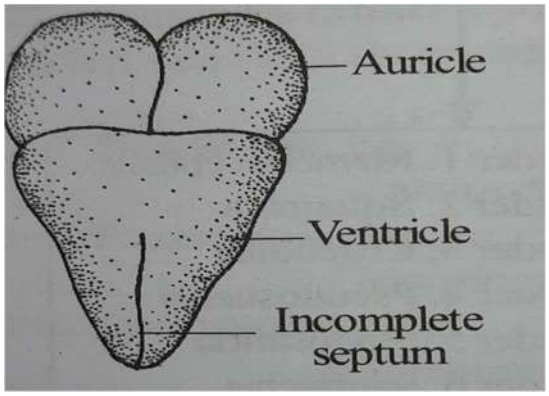

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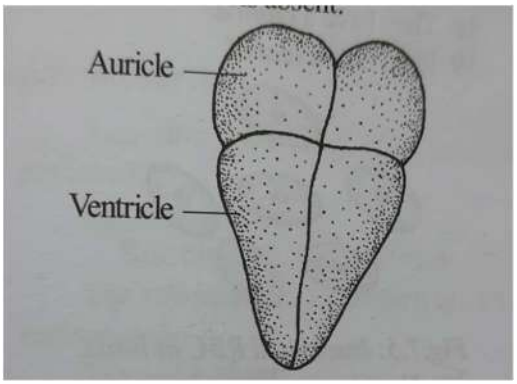
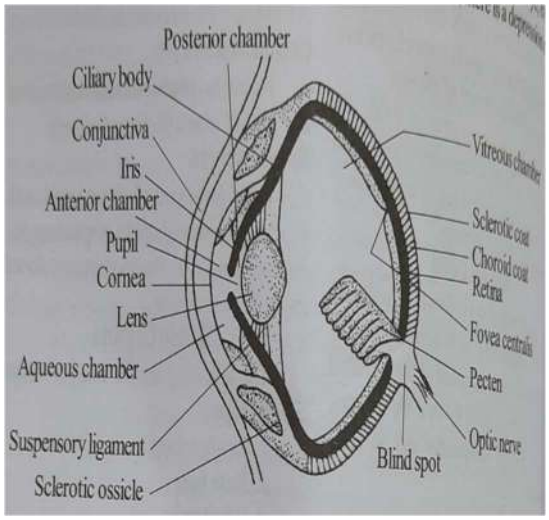


1.Occipital condyle 2. Air sacs in birds 3. Heart of Reptilia 4. Heart of bird

5.



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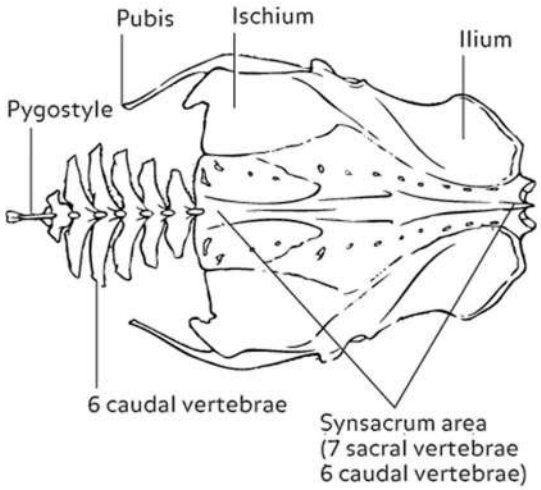

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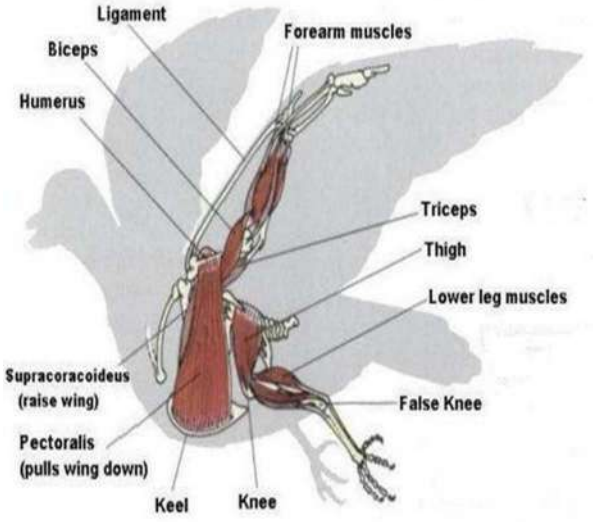

5. Eye of bird-pecten 6. synsacrum 7. Archaeopteryx 8. Flight muscles

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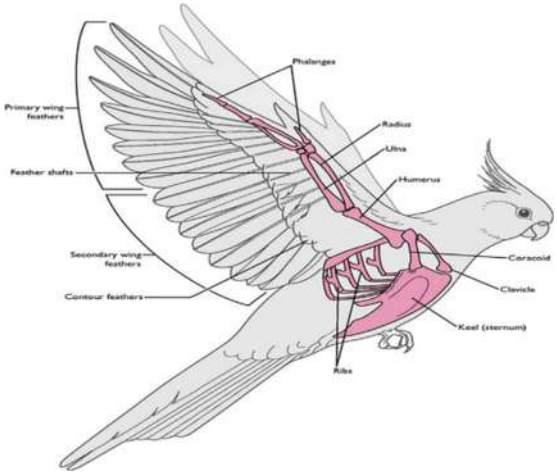

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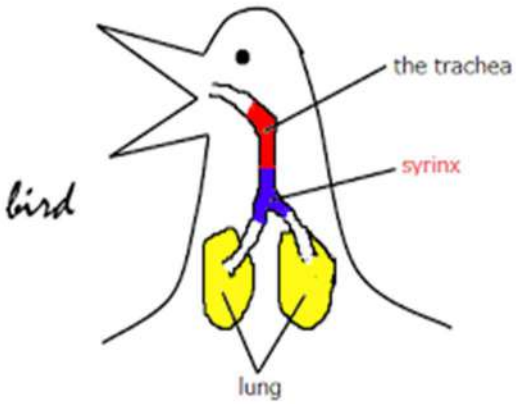


11.

9. Sternum 10. Syrinx 11. Parental care

AVIFAUNA OF INDIA

The Indian subcontinent, a part of the vast Oriental biogeographic regions, is rich in biodiversity. (Oriental region: Southeast Asia). Its fauna is numerous and highly diverse. Out of the more than 9,000 birds of the world, the Indian subcontinent contains about 1,300 species, or over 13% of the world's birds (Grimmett et al. 1998). Indian subcontinent, rich in avifauna also claims 48 bird families out of the total 75 families in the world. The Oriental region is the centre of radiation for many bird groups such as the pheasants, laughingthrushes, drongos, leafbirds, pittas, parrotbills, and flower-peckers.

Being a physical part of Asia, India has acted as a center of dispersal of species as well as has received species from the Palaearctic, Ethiopian, Indo-Chinese and Indo-Malayan subregions. But the dominant groups of birds in India belong to what is sometimes called the 'Indo-Chinese' fauna, the birds adapted to life in the warm, moist tropical southeast Asia, birds primarily of jungle or heavy forests (Ali and Ripley 1987). The geographical difficulties of southeast Asia, the twisted patterns of mountain chains, river drainage systems and a long period of stable climate seem to have been ideal for the evolution of a wide array of species of birds.

Ali and Ripley (1987) consider 176 species of bird's endemic (local) to the Indian subcontinent. Of these 30 (17%) have affinity to the Palaearctic species (i.e. are related to birds found in Europe and temperate Asia), 109 (62%) are related to Indo-Chinese species (i.e. southeast Asian species), another 30 are related to Ethiopian (African) species, and the rest show no clear-cut affinity. Thus, the major proportion of the Indian bird species are related to species of the tropical Oriental region, with an equal number of endemic species having their origin in the Palaearctic and Ethiopian regions.

IMPORTANT BIRD AREAS IN INDIA

One of the main reasons for high avian diversity in India is the presence of diverse habitats, from the arid cold desert of Ladakh and Sikkim to the steamy, tangled jungles of the Sunderbans to the wet, moist forests of the Western Ghats and Arunachal Pradesh. Rodgers and Panwar (1988) of the Wildlife Institute of India have divided India into ten major biogeographical zones:
Rodgers and Panwar's classification are used for describing the avifauna of India.

1. **Trans-Himalayas**
2. **Himalayas**
3. **Desert**
4. **Semi-Arid**
5. **Western Ghats**
6. **Deccan Peninsula**
7. **Gangetic Plains**
8. **Northeast**
9. **Islands and**
10. **Coasts**

1. THE INDIAN TRANS-HIMALAYAS

The Trans-Himalayas (4,500 to 6,000 m) consisting of Ladakh (Jammu and Kashmir), Lahul-Spiti (Himachal Pradesh), and a small area of Sikkim. In India, the **Trans-Himalayas cover** about 5.62% of India's geographical area. It has high mountains, deep valleys and flat, arid plains. Major rivers-Brahmaputra, Sutlej and Indus start from this region. Such lakes and marshes (mostly saline) are important as breeding grounds for birds such as

1. Black-necked Crane ***Grus nigricollis***
2. Bar-headed Goose ***Anser indicus,***
3. Great Crested Grebe ***Podiceps cristatus***

Flat plains provide habitat to

1. Tibetan Sandgrouse ***Syrrhaptes tibetanus***
2. Horned Lark ***Eremophila alpestris***
3. various species of wheatears ***Oenanthe***

On the treeless mountains

1. Tibetan Snowcock ***Tetraogallus tibetanus***
2. Himalayan Snowcock ***Tetraogallus himalayensis***

Tibetan Eared Pheasant ***Crossoptilon harmani-*** is found at the edges of mixed broadleaf-coniferous forests, rhododendron, juniper and deciduous scrubs and grasslands, between 3,000 to 5,000 m. It is locally common and has adapted to disturbed habitats.

WETLANDS OF TRANS-HIMALAYAS

Most of the wetlands are found in the **Changthang region** of Ladakh between the altitude 4000 to 5000 m. Changthang area provide a sanctuary for many species of mammals, and birds. Some of the important high-altitude lakes such as Tso Kar, Tso Morari, Pangong Tso, and marshes such as Hanley, Phoktsey and Chushul are located in this region, are identified as **IBA**s.

Most of them are common and widespread, live in low density –

1. Himalayan Griffon ***Gyps himalayensis***
2. Snow Partridge ***Lerwa lerwa***

But some of the smaller species move in large flocks, especially during their migration

1. Long-billed Calandra Lark ***Melanocorypha maxima***
2. Hume's Short-toed Lark ***Calandrella acutirostris***

During winter, many species of this region move down to other regions

1. Brown-headed Gull ***Larus brunnicephalus***
2. Tickell's Warbler ***Phylloscopus affinis***

while some species do not move or show small altitudinal movement

1. Tibetan Snowcock ***Tetraogallus tibetanus***
2. Himalayan Snowcock ***T. himalayensis***
3. Tibetan Sandgrouse ***Syrrhaptes tibetanus***
4. Alpine Accentor ***Prunella collaris***

Globally Threatened species of the Indian Trans-Himalayas

1. Black-necked Crane ***Grus nigricollis***
2. Wood Snipe ***Gallinago nemoricola***
3. Giant Babax ***Babax waddelli***

2. HIMALAYAS

Nearly 6.41% of the total area of India consists of the Himalayan mountain ranges. It shows extreme temperature and rainfall variation from the West to East Himalayas. Also, it has

altitudinal gradation both in temperature and rainfall which again increases the habitat diversity. It is the center of species radiation of **pheasants.** Out of the 49 species of pheasants in the world (del Hoyo et al. 1994), 18 are found in the Himalayan region (Ali and Ripley 1987).

Important species found in India are the

1. Western Tragopan ***Tragopan melanocephalus***
2. Satyr Tragopan ***Tragopan satyra***
3. Monal Pheasant ***Lophophorus impejanus***
4. Sclater's Monal ***Lophophorus sclateri***
5. Cheer Pheasant ***Catreus wallichii***
6. Blood Pheasant ***Ithaginis cruentus***
7. Kalij (= Kaleej) Pheasant ***Lophura leucomelana***
8. Koklass Pheasant ***Pucrasia macrolopha***

The Himalayas also have a monotypic species (i.e. only one species in a genera), the Ibisbill ***Ibidorhyncha struthersii***. -Found near streams and rivers of the Himalayas. This partridge-sized bird, with long red legs and down-curved, red bill and a black band across the breast is found from 1,700 to 4,400 m.

The Himalayas are geographically divided into four biotic provinces or sub-regions, namely

1. **Northwest Himalayas**
2. **Western Himalayas**
3. **Central Himalayas (Nepal) and**
4. **Eastern Himalayas**

(Rodger and Panwar 1988)

NORTHWEST HIMALAYAS

This part of the Himalayas occurs from Kashmir to the River Sutlej in Himachal Pradesh. There are several wetlands in this region and many of them are identified as IBAs for their bird congregations, such as Pong Dam in Himachal Pradesh, and Hokasar, Walur, Shallabugh and Mirgund in Jammu and Kashmir.

WESTERN HIMALAYAS

The West Himalayas, the smallest among the Himalayan regions, comprises the Garwal and Kumaon hills and includes eight hilly districts of Uttaranchal. It lies between the Kali and Sutlej rivers. Some of the most important rivers of the Gangetic Plains originate in this area, i.e. Yamuna, Ganga, Bhagirathi, Ramganga, Kosi, Sharda, Surya, and their tributaries.

Many of these rivers have been dammed for hydroelectric purposes, and many more dams are planned and are under construction. The avifauna of the Western Himalayas is also rich, and more than 500 species are found. Some of the threatened species of the Western Himalayas are the Cheer Pheasant, Himalayan Quail Ophrysia superciliosa, Western Tragopan, Satyr Tragopan and Black-necked Crane.

CENTRAL HIMALAYAS: This region falls in Nepal.

EASTERN HIMALAYAS

The Eastern Himalayas, consists of the Kingdom of Bhutan and the Indian states of Sikkim and Arunachal Pradesh, is one of the richest bird zones in India. Ali (1977) has identified 536 bird species. This zone, about 1000 km long and 150 to 200 km wide, consists of extremely rugged mountains, deep-forested valleys, and steamy tropical plains. The altitude varies from 300 to 4,500 m and the region is a meeting point of Palaearctic, Indo-Chinese and Indo-Malayan biogeographical regimes. As it is close to the Bay of Bengal, moisture-laden clouds are intercepted by abruptly rising chains of mountains, resulting in heavy precipitation.

Most of the birds of Eastern Himalayas are small passerines or perching birds which live in forests.

1. 14 *sp*- pigeons and doves
2. 17 *sp*- cuckoos
3. 6 *sp*- barbets
4. 17 *sp*- woodpeckers
5. 7 *sp*- drongos
6. 9 *sp*-bulbuls
7. 7 *sp*- scimitar babblers
8. 8 *sp*- wren-babblers and

9. 8 *sp*- parrotbills and 16 *sp* of laughingthrushes make the Eastern Himalayas a centre of speciation for many groups of birds.

