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PSG PROGRAMME (NCQF LEVEL 5)

MODULE 13

BIRDS - CLASS AVES

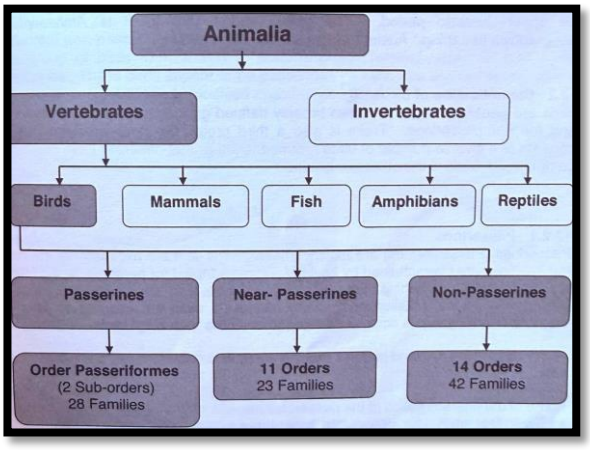
OBJECTIVES (13.1)

❖ On completion of this module, you will:

- Know the characteristics of the class of birds.
- Understand the difference between passerines and non-passerines.
- Be able to give explanations of the various feeding methods and type of food that birds eat.
- Be able to point out examples of prominent bird species nests.
- Be able to explain what altricial and precocial birds are.
- Be able to explain what a “brood parasite” is and provides some common examples.
- Be able to give a basic explanation of commonly displayed bird behavior.
- Know how to identify birds making use of the various identification pointers (GISS).
- Be able to identify the prominent and common bird species by sight and sound.

BIRD CLASSIFICATION (13.1.1)

See diagram below:



ORIGIN OF BIRDS - Evolution of Birds (13.1.2)

❖ **Reptilian Origin – Archaeopteryx Lithographica:**

- The most important adaptation that birds have undergone since they evolved from their prehistoric reptilian ancestors, is the ability to fly. The earliest known bird is the **archaeopteryx lithographica**, whose feathered body shows some similarities with modern bird, apart from its other similarities with dinosaurian. Like reptiles birds also have horny scales, but this is confined to their legs and in a modified form to their bills. The rest of the body is covered with feathers, which are lubricated by an **oil gland** on the rump. Similar to mammals' birds are **endothermic** (warm blooded) and can thus maintain a high and constant body temperature.

❖ **Characteristics of birds.**

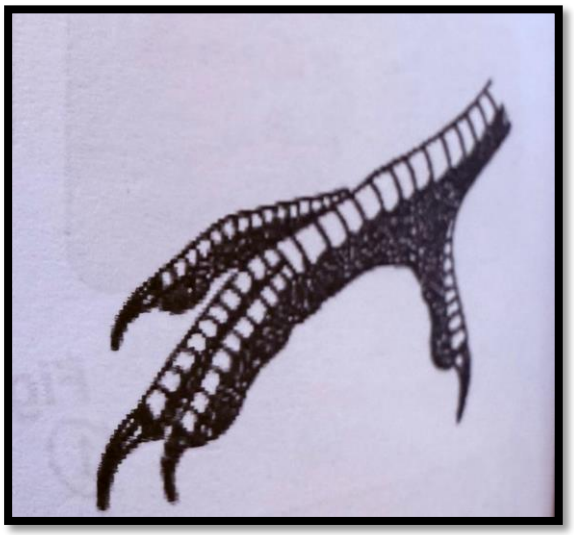
- Birds, with more than 1000 species distributed over nearly the earth, outnumber all other vertebrates except fishes. The single unique feature that distinguishes birds from other animals is their feathers. If an animal has feathers, it is a bird and if it lacks feathers, it is not a bird. No other vertebrate group bears such an easily recognizable and full proof identification tag.
- Despite approximately 150 million years of evolution, during which time they multiplied and adapted themselves to specialized ways of living, there is no difficulty recognizing a bird as a bird due to the great uniformity of structure among birds. In addition to feathers, all birds have fore limbs modified into wings (although they may not be used for flight), all have hind limbs adapted for walking, swimming or perching; all have horny beaks and all lay eggs. The probable reason for the functional and structural uniformity is that birds evolved into flying creatures, hence the restrictions of diversity that is evident in other vertebrates' classes.

