

Practical Manual

Ornithology and Herpetology

FWM-236 3(2+1)

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2020

**College of Horticulture & Forestry
Rani Lakshmi Bai Central Agricultural University
Jhansi-284003**

Ornithology & Herpetology Practical FWM 236 3(2+1): Field identification of major birds of India. Bird watching and drawings. Study of feathers, beak and leg types of different groups of birds. Study of the nest and eggs of birds. Mist netting and tagging/marketing of birds for the bird migration studies. Bird census techniques. Visit to different bird habitats.

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Roll No.

Batch.....

Session.....

Semester.....

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Credit.....

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CERTIFICATE

This is to certify that Shri./Km.ID No.....has completed the practical of course.....course No. as per the syllabus of B.Sc. (Hons.) Forestry semester in the year.....in the respective lab/field of College.

Date:

Course Teacher

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Practical No. 1

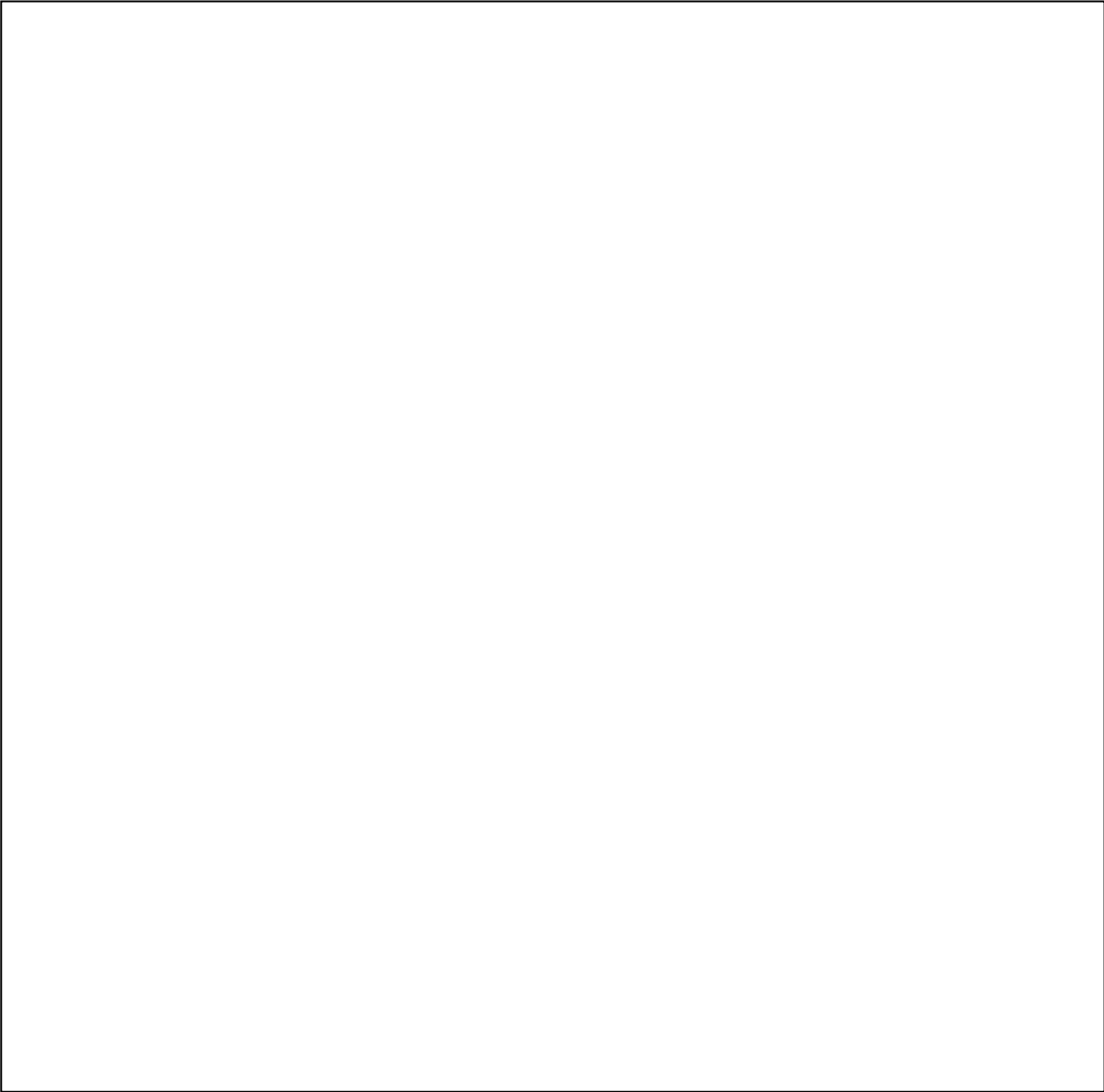
Objective: To study different types of birds found in locality

Enlist birds and their living habitat

S. N.	Common name	Scientific name	Habitat
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28			

Objective: To study bird and its body parts

1. Draw diagram of birds with different parts of birds



2. Write down different body parts of birds

Head:
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Bill:
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Chin.....
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Throat.....
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Neck.....
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Back.....
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Chest.....
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Abdomen.....
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Flanks.....
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Wings.....
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Rump.....

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Tail.....

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Undertail coverts.....

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Legs.....

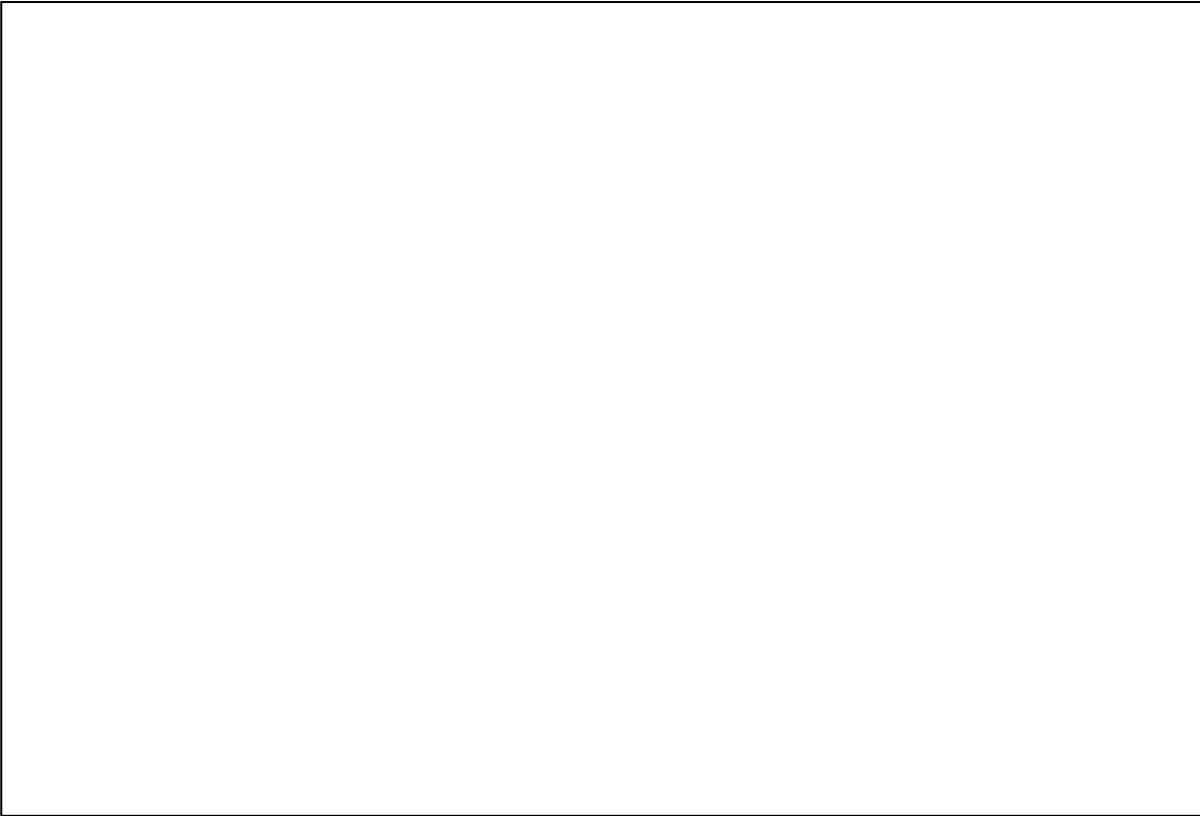
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Feet.....