The Eastern Himalayas is one of the biodiversity hotspots of the world. It is also the least studied region of India, perhaps many taxa await discovery. As the human population density is low, this region still has good natural forest. Also, this region is important for many globally threatened, near threatened and restricted range species. The genus ***Sphenocichla*** is endemic. The species with small ranges (Wren babblers) or species living in low densities are subject to hunting pressures e.g. pheasants, Rufous-necked Hornbill **Aceros nipalensis** and Wood Snipe **Gallinago nemoricola.**

The Himalayas are the centre of radiation of many pheasant species.

> ***(a type of bird with a long tail. The males have brightly coloured feathers. Pheasants are often shot for sport and eaten)***

3. THE INDIAN DESERT (THAR)

The Thar desert occupies nearly 10 % of India's geographical area and covers 2,08,751 sq. km in Rajasthan alone. It includes areas of Punjab, Haryana, North Gujarat and extending up to Delhi. The total desert area in Gujarat forms 20% of the Thar desert.

The Thar Desert is one of the smallest deserts in the world, but it exhibits a wide variety of habitats and biodiversity. Between **250 to 300 species** have been reported from the Thar desert. Tremendous changes in the avifaunal structure of the Thar desert are taking place due to the **Indira Gandhi Nahar Project (IGNP)** and species never seen earlier are now regularly found near the canal. Due to this project –severe **impact on desert ecosystem** -- changing the crop pattern, traditional grazing regime etc. Due to easy availability of water everywhere, unsustainable livestock grazing is taking place and the famous **Sewan grasslands** which have survived for hundreds of years with low grazing pressure are now are under tremendous pressure.

These grasslands are the major habitat of the highly endangered Great Indian Bustard ***Ardeotis nigriceps***, and the winter migrant Houbara or the Macqueen's Bustard ***Chlamydotis macqueeni***.

> *The great Indian bustard or Indian bustard is a bustard found on the Indian subcontinent. A large bird with a horizontal body and long bare legs, giving it an ostrich like appearance, this bird is among the heaviest of the flying birds.* **(Critically Endangered -Population decreasing)**

Other important desert species are the

1. Cream-coloured Courser ***Cursorius cursor***
2. Greater Hoopoe-Lark ***Alaemon alaudipes***

Various species of sandgrouse, raptors, wheatears, larks, pipits and munias.

In the Rann of Kutch of Gujarat, both Greater ***Phoenicopterus roseus*** and Lesser ***P. minor*** flamingos breed when conditions are suitable. These nesting colonies come under increasing pressure due to tourist disturbance, and many nests have been reported to be destroyed. As the sites of the nesting colonies shift, depending upon inundation, it is difficult to protect them.

Besides the globally threatened species, the Thar desert hosts many Near Threatened species in significant numbers.

The main **Near Threatened species** for which the Thar desert is extremely important are:

1. Lesser Flamingo **Phoenicopterus minor**
2. Cinereous Vulture ***Aegypius monachus***
3. Red-headed Vulture ***Sarcogyps calvus***
4. Pallid Harrier ***Circus macrourus***

Kutch in Gujarat is the only district where both the species of flamingo's breed.

4. THE SEMI-ARID REGION

It is a region with rainfall varying from 400 to 1,000 mm and dominated by grass and shrub species. The semi-arid region shows high avian numbers, especially granivorous species such as finches, munias, larks, doves, and pigeons. More than 100 species of birds use the semi-arid grasslands for foraging and/or nesting.

Four species are found only in the Semi- Arid and Deccan regions and nowhere else.

They are –

1. Malabar Crested Lark ***Galerid malabarica***
2. Syke's Crested Lark ***G. deva***
3. Green Munia ***Amandava formosa***
4. Rock Bush Quail ***Perdicula argoondah***

The Indian Chat or Brown Rock Chat ***Cercomela fusca*** is another endemic bird found in the Arid, Semi-arid regions and the Gangetic Plains. The most endangered species of the Semi-Arid Zone is the Lesser Florican ***Sypheotides indica***. Its main breeding areas is the grasslands of the Malwa plateau and Sauarashtra but due to destruction of grasslands, this bird has disappeared from most of its range (Sankaran et al. 1992).This region has numerous human-related problems (encroachment, overgrazing, illegal tree felling, poaching, mining etc).

Globally Threatened species of the Semi-Arid Zone

Critically Endangered

1. Oriental White-backed Vulture- ***Gyps bengalensis***
2. Long-billed Vulture - ***Gyps indicus***

5. THE WESTERN GHATS

The Western Ghats on the northwest coast of India extend for about from the River Tapti in the north to Kanyakumari in the south. The Western Ghats stand unbroken, but the peaks vary greatly. The highest peak is Anamudi (2,700 m). The Western Ghats constitutes about 4.03% of India's geographical area. The key habitats are Lowland Evergreen Rain Forest, Semi-Evergreen Rain Forest, Moist Deciduous Forest, and Hill Evergreen Forest.

The Western Ghats are one of the biodiversity hotspots of the world. The Western Ghats could be divided into three regions, **(a) northern; (b) central; and (c) southern Western Ghats.** The major rivers which originate in the Western Ghats are the Godavari (1,500 km), Krishna (1,400 km), and Cauvery (805 km). These rivers are dependent on the monsoons,

because the Western Ghats are chiefly monsoonic and the main rainy season lies between June-September. Rainfall also depends on the elevation and topography of the area.

16 endemic species reported here is found nowhere else in the world. None of which is at present in danger of extinction, but habitat loss is a major concern.

1. Nilgiri Laughingthrush ***Garrulax cachinnans*** (distributed only in the Nilgiri Hills)
2. Nilgiri Pipit ***Anthus nilghiriensis*** &
3. Broad-tailed Grass-Warbler or Grassbird ***Schoenicola platyura*** (Montane Grasslands).
4. Nilgiri Wood-Pigeon ***Columba elphinstonii*** &
5. Small or Crimson-backed Sunbird ***Nectarinia minima*** (whole of the Western Ghats).

Below are confined to undisturbed forests

1. Ceylon Frogmouth ***Batrachostomus moniliger***,
2. Malabar Trogon ***Harpactes fasciatus***,
3. Malabar Pied Hornbill ***Anthracoceros coronatus***,
4. Malabar Whistling Thrush ***Myiophonus horsfieldii*** &
5. Black-headed Babbler ***Rhopocichla***

More studies are required to lesser known Niligiri Flycatcher *Eumyias albicaudata* in Western Ghats

6. THE DECCAN PENINSULA

Deccan is derived from Dakshina (Sanskrit word) which means south. The area of the Deccan Peninsula is about 42% of the total area of India. Peninsula is formed by the Deccan plateau, with a mean elevation of about 600 m-900 m. A narrow coastal strip on the west and much broader coastal region on the east. It extends over eight Indian states (Telangana, Maharashtra, Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu). The main rivers of the Deccan Peninsula are the Narmada, Tapti, Mahanadi, Godavari, Krishna and Cauvery and their tributaries and associated lakes. The climate of the Deccan Plateau is mostly dry.

The Deccan Peninsula has the best Dry Deciduous Forests. It also has some grasslands where relict populations of the **Great Indian Bustard** and **Lesser Florican** are found.

The common endemic species (found in India only) are :

1. Grey Junglefowl - ***Gallus sonneratii***
2. Painted Francolin - ***Francolinus pictus***
3. Rock Bush-Quail - ***Perdicula argoondah***
4. Painted Bush-Quail - ***Perdicula erythrorhyncha*** &
5. Syke's Crested Lark - ***Galerida deva***

Among the threatened species of birds in the Deccan Peninsula, there are endemic species namely –

1. Yellow-throated Bulbul - ***Pycnonotus xantholaemus***
2. Forest Owlet- ***Heteroglaux blewitti***
3. Jerdon's Courser- ***Rhinoptilus bitorquatus***
4. Green Munia - ***Amandava formosa***
5. Great Indian Bustard &
6. Lesser Florican

7.THE EASTERN GHATS

The Eastern Ghats are spread through Orissa, Andhra Pradesh, and Tamil Nadu. The climate of the Eastern Ghats is tropical. The region receives rainfall from the southwest monsoon, and the northeast retreating monsoon, ranging from 1200 to 1600 mm. Cyclonic storms are frequent. The temperature in January ranges between 20 ºC and 25 ºC, and the maximum temperature shoots up to 41 ºC during the summer months and the minimum is 5 ºC in the winter.

The vegetation of the Eastern Ghats consists of Evergreen Forests, Tropical Semi-Evergreen Forests, Tropical Moist Deciduous Forests, Southern Tropical Dry Deciduous Forests, Northern Mixed Dry Deciduous forests, Dry Savannah Forests, Tropical Dry Evergreen Forests and Tropical Dry Evergreen Scrub (Pullaiah 2002).

The Eastern Ghats are rich in avifaunal diversity.

1. Yellow-throated Bulbul ***Pycnonotus xantholaemus***
2. Tree Sparrow ***Passer montanus***
3. Abbot's Babbler ***Malacocincla abbotti*** and
4. Little Spiderhunter ***Arachnothera longirostra***
5. Yellow-browed bulbul ***Iole indica*** and
6. White-bellied Treepie ***Dendrocitta leucogastra*** are mainly found in the Western Ghats.

The Eastern Ghats are important **flyways** for winter visitors. Coastal wetlands and forested watershed in the Eastern Ghats hill ranges act as important wintering ranges for migrant bird species.

Globally threatened species of the Deccan Biogeographic Zone

Critically Endangered

1. Oriental White-backed Vulture ***Gyps bengalensis***
2. Long-billed Vulture ***Gyps indicus***
3. Jerdon's Courser ***Rhinoptilus bitorquatus***
4. Forest Owlet ***Heteroglaux blewitti***

8. THE GANGETIC PLAINS

The Gangetic Plains are one of the most fertile areas of the world, with a nearly 3,000 year history of human occupation. It is most densely populated areas of the world. The long history of human occupation and dense and still growing human population have resulted in an almost complete conversion of the original vegetation into cropland and human settlements. The Gangetic Plains are most famous for River Ganga. Also, famous for its flood-plain wetlands. This is due to abundant rainfall in the Gangetic Plains and the Himalayas from where most of the rivers originate. The Gangetic Plains forms almost 11% of the land surface of India.

Large areas are wetlands and are extremely productive in terms of vegetation biomass and avian diversity. Some of the most important wetland IBAs are found with significant populations of waterfowl. This region supports a large number of marsh-dependent species such as

1. Striated Marsh Warbler or Grassbird ***Megalurus palustris***
2. Bristled Grass-Warbler or Grassbird ***Chaetornis striatus***
3. Rufous-rumped Grass-Warbler or Grassbird ***Graminicola bengalensis***
4. Yellow-bellied Prinia ***Prinia flaviventris***
5. Swamp Francolin ***Francolinus gularis***
6. Bengal Florican ***Houbaropsis bengalensis*** and various ducks.

Unfortunately, one of the species, the Pink-headed Duck ***Rhodonessa caryophyllacea,*** has become extinct, not due to any geological upheaval but due to human-related activities.

The tall, moist grasslands with the Sal ***Shorea robusta*** forest contain some of the most endangered bird species of India such as the Swamp Francolin, Bengal Florican, and Finn's Weaver ***Ploceus megarhynchus.*** The Gangetic Plains Biogeographic Zone is also important for many Near Threatened species, especially

1. Darter ***Anhinga melanogaster***
2. Painted Stork **Mycteria leucocephala**
3. Black-necked Stork ***Ephippiorhynchus asiaticus***
4. Oriental White or Black-headed Ibis ***Threskiornis melanocephalus***
5. Ferruginous Duck ***Aythya nyroca***, and
6. Black-bellied Tern ***Sterna acuticauda***.

Globally threatened bird species of the Gangetic Plains

1. Oriental White-backed Vulture ***Gyps bengalensis***
2. Long-billed Vulture ***Gyps indicus***
3. Siberian Crane ***Grus leucogeranus***

9.THE NORTHEAST INDIA

Northeast India is one of the biodiversity hotspots of the world. This region includes the states of Assam, Meghalaya, Manipur, Mizoram, Nagaland, and Tripura. The Northeast is a poorly protected area. The Northeast is considered as the 'biological gateway' for much of India's fauna and flora. It represents the transition zone between the Indian, Indo-Malayan and Indo-Chinese biogeographic regions.

The main vegetation is floodplain forest and grassland, marshy and tall elephant grass. It supports some of the most threatened bird (and mammal) species of the world. Three species breed in this region and are found in grassland, scrub, wetland habitats on the plains, often along rivers, and in the foothills.

1. Manipur Bush-Quail ***Perdicula manipurensis***
2. Black-breasted Parrotbill ***Paradoxornis flavirostris***
3. Marsh Babbler ***Pellorneum palustre*** -needs proper study to know its distributional range and breeding habitat.

10. ISLANDS

The **Andaman and Nicobar Islands**, consists of over 560 islands and rocks.

The vegetation is mainly tropical evergreen, with some grasslands in the inland areas. The coastline is mainly covered by mangrove.

The highest conservation priority species are the

1. Nicobar Megapode or Scrubfowl ***Megapodius nicobariensis***,
2. Edible-nest Swiftlet ***Collocalia fuciphaga inexpectata*** and
3. Narcondam Hornbill ***Aceros narcondami.***

The species is not endangered but is under pressure of habitat loss and poaching with airguns and snares. The **Edible-nest Swiftlets** are widely distributed on the islands, the major threat faced is excessive and unregulated nest collection. This species belongs to the 'white nest swiftlet' group, whose nests are made entirely of agglutinated saliva, and are of a remarkably high commercial value in the international market. At Port Blair, a kilogram of nests (one kg normally consists of between 70-125 nests) fetches between Rs. 15,000 and Rs. 20,000 or more. It is found that almost all colonies are exploited, and nests are collected irrespective of whether there are eggs or chicks in them, with serious impact on the species.

Another endemic species of serious concern is the **Narcondam Hornbill**. This species is found only on the 7.5 sq. km Narcondam Island. This is due to loss of natural vegetation. The hornbills nest in the hollows of old trees and every year, many old trees die or fall down due to storms which are prevalent in the area. If there is no regeneration of trees (loss of new tree due to wild goats) , then there is a probability that in another 60-80 years, when all the old trees are gone, the **Narcondam Hornbills** will face a problem of scarcity of nesting holes. This species also faces poaching.