❖ **Classification of Birds.**

- Birds are generally divided into two broadly defined groups, namely: the **passerines** and the **non-passerines.** There is also a third group, the **near-passerines** which consists of a diverse number of birds grouped together that generally have nothing in common with birds in the other two groups.
  1. **Passerines** (Passeriformes) – are mostly smallish birds with the exception of the crow family. They are characterized by having feet well adapted for perching, that is, three

toes in front and one behind. With exceptions, the toes are not joined, cannot be placed in any other position and usually cannot be used for grasping or catching prey. This large group is sometimes referred to as the **"perching birds".** All the passerines are land birds of small to medium size. Some of the characteristics of the passerines are:

- Their feet have four un-webbed toes, three in front and one behind, adapted especially for perching. (See picture below):

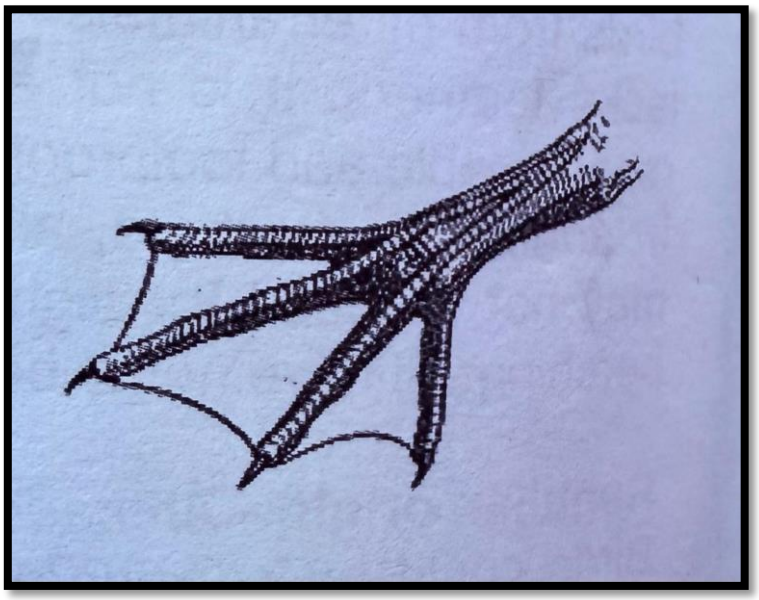


- All passerines are **altricial** young; that is they are naked and helpless when hatched and are reared in a nest.

2. **The non-passerines** - all the other orders of birds that are not passerines are grouped as the non-passerines. These include all birds with webbed or semi-webbed feet, and specially adapted or modified feet, although a few non-passerines have feet that rather resemble those of passerines. In such cases, their classification as non-passerines would stem from some other morphological reasons.

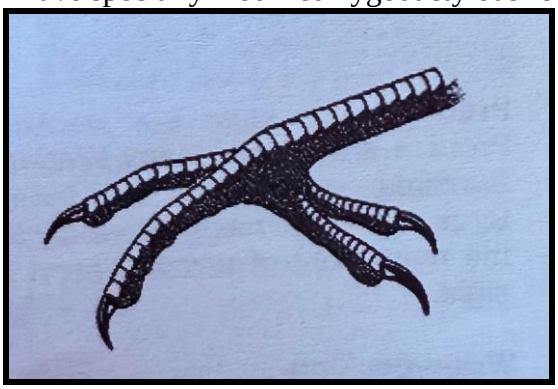
- A further division is made here, splitting the non-passerines into two groups.

a) **The terrestrial non-passerines** - those that frequent ground and water. (See picture below):



b) **The Arboreal non-passerines** - or near-passerines-those that frequent trees. This group of birds form a sort of shadow-group between non-passerines and passerines.

These birds appear to be passerines by their size and behavior. Many of these birds have specially modified zygodactylous feet for clinging. See picture below:



- Examples of birds with zygodactylous feet: woodpeckers, barbets, parrot, coucals and cuckoos.