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Objective: To study different types of feathers of birds

1. Draw feather with label



2. Write down feather and its different parts

Feather
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Types of feathers

Rachis.....
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Barb.....
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Barbules.....

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.....
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After feather.....
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Inter locking barbs.....
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Calamus.....
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Vane.....
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Hallow shaft.....
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3. Write down different types of feathers and its function

Counter feather:
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Flight feathers:
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Down feathers:

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Filoplumes:

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Semiplume feathers:

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Bristle feathers:

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Practical No. 4

Objective: To study different types of beaks of birds and feet of birds

1. Write down different types of beaks of birds

S.N.	Type of beak	Function of beak	Bird
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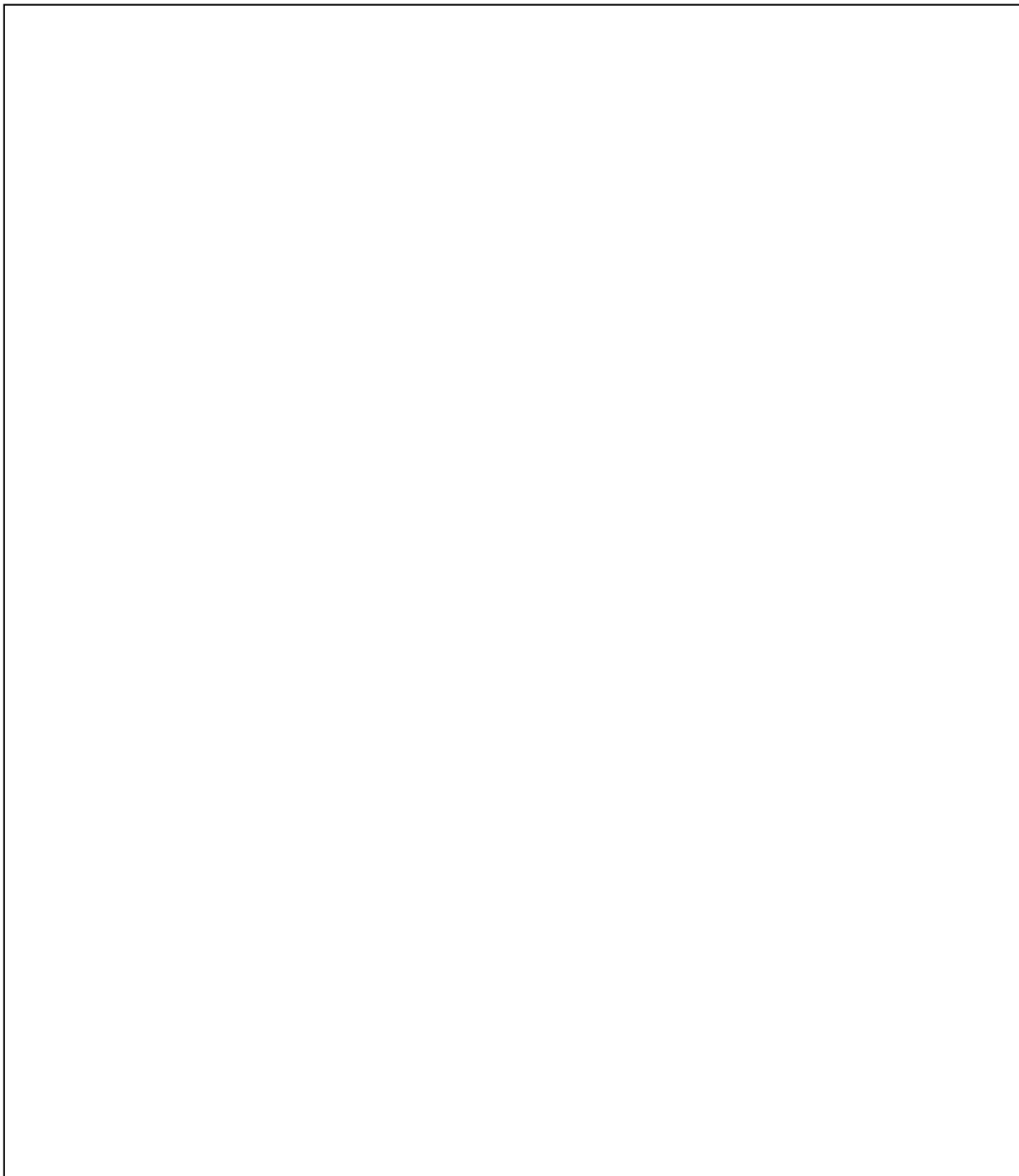
2. Draw diagram of Beak with label



3. Write down types of feet and their functions

S.N.	Types of feet	Function
1		
2		
3		
4		
5		

2. Draw diagram of feet with label



Objective: To study skeleton system of birds

1. Write down different parts of skeleton of birds

The skull:

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Vertebral column:

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Ribs:

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The chest:

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The apendicular skeleton:

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Wing:

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Pectoral girdle:

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Pelvic girdle:

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Leg and foot:

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Feet:

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Objective: To study digestive system and excretory system of birds

1. Draw diagram of digestive system



2. Write Different parts of digestive system

Bill:
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Mouth
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Tongue:
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Pharynx:
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Esophagus:

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Crop:

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Proventriculus:

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Gizzard:

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Small intestine:

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Caeca:

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Rectum:

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Cloaca:

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3. Write down excretory organs of birds

Kidneys:
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Ureter:
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Cloaca:
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Urine:
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b) Major habitat:

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c) Type of birds:

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d) Example of birds:

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b) Major habitat:

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c) Type of birds:

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d) Example of birds:

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b) Major habitat:

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c) Type of birds:

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d) Example of birds:

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b) Major habitat:

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c) Type of birds:

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d) Example of birds:

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b) Major habitat:

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b) Major habitat:

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c) Type of birds:

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d) Example of birds:

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b) Major habitat:

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c) Type of birds:

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d) Example of birds:

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b) Major habitat:

c) Type of birds:

d) Example of birds:

3. Write down order Passeriformes with example

a) Classification of Order Passeriformes:

b) Major habitat:

c) Type of birds:

d) Example of birds:

Objective: To study the nest and eggs of birds

1. Write down different types of nests of birds

S. N.	Shape of nest	Description	Example
1			
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2. Write details about eggs

Oology:

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Size:

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Shape:

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Colour:

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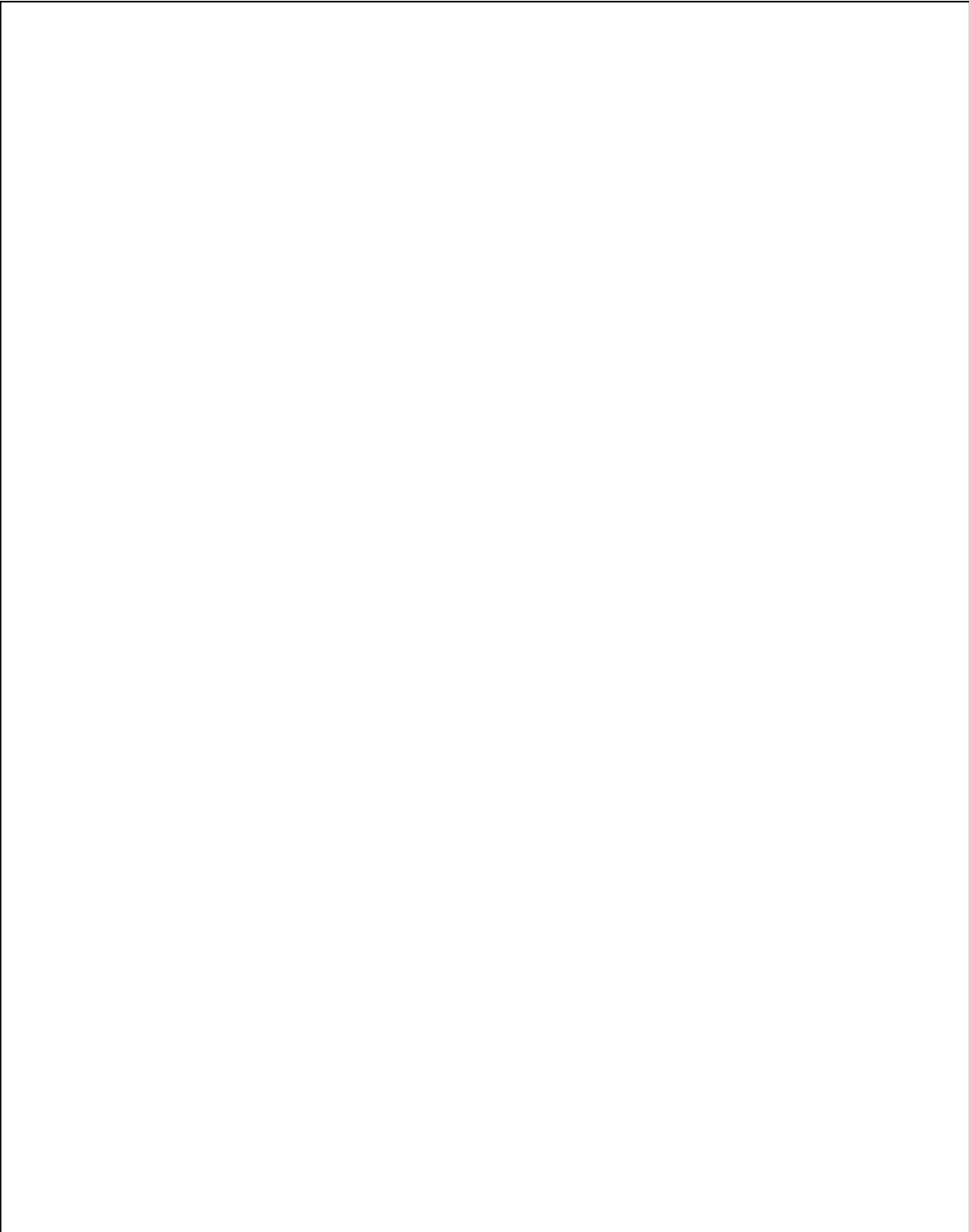
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3. Draw typical diagram of nest and egg



Objective: To visit nearby bird habitat forest/wetland

1. Write down details of following

i) Name of site

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ii) Visiting date and time for bird watching

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iii) List of the instruments carried for observation of birds

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2. List out birds observed in forest/ wetland

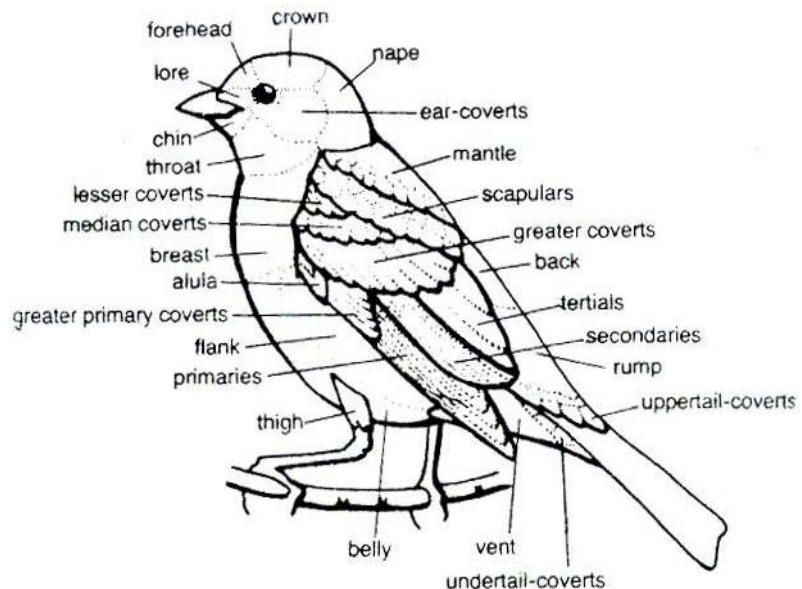
S. N.	Name	Scientific name	Habitat
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BIRD

A warm-blooded egg-laying vertebrate animal distinguished by the possession of feathers, wings, a beak, and typically by being able to fly.

Different body parts of birds

- **Head:** The bird's head is one of the best places to look for field marks such as eye color, malar stripes, eyebrows, eye rings, eye lines, and auricular patches. The crown (top) and nape (back) are also key parts of the head that can help identify a bird.
- **Bill:** The size, shape and color of a bird's bill is critical for identification. Also check for any curvature in the bill or unique markings such as differently colored tips or bands.
- **Chin:** The chin is present directly below the bill, is often hard to see on many birds, but when it is a different color it can be an exceptional body part to check for identification.



- **Throat:** A bird's throat may be a different color from its surrounding plumage, or it may be marked with spots, streaks or lines.
- **Neck:** The neck of a bird is hard to see on many species, since it can be relatively short and insignificant. On wading birds, however, the neck is much more prominent and can be a good place to look for field marks. The length of the neck can also help distinguish different bird species.
- **Back:** A bird's back is often broad and easy to see in the right posture. Different colors and markings along the back that distinguish it from the neck, rump and wings.
- **Chest:** The chest (also called the breast) is the upright part of the bird's body between the throat and the abdomen. A bird's chest may be differently colored or marked with stripes, streaks or spots that can help with identification.
- **Abdomen:** The abdomen or belly of a bird extends from the bottom of the chest to the undertail coverts. The colors and markings on the abdomen may vary from the chest and flanks, making it a good feature to check for identification.
- **Flanks:** The flanks (sides) of a bird are located between the underside of the wings and the abdomen. In many bird species, the flanks have unique colors or markings, though depending on how the birds carry their wings, the flanks may be difficult to see.
- **Wings:** Birds' wings are their upper limbs used for flight. Wing bars or patches are useful field marks, as are the lengths of the wings compared to the length of the tail when the bird is perched. In flight, wing shape is also a great field mark.
- **Rump:** A bird's rump is the patch above the tail and low on the back. For many birds, the rump does not stand out, but some species show unique rump color patches that are useful for identification.
- **Tail:** The length, shape and colors of a bird's tail are important for proper identification. The tail can be held in different positions when the bird is perched or flying, however, and watching for different markings can help distinguish different birds.
- **Undertail coverts:** The short feathers beneath the tail are the undertail coverts, and these feathers often show unique colors or markings that can distinguish bird species.
- **Legs:** Birds' legs vary in length and color, both of which can be useful field marks for proper identification. The thickness of the leg, while difficult to see on many species, can also be a clue, as can any feathering. Some raptors, for example, have heavily feathered legs that can be used to identify the birds.
- **Feet:** Many birds' feet are the same color as their legs, but not always. The orientation of the toes, the size of the talons and how a bird uses its feet are also useful identification characteristics.

PARTS OF FEATHERS

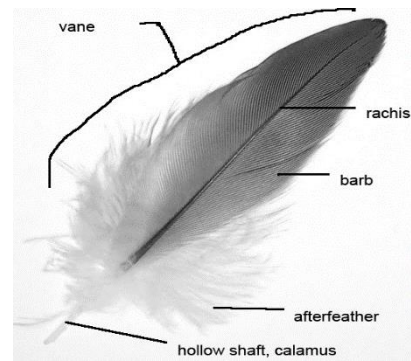
Rachis: The main shaft of a bird's feather, especially the part to which the barbs are attached. The spinal column.

Feathers: Feathers are composed of a supple shaft with barbs and barbules. It cover the body of the bird, protecting it and maintaining its body temperature

Down feather: It is the soft, first feathers that grow on a bird.

Long flexible barbs: Filaments of down feathers, which are not attached to each other.

Barb: The barbs grow from the rachis. Each barb is a feather within a feather with a little shaft and little barbs of its own called barbules. When viewed as a whole the barbs are the vane.



Barbules (too tiny to show above): Barbules are mini-barbs that grow from the central shaft of each barb. The barbules on one side of the shaft are smooth. Those on the other side have tiny little hooks called barbicels that grab the smooth barbules that lie next to it. When properly preened the barbicels all hook up to their nearby barbules and the feather vane is smooth.