Lakshadweep archipelago

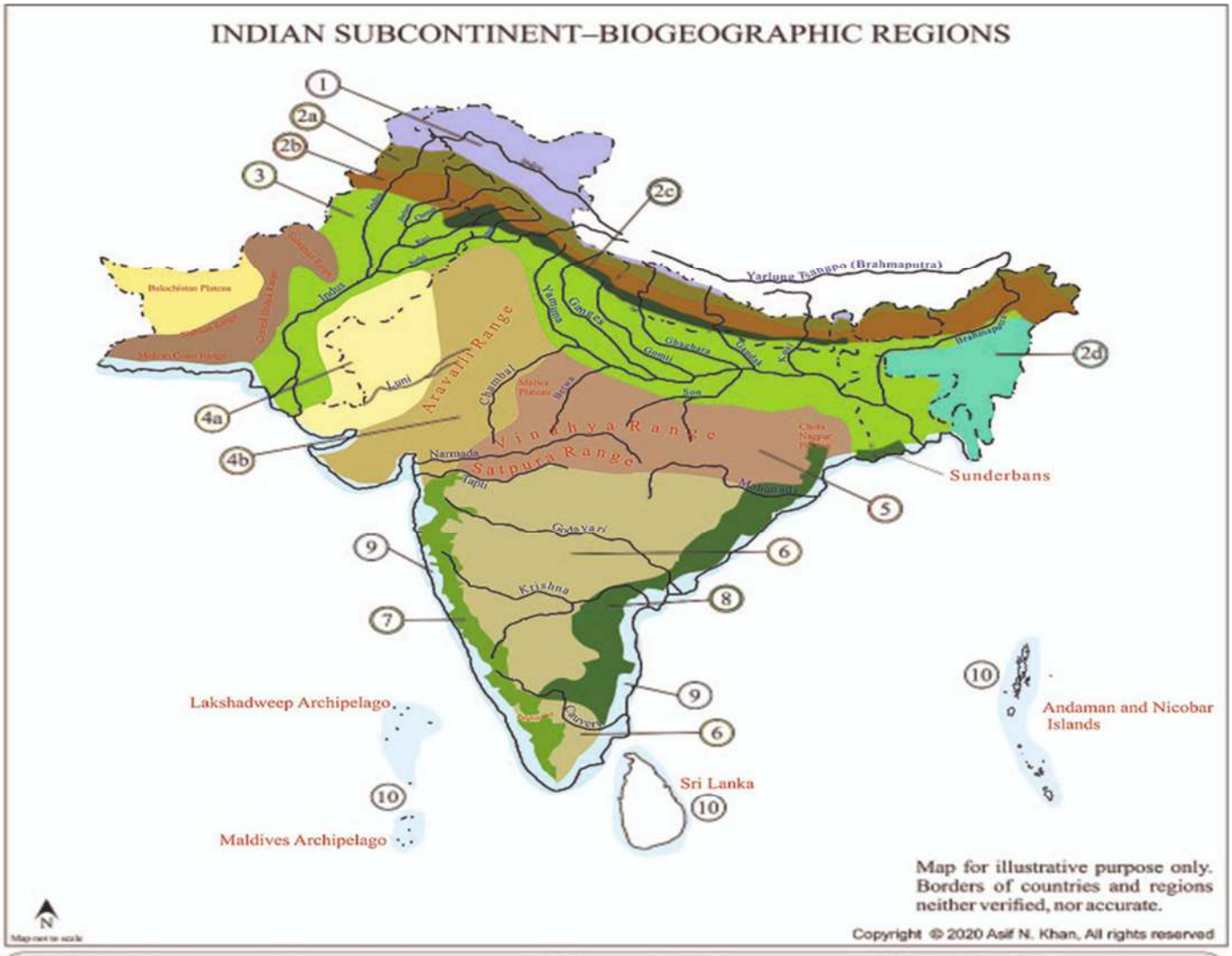
The Lakshadweep archipelago is the smallest Union Territory and consists of a group of 36 coral islands. Unlike the Andaman and Nicobar Islands which are continental, the Lakshadweep Islands are oceanic, thus the biodiversity is not so rich. Habitat diversity is also poor. According to Daniels (1991), till now only 67 species of birds have been authentically reported. Fifty per cent of these are migratory waders and the typically oceanic birds such as terns, skuas, petrels and boobies The uninhabited Pitti Island is a bird sanctuary where a large colony of the Sooty Tern ***Sterna fuscata***, Great or Large Crested Tern ***Sterna bergii*** and Noddy Tern ***Anous stolidus***

is found. Some of the islands of the archipelago are breeding ground for Wedge-tailed Shearwater ***Puffinus lherminieri*** and boobies ***Sula*** species.

11. COASTS

The coastline of India, excluding the Andaman and Nicobar Islands, is about 7,500 km. The coasts have wonderful bird concentrations, as seen in the Chilika Lake (IBA) and Bhitarkanika in Orissa, Point Calimere Wildlife Sanctuary (IBA) in Tamil Nadu, Sunderbans (IBA) in West Bengal, Sewri mudflats (IBA) in Maharashtra and Kori Creek in Gujarat.

Snipe-billed or Asian Dowitcher ***Limnodromus semipalmatus*** and Crab Plover ***Dromas ardeola*** are seen along the Maharashtra coast. The sand beaches and rocky outcrops are important foraging sites for many waders, the mangroves serve as breeding ground for many species such as **egrets, herons, storks, warblers, and raptors.** A checklist of some birds associated with the mangroves of Ratnagiri has been prepared by Samant (1985). Deshmukh (1990) has identified 147 species of birds from the mangrove swamps of Vikhroli, near Mumbai.



(1) Trans-Himalayas (2a) Greater Himalayas (2b) Lesser/Middle Himalayas (2c) Siwalik Hills/Outer Himalayas
(2d) Northeast Hills (3) Indo-Gangetic Plains (4a) Desert/Arid Zone (4b) Semi-Arid Zone (5) Central Highlands
(6) Deccan Plateau and the southern peninsular plains (7) Western Ghats (8) Eastern Ghats (9) Coasts (10) Islands

Flight muscles: Muscles used for flight are known as flight muscles. Flight is cause by the flapping of wings. Wings are operated by a set muscles called flight muscles. Some 12 muscles are related to flight. Pectoralis major is the largest powerful flight muscle. It brings about downstroke of the wings. Pectoralis minor brings the upstroke of the wings.

Endemic Species: Species of animals that are found in a particular geographical region and nowhere else in the world. An endemic species is important because they are in the habitats restricted to a particular area due to climate change, urban development, or other occurrences. Endemic species are often endangered, so it is important to save the species.

Archaeopteryx

1. Archaeopteryx is the first bird.
2. It is a connecting link between reptiles and birds.
3. It is a fossil animal. Hence it is called a missing link.
4. It was first described in 1861 by the German palaeontologist Hermann von Meyer (1801-1869).
5. Only 12 fossil specimens have ever been found.
6. It retains many reptilian characters like presence of teeth, long tail etc.
7. Archaeopteryx provided with teeth, a long tail, feathers and had no bony, keeled sternum where flight muscles attach.

Important Bird Area (IBA)

An Important Bird and Biodiversity Area (IBA) is an area identified using an internationally agreed set of criteria as being globally important for the conservation of bird populations. Currently there are over 12,000 IBAs worldwide. These sites are small enough to be entirely conserved. They differ in their character, habitat, or ornithological importance from the surrounding habitat. Often IBAs form part of a country's existing protected area network, and so are protected under national legislation.

Criteria

IBAs are determined by an internationally agreed set of criteria. To be listed as an IBA, a site must satisfy at least one of the following rating criteria:

A1. Globally threatened species

A2. Restricted-range species

A3. Biome-restricted species

A4. Congregations

BirdLife International

It is a global partnership of non-governmental organizations that strives to conserve birds and their habitats.

1. BirdLife International's priorities include preventing extinction of bird species, identifying, and safeguarding important sites for birds, maintaining, and restoring key bird habitats, and empowering conservationists worldwide.
2. BirdLife International was founded in 1922 as the International Council for Bird Protection by American ornithologists T. Gilbert Pearson and Jean Theodore Delacour. The group was renamed as BirdLife International in 1993. Headquarters is at Cambridge, United Kingdom.
3. It has a membership of more than 2.5 million people across 116 country partner organizations, including the Royal Society for the Protection of Birds, the Wild Bird Society of Japan, the National Audubon Society and American Bird Conservancy.
4. BirdLife International has identified 13,000 Important Bird and Biodiversity Areas. As of 2015, BirdLife International has established that 1,375 bird species (13% of the total) are threatened with extinction (critically endangered, endangered, or vulnerable).
5. BirdLife International publishes a quarterly magazine, BirdLife: The Magazine, which contains recent news and authoritative articles about birds and their conservation.

Bombay Natural History Society (BNHS)

The Bombay Natural History Society was founded on 15 September 1883.

1. It is one of the largest non-governmental organizations in India engaged in conservation and biodiversity research.
2. It supports many research efforts through grants and publishes the Journal of the Bombay Natural History Society.
3. Many prominent naturalists, including the ornithologists Sálim Ali and S. Dillon Ripley, have been associated with it.
4. BNHS is the partner of BirdLife International in India.
5. It has been designated as a 'Scientific and Industrial Research Organization' by the Department of Science and Technology.
6. Its headquarter is in Mumbai.
7. The BNHS **logo** is the **great hornbill.**

Contributions of Dr. Salim Ali

Sálim Moizuddin Abdul Ali (12 November 1896 – 20 June 1987) was an Indian ornithologist and naturalist.

He is sometimes referred to as the **"Birdman of India"**

His books on birds have helped immensely in enriching the knowledge about birds.

1. Salim Ali was the first Indian to conduct **systematic bird surveys** across India and wrote several bird books that popularized ornithology in India.
2. He became a key member of Bombay Natural History Society in 1947, he utilized his influence to obtain government aid for this institution.
3. He played important role in formation of **Bharatpur Bird Sanctuary** (Keoladeo National Park).
4. He also made great efforts to stop the construction of a dam project which was a threat to the Silent Valley National Park.
5. His research work is considered highly influential in the development of ornithology.
6. Along with Sidney Dillon Ripley he wrote the landmark ten volume **Handbook of the Birds of India and Pakistan,** a second edition of which was completed after his death.
7. He was awarded the **Padma Bhushan** in 1958 and the **Padma Vibhushan** in 1976, India's third and second highest civilian honours respectively.
8. Several species of birds, a couple of bird sanctuaries and institutions have been named after him.
9. In his **autobiography**, **The Fall of a Sparrow**, Ali notes the yellow-throated sparrow event as a turning point in his life, one that led him into ornithology, an unusual career choice, especially for an Indian in those days.

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QUESTIONS

SHORT ANSWER QUESTIONS

Q1. Write the important characters of birds.

Q2. Write short notes on Archaeopteryx.

Q3. Explain the flight adaptations in birds.

Q4. Contributions of Dr. Salim Ali

ESSAY TYPE QUESTIONS

Q5. The birds are glorified reptiles -Discuss

Q6. Write an essay on avifauna of India.

MBE - I AVIAN BIOLOGY

Subject code : 18KPIZELZ1

Unit - II

Birds of Biological Significances - Game Birds - Plumage Birds - Song Birds - Cage Birds.

Introduction :

Birds help maintain sustainable population levels of their prey and predator species and, after death, provide food for scavengers and decomposers. Many birds are important in plant reproduction through their services as pollinators or seed dispersers.

Domesticated birds such as chickens and turkeys, are raised for meat and eggs. Chickens account for much for human poultry consumption, although turkeys, ducks and geese are also relatively common. Many species of birds are also hunted for meat.

Birds are important members of many ecosystems. They play a vital role in controlling pests, acting as pollinators, and maintaining island ecology. In addition, birds are important to humans in many ways, such as serving as a source of food and providing fertilizer in agricultural settings.

Plant species would disappear. Another aspect of the environment that will be rocked hard is the flora. Many species of plants depend on birds to pollinate flowers, spread seed and eat pests. The loss of plant species could devastate ecosystems.

The six categories of birds used by birdwatchers Sperching birds, birds of prey, water birds, game birds, flightless birds, tropical birds.

GAME BIRDS :

A bird shot for sport or food. a bird of a large group that includes pheasants, grouse, quails, guinea fowl, etc.

Any bird hunted chiefly for sport, as a quail or pheasant, especially such a bird that is protected by game laws. As the name implies, game birds are birds that are hunted in the wild, as well as kept in captivity where they are raised, often with some difficulty. They include guinea fowl, partridge, pheasants, squabs, and quail. Small bird Quail is game bird. Game means hunted for sport or for food. game birds are such as pigeon, squab, pheasant, duck etc, served rare, when chicken and turkey.

The wild turkey is the largest game bird in North American with mature males weighing upwards of 20 pounds and standing 40 inches tall. Game birds are native or non-native birds that historically were wild game or decorative fowl but are now raised commercially for their meat or egg production or as "flight-ready" birds for release on hunting preserves or by state wildlife agencies.

The definition of a Bird is a warm blooded member of the Aves class, which has

feathers, a beak, no teeth, wings and lays young in eggs. An example of bird is a robin.

Game birds are wild birds which are hunted, killed and eaten by humans. It is a sport, and eaten by humans. It is a sport, and a way of getting food. It happens in most countries, but the details vary. Usually there are laws which govern the hunting. Usually, guns are used, and so there are guns laws. Also regulations protect the birds' breeding season, so that another generation of birds will grow to replace the present generation.

Black grouse, Red grouse, Brown hare, ptarmigan, Grey partridge and red-legged partridge, common pheasant, Duck, including mallard, tufted duck, teal, pintail and pochard Goose, including greylag goose, canada goose pink-footed goose and in England and wales white-fronted goose, wood pigeon, wood cock, snipe, Golden plover these are some game birds in this world.

INDIAN GAME BIRDS:-

The 'Game-birds of India. By F.C. Stuart Baker. Vol. I. Ducks, and their Allies (Swans, Geese and Ducks). Vol-II simple, Bustrads, and Sand-Grouse. (Bomby Natural History Society, London, J. Bale, Sons, and Danielsson, Ltd, 1921.)

The first of these volumes, dealing with Ducks published by the author in 1908, which again, was a reprint from a series of articles w... appeared in the Journal of the Bombay Natural History Society.

The matter has therefore had the advantage of two revisions and is brought completely up to date as regards nomenclature and records.

The second volume, now before us, deals with birds which are included by the Sports man among the game-birds, though in Scientific classification they are not so.

These are the Snipe, Bustards and Sand-Grouse. One of the most interesting facts recorded in these volumes relates to the habits of two species of Sand-grouse, Pterocluros alchatus and P. senegalensis (formerly known as P. exustus).

Although these birds inhabit the dryer and more desert regions of north west India and Central Asia, they are unlike some other desert forms, unable to do without water, and resort in enormous flocks to well known watering-places at certain fixed hours to quench their thirst.

It has always been stated by native shikarees that when they have young broods they convey water to them by thoroughly soaking the feathers and the breast and underparts, and that the young birds suck the water thus conveyed to them.

This story has been confirmed by Mr. Meade Waldo, who has repeatedly bred P. alchatus and other species in Confinement and has watched the process of the male saturating the feathers of his breast and subsequently ~~of~~ satisfying the thirsty brood.