FOOD AND FEEDING METHODS (13.1.2).

- Birds exploit almost all forms of available animal and plant life that exists. This variety of food-stuffs includes algae, microscopic organisms, invertebrates, fruits, seeds nectar and carrion. Birds have evolved a great number of adaptations in order to acquire and process the large variety of foods within the multitude of different niches.

  - **Fish-eaters** - (stabbers and grabbers)-herons, darters and cormorants, hamerkops, yellow-billed storks and king fishers and African fish eagle and pel's fishing owl
  - **Meat eaters** - (raptors and scavengers)- All raptors use their bills for tearing of flesh be they vultures or falcons. The owls are raptors, but in comparison to hawks, falcons, eagles and others, their bills are fairly insignificant. The reason for this is that, most of owls do not tear their prey, they swallow it whole when size permits.
  - **Insect eaters** - insects are caught in two main regions; in the air and off firm surfaces. When a bee is caught in the air, it is brought to a perch and the sting removed by rubbing the bee's abdomen quickly against the perch before swallowing. The long bill of the bee eaters is ideally suited to catching the prey at a safe distance from the head, and to processing it before swallowing. Other insect eaters are: fork-tailed drongo, shrikes, rollers, woodpeckers and many more.
  - **Seed eaters** - examples of seed eaters are: parrots, doves, weavers, sandgrouse and many more.
  - **Fruit eaters** - these birds include: turacos, parrots, mouse-birds, hornbills, barbets, orioles, bulbuls, starlings and white-eyes. Most birds' families supplement their diet with insects and other animal food.
  - **Nectar eaters** - sun birds and sugarbirds have needle like curved bills that enable them to suck nectar from flowers as well as catching insects that are also trying to feed on the nectar.

❖ **Specialized Feeding Methods.**

- **Filter feeders** - straining fine particles out of water has been evolved by the ducks, flamingos and prions or whale birds.
- **Probers** - are ibises, many waders, woodhoopoes, African hoopoes, sugarbirds and sunbirds. Birds that probe have extremely sensitive touch receptors in their bills, in order to feel the movement of any live prey, since they find their food by touch rather than by sight.
- **Wood pecking** - woodpeckers can excavate wood efficiently and are equipped with tongues that can be greatly extended into the burrows of wood-boring insect larvae to extract the larvae. The woodpecker's skull has a special shock absorbing mechanism (a

broad base to the bill and a hinge between the nasal and frontal bones of the skull), to prevent concussion of the individual.

BREEDING (13.1.3).

- Courtship displays are common among birds, and include some of the most spectacular to be seen in the animal world. It ranges from the nest-building and advertising routine of weavers, to the elaborate dancing displays of ostriches, not to be outdone by spectacular death-defying aerial display by fish eagles. All this courtship displays have one thing in common-**to find the right mate**. The right mate means finding the right species for starters, and secondly selecting the most successful individuals for mating. This ensures long-term survival of the species.

- All birds lay eggs while most birds make nests and some use the nests of others. Owls do not make their own nests, but use holes, burrows, ledges, or old nests of other birds. Social weavers construct huge communal nest with up to 300 birds, while accommodating several other species such as pygmy falcon, pied barbet, familiar chat and others in empty chambers. Most birds which breed in nests which differ vastly between species.

❖ **Nests and nesting behavior:**

- Birds build a large variety of nests depending on the particular species of birds. A nest can be seen as a place where an egg is deposited. All birds lay eggs, but not all species construct a nest. Some kestrels and falcons do not build nests but use rocky ledges, tree holes old buildings and the nests of other birds that they sometimes modify. Other birds that do not construct nests do so in a number of forms and places. Included in this group would be the brood parasite as they lay their eggs in other bird's nests.
- **Ground nests** - the eggs of ground nesters are very well camouflaged, as the parents have to leave the nest unprotected at various times. Lapwings, plovers, terns, ostriches and nightjars all construct similar ground nests which are merely 'scrapes" in the ground. Sometimes they are lined with twigs or small pebbles. The chicks of these birds are precocial**. (**See Picture below**)**:



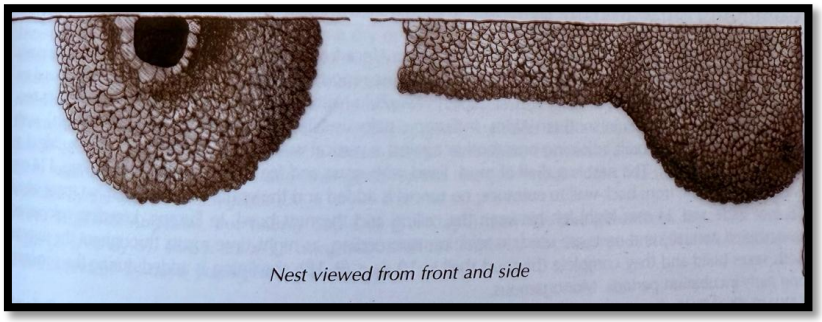
- **Floating nests -** grebes and coots build floating nests that are generally a collection of reeds and grasses, laid over the other until a fairly substantial platform is made. The eggs are well camouflaged and the chicks are also precocial. (See picture below):



- **Hole nests** - the hole nester's eggs, because of being well hidden, are often white or light colored so allowing the parents to see them easily in the often-dark interiors. The kingfishers and bee- eaters use a hole of a different kind. Using their beaks they burrow into a sand, clay or mud bank and chisel out tunnels up to 2.5meters deep (as in the case of the giant kingfisher) so providing a really secure environment. (See picture below):



- **Mud-nests** - birds such as swallows are masters at the art of mud-nest construction. These nests vary in terms of architecture of the entrance tunnels and whether or not they are totally enclosed. (See picture below):