After feather: After feathers are downy, lower barbs. They lack barbicels and don't "hook up" because they're used for warmth, not flight.

Calamus or hollow shaft: It is hollow quill of the feather. The large hollow portion of the shaft that attaches the feather to the bird's skin or bone. It doesn't have any barbs on it.

Rachis or rigid shaft: Rachis is solid part of the shaft.

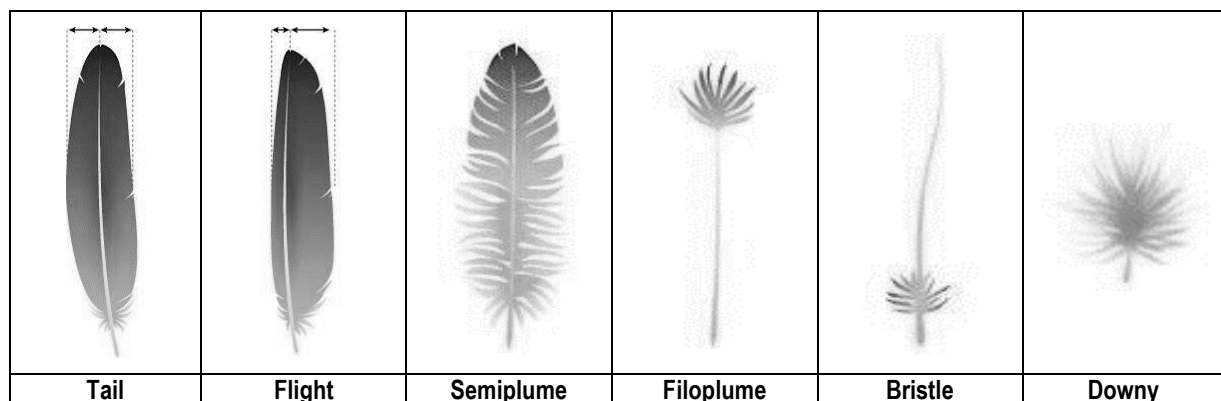
Inter locking barbs: Filaments of the feather that are not soft and free.

Vane: Thin flat part of the feather. The plumed part of the feather that grows from the central shaft. The vanes are like the canvas sails on a mast. The two vanes of this feather are about equally wide.

TYPES OF FEATHERS

Counter feathers: Counter feathers cover most of the surface of the bird providing a smooth appearance. They protect bird from sun, wind, rain and injury. Contour feathers are divided into flight feathers and those that cover the body. They are the largest feather on the edge of a bird's wing.

Flight feathers: Flight feathers are the large feathers of wings and tail. Flight feathers and wing feathers are collectively called as remiges and separated into three groups. The primaries attach to the metacarpal (wrist) and phalangeal (finger) bones at the far end of the wing and are responsible for forward thrust. There are usually 10 primaries and they are numbered from the inside out. The secondaries attach to the ulna, a bone in the middle of the wing, and are necessary to supply "lift." They are also used in courtship displays. There are usually 10-14 secondaries and they are numbered from the outside in. The flight feathers closest to the body are sometimes called **tertiaries**. The tail feathers are as called **retrices** and it act as brakes and a rudder, controlling the orientation of the flight. Most birds have 12 tail feathers. The bases of the flight feathers are covered with smaller contour feathers called **coverts**. There are several layers of coverts on the wing. Coverts also cover the ear.



Down feathers: Down feathers are small, soft, fluffy, and are found under the contour feathers. They are plumaceous, and have many non-interlocking barbs, lacking the barbules and hook lets seen in contour and flight feathers. This makes it possible for them to trap air in an insulating layer next to the skin, protecting the bird from heat and cold. There

are special types of downy feathers called **powder down feathers**. When the sheaths or barbs of these feathers disintegrate, they form a fine keratin powder, which the bird can spread over its feathers as a water-proofing agent. The powder also assists in cleaning as the bird preens.

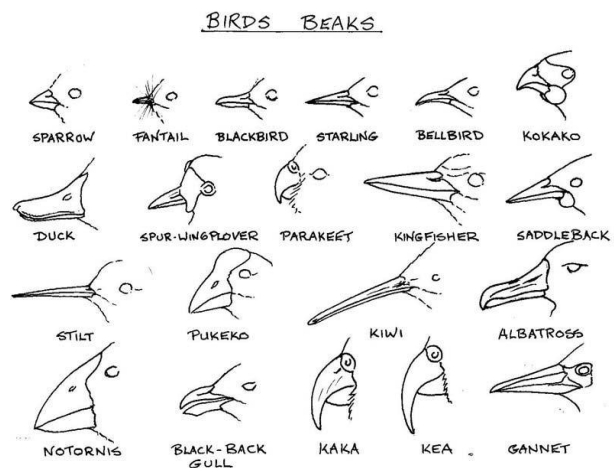
Filoplumes: Filoplumes are very fine, hair-like feathers, with a long shaft, and only a few barbs at their tips. They are located along all the pterylae. They have a sensory function, adjusting the position of the flight feathers in response to air pressure.

Semiplumes: Semiplumes provide form, aerodynamics, and insulation. They also play a role in courtship displays. They have a large rachis, but loose (plumaceous) vanes. They may occur along with contour feathers or in separate pterylae.

Bristle feathers: Bristle feathers have a stiff rachis with only a few barbs at the base. They are usually found on the head (around the eyelids, nares, and mouth). They are thought to have both a sensory and protective function.

BIRDS BEAK

A bird's beak or bill has the primary function of gathering and eating food. It is designed to help the bird to eat the foods it needs including tearing, crushing, picking, probing and breaking the shells of food items. Birds also use their beaks to preen or clean and oil their feathers. Preening keeps their feathers healthy and in the right position. It is a layer of epidermis, made up of keratin. The two holes that are seen on the top of the beaks in most species are called nares, which are used for respiration. Despite the various types of beaks that have been observed, their basic structure is pretty much the same, with two jaws connected by bones and soft tissues. Birds make use of their bills to perform various functions, but its most significant function remains feeding, and it is typically seen that the beak is shaped corresponding to their eating habits.

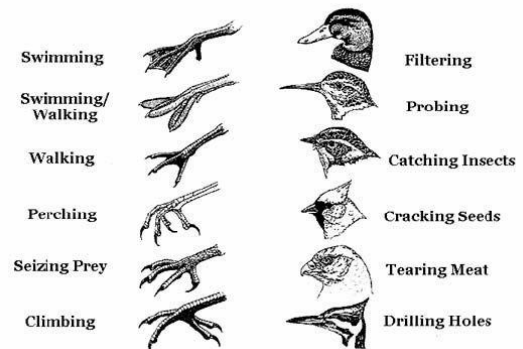


No.	Type of beak	Function of beak	Bird
1	Thin and pointed beak	Birds are insect eaters, with their tweezer-like bills helping them catch prey.	Warbler
2	Sharp and curved beak	Curved beaks with a razor-sharp tip that helps them tear their prey into smaller parts, so as to make it easy to swallow	Hawks, Eagles
3	Short and slender beak	Helps to feed on seeds, fruits, and plants and to consume worms	Doves
4	Flat beak	Flat beaks that help strain the water from the sides when they consume food which includes aquatic plants and animals	Duck, Swan
5	Sharp beak	It helps them consume a variety of food materials like fruits, seeds, insects, fish, and other small animals.	Crow
6	Conical beak	Conical bills are short and thick, useful for cracking and opening seeds	Sparrows and cardinals
7	Chisel beak	Chisel-like feature helps them bore into barks and consume the insects and tree sap by extending their barbed tongue.	Woodpeckers
8	Long tapered beak	Clatter their long beaks to communicate. It also helps them catch prey, namely, frogs, fish, insects, earthworms, and small birds.	Storks
9	Crossed beak	Feed on seeds present in coniferous cones, and are therefore found in abundance in the higher northern coniferous belts.	Crossbills birds
10	Probing beak	Feed on the nectar present in flowers. Their long and slim bill lets them probe their food and extract it.	Hummingbird
11	Filter beak	Head upside down, with the top portion of the beak serving as a scoop, and the fleshy tongue pressing on to the upper jaw, it helps to strain out excess water.	Flamingo
12	Longest beak	helps them strain excess water when they make a catch, and comes in useful to scare predators, as well as attract a potential mate.	Pelican
13	Shredding beak	hooked shape with the sharp tip helps them to gravely injure their prey, even if it happens to be slightly larger in size.	Owls
14	Colorful beak	Attractive beak mostly frugivorous, they may also, at times, feed on insects and tiny lizards.	Toucans
15	Curved beak	It enables them to crack seeds and nuts, and assists them in gripping barks and branches while climbing as well.	Parrots
16	Fishing beak	long, slender beak is known to be quite sharp, and enables them to catch their prey underwater, foraging fish, crustaceans, and cephalopods	Penguins