PLUMAGE BIRDS:

Plumage, collective feathered covering of a bird. It provides protection, insulation, and adornment and also helps streamline and soften body contours, reducing friction in air and water.

plumage (Latin: pluma "feather") is a layer of feathers that cover a bird and the pattern, colour, and arrangement of those feathers. Most birds moult twice a year, resulting in a breeding or nuptial plumage and a basic plumage.

Feathers perform a number of functions for a bird ① They provide insulation, body temperature of most birds is maintained at around 40°c.

② Feathers allow for flight

③ Feathers control what a bird looks like by supplying the bird with colors.

Related words for plumage, like; down, mantle, feather, plume and feathers.

Cuckoos are abundant, some of them of lovely plumage, also rollers, king fishers and hornbills. Still it is brisk in its movements, and its variegated plumage makes it a pleasing bird. As a whole, the birds of papua are remarkable for their brilliance of plumage, or their metallic colouring.

Plume means a large or showy feather of a bird. and Ornamental feather or tuft of feathers (as on a hat) then something shaped like a large feather a plume of smoke.

Abnormal plumages include a variety of conditions. Albinism, total loss of colour, is rare, but partial loss of colour is more common. Some species are colour polymorphic, having two or more colour variants.

A few species have special types of polymorphism, as in the male ruff which has an assortment of different colours around the head and neck in the breeding season only

Hen feathering is an inherited plumage Character in domestic fowl controlled by a single gene.

Plumology (or plumage science) is the name for the science that is associated with the study of feathers.

Pigmentation conditions:-

- Albinism the lack of melanin pigmentation
- Leucism, a condition similar to albinism is animals, characterized by reduced pigmentation in general.
- Melanism (or melanosis), unusually dark melanin pigmentation.
- Xanthochromism unusually yellow Pigmentation.

Ino do budgerigar mutation, the occurrence of this mutation in captive-bred budgerigars

Eclipse plumage:-

Many male ducks have bright, colourful plumage, exhibiting strong sexual dimorphism. However, they moult into a dull plumage after breeding in mid-Summer. This drab, female-like appearance is called eclipse plumage.

Abnormal plumages:-

There are hereditary as well as non-hereditary variations in plumage that are rare and termed as abnormal or aberrant plumages.

Melanism refers to an excess of black or dark colours. Erythromelanism or erythrism is the result of excessive reddish brown erythromelanin deposition in feathers that normally lack melanin.

Melanin of different forms combine with xanthophylls to produce colour mixtures and when this combination is imbalanced it produces colour shifts that are termed as Schizochroisms.

Carotenism refers to abnormal distribution of carotenoid pigments.

Albinism:-

Albinism in birds is rare, occuring to any extent in perhaps one in 1800 individuals. It involves loss of colour in all parts including the iris of the eyes, bills, skin, legs, and feet.

It usually the result of a genetic mutation causing the absence of tyrosinase, an enzyme essential for melanin synthesis.

Leucism refers to loss of pigments in some or all parts of feathers. A bird that is albino has white feathers in place of coloured ones on some portion of its body.

A bird that is naturally white, such as a swan, goose or egret, is not an albino nor is a bird that has seasonally alternating white plumage.

SONG-BIRDS:

One of the two main functions of bird song is mate attraction. Scientists hypothesize that bird song evolved through sexual selection, and experiments suggest that the quality of bird song may be a good indicator of fitness.

First, shared songs may be attractive to females. Second, shared songs may provide a mechanism by which two neighbors might effectively defend their territories against other birds: each bird would effectively be mimicking the other while repelling prospective intruders.

In fact, while singing, a bird can alternate exhaling between its two lungs and thereby sing in harmony with itself. In the final analysis, different birds sing different songs but usually for much the same reasons.

One of those just might be that they are well fed, stress free and happy. These sounds are usually short, quick, and quiet, though if birds get separated, they make louder, more urgent "separation calls"

The MAGIC OF BIRDS SONG:

There is no sound more welcom than the songs of birds. This is not only because of its varied beauty but for a deeper reason.

Bird song is a languge, one without words, but with a meaning. It magic comes bubbling out of the deepest sources of Springtime well-being.

The male sings through the nesting season, perhaps to please his lady. But with the hatching of the nesting. Songs lessen, as the bread winner and grub gatherer, the father bird has less time for singing.

The bird sings at his chosen moment at a certain time of the day, as well as the time of year. Some birds, like the vesper, Sparrow, are drawn to sing with the

coming of dusk, others, like the whippoorwill, are vocal only at night. But Nightingales, sing both by day and night.

The marvellous spontaneity of bird song is a mystery. Careful studies by ornithologists using tape recorders and electronic devices, give us a paradoxical answer.

W.H. Thorpe and his team of researchers at cambridge University have found that when a young chaffinch is taken from the nest and reared alone, it sings but a poor and restricted version of the song of its kind in the wild. This may be taken as inherited song pattern.

But given the prisoner in solitary confinement a fellow chaffinch, his song improves as he listens to his companion.

The Cambridge Ornithologists found that what the bird learnt in its youth was fixed for life.

Some birds incorporate in their singing, the songs of other species. The Jay and the Mocking bird have a reputation for imitation.

A caged bird in a house or in an office imitates perfectly not only the squeak of a chair, whistle for a dog, but also the sound of the children knocking at the door and calling to be let in.

It is understood that a birdsong is a sort of emotional release rather than

the process of Communication. The possibility of birds singing for pleasure is by no means ruled out.

CAGE BIRDS

A bird cage is a cage designed to house birds as pets. Antique bird cages are often popular as collector's items or as household decor but most are not suitable for housing live birds, being too small, improper shape, using unsafe materials or construction.

Birds are a diverse group, and their bright colours, distinct songs and calls, and showy displays add enjoyment to our lives. Most of people all over the world keep pets and pet birds are avreny popular choice. Birds are generally much easier to look after than cats or dogs, are cheaper to keep and demand a lot less of your time.

Parrots are intelligent, fun, loving and make wonderful pets and is the first choice of the people today. To keep birds happy toys are very important resource. Toys provide exercise, mental stimulation, and relief from boredom. We can choose toys that are appropriate to your birds size. Small or large, colorful light weight bird toys and mirrors are perfect for small birds. larger birds like to manipulate thicker toy pieces with their beaks, tongues and feet.

Almost all parrots nest in tree hollows and lay white eggs from which hatch altricial young. parrots, along with ravens, crows, jays, and magpies, are among the most intelligent birds, and the ability of some species to imitate human speech enhances their popularity as pets.

Trapping wild parrots for the pet trade, as well as hunting, habitat loss, and competition from invasive species, has diminished wild populations, with parrots being subjected to more exploitation than any other group of birds. Measures taken to conserve the habitats of some high-profile charismatic species have also protected many of the less charismatic species living in the same ecosystems.

All the best.

Dr. P. REXT
Department of Zoology
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Thanjavur.

Answer the following Questions:-

1. What is the meaning of game bird?
2. What is plumage on a bird?
3. Cage Birds.
4. Eclipse plumage.
5. Song birds.
6. RSPB
7. Write Short notes on Cage birds.
8. Write about economic importance of birds.
9. Describe the Biological Significance of plumage.
10. Give a detail account on Game Birds and Song birds.

Dr. P. REXT
Dept. of Zoology.

Bobwhite quail, an important North American gamebird

Game birds at Borough Market in London

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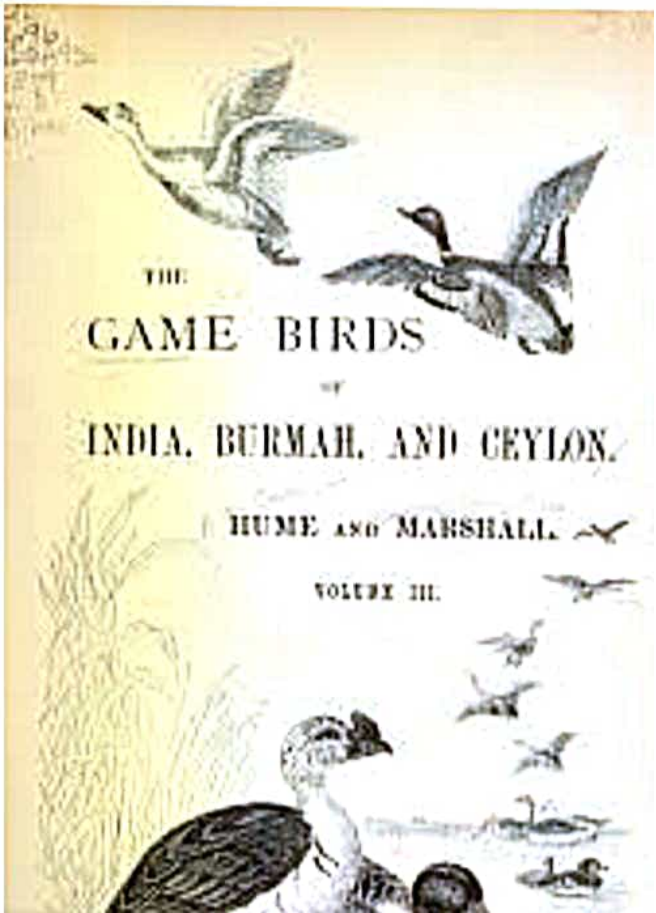

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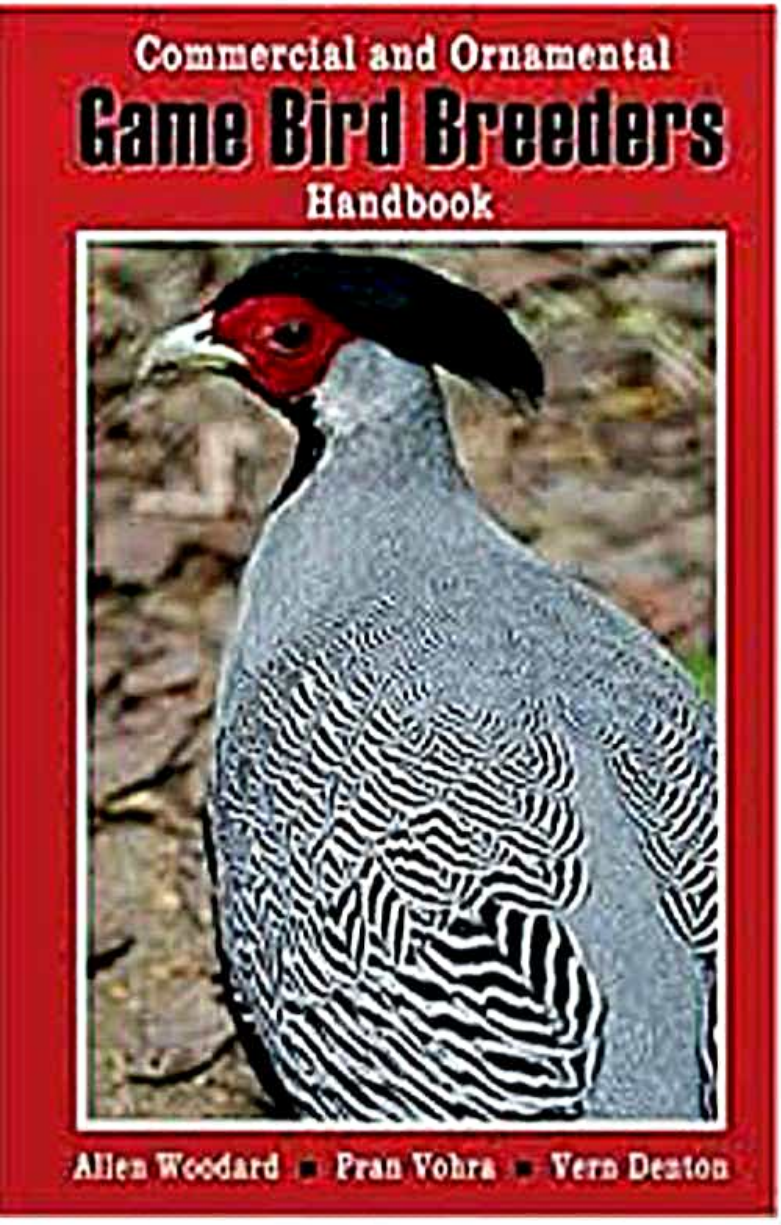

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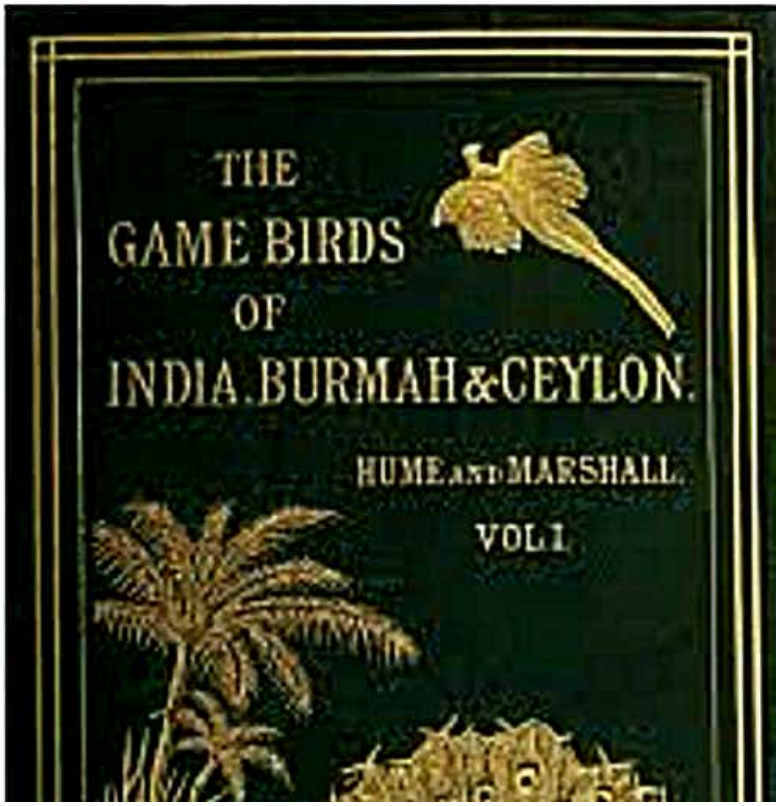

How do birds get their colors?

phys.org

Pin on redhead

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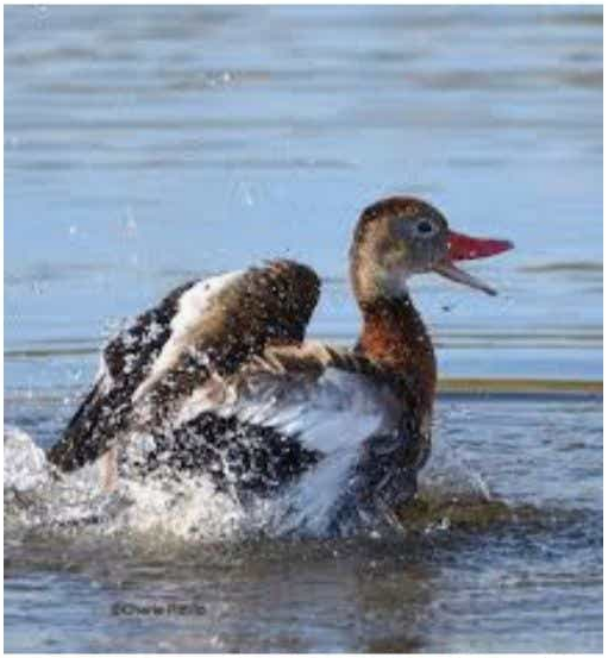


BACKYARD BIRDING IN MERI...

theyucatantimes.com

How Feathers Insulate | Audu...

audubon.org

Canon Bird Branch Project | B...