Type of feet:

No.	Types of feet	Function
1	Strong feet with long toe	Hawks, eagles and owls have strong feet with long claws or talons to help them capture, grasp and kill their prey
2	Four toes, two pointed forward and two pointed backward.	Woodpeckers, helps them grasp tree bark and climb.
3	Three toes pointing forward with one opposing toe	Song birds, helps them grasp their perch.
4	Long toes	Wading birds including cranes and herons help have long toes to help them walk through soft bottoms in wetlands in search of food.
5	Having webbing between their toes to help them paddle in water	Ducks and geese

Bird Beaks and Feet

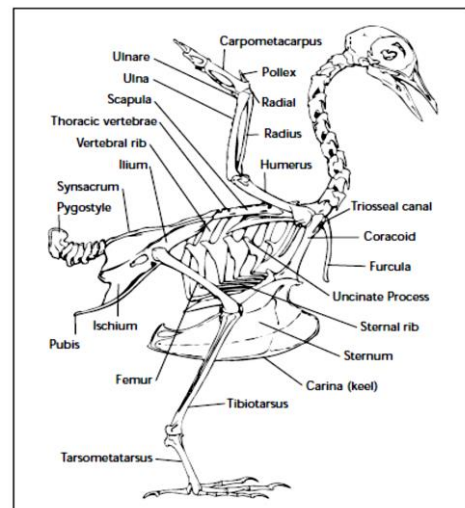


SKELETON OF BIRDS

The skeleton system of bird is light weighted. Bones of birds are hollow which makes them light-weighted while internal struts or cross walls make them strong. Hollow bones contain air spaces in them. These allow more oxygen absorption and provide the extra energy needed for flight. Numerous bones fused together to reduce the count and make the bird's skeleton rigid. Breastbone (keel-shaped sternum) its large surface area provides the attachment for muscles for flight. Breast bones are fused collarbones (furcula or wishbone).

Unique features of skeleton system of birds

1. The vertebral sections of the bird's backbone are fused together to provide the rigidity which is required for them to flight.
2. The skull size of the birds is proportionally smaller compared to the other species and this helps birds to fly easily.
3. The Skeletal System of birds includes various hollow bones with crisscrossing reinforcements for structural strength.
4. Birds lack teeth and have a beak which is more lightweight.
5. Birds have a fused collarbone, attached to the site of the muscles used for flight.



The Skull: The bones of skull are generally fused providing protection to the brain while being light weight. It consists of five major bones: the frontal (top of head), parietal (back of head), premaxillary and nasal (top beak), and the mandible (bottom beak). The skull of a normal bird usually weighs about 1% of the bird's total body weight. The eye occupies a considerable amount of the skull and is surrounded by a sclerotic eye-ring, a ring of tiny bones. This characteristic is also seen in their reptile cousins.

Beak: It is toothless and highly modified for different types of food and feeding behavior.

Neck: It is very important for body to maintenance and eyesight

Vertebral column: It divide into 5 sections

- a) **Cervical: 11-25 (Neck)**
- b) **Trunk:** (dorsal or thoracic) vertebrae usually fused in the notarium
- c) **Synsacrum:** (fused vertebrae of the back also fused to the hips/pelvis). This region is similar to the sacrum in mammals and is unique in the pigeon because it is a fusion of the sacral, lumbar, and caudal vertebra. It is attached to the pelvis and supports terrestrial locomotion of the pigeon's legs.
- d) **Caudal (5-10):** This region is similar to the coccyx in mammals and helps control the movement of feathers during flight
- e) **Pygostyle (tail):** This region is made up of 4 to 7 fused vertebrae and is the point of feather attachment.

The neck of a bird is composed of 13-25 cervical vertebrae enabling birds to have increased flexibility. A flexible neck allows many birds with immobile eyes to move their head more productively and center their sight on objects that are close or far in distance.

Ribs: Birds have uncinat processes on the ribs. These are hooked extensions of bone which help to strengthen the rib cage by overlapping with the rib behind them. This feature is also found in the tuatara (*Sphenodon*).

The chest: The chest consists of the furcula (wishbone) and coracoid (collar bone), which, together with the scapula, form the pectoral girdle. The side of the chest is formed by the ribs, which meet at the sternum (mid-line of the chest).

Apendicular skeleton: The shoulder consists of the scapula (shoulder blade), coracoid, and humerus (upper arm). The humerus joins the radius and ulna (forearm) to form the elbow. The carpus and metacarpus form the "wrist" and "hand" of the bird, and the digits are fused together. The bones in the wing are extremely light so that the bird can fly more easily.

Wing: The avian wing contains the usual arm bones of reptiles and mammals, but in a highly modified form. The humerus is rather short compared to the total length of the wing, as it must withstand the pulling of the flight muscles. The large crests on the proximal humerus for the attachment of the flight muscles. The radius (slightly thinner than the ulna) and ulna form the support for the mid-wing. On the ulna are small bumps, the attachment sites for the secondary feathers. Two separate wrist bones, the radiale and ulnare, are immediately distal to the radius and ulna. The distal (outer) wing or "hand" bones are highly fused for strength and feather support and form the carpometacarpus. The first digit or pollex supports the alula, a small feather used to control air flow around the wing.

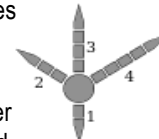
Pectoral girdle: Pectoral girdle is made up of the sternum, clavicle, coracoid and scapula. Clavicles come together to form the furcula or "wishbone". The furcula provides a flexible attachment site for breast muscles and along with coracoids act as struts that resist pressure created by wing stroke during flight.

Pelvic girdle: The extensive fusion of bones of the pelvic region to provide stiff support for the legs in order to deal with the stress of take-off and landing. The three pelvic bones, the ilium, ischium and pubis are fused to form the innominate bone. Fused dorsally to the innominate bone is the synsacrum to make one complete unit of bone. The synsacrum is a fusion of the sacral (pelvic) and 6 caudal (tail) vertebrae. At the end of the spinal column is the pygostyle, a fusion of the final few caudal vertebrae. The pygostyle supports the tail feathers and musculature.

Leg and foot: The upper leg is composed of a fairly standard femur, but the lower leg and foot are highly modified by fusion. Distal to the femur is an extremely reduced fibula. Next to this is the tibiotarsus, a fusion of the tibia (a lower leg bone) and some tarsals (foot bones).

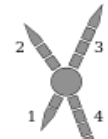
Feet: Birds feet are classified as anisodactyl, zygodactyl, heterodactyl, syndactyl or pamprodactyl.

- **Anisodactyl** is the most common arrangement of digits in birds, with three toes forward and one back. This is common in songbirds and other perching birds, as well as hunting birds like eagles, hawks, and falcons.



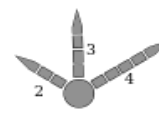
Anisodactyl

- **Syndactyl feet** is like anisodactyly, except that the second and third toes (the inner and middle forward-pointing toes), or three toes, are fused together, as in the belted kingfisher. This is characteristic of Coraciiformes (kingfishers, bee-eaters, rollers, etc.).



Zygodactyl

- **Zygodactyl feet** have two toes facing forward (digits two and three) and two back (digits one and four). This arrangement is most common in arboreal species, particularly those that climb tree trunks or clamber through foliage. It occurs in parrots, woodpeckers (including flickers), cuckoos and some owls.



Tridactyl



Didactyl

- **Heterodactyl feet** is like zygodactyly, except that digits three and four point forward and digits one and two point back. This is found only in trogons, while pamprodactyl is an arrangement in which all four toes may point forward, or birds may rotate the outer two toes backward. It is a characteristic of swifts

THE DIGESTIVE SYSTEM OF BIRDS

Bill: The different shape and size of bill used for scooping, pecking, tearing and generally picking up the bird's food.