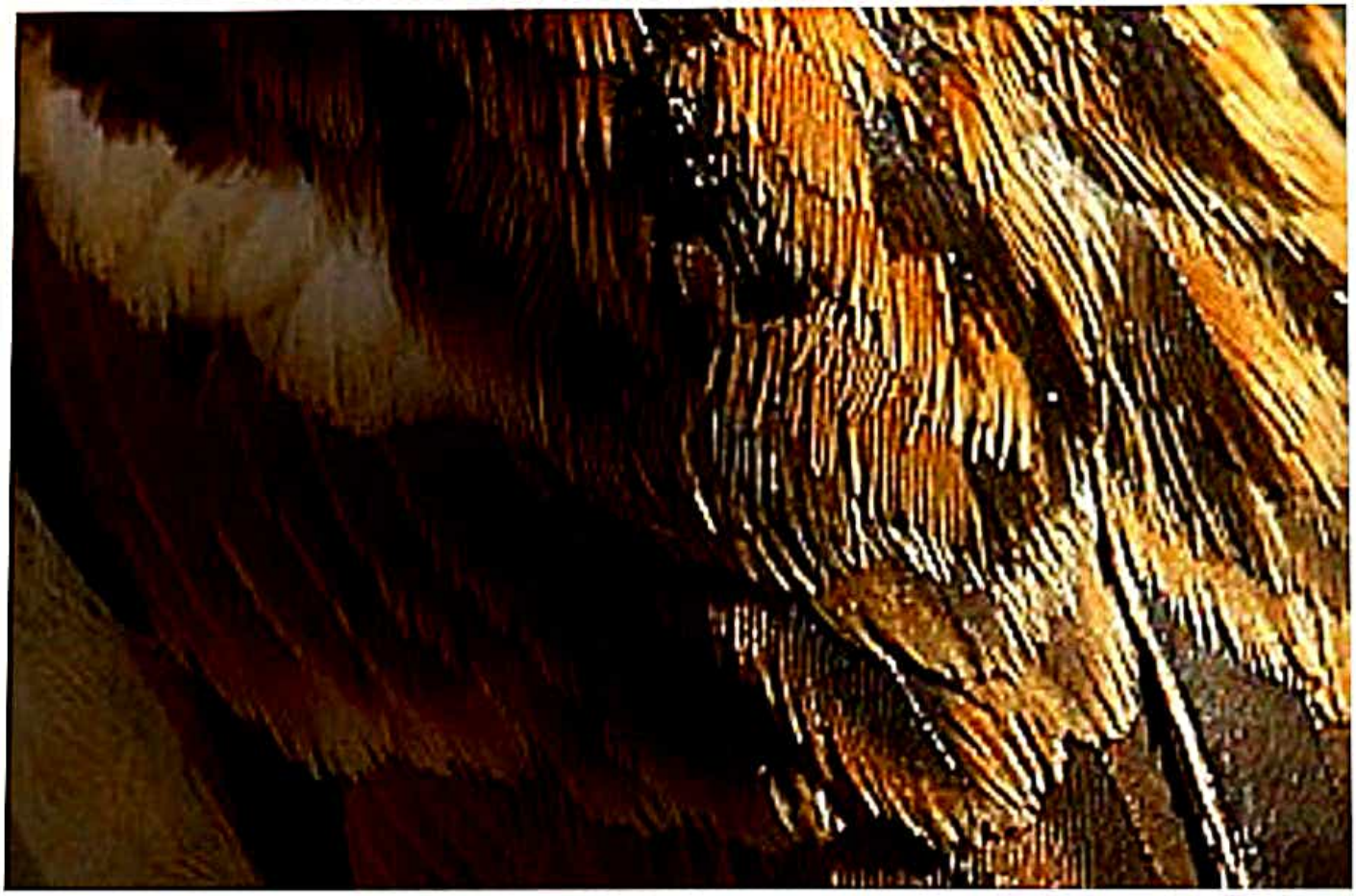
global.canon

Birds of a Feather

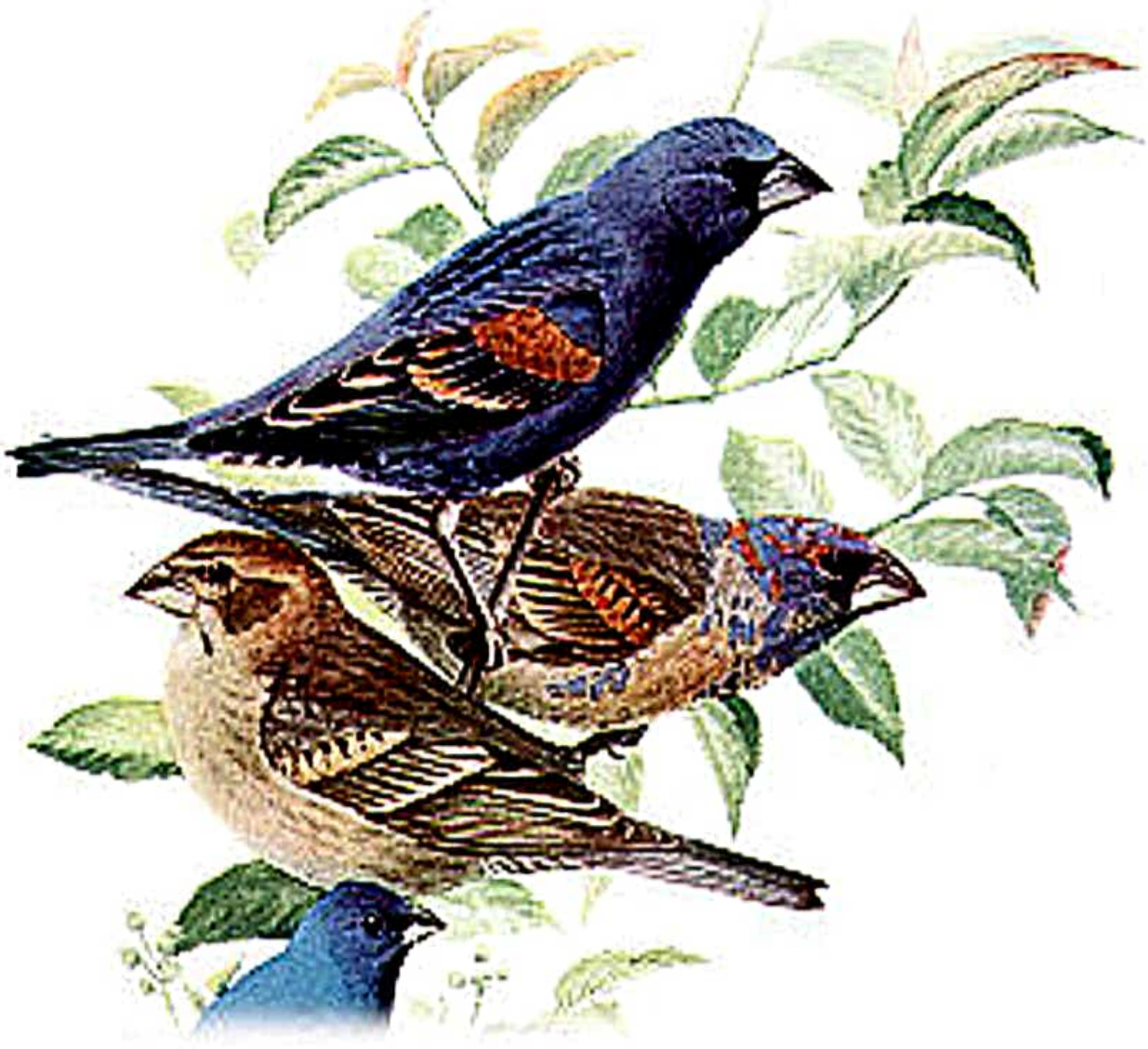
dupageforest.org

Birds of a Feather

Plumage, collective feathered covering



Close up view of the plumage on a house sparrow



Eclipse plumage

Mandarin duck (male) in eclipse plumage

Abnormal plumages

Axanthic budgerigar

An albino African penguin.

A young completely albino crow in Malacca, Malaysia.

withouts its seeds passing through the dodos digestive tracts. which process sacrified the seed coat enabled germenation.

Birds have been integral to humans since prehistory. To birds detriment they and their eggs have been an important human food source since humans evolved and we have hunted many species to extinction. Feathers, usually obtained by killing their original owners have been used as adornment in hats headresses and caps.

Birds appear in ancient art and mythology worldwide. Bird watching is one of the fastest growing recreational activities. Birds also were primary inspiration for flight

by 5.5 million spreading rabies and leading to an estimated 47300 human deaths.

iv) Birds spread seeds:

When birds travel they take the seeds they have eaten with them and disperse them through their droppings. They bring plants back to the ecosystem that they have been destroyed.

v) Birds transform entire landscapes:

Habitats like forests marshes and grass lands affect people across the whole planet, even those living hundreds of miles away. They store carbon, keep the climate stable oxygenate the air and transform pollutants to nutrients.

vi) Birds keep coral reefs alive:-

Sea birds play a key role in cycling nutrients and helping to fertilize marine ecosystems such as coral reefs. Sea birds travel hundreds of kilometers to feed out ocean and when they return they deposit layers of highly pungent guano at their colonies. This guano leaches into the ocean and fertilizes nearby community such as coral reefs.

vii) Birds inspire science:

Technology of flight to the invention of zippers modelled on the barbules of feathers. Birds are widespread and respond quickly to changes in the environment.

Attacks on humans:

Some evidence supports that the contention that the African crowned eagle occasionally views human children as prey with a witness account of one attack (in which the victim a seven year old boy survived and the eagle was killed) and the discovery of a part of a human skull in a nest. Various large raptors like golden eagles are reported attacking human beings.

Some fossile evidence indicates large birds of prey occassionally preyed on prehistoric hominids The taung child an early human found in Africa, is believed to have been killed by an eagle like bird similar to the crowned eagle

Questions

1. Vector
2. Coral reef
3. middlevel consumers.
4. Obligate & cavenging.
5. Facultative Scavenging.
6. Decomposers
7. Detritivores
8. List out the importance of birds
9. " Birds transform the landscape" - Justify the Statement
10. Describe the economic importance of birds
11. Explain about scavenging birds
12. Explain the birds of prey.
13. List out the medicinal uses of birds.

Importance of birds

Why we need birds:

Can you imagine a world without birds.

The benefits birds brings us are not cultural. Birds play an important role in the functioning of the world's ecosystem, in a way directly impacts human health, economy and food production.

(i) Birds control pests:.

A recent study has shown that the birds eat 400 - 500 million tones of insects/year. In china 2/3 of the diet of house swift Apus nipalensis consists of agricultural pests, an in forest across the America, Evening Gross beak Hesperiphona vespertina becomes a Super ~~hero~~ hero during outbreaks of spruce budworm, providing biological control worth of $ 1820/Squaresku. Birds are so efficient that nest boxes have become a pest control practice throughout Europe.

(ii) Birds pollinate plants.

Birds pollinators such as humming birds and honey eaters also make big contribution especially high altitude and hot climates. In S. Africa 1/4 Salva species are bird pollinated.

(iii) Birds are natures clean up:

Over the life time of single vulture provides the waste disposal services worth around US $11,600. Following the collapse of Asia's Vultures, India's feral dogs population surged by 5.5 million

Medicinal Uses of Birds.

Over the years birds and their parts have been ... touted as remedies for various ailments. ex: In South America, concoctions made from Condor feathers are used in traditional medicines. In middle ages powdered heron bill was used as sleeping powder and herons fat to reduce pains. The blood of Patridge was thought to help blood shot eyes. In India peacock feathers have been used in traditional medicine for snakebite, infertility and coughs. The brain of eagle drank in wine helps to cure jaundice. The oil grease of geese was thought to cure baldness, help deafness, reduce pain and noise in the ears and is good for lameness, palsies, numbness, use the bill of osprey picking the gums with it until they bleed.

It is understandable that the early Europeans thought that ashes of a cuckoo would cure epilepsy and the dung of canary would prevent Rabies.

Alterations in scavenging communities may result in drastic changes to the scavenging community in general, reduce ecosystem services and have detrimental effects on animals and humans. Ex: The reduction of Vulture sp in India lead to the increase of opportunistic species such as feral dogs and rats. The presence of both species at carcasses resulted in the increase of diseases such as rabies and bubonic plague in wild life and livestock, as feral dogs and rats are transmitter of such disease. Further more, the decline of vulture populations in India has been linked to the increased rates of anthrax in humans due to the handling and ingestion of infected livestock carcasses. An increased disease transmission has been observed in mammalian scavengers in Kenya due to the decrease in vulture populations in the area, as the decrease in vulture populations resulted in an increase of the number of mammalian scavengers at a given carcass along with the time spent at carcass.

Disease transmission:

Scavenging may provide a direct or indirect method for transmitting disease between animals. Scavengers of infected carcasses may become host for certain pathogens and consequently vectors of disease themselves. A major vector of transmission of diseases are various bird species, with outbreaking being influenced by such carrier birds and their environment. An avian cholera outbreak from 2006 - 2007 off the coast Newfoundland

Importance of Birds – Scavengers

Scavengers are animals that consume dead organisms that have died from causes other than predation. While scavenging generally refers to carnivores feeding on carrion, it is also a herbivorous feeding behaviour. Scavengers play an important role in ecosystem by consuming dead animal and plant material. Decomposers and detritivores complete this process by consuming the remains left by the scavengers.

Scavengers aid in overcoming fluctuations of food resources in the environment. The process and rate of scavenging is affected by both biotic and abiotic factors, such as carcass size, habitat, temperature and seasons.

Types of Scavengers:

Obligate scavenging is rare among Vertebrates, due to the difficulty of finding enough carrion without expending too much energy. Most scavenging animals are facultative scavengers that gain most of their food through other methods, especially predation. Many large carnivores that hunt regularly, such as hyenas and jackals, but also animals rarely thought of as scavengers. Such as African Lions leopards etc. will scavenge if given the chance.

Scavengers of dead plants materials include termites that build nests in grasslands and then collected dead plants materials for

legs and feet feathered to the toes and build very large stick nests.

(ii) Ospreys, a single species found world wide that specializes in catching fish and builds large stick nests.