Mouth: Mouth is the opening where digestive process starts.

Tongue: The tongue is used to direct the food item down the digestive tract and sometimes to help hold onto a wiggling worm or other insect

Pharynx: The pharynx is the part between the mouth and esophagus that helps the bird to swallow the food item

Esophagus: The esophagus is the tube leading down from the pharynx to the crop.

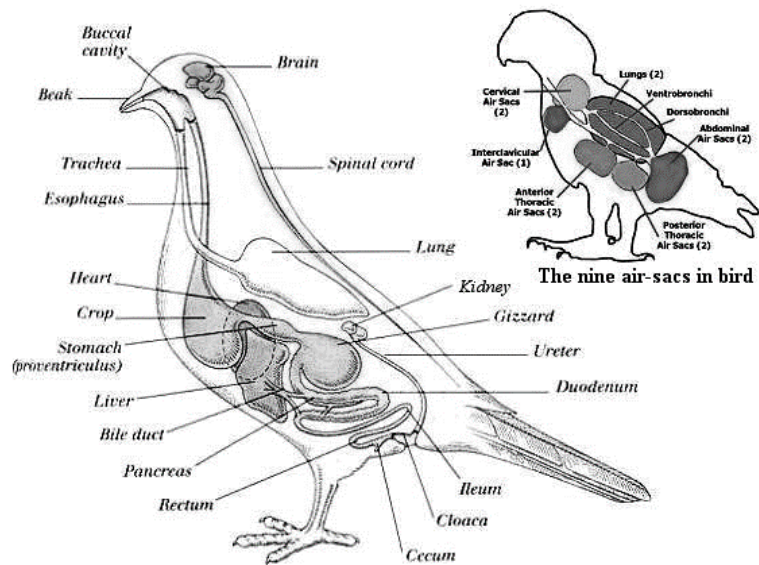
Crop: The crop enables the bird to fill up and then the bird can do the digesting later when it has time to rest and avoid predators that may be lurking nearby while the bird is in the act of eating.

The stomach: it consists two parts. Proventriculus and gizzard.

a) Proventriculus: The proventriculus is the first part of the bird's two-chambered stomach. The proventriculus secretes an acid used for breaking down food, and is best developed in birds that swallow entire fish or other animals containing bones which must be digested.

b) Gizzard: The gizzard is the second chamber of the stomach and it consists of very tough muscles. These muscles are used to grind and digest various types of foods. The muscles don't do this process alone. Many birds pick up small pebbles, sand or grit while they are eating and these items end up in the gizzard.

The gizzard then uses these grit-like items to help pulverize the food items to aid in digestion. Different bird species eat different food items and their gizzards are designed to work specifically on the types of food that they eat.



Small intestine: The intestines are where the nutrients from the food are absorbed and the waste products are sent further on through the digestive system. This is very similar to the human intestine function. Birds that eat easily digestible foods like fruit, flesh and insects have short lengths of intestines and those that eat seeds, plants and fish need longer intestines so that the food items have enough time for the nutrients to be absorbed

Caeca: The birds have two caeca known as caecum. The function of the caeca is to aid in the absorption of water and proteins, and the microbial decomposition of fiber.

Rectum: The rectum is the end part of the intestine and no digestion or absorption of food takes place

Cloaca: The cloaca is the end of the digestive tract where waste from the digestive and urinary tract accumulate before being dumped. Many times the waste is a white liquid with a dark center. Uric acid is a by-product of the bird's digestive system.

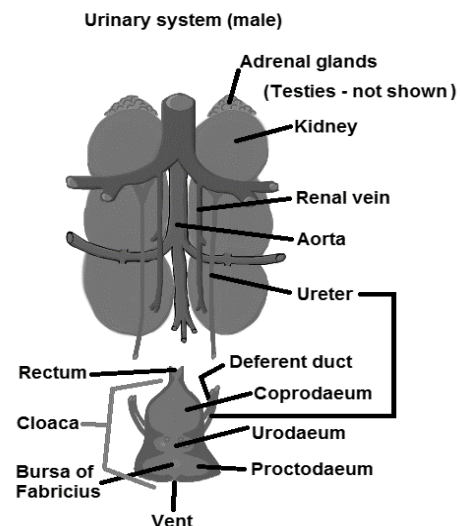
EXCRETORY SYSTEM OF BIRDS

The main functions of the bird excretory system are to maintain the electrolyte balance, to maintain the water balance and to eliminate residues of the metabolic process, in particular nitrogenous products such as uric acid.

The main functions of kidneys are as follows

1. To maintain the electrolyte balance
2. To maintain the water balance
3. To eliminate metabolic wastes, particularly nitrogen products of metabolism (except carbon dioxide)

Kidneys: The most important organ of excretory system of bird are the kidneys. The kidneys are responsible for filtering the nitrogen and uric acid residues from the blood. These are sent through the ureters to one of the cloacal chambers, since they are expelled to the outside. These are two reddish brown organs, each generally consisting of three lobes. They are found behind the lungs and on each side of the spine of the birds. The kidneys have two thin, straight tubes connected in their mid-lateral part known as ureters. A kidney is made up of the renal cortex and the renal medulla. A microscopic examination of a dissected kidney shows how it is composed of a large number of renal tubules or Nephrons, each of them divided into cortical and medullary parts. Birds have two types of nephrons, similar to those found in mammals with a Henlewing (Used to help concentrate urine) found in the renal medulla, and other reptilian nephrons located in the renal cortex. Nephrons have a duty to extract components of the urine from



the blood that flows through the kidneys. A nephron is composed of a complex network of capillaries contained by a capsule, called Bowman's capsule, in which the blood is directly filtered. It also has a spiral segment ranging from the Bowman Capsule to the Henna Asa (in the mammalian nephrons) and finally have a Distal tubule Which directs the urine to the ureters for subsequent removal of the body.

Ureter: A relatively straight narrow tube called ureter. The ureters open and connect to the sewer, located adjacent to the vas deferens of the male or female oviduct. The ureters are connected internally to the kidneys through funnel-shaped structures in each of the lobes of the kidney. They are conduits that are used to transport the urine directly to the sewer. Since birds do not have a bladder, the ureters must deposit the filtrate through the kidneys into the sewer chamber intended for storage.

Cloaca: The sewer is an organ located at the bottom of the digestive, excretory and reproductive systems of birds. It is used to expel faeces and lay eggs. It is located at the back of the body, below the base of the tail of the birds and is covered by feathers at the lower end of the abdomen. Birds have a single hole to expel faeces, urine and lay eggs. The cloaca is the organ that allows the execution of all these functions to the extent that bird needs it. Within it are multiple folds of skin and muscle that subdivide it into cameras suitable for different uses. Bird feces are usually stored in one or several chambers of the sewer. Within it, the absorption of nutrients continues and solid and liquid wastes are mixed and excreted simultaneously once the bird's digestion concludes.

Urine: Birds generally do not have a bladder. Urine passes directly from the kidneys to the sewer through the ureters, from where it is transported by a Peristaltic movement to the intestine. There the excess water is reabsorbed before the disposal of the waste. This process of water reabsorption in birds is similar to that in mammals. However, birds lack the ability to concentrate urine. The urine of the birds in a thick paste with a low water content and a high content of uric acid, product of the nitrogen metabolism. After being mixed in the sewer with solid waste, it is expelled from the bird's body in the form of white or creamy paste on the solid stool.

BIRD NEST

A bird nest is the spot in which a bird lays and incubates its eggs and raises its young.

Caliology: The study of bird's nest is called as caliology

Type of nests:

Scrape: The simplest nest construction is the *scrape*, which is merely a shallow depression in soil or vegetation.

Mound: The mound nests made of soil, branches, sticks, twigs and leaves, and lay their eggs within the rotting mass.

Burrow: Soil plays a different role in the burrow nest; here, the eggs and young—and in most cases the incubating parent bird—are sheltered under the earth.

Most burrow-nesting birds excavate their own burrows, but some use those excavated by other species and are known as secondary nesters; burrowing owls

Cavity: The cavity nest is a chamber, typically in living or dead wood, but sometimes in the trunks of tree ferns or large cacti, including saguaro.