(iii) Kites have long wings and relatively weak legs. They spend much of their time in soaring. They will take live vertebrate prey, but mostly feed on insects or even carrion.

iv) The true hawks are medium sized birds of prey that usually belong to the genus Accipiter.

v) Vultures are carrion eating raptors. Members of the groups have heads either partly or fully devoid of feathers.

vi) Falcons are medium sized birds of prey with long pointed wings

Raptors are known to display patterns of sexual dimorphism. It commonly believed that the dimorphisms found in raptors occur due to sexual selection or environmental factors. Dimorphisms can also be the product of intersexual selection between males and females. It appears that both sexes of the same species play a role in the sexual dimorphism within raptors, females tend to compete with other females to find good place to nest and attract males.

Importance of Birds – Prey.

Birds of prey, also known as raptors, include species of bird that primarily hunt and feed on vertebrates that are large relative to the hunter. Additionally they have keen eyesight for detecting food at a distance or during flight, strong feet equipped talons for grasping or killing prey and powerful curved beaks for tearing flesh. The term raptor is derived from rapio meaning to seize or take by force. In addition to hunting live prey, many birds such as fish eagles, vultures, and condors eat carrion.

Although the term bird of prey could theoretically be taken to include all birds that primary consume animals, Ornithologists typically use the narrow definition. Examples of birds of prey not encompassed by the ornithologists definition include storks, herons, gulls, penguins aswell as many song birds that are primarily insectivorous. Some extinct predatory birds had talons similar to those of some Enantiornithes indicating possible similar habits.

The common names for various birds of prey are based on structure but many of the traditional names donot reflect evolutionary relationships between the groups.

(i) Eagles tend to be large birds with long, broad wings and massive feet. Booted eagles have

Economic Importance:

Many species are of economic importance, mostly as sources of food acquired through hunting or farming. Some species, particularly song birds and parrots are popular as pets. Other uses include the harvesting of guano (droppings) for use as a fertilizer.

Domesticated birds such as chickens and turkeys are raised for meat and eggs. Chickens account for much of human ~~population~~ poultry consumption, although turkeys, ducks and geese are also relatively common. Many species of birds are also hunted for meat. Other commercially valuable products from birds include feathers especially down feathers of geese and ducks) which are used as insulation in clothing and bedding.

Some birds can acts as vectors for spreading diseases such as psittacosis, salmonellosis, campylo bact-eriosis, giardiasis and cryptosporidiosis, over long distances.

Birds occupy many levels of trophics webs from midway/ mid level consumers to top predators. As with other native organisms, birds help maintain sustainable population levels of their prey and predator species and after death, provide food for scavengers and decomposers.

Many birds are important in plant reproduc-tion through their services as pollinators are seed dispersors. Some birds are considered keystone sp as their presence in an ecosystem affects other species indirectly. After the extinction of dodo, it was discovered that the trees whose fruits had been a primary food item of the dodo was unable to reproduce

consumption within the nests

Ecological function:

Scavengers play a fundamental role in the environment through the removal of decaying organisms, serving as natural sanitation service. While the microscopic and invertibrate decomposers break down dead organisms into simple organic matter which are used by nearby autotrophs. Scavengers help conserve energy and nutrients obtained from carrion within the upper troplic levels and are able to disperse the energy and nutrients farther away from the site of the carrion than decomposers.

Scavanging unites animals which normally would not come into contact and results in the formation of highly structured and complex communities which engage in non random interactions. Scavenging communities function in the redistribution of energy obtained from carcasses and reducing disease associated with decomposition. Oftentimes, Scavenging communities differ in consistency due to carcass size and carcass type as well as by seasonal effect as consequence of differing invertebrate and microbial activity.

Competition for carrion results in the exclusion or inclusion of certain scavangers from access to carrion, shaping the scavenger community. When carrion decomposes at a slower rate during cooler seasons, competition between scavengers decreases, while the number of scavenger sp present increases.

Canada resulted in the mortality of marine bird species. The transmission, perpetuation and spread of the outbreak was mainly restricted to gull species who scavenge for food in the area.

Threats:

Many species that scavenge face persecution globally. Vultures in particular have faced incredible persecution and threats by humans. Before its ban by regional governments in 2006, the Veterinary drug Diclofenac has resulted in atleast 95% decline of vulture species in West Africa due to the growing human population and overhunting of vulture food sources, as well as changes in livestock husbandry.

Benefits to human well being:-

Highly efficient scavengers, also known as dominant or apex scavengers, can have benefits to human well being. Increases in the dominant scavenger populations such as vultures, can reduce populations of smaller opportunistic scavengers such as rats. These smaller scavengers are often pests and disease vectors.

Birds in Agriculture

Birds, known to play an important role in pollination, putting a check on pesky insects and rodents, could also be causing drastic decrease in crop yields by destroying them, according to a report, which calls it as an emerging concern in Indian agriculture.

The avian species inflict losses in agriculture by damaging crops during sowing, seedling and ripening stages, leading to economic losses to the farming community

“Birds are known to cause considerable economic damage to variety of crops during vulnerable stages in different agro-ecological regions of the country. The extent of bird damage to any crop depends on several factors like concentration of local bird population, total area under the crop, cropping pattern habitat of the area, season and physiological status of the birds,” stated the report.

It is identified 63 bird species of birds, 1,364, from 19 families that caused damage to several crops. A whopping 52 bird species attacked cereals, pulses got attacked by 14 bird species, while oilseeds faced damage risk by 15 species, and fruits by 23 species. They also caused damage to the crops of smaller grains such as pearl millet and sorghum as well as maize.

Of these, the **Grey Partridge, Blue Rock Pigeon** and **House Sparrow** were found to inflict most damage to crops. Other species include the **Rose ringed parakeet, weavers, munias** and **doves** that manage to nest in close proximity to agricultural fields.

A report identified **46 bird species as beneficial for agriculture**. They help destroy insects feasting on crops and also consume rodents. Such beneficial birds need to be encouraged and conserved, the report suggested.

Moreover, bird damage was found to be more in isolated, early or late maturing fields, varied between regions, seasons, number of species, their density, concentration of migrants and their food habits.

Protecting the production system and effective management of vertebrate pests is important to realise targeted yields.

While traditional management techniques for predatory birds include erecting a machan amidst crop fields, pitcher-effigy (scare

crows), drum beating; habitat manipulation, block plantation, reflective ribbon for bird scaring, reflective paper plate, bird resistant hybrids, could be some of the eco-friendly management methods.

State departments should help in the dissemination of such technologies to farmers for protecting the standing crop from raids and damages, the report suggested.

Birds control techniques

Bird is a warm-blooded (104° F), egg-laying vertebrate animal distinguished by the possession of feathers, wings, a beak without teeth, and typically by being able to fly. Its body contains air sacs which help in flight, four chambered heart, feather covered body. Birds are Oviparous (egg laying). The hind limbs used for walking, running and swimming and the fore limbs modified into wings and the mouth as a beak

General characters of Birds

Classification: Kingdom: Animalia, Phylum: Cordata, Subphylum: Vertebrata, Class: Aves

Birds are of two categories as for as agriculture concerned. One type beneficial Birds, and the other are destructive birds. Weaver bird (Quelea quelea) is considered as the world's worst bird pest, affects African counties. In West Africa, 32 it is studied that the average loss of cereals was 6.9 %; in Sahelian zone cereal losses were 24.6%, in humid zone rice losses were 13.8%.

Birds are having high metabolic rate and hence consume 10% of their body weight in 24 hours.

In India, 25 species out of 1200 species (2.1 %) are highly destructive. Peach yield is decreased 32 % by parakeets and crows. Parakeets damage Guava 20 % at ripening. Crows can damage wheat 17-20 % at sprouting. There is up to 66 % damage of pulses by Doves, pigeons, parakeets and sparrow. Mustard damage is up 63 % by parakeets at ripening.

In India, birds also serve as vectors of plant pathogens like bacteria. Damage irrigation pipes. Fouling nursery stock and lawns. Nipping buds. Breaking branches when roosting. Trampling seedling. Pulling up seedling. Feeding on grains, fruits and sown seed.
Birds causes crop losses. The following birds causes serious loss by destroying fruit Blue rock pigeon (Columba livia), Rose ringed parakeet (Psittacula krameri), Common myna (Acridotheres tristis), House sparrow (Passer domesticus), Common weaver bird (Plocea philippinus), House crow (Corvus splendes). Some depredatory Birds, Common myna, Common weaver bird, Blue rock pigeon, Rose ringed parakeet

Bird Control

Birds attack can be controlled by following methods.
Man operated traps, Automatic traps, Scaring techniques
1.By spreading net and producing musical sounds , 2. Using straw basket, wooded rod and long rope, 3. By recording birds' call notes and nets. 4. Potter trap 5. House trap . Crow scare 5. Drumming 6. Platform 7. Automatic crow scarer 8. Hanging dead bird 9.Shouting and using Gulel 10. Hawk kite 11. Balloons 12. Fireworks 13. Using CDs

Man operated traps

Birds are attracted to the sound and approach the area of net and thus caught in the net.

- Birds are attracted by producing musical notes.
- Spreading of net of small mesh on a part of field during late evening.
- By MusiCal notes
- When birds come for feed the rod is gently released with the help of attached rope and the bird are caught.
- Baits considering of grains is spread under the basket.
- A long rope is attached to the rod and other end is held at a distance by man.

- Big straw basket are held inverted supported on a wooden rod.
  ¬using straw Basket

The tape recorder is played and birds attracted by call notes gather in big flocks.

- A fairly large net of small mesh is spread over the field.
- The call notes of various birds are recorded.
- By recording call notes

Automatic traps:

The weight of the bird is sufficient to release the door above and the bird is thus caught. A bird entering a compartment alights on this platform.

The trap door is kept open by means of a wire attached to a platform below. It consists of several compartments each fixed with a vertically sliding door.

Baits can be used but these should be scattered outside as well as inside the trap. Birds tend to fly towards the light at the end and collected without difficulty. The end of this is closed by a piece of glass. Provided with a door on one side and one or more small entrances. A large wooden cage (6 x 4 x 4 ft) covered with a fine mesh netting.

Bird scaring techniques

Clothes are worn to these figures. Earthen pot is painted as face of man. A sort of human figure is made in the field. crow scare Drumming by hand can also be done. Rope is pulled regularly by hand to produce sound. Empty tin is tied to branch of trees and connected with long rope. Applicable for orchards and fruit trees.

Drumming: The stone is placed on the net and rotated vigorously by hand and suddenly one end of string is released which flings the stone to a great distance with considerable force. Stone is held in a small piece of gunny net or cloth, the two ends of which are attached to strings. Farmer gets on this platform and throw small stones. Floor should be 6 ft. from ground. Straw and wood platform is made in the centre of field.

The use of model or actual dead birds is used to signal danger to others. It is hanged in the field/ orchard where bird visit regularly.

A bird is killed by gun or poisonous bait feeding. Hanging dead Bird. Loudly shouting is do. This is generally used in orchards. shouting or using gulel Gulel is used to throw stones.

"Hawk kites" are designed to fly from poles in the wind and hover above the field to be protected. Bird are naturally afraid of predators such as birds of prey. The long-term effectiveness of this method can be increased by periodically moving the placement of the scare devices.

Eye illustrations on the balloons has been shown to increase this method's effectiveness. Balloons are an inexpensive deterrent.

The loud bangs can also irritate people living on nearby properties. Jurisdictions issue special licences for agricultural fireworks. Fireworks can also be used as bird scarers.

Cheap and easy method.

Birds will be scared due to reflection of CDs. Fix CDs on different plants in the field. Mechanical device operated by hand with the help of carbide gas.

Automatic Crow scarer:

Cracker like bursting sound helps to scare away the birds. As carbide gas burns a cracking sound is produced. Fresh air is introduced in small chamber with the help of pipe. Fire is set in a small chamber set for this purpose. As the water drops fall on the carbide material in funnel, gas is produced which rise up. Carbide gas is filled in the form of small pieces or powder in funnel of lower cylinder and upper cylinder is filled with water.

They don’t harm birds. Before After upward pointing metal spikes to prevent birds from sitting or landing on ledges.

Other Deterrents. Bird spikes For all kind of birds (Pigeons, sparrows, crows and mynahs)
For pigeons For sparrow, Simplest, most commonly used and cost effective. Bird net system
Chemical Control : A piece of chapati dipped in 0.3% methyl parathion or 2 % fenthion placed on top of roof

Birds in Horticulture:

Introduction

Bird damage in horticultural crops is a serious problem for many growers. Unchecked, birds can completely destroy an entire crop. If each bird eats just 4 grapes/day, a flock of 5,000 starlings will consume 1,000 kg (1 tonne) of food over a 10-day period.

Developing an Effective Bird-Control Strategy

Growers want a simple, cost-effective way to keep birds away from their crops. Neighbours want a solution that does not involve noise-producing devices. Finding a balance is difficult. Even modern equipment and the best effort will not prevent all bird damage, and some devices can create a social disturbance if they are not managed properly. However, the right tools and good management can reduce bird pressure and preserve more crops, while minimizing the impact on neighbours.

Follow these five steps to develop an effective bird-control strategy that balances the needs of the crop with those of the surrounding neighborhoods:

1. Evaluate the bird problem.
2. Use an integrated approach.
3. Start early with a control program.
4. Avoid predictable patterns.
5. Respect your neighbours.

Step 1: Evaluate the Bird Problem

To solve the bird-control problem, start by understanding which birds are causing damage, where they are coming from, how they behave and where the highest-risk areas are located.

Identify Problem Bird Species

Cedar waxwing

Crow

Grackle:

Gull

House Finch

House Sparrow

Mockingbird

Oriole

Robin

Red-winged Blackbird (female)

Red-winged Blackbird (male)

Starling

Figure. Common bird pests affecting horticultural crops.

Bird Behaviour:

Birds act based on instincts and environment. Observe birds in the crops, and identify key behaviours. Look for ways to disrupt these behaviours to make feeding more difficult.

Flying

- Some birds travel in migratory flocks (e.g., starlings), while others fly in from local woods.
- Birds often follow the same flight patterns to feed.
- Starlings will fly up to 25 km from a roosting site to feed.
- Starlings fly in from the ends and sides of fields and love to perch on overhead wires.

Nesting

- Birds establish their home territory in April and May, and often remain in the area until the crop ripens.
- It is difficult to repel birds once they find a food source.

Feeding

- Birds usually feed early in the morning around sunrise and late afternoon/evening around sunset.
- Birds like to drink water when they feed.
- Birds will endure significant hardship to feed.
- Robins hop along the ground to forage.
- Cedar waxwings eat while perching or hanging.
- Birds feeding will attract other birds, compounding the problem.
- Birds can be diverted to nearby feeding areas.

Diet

- Birds are opportunists, feeding on whatever is available.
- Earlier ripening crops are more attractive to birds, because there are fewer ripe food sources available.
- Sweeter crops (higher Brix content) are typically more attractive to birds.

Scaring

- Large flocks of birds are easier to scare than small ones.
- Birds acclimate quickly to uniform, regular movements or noise patterns.
- Different species of birds respond differently to various repellent methods.
- Even if crops are protected with netting, birds may perch on the nets and feed through them or find small holes.

Estimate Bird Pressure

To understand the risk of bird damage and opportunities for control on a specific farm, create a property map for each crop area. On the map, identify relevant features within a few hundred metres of the crop.

Crop features

- different crops or varieties
- past history of bird damage in individual blocks

Bird features

- bird flight paths
- areas of high bird activity

Property features relevant to bird damage

- surrounding vegetation
- power lines
- ponds, creeks, swampy areas or other watering points
- sheds and farm buildings, especially if used for grain or feed storage
- nearby alternative food sources for birds

Nearby sensitive areas

- neighbours' dwellings
- nearby towns or developed areas
- livestock facilities where noise may impact the animals

- recreational areas (golf courses, walking trails, sports parks, etc.)

Identify How Much Crop Is Lost to Birds

Bird damage is not always obvious. Crops with physical damage (bird pecks) are easy to spot, but crops eaten completely by birds can only be estimated. At harvest time, it can be difficult to know the impact of bird damage on the crop. Use the property map and the bird-pressure assessment to identify areas with a higher risk of bird damage. Estimate potential bird losses in these areas with field tests, depending on the type of crop. Calculate the value of the lost crop to determine a budget for bird-control equipment.

Step 1: Keep records of all assessments. Use these assessments to identify locations where control equipment is needed. Look for other opportunities to limit bird damage, such as making habitats less attractive or eliminating water sources.

➢ Step 2: Use an Integrated Approach

The most effective bird control uses a combination of deterrent methods at the same time. Even netting does not provide 100% protection and can be improved with other devices. There are three categories of bird deterrent methods currently available:

- acoustic
- visual
- physical

Chemical deterrents (e.g., methyl anthranilate) are also available. These products must be approved for use on the specific crop and used according to the label instructions. These products can leave unwanted flavours on fresh food. As a result, their use in agricultural applications is very limited.

Acoustic Deterrents

Acoustic deterrents use sound to scare birds away. Birds have a hearing range similar to humans; if people can hear it, so can birds. Birds cannot hear ultrasonic sounds.

Propane-Fired Cannons (Bird Bangers)

Bird bangers ignite propane to produce loud, random, unexpected sound blasts (Figure 2). Modern devices fire sets of 3 blasts while rotating to cover a larger area. They must be used in compliance with best management practices (see **Best Practices for Use of Acoustic Bird Deterrents** and the OMAFRA factsheet, **Using Propane-Fired Cannons to Keep Birds Away from Vineyards**).

Figure. A propane-fired canon.

Electronic Sound Devices (Squawkers)

Electronic sound devices broadcast either electronic noises to irritate birds and disrupt their sensory system, or distress calls of specific bird species and predatory attack calls (Figure 3). The latter sound like real birds and are usually more acceptable to neighbours than propane-fired cannons. Some farmers report the distress calls actually attract birds of prey, which can help scare problem birds away.

Electronic sound devices and propane-fired cannons are often used together. The electronic devices keep birds irritated and edgy, while the cannon provides stimulus to drive them away.

Shotguns

Shotguns pose a serious safety risk and must never be used without a licence and proper training. A shotgun is not as effective at scaring birds as a pyrotechnic cartridge. Lethal control is usually ineffective because of the large bird numbers. Obtain permission from governing authorities before using shotguns.

Other Sound-Producing Devices

Devices such as air horns, clanging metal or Mylar humming lines generally work for a few days before birds start to ignore them. They can also be disruptive to neighbours. These devices may provide the most benefit when used only in the days just before harvest, when bird pressure is highest.

Figure. An electronic sound device (squawker)

Best Practices for Using Acoustic Bird Deterrents

- Inform neighbours
  - Explain which devices are being used, how they work and when they will operate.
  - Explain how to reach you if there is a problem.

  Use sparingly during nesting
  - Use electronic bird scarers and visual deterrents in nesting areas.

- Stop after nesting season.

Wait for ripening fruit

- Do not use deterrents until 3-4 weeks before the crop starts to ripen (depends on crop).

Dawn to dusk only

- Use only between sunrise* and sunset* when birds feed.
- Use electronic timers and light sensor overrides.

Observe minimum setbacks

- at least 125 m* from neighbours' houses
- at least 125 m* from other acoustic devices

Use proper frequency

- Use the 4-8-minute setting* on propane-fired cannons.

Move devices regularly

- Move devices at least once a week.
- Move devices immediately if there is no effect.

Stop as soon as possible

- Stop as soon as crops are harvested.
- Stop or move devices immediately if there is no effect.

Physical Exclusion (Netting)

Physically excluding birds from the crop using netting is the best way to ensure crop protection. Unfortunately, it is usually the most expensive option and will not guarantee 100% protection. Desperate birds can still find a way into the crop (Figures 8 and 9).

Nets are available in many sizes, colours and materials. The choice depends on the crop, field layout, expected life and installation equipment. Netting material costs have dropped over the years, and systems for applying the netting are improving. The high value of some horticultural crops makes netting a worthwhile investment.

Figure : Netting installed directly on grapes

Netting Installed Directly on the Crop

Direct installation is best suited for crops that do not require multiple pickings (e.g., grapes). Coloured nets may also act as camouflage, making it harder for birds to see ripening fruit.

For ice wine grapes, netting is a necessity. Ice wine netting is draped completely around the vines and fastened tightly under the lowest bunches of grapes. This protects the crop from birds and keeps grapes from dropping on the ground during the long period until harvest in mid-winter.

Netting fastened to overhead structure

Overhead netting is best suited for crops picked more than once (e.g., blueberries). Overhead systems allow work to occur beneath the nets, while still protecting the crop from birds. Overhead nets must be removed or retracted at the end of the season to prevent ultraviolet degradation and snow load damage.

Step 3: Start a Control Program Early

Bird control must be started early, before birds get a foothold in the area. Growers often start their bird-control program too late, after the birds have already tasted the crop.

During the Nesting Season

- Use electronic bird scarers and visual deterrents in nesting areas to convince birds to settle elsewhere.
- Once nesting season is over, remove the deterrents.

During the Growing Season

- Set up bird-control equipment at least 10 days before the crop is attractive to the birds (when it is colouring, softening or sweetening).
- For early control, set acoustical equipment to run infrequently. For propane-fired cannons, start on the 8-16-min. setting.
- As the crop ripens and bird pressure increases, set equipment to run more often. For propane-fired cannons, use the 4-8-min. setting.
- Do not operate equipment too frequently, or the effectiveness will be reduced.

Step 4: Avoid Predictable Control Patterns

Birds are intelligent and will quickly get used to regular, repeated, consistent control methods. Use a variety of strategies and change both the timing and locations of these devices regularly to get the best control:

- Start using controls infrequently, early in the season, ramping up use as the season progresses.
- Observe bird behaviour when controls are being used. If something is not working, change it immediately.
- Combine scaring methods to disrupt the birds' senses and to instill or reinforce fear all at once.
- Position more scaring devices along the perimeter of crops, near trees/ponds and at flight-pattern entry areas.
- Use random, unexpected methods instead of predictable, patterned controls.

- Move and/or change control methods often to prevent birds becoming accustomed to them.
- Use prevailing winds and/or echoing effects to maximize sound dispersal from acoustic devices.
- Be conscious of surrounding neighbours, especially when using acoustic devices.

Appendix B provides an example strategy for bird control in a 4-ha (10-acre) vineyard. The strategy uses more aggressive methods for higher levels of bird pressure.

Step 5: Respect Your Neighbours

Unfortunately, any device that annoys birds can also irritate nearby neighbours. Most complaints about bird-scaring devices involve propane-fired cannons. Complaints can increase over time if nothing is done.

Bird Watching Observation:

Speak to the farmer and obtain permission to walk through the crops and take pictures of bird activity. Monitor bird activity to better understand the scale of the farmer's problem.

- Walk through the crops, looking for evidence of bird damage.
- Take notes of times of day and locations in the field where birds are most active.
- Take pictures and videos to document bird activity.
- Share observations with the farmer to help them make better bird-control decisions.

Summary

The most effective bird control balances the needs of the crop, the effectiveness and costs of various control methods and the best interests of the environment and the neighbourhood.

- Evaluate the risk of bird damage by identifying problem birds, observing bird behaviours, identifying high-risk areas and estimating potential bird pressure.
- Use an integrated approach with multiple devices and strategies that complement each other to disrupt bird behaviours.
- Start early with a control program to deter birds before they become established in the area.
- Avoid predictable patterns by changing control methods, moving equipment regularly and monitoring effectiveness.
- Respect nearby neighbours by keeping them informed about the bird-control systems being used and managing equipment properly to reduce social impact.

Birds in FORESTRY

WILDLIFE BENEFITS & NEEDS

Wildlife benefits people through its aesthetic and recreational opportunities, such as observing

Wildlife benefits the forest by burying or dropping nuts, which helps plant regeneration

Birds also disperse seed through their droppings

Birds and bats also help control insects

In exchange, the forest provides wildlife with food and water and with cover and habitat

FORESTRY PRACTICES FOR WILDLIFE

Mature forests are necessary for: • Birds that nest and feed in the upper canopy. • Cavity-nesting birds and mammals • Some ground-nesting birds. • Food – seeds, hard mast (nuts)

Forest fragmentation hurts those species that need continuous areas of forest The size requirements vary with species. Goshawks, for example, require large, unbroken home ranges

Salamanders, which have a smaller home range – can’t cross “hostile” terrain such as roads, clear-cuts, or crop fields. They require a continuous, unbroken range

Forest fragmentation leads to unsuccessful competition between migratory songbirds (such as this Scarlet Tanager) and birds that inhabit forest edges

Other species use a combination of habitat types. Different areas are used at different times of the year, depending on food, breeding, and cover needs. They can benefit from diverse edges or transition zones. For example, wild turkeys: • spring and summer – herbaceous plants, seeds, insects in forest clearings. • fall – fruits and nuts from deeper in forest. • winter – leftovers from autumn, plants and insects in warmer, spring seep areas

Forest Eco system

` The increasing expansion of productive lands around the world during the last decades constitutes a strong driver of biodiversity loss, as they are usually established near to high diversity areas. Despite many studies that have compared bird diversity between natural and productive systems, a global synthesis is still missing and important for understanding how biodiversity is being altered. We conducted a meta-analysis based on 144 case studies to assess the effects of four types of plantations (forestry, oil palm, coffee, and cacao) on bird species richness and abundance.

We examined those effects in function of plantation type, latitudinal zone (temperate or tropical), geographical context (mainland or island), zoogeographic zone, and biodiversity hotspots. Plantations presented negative effects on both bird species richness and abundance. Oil palm plantations showed more negative effects followed by forestry plantations, whereas coffee and cacao agro forestry plantations had no significant effects. Those effects were geographically variable, being more pronounced in islands and temperate zones, as well as at the Oriental, Palearctic, and Neotropical zoogeograghic regions, and at the Sundaland and Mediterranean Basin biodiversity hotspots.

Our results showed that productive systems reduce both species richness and abundance of bird species, being insular species particularly susceptible. Exotic monocultures with low structural

heterogeneity (e.g., oil palm plantations) derive in highly impoverished bird communities dominated by generalist species. We identified South East Asia, tropical South America, and the Mediterranean Basin as the most threatened regions because of the sensitivity of their bird communities and the increasing rates of native forest replacement.

How Forest Structure Influences Bird Populations

Vegetation structure is only one of the factors that impacts bird species diversity in an area, but it is an important one. Forested areas have a mix of different vegetation types including the tall trees that make up the forest canopy as well as layers of shrubs, mosses, ferns and other plants that make up the understory. These plants provide food sources, breeding and nesting habitats, and protection from predators.

The type, density and structure of plant life in a forest will influence the bird species that live there. Different species thrive under different conditions, with some preferring dense, mixed underbrush and others.

What are Forest Birds?

The term “forest birds” is often used to refer to migratory forest songbirds that breed in the extensive forests of the northeastern United States and winter in the southern U.S., Central America or South America. This group includes the colorful warblers, vireos, thrushes, flycatchers, and others that fill northeastern forests in the spring and summer. The northeastern U.S. has some of the highest diversity of breeding birds in the country due, in large part, to the varied species of forest songbirds. Many of these species are showing longterm population declines and/or have a high proportion of their global breeding population in this region, making their conservation especially important. Priority species in Vermont include Canada warbler, blackthroated blue warbler, veery, wood thrush, and many more.

What makes good forest bird habitat?

Many forest birds are particular about the makeup of their habitat. Some prefer hardwood forests while others prefer softwood (coniferous) forests or mixed forest. Certain species nest only in young forests; others require older forests. Within these forests a variety of vegetative layers (e.g. ground, understory, mid-story or canopy layer) are used for nesting or feeding. To provide the appropriate habitat for forest birds, it is critical to have a diverse and well-structured forest. This is not a “park-like” forest with only large trees and nothing else growing. A well-structured forest has a mix of various species of large trees, medium size trees and small trees throughout. Standing dead trees (snags) and logs and tree tops on the forest floor may look rather messy, but provide excellent habitat for forest birds

UNIT V

PAPER: AVIAN BIOLOGY

SUBJECT CODE-18KP1ZELZ1

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MIGRATION OF BIRDS

DEFINITION

The word **"migration"** is Latin word -migrara -which means going from one place to another.

The periodic travelling of birds from one place to another and back, for breeding is called **migration.**

The following are the important migratory birds:
Golden plover, Hummingbird, Paradise flycatcher etc.

PURPOSE OF BIRD MIGRATION

1. Breeding
2. Feeding
3. For getting suitable climatic conditions.

CAUSES OF MIGRATION

Birds migrate on schedule and follow the routes in a regular fashion.
The exact factors that affect the course and direction of migration are not clearly known.

Some of the factors related to migration are follows:

1. **Instinct and Gonadal changes:**

The impulse to migrate is natural and associated with gonadal changes.

2. **Scarcity of food and day length:**

Scarcity of food, shortening of daylight and increase of cold stimulate migration. It is related to endocrinal changes.

3. **Photoperiodism:**

The increase of day length (Photoperiodism) induces bird's migration.

4. **Pituitary and pineal glands:**

The pituitary and pineal glands induce growth of gonads to secret sex hormones that act as stimulant for migration.

5. **Seasonal variation:**

The north-to-south migrations of birds take place under stimulus from the internal condition of the gonads which are affected by seasonal variation.

6. **Light:**

Light plays an important role in the development of gonads, so it has indirect role on migration.

TYPES OF BIRD MIGRATION

All birds do not migrate, but all species are subject to periodical movements.

Migration may be:

(i) Latitudinal migration:

The birds move from north to south and back.

E.g Arctic tern- breeds in the northern temperate region and migrates to the Antarctic zone. It covers a distance of 22 500 km during migration.

(ii) Longitudinal migration:

The birds migrate from east to west and back.