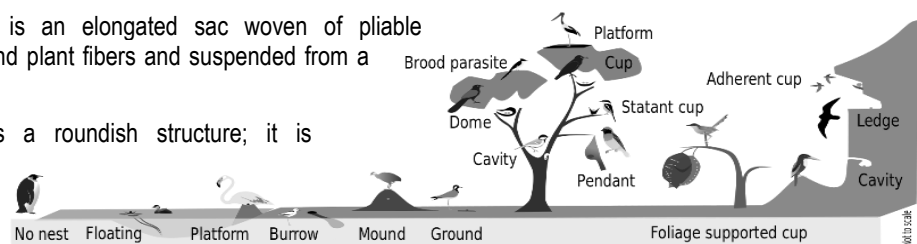
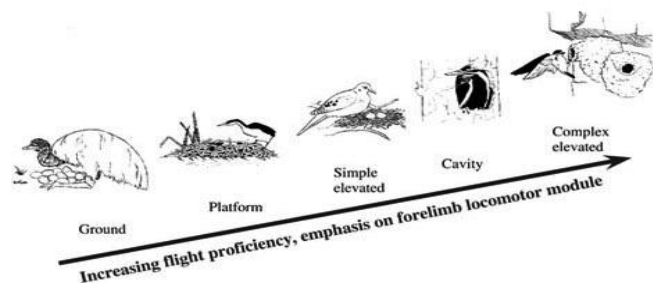
Cup: The cup nest is smoothly hemispherical inside, with a deep depression to house the eggs. Most are made of pliable materials—including grasses—though a small number are made of mud or saliva.

Saucer or plate: The saucer or plate nest, though superficially similar to a cup nest, has at most only a shallow depression to house the eggs.

Platform: The platform nest is a large structure, often many times the size of the (typically large) bird which has built it.

Pendant: The pendant nest is an elongated sac woven of pliable materials such as grasses and plant fibers and suspended from a branch.

Sphere: The sphere nest is a roundish structure; it is completely enclosed, except for a small opening which allows access.

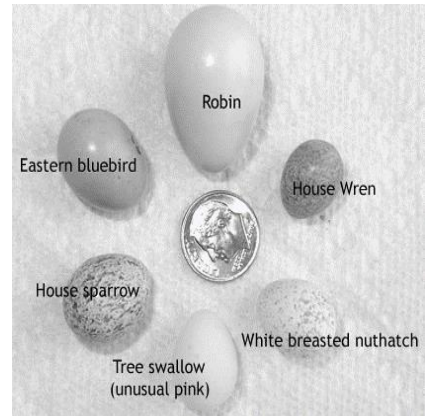


BIRD EGGS

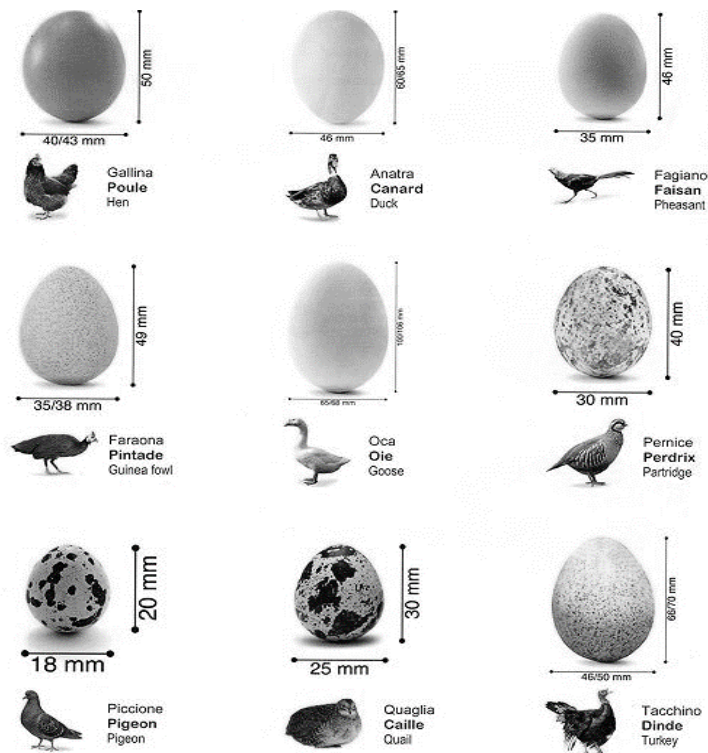
Bird eggs are laid by the females and incubated for a time that varies according to the species; a single young hatches from each egg.

Clutch: Clutch is a group of egg lay by birds. The clutch size varies from 1 to 7. Clutch size may vary attitudinally within species.

Oology: Oology is the branch of ornithology studying bird eggs, nests and breeding behavior.



BIRDS COLOURS, SIZE AND SHAPES



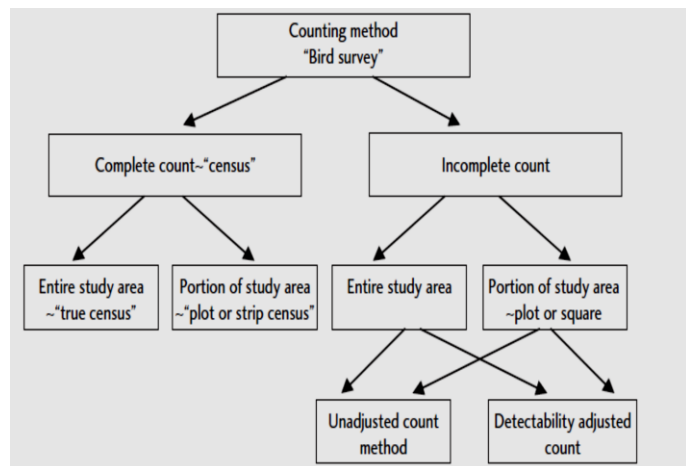
BIRD CENSUS TECHNIQUES

Major two type of methods used for bird census.

i) **Census method:** Direct method subdivided into two a) entire study area and b) portion of the study area

a) **Entire study area:** It also called as true census. It is very effective method for population estimation of birds. Rare birds with restricted ranges are often easier to count using a true census, because sampling might record too few birds to produce a reliable estimate. For more common and widespread species, it may be expensive and unnecessary to count the whole area, and it might be more cost-effective to census or survey a representative selection of areas.

b) **Portion of the study area:** Plot or strip census enque used in this method.



ii) **Indirect count Incomplete count:** a) Entire study area b) Portion of study area

Call counts: Call count method used for bird census according to season.

a) Spring call count during mating: Counts conducted in the spring and early summer can provide an index of whistling males. During this time, males give the familiar "poor-bob-white" whistle to attract a mate. The calling heard at this time is thought to represent bachelor, or not-yet-paired, males in the population. Surveys should be conducted during peak calling, which is typically in June. To get an index of the number of birds available for breeding, listen for whistling males after sunrise at the listening stations you have established. Monitor each station for five minutes, and simply count the number of individual call. Mark the location of calling males on a data sheet or aerial photo to help to determine. Conduct these surveys at least three times in June. Although males will whistle throughout the day, the most consistent measurements occur during the first two hours of daylight. Be careful not to recount the same bird during this process. These counts provide an index of breeding "capital."

b) Fall covey counts: The covey-call survey can be used to estimate the size of the fall bobwhite population or to provide a measurement of production just before the hunting season. During the late summer and fall, birds from different broods begin to mix and form coveys, or social groups, of 20 to 30 birds. These groups begin the characteristic night roosting behavior of forming a circle on the ground, tails together and heads pointing out a behavior that may have important social and heat conservation benefits. Group size may reduce to 10 to 15 birds as each covey begins to settle into its winter range during the fall. At this time, populations have reached their peak for the year.

Covey calling behavior: Just before leaving the roost in the early morning, one or two birds from a covey will whistle." These calls announce a covey's location to neighboring coveys, and coveys appear to use these location cues to space themselves across the landscape, which, in effect, reduces competition for food and cover.

Coveys call at high enough rates that the calls can be used to monitor quail abundance in a given area. Covey-call surveys work because bobwhites are social birds and, during the fall, coveys communicate with each other by whistling just before sunrise. Most whistling occurs sporadically 20 to 30 minutes before sunrise.