E.g California gulls, a resident and breed in Utah, migrate westward to winter in the Pacific coast.

(iii) Altitudinal migration:

Migration occurs in mountainous regions.

Many birds inhabiting the mountain peaks migrate to lowlands during winter. E.g., Golden plover.

(iv) Partial migration:

All the members of a group of birds do not take part in migration. E.g., Coots and spoon bills of our country.

(v) Total migration:

All the members of a species take part in the migration, it is called total migration.

(vi) Vagrant or irregular migration:

Birds go to a short or long distance for safety and food it is called vagrant or irregular migration. Herons, black stork, spotted eagle and bee eater.

(vii) Daily migration:

Some birds make daily journey from their nests. This is due to the influence of environmental factors such as temperature, light, and humidity. E.g crows and herons.

(viii) Seasonal migration:

Birds migrate at different seasons of the year for food or breeding. E.g., cuckoos, swifts and swallows.

Summer visitors: migrate from the south to the north during summer. E.g., cuckoos, swifts and swallows.

Winter visitors: migrate from north to south during winter. E.g snow bunting, red wing, shore lark, grey plover

MODES OF FLIGHT IN MIGRATION

During migration, most migratory birds display following significant features:

1. Time of Migratory Flights:

The most migratory birds either fly during daytime or night time

(a) Diurnal Migration:

Birds fly during daytime E.g crows, robins, hawks, cranes, pelicans and shore birds. They travel in flocks e.g ducks, geese and swans.

(b) Nocturnal Migration:

Birds fly during nighttime. E.g. Small-sized birds, sparrows, warblers and thrushes. It is to escape from enemies.

2. Range of Migration:

Birds fly few miles to thousands of miles in different groups. It is constant for a particular species.

E.g.

1. Golden plovers, sandpipers and swallows - 6,000 to 9,000 miles from the Arctic to the grassy plains of Argentina.
2. Arctic tern - 11,000 miles

It is calculated that 5,000 million land birds migrate from Europe to Africa each autumn and half of them succeed in returning next spring.

3. Altitude of Flight:

Most routine migration occurs within 3,000 feet of the earth.

Small land birds fly in night at 5,000 to 14,000 feet altitudes. Avian species even cross the Andes and the Himalayas at altitude of 2,000 feet or more.

4. Velocity during Migration:

The speed or velocity of flight of birds varies from individual to individual and species to species. Affected by the speed of air and its direction.

E.g

1. Cranes, crows and finches fly - 30 miles/ hour.
2. Indian swifts -170-200 miles/ hour

Migratory birds fly five or six hours per day and take rest in between for drink and food.

Golden plovers fly nonstop covering a distance of 2,400 miles.

5. Routes of Migration:

The migratory birds usually follow definite lines of flight (route).

(a) Sea Routes:

Marine birds follow sea routes.

(b) Coastal Routes:
Large number of birds follows coastal routes. Important migratory coastal routes are- East Atlantic coastline; West Atlantic coastline; East Pacific coastline; West Pacific coastline; East Indies coastline and West Indies coastline.

(c) River-Valley Routes:

The migratory birds cross rivers and river-valleys falling in the way.

(d) Mountain Ranges:
Very rarely the birds cross mountain ranges.
The river valleys, mountain ranges and coastal routes provide good landmarks for the migrating birds.

6. Segregation during Migration:

Birds like kingfishers, swifts, and night-hawks travel in separate companies.

Swallows, vultures and turkeys travel in mixed companies of several species due to similarity in their size and method of search of food.

In some avian species, the male and female individuals travel separately. Males arrive first to build the nests. The young birds usually go with their mothers.

7. Order of Migration:
During migration, the birds follow a definite order which is strictly followed. Normally the adults migrate first and they are followed by young birds.

8. Regularity of Migration:
Migratory birds show a remarkable regularity in their timings of arrival and departure. Most migratory birds come back to the same breeding place year after year.

FACTORS AFFECTING MIGRATION OF BIRDS

Height: Most of the birds fly at altitudes of 2,500 to 5,000 feet.

Weather Conditions: weather conditions at the destination or starting point of the flight is important for bird's survival.

Direction and Speed of Wind:

Winds blow clockwise around high air-pressure systems and counter-clockwise around low air-pressure systems.

Migration is heaviest when the wind blow in same direction of bird flying and lightest when wind blow in opposite direction.

Wind direction Fall **Wind direction Spring**

GUIDING MECHANISMS IN BIRD NAVIGATION

It is difficult to identify the means of orientation and navigation in migration.

The different groups of birds with different modes of existence have evolved different means of finding their way from one place to another.

The birds are guided by a number of factors:

a. Sun—the guiding agent in diurnal migration:

Many wild birds use the sun as the compass. The birds are guided by the position of the sun in the sky with its internal clock. E.g., Pigeons

b. Stars—the guiding agent in nocturnal migration:

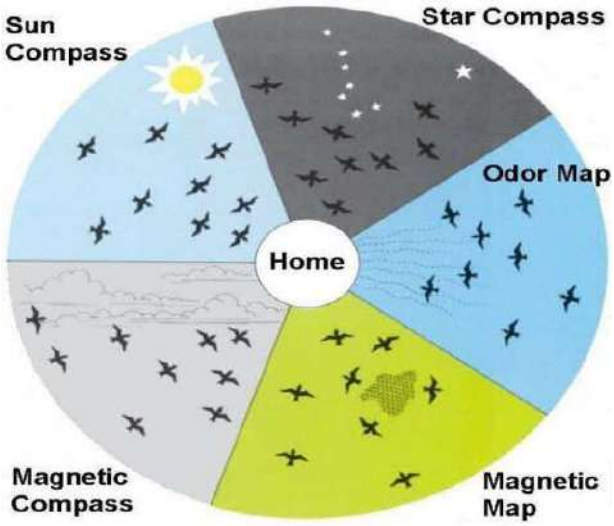
Birds are able to navigate using star (e.g north star) as compass. E.g., warblers

c. Earth's magnetic field—as the guiding factor:

Magnetoreception allows an organism to detect a magnetic field to identify direction, altitude or location. This is used by birds for orientation and navigation.

d. The 'compass' and the 'internal clock' in bird migration:

Existence of biological clocks is a property of living organisms. The birds use this property to navigate the direction.



BIRD RINGING

Bird ringing or **bird banding** is the attachment of a small, individually numbered metal or plastic tag to the leg or wing of a wild bird to enable individual identification.

Advantages:

1. Bird ringing is a useful research tool for the study of migratory birds and their conservation.
2. It allows birds to be individually marked and their movements and other life history traits to be tracked over time.
3. By ringing, information on dispersal, migration, longevity, behavior, survival rate, reproductive success and population trends of migratory birds can be obtained.
4. Ringing programmes, for example, make it possible to identify how many chicks from one population survive and which environmental conditions are favorable or detrimental to the birds.

5. This information leads to a better awareness of the birds' biology and ecology and their demographic changes over time.
6. This knowledge is an important foundation for successful conservation measures.
7. Whenever ringed birds are found dead, or re-sighted (in the case of colour-rings), they can be identified, and their movements can be tracked.
8. It helps to identify the critical sites along their migratory routes (flyways) and provides fundamental information for conservation planning and site management.
9. The recapture or recovery of the bird can provide information on migration, longevity, mortality, population, territoriality, feeding behavior, and other aspects that are studied by ornithologists.

ADVANTAGES OF MIGRATION TO BIRDS

1. better climatic conditions
2. abundant food supply
3. increased space for breeding and nesting
4. long daylight hours for search of food
5. Chance for gene exchange

DISADVANTAGES OF BIRD MIGRATION

1. cold weathers and snowstorms
2. Sudden changes in climate e.g., storms and hurricanes
3. shortage of food
4. strong current of wind and fog cause death of birds
5. man-made lighthouses and electric towers
6. mountains
7. big buildings
8. television towers
9. ceilometer beams at the airports, etc.
10. Man shoot the birds for their own leisure and amusement

WHY DO BIRDS NEED CONSERVATION OR PROTECTION?

1. Birds are sensitive indicators of biological richness and the health of our environment.
2. Birds play a vital role in our natural ecosystem.
3. They provide pest control.

4. They clean up the dead and decaying animals. E.g vultures
5. They help in spreading of seeds.
6. Birds announce danger. They could serve as "winged sentinels" of environmental degradation.
7. More than 900 bird species worldwide help in pollination.
8. Birds help farmers. By foraging leftover grain, weeds and bugs in fields and also help in decomposition.
9. Seabird guano—rich in nitrogen, phosphorus, and other nutrients—provides an important source of fertilizer and income to many people living near seabird colonies.
10. Birds possess skills that historically made them useful to militaries.
11. Birds have direct and indirect economic and cultural values for people.
12. Birds provide a means to improve our scientific knowledge and understanding of our environment.
13. Birds are beautiful and inspirational, a source of happiness and pleasure for people everywhere.
14. Birds are ideal for promoting conservation and environmental awareness.
15. Birds are the public relations officer for wildlife. People like to see, hear, and identify them.
16. Birds are messenger of the seasons.
17. Birds are source of attraction and have symbolic influence. They are most universally celebrated form of nature, found in pictures, photographs, sculptures, word, and song.

ENDANGERED BIRDS

Birds at high risk of extinction are called **Endangered Birds.**

Twelve bird species come under this category.

E.g.,

1. **Great Indian Bustard (*Ardeotis nigriceps*)**

Historically spread all over Indian subcontinent.

Now restricted to only a few places in Rajasthan, Maharashtra, Karnataka, Andhra Pradesh, and Madhya Pradesh.

Representative of Grassland.

Threats – expansion of agriculture, habitat fragmentation, overgrazing, pesticides, and hunting

Conservation - listed in CITES Appendix I.

It is listed in Schedule I of the Indian Wildlife (Protection) Act. 1972.

BNHS is carrying out conservation and awareness Campaign in many states.

2. **Lesser Florican (*Sypheotides indicus*)**

This bird is endemic (common) to India and Nepal.

Historically spread all over peninsular India.

Representative of Grassland.

Threats - habitat loss, hunting and failure of monsoon rains.

Conservation - Species is protected under Schedule I of the Wildlife (Protection) Act. 1972.

Great Indian Bustard

Lesser Florican

BIRD SANCTUARIES OF INDIA

India is a home to many beautiful species of birds, local as well as migrant birds. Bird sanctuaries in India is a hot spot for nature lovers and birdwatchers.

Some of the famous Bird Sanctuary are as follows:

1. **BHARATPUR BIRD SANCTUARY**

   The famous Bharatpur Bird Sanctuary is situated in **Rajasthan**.

1. Bharatpur bird sanctuary is one of the best bird sanctuaries in India.
2. Apart from the Great Thar Desert, Big forts and beautiful lakes, Birds of Bharatpur sanctuary are one of the major tourist attractions in Rajasthan.
3. Thousands of rare and highly endangered birds come here during the winter season.

2. **SULTANPUR BIRD SANCTUARY**

   Sultanpur bird sanctuary known for several colorful winged migratory species, located at Gurgaon district of **Haryana**.

1. It is a small area covering shallow freshwater where 100 of migratory bird species visit to feed every year.
2. The Sultanpur National Park also known for its rich variety of wild animals and flying predators along with beautiful birds.

3. **SALIM ALI BIRD SANCTUARY**

   The Salim Ali bird sanctuary is situated in Chorao Island along the river Mandovi in **Goa**.

1. The sanctuary is one of the best known and very famous bird sanctuaries in India.
2. It is one of the smallest bird sanctuaries where flying Sparrows, Beautiful peafowl, Parrots, pelican, Indian giant squirral and other rare species of fauna can be spotted.
3. Beyond the Beaches of Goa, Salim Ali bird sanctuary is one of the major tourist attractions in Goa.

4. KUMARAKOM BIRD SANCTUARY

Kumarakom bird sanctuary also known as Vembanad bird sanctuary is situated in **Kerala**.

1. It is a home for large number of migratory birds like Flycatcher, Teal, Siberian Stork, Crane, Parrots and Wood Beetle.
2. By riding a houseboat will be the best way for birdwatching in Kerala.
3. It is a favorite spot for migratory birds and paradise for the bird lovers.

5. RANGANTHITTU BIRD SANCTUARY

Ranganthittu bird sanctuary is situated in **Karnataka**.

1. The exotic migratory birds like light Ibis, Egret, Partridge, Heron, River Tern, Snake Bird, stone Plougher are the attraction for the tourist.
2. This is an important tourist destination of Mysore.
3. It is located about 20 kilometers from the famous Brindavan garden lies adjoining the Krishnarajasagara dam.

6. VEDANTHANGAL BIRD SANCTUARY

The Vedanthangal bird sanctuary is the oldest bird sanctuary in India, situated in **Tamil Nadu**.

1. Variety of birds such as pintail, garganey, grey wagtail, blue-winged teal, common sandpiper are seen.

7. KAUNDINYA BIRD SANCTUARY

Kaundinya bird sanctuary is situated near Chittor in **Andhra Pradesh**.

1. The habitat is rocky with high hills and deep valleys and Kaigal and Kaundinya are two beautiful streams, which flow through the sanctuary.
2. Kaundinya sanctuary offers the best of wildlife and bird watching in India.

8. CHILKA LAKE BIRD SANCTUARY

Chilka lake bird sanctuary is extremely popular among tourists, located near Puri in **Orissa**.

1. The chilka lake is the most beautiful brackish water lake in Asia and famous for a rich variety of birds.
2. Chilka Lake serves as a bird sanctuary and is the largest wintering ground for migratory birds in India.
3. The pear-shaped Chilka lake is one of the best birds watching spots in India.

9. MAYANI BIRD SANCTUARY

It is situated in Satara district of **Maharashtra**.

1. The Mayani bird sanctuary is globally calculated for its huge range of species for migratory birds.
2. Many migratory birds pass through the area, such as flamingos from Siberia come in large numbers.

10. NAL SAROVAR BIRD SANCTUARY

Nal Sarovar bird sanctuary is situated in **Ahmedabad, Gujarat**.

1. It is the largest wetland bird sanctuary in Gujarat, and one of the largest in India.
2. Spot birds like Flamingos, Pelicans, Spoonbills, Avocets, Coots, Pintails, small Cormorants, small Grebes and Shovellers.
3. It is one of the busiest tourist attraction spots in India.

Other list of bird sanctuaries of India is

Kutch Bustard Sanctuary,

Pulicat Lake Bird Sanctuary,

Najafgarh drain bird sanctuary,

Chitrangudi Bird Sanctuary,

Karnala Bird Sanctuary and

Bhigwan bird sanctuary of Maharashtra also known as mini Bharatpur of India.

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QUESTIONS

SHORT ANSWER QUESTIONS

Q1. What are the causes of Bird Migration ?

Q2. Why do birds need conservation ?

Q3. Write notes on Bird watching.

Q4. Write short notes on Endangered Birds.

ESSAY TYPE QUESTIONS

Q5. Write an essay on migration in birds.

Q6. Write an essay on the Bird Sanctuaries of India.