MIST NETTING

Mist-netting is an important technique for capturing small birds. Some earlier studies on mist-netting for monitoring avian population, migration and community studies served as an impetus for this study. This method is generally used to survey birds in a forested Habitat with dense undergrowth under where other direct census methods are unsuitable due to poor visibility and fast moving nature of the small feathered creatures.

Nest count is performed for many species of birds, particularly those whose nest is in colonies. Population of colonial species is easily estimated using this method.

Order	Family	Group Name
GAVIIFORMES	Gaviidae	Divers (Loons)
PODICIPEDIFORMES	Podicipedidae	Grebes
PROCELLARIIFORMES	Procellariidae	Petrels, Shearwaters
	Hydrobatidae	Storm-Petrels
PELECANIFORMES	Phaethontidae	Tropicbirds
	Pelecanidae	Pelicans
	Sulidae	Boobies
	Phalacrocoracidae	Cormorants, Shags
	Anhingidae	Darters (Snakebirds)
	Fregatidae	Frigatebirds
CICONIIFORMES	Ardeidae	Hérons, Egrets, Bitterns
	Ciconiidae	Storks
	Threskiornithidae	Ibises, Spoonbills
PHOENICOPTERIFORMES	Phoenicopteridae	Flamingos
ANSERIFORMES	Anatidae	Swans, Geese, Ducks, Mergansers
FALCONIFORMES	Accipitridae	Hawks, Eagles, Buzzards, Old World Vultures, Kites, Harriers
	Pandionidae	Osprey
	Falconidae	Falcons
GALLIFORMES	Megapodiidae	Megapodes (Scrubfowl)
	Phasianidae	Pheasants, Partridges, Quails
GRUIFORMES	Turnicidae	Buttonquails (Bustardquails)
	Gruidae	Cranes
	Rallidae	Rails, Crakes, Moorhens, Coots
	Heliornithidae	Finfoots
	Otididae	Bustards
CHARADRIIFORMES	Jacaniidae	Jacanas
	Rostratulidae	Painted-Snipes
	Haematopodidae	Oystercatchers

	Charadriidae	Plovers, Dotterels, Lapwings
	Scolopacidae	Sandpipers, Snipes, Curlews
	Recurvirostridae	Ibisbill, Avocets, Stilts
	Phalaropodidae	Phalaropes
	Dromadidae	Crab-Plover
	Burhinidae	Stone-Curlew, Stone-Plovers (Thick-knees)
	Glareolidae	Coursers, Pratincoles
	Stercorariidae	Skuas, Jaegers
	Laridae	Gulls, Terns, Noddies
	Rynchopidae	Skimmers
COLUMBIFORMES	Pteroclididae	Sandgrouse
	Columbidae	Pigeons, Doves
PSITTACIFORMES	Psittacidae	Parakeets, Hanging-Parrots (Lorikeets)
CUCULIFORMES	Cuculidae	Cuckoos, Malkohas, Coucals (Crow-Pheasants)
STRIGIFORMES	Tytonidae	Barn Owl, Grass Owl, Bay-Owl
	Strigidae	Owls, Owlets
CAPRIMULGIFORMES	Podargidae	Frogmouths
	Caprimulgidae	Nightjars
APODIFORMES	Apodidae	Swifts, Needletail-Swifts, Palm-Swifts
	Hemiprocnidae	Tree-Swifts
TROGONIFORMES	Trogonidae	Trogons
CORACIIFORMES	Alcedinidae	Kingfishers
	Meropidae	Bee-eaters
	Coraciidae	Rollers
	Upupidae	Hoopoes
	Bucerotidae	Hornbills
PICIFORMES	Capitonidae	Barbets
	Indicatoridae	Honeyguides
	Picidae	Woodpeckers, Wrynecks, Piculets
PASSERIFORMES	Eurylaimidae	Broadbills
	Pittidae	Pittas
	Alaudidae	Larks
	Hirundinidae	Swallows, Martins
	Motacillidae	Wagtails, Pipits
	Campephagidae	Cuckoo-Shrikes, Trillers, Minivets, Flycatcher- Shrikes, Woodshrikes
	Pycnonotidae	Bulbuls, Finchbills
	Irenidae	Ioras, Chloropsis (Leafbirds), Fairy-Bluebirds
	Laniidae	Shrikes
	Bombycillidae	Waxwings, Hypocolius
	Cinclidae	Dippers
	Troglodytidae	Wrens
	Prunellidae	Accentors
	Muscicapidae	
	Subfamily: Turdinae	Thrushes, Robins, Redstarts, Wheatears
	Subfamily: Timaliinae	Babblers, Laughingthrushes, Babaxes, Sibias, Yuhinas
	Subfamily: Panurinae	Parrotbills
	Subfamily: Sylviidae	Warblers, Goldcrest, Prinias, Tesias
	Subfamily: Muscicapinae	Flycatchers
	Subfamily: Monarchinae	Monarch-Flycatchers (Monarchs), Paradise- Flycatchers
	Subfamily: Rhipidurinae	Fantail-Flycatchers (Fantails)
	Subfamily: Pachycephalinae	Whistlers
	Aegithalidae	Long-tailed Tits
	Remizidae	Penduline-Tits
	Paridae	Tits
	Sittidae	Nuthatches, Wallcreeper
	Certhiidae	Tree-Creepers, Creepers
	Dicaeidae	Flowerpeckers
	Nectariniidae	Sunbirds, Spiderhunters
	Zosteropidae	White-eyes
	Emberizidae	
	Subfamily: Emberizinae	Buntings
	Fringillidae	Finches, Grosbeaks
	Estrildidae	Munias
	Passeridae	

	Subfamily: Passerinae	Sparrows, Snowfinches
	Subfamily: Ploceinae	Weavers
	Sturnidae	Mynas, Starlings
	Oriolidae	Orioles
	Dicruridae	Drongos
	Artamidae	Woodswallows (Wood-Shrikes)
	Corvidae	Crows, Jays, Treepies, Magpies

BIRD LIST

Common Name	Scientific Name
<u>Grebes</u>	
Horned grebe	<i>Podiceps auritus</i>
Eared grebe	<i>Podiceps nigricollis</i>
Pied-billed grebe	<i>Podilymbus podiceps</i>
Western grebe	<i>Aechmophorus occidentalis</i>
Clark's grebe	<i>Aechmophorus clarkii</i>
<u>Pelecaniformes</u>	
American white pelican	<i>Pelecanus erythrorhynchos</i>
Brown pelican	<i>Pelacanus occidentalis</i>
Double-crested cormorant	<i>Phalacrocorax auritus</i>
<u>Wading Birds</u>	
American bittern	<i>Botaurus lentiginosus</i>
Great blue heron	<i>Ardea herodias</i>
Great egret	<i>Ardea alba</i>
Snowy egret	<i>Egretta thula</i>
Black-crowned night-heron	<i>Nycticorax nycticorax</i>
<u>Geese and ducks</u>	
Greater white fronted goose	<i>Anser albifrons</i>
Canada goose	<i>Branta canadensis</i>
Mallard	<i>Anas platyrhynchos</i>
Gadwall	<i>Anas strepera</i>
Northern pintail	<i>Anas acuta</i>
American wigeon	<i>Anas americana</i>
Northern shoveler	<i>Anas clypeata</i>
Cinnamon teal	<i>Anas cyanoptera</i>
Green-winged teal	<i>Anas crecca</i>
Canvasback	<i>Aythya valisineria</i>
Redhead	<i>Aythya americana</i>
Greater scaup	<i>Aythya marila</i>
Lesser scaup	<i>Aythya affinis</i>
Long-tailed duck	<i>Clangula hyemalis</i>
Surf scoter	<i>Melanitta perspicillata</i>
Common goldeneye	<i>Bucephala clangula</i>
Bufflehead	<i>Bucephala albeola</i>
Ruddy duck	<i>Oxyura jamaicensis</i>
<u>Raptors</u>	
Northern harrier	<i>Circus cyaneus</i>
White-tailed kite	<i>Elanus leucurus</i>
Cooper's hawk	<i>Accipiter cooperii</i>
Sharp-shinned hawk	<i>Accipiter striatus</i>
Red-shouldered hawk	<i>Buteo lineatus</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Swainson's hawk	<i>Buteo swainsoni</i>