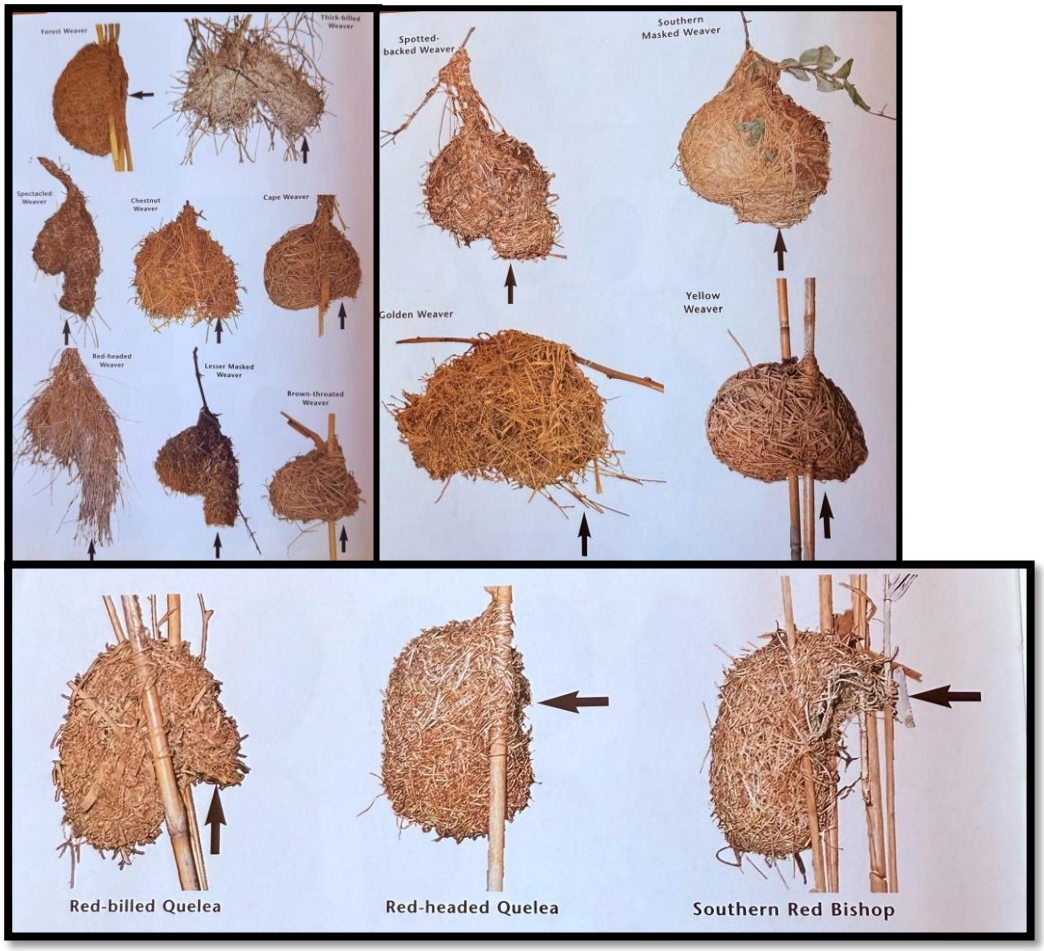


- **Cup nests -** many passerines or perching birds build this kind of nest, although usually off the ground, in a shrub or tree. The robins, thrushes, bulbuls and wagtails all build neat, cup-shaped nests in convenient places in shrubs or trees, whereas the white eyes build their nests high up in trees. The batises and flycatchers

skillfully camouflage their small cup nests with lichen, which they stick to the outside of the nests with cobwebs. (See picture below):



- **Enclosed woven nests with entrances** - the most famous nest of this type are the weaver birds' various constructions. After selecting a suitable site, often above water the male weaver gathers the leaves of the green grass and literally 'weaves' its nest. Each species has its own entrance design, some preferring long tubes, whereas some are content with a neat hole, reinforced for take-off and landing. (See pictures below):



- **Platform nests** - darters, heron, storks, pigeon's, doves and some birds of prey build simple platforms of sticks or twigs on convenient branches of trees. The birds that build these nests usually lay white eggs and keep them covered and hidden nearly all the time, however, the color white denotes something not very tasty to most predators. (See pictures below):







- **Unusual nests -** the palm swift builds a strange nest of feathers glued together with special sticky saliva, which it fastens to the underside of palm leaves and then builds a lip at the bottom where the two eggs are also cemented in place with

saliva, to prevent them from falling out as the leaf sways in the wind. (See picture below):



❖ **Hatchlings -** newly hatched birds are of two types:

a. **Precocial** - the Precocial young, such as plovers, lapwings, francolins, spur fowl, Guinea fowl, quails, ducks and most other water birds are covered with down feathers when hatched and can run or swim as soon a s their plumage is dry (hatched with eyes open). Such chicks would be able to leave the nest within minutes or hours of hatching and capable of thermos-regulating, and often feeding by themselves

b. **Altricial -** the altricial birds are naked and helpless at birth and remain in the nest for a week or more. Most non-ground nesting birds fall into this category. (See picture below):



- **Brood parasite** - A brood parasite is a bird that lays eggs in the nest of a foster parent or host of another species for rearing, and does not involve itself with any kind of parental behavior. Take note a brood parasite is not a bird that eats other birds of the same species and also a brood parasite not a bird that feeds on the blood of mammals. The newly hatched young of parasite brooders may respond to the presence of eggs or young of the host in the nest in various ways:

a) May hatch first and evict the host's eggs or evict the host's chicks after hatching.
b) May outgrow the host chicks and smoother them to death and trample them into the floor of the nest.
c) May be reared with chicks of the host species.

- ❖ Of the world's nearly 10 thousand bird species, only about one percent are brood parasites. South Africa is fairly rich in parasitic bird species. Twenty-four (24) species place their parental responsibilities onto other birds. The Southern African parasitic brooders belong to three different and completely unrelated families:
    I. Cuckoos
    II. Honeyguides
    III. Whydahs and indigobirds (widow finches)
    - The Cuckoos belong to a family that also contains non-parasitic members that build their own nests, the coucals.

      NB// none of the coucals in southern Africa are parasitic brooders. The sub family vivinae consists of the parasitic whydahs and the indigo birds (widow finches) and they belong to the larger family of weavers. None of the other weavers are parasitic except for the cuckoo's finch, whose relationship no one is quite sure.
    - The honeyguide family is the only family that is exclusively parasitic. An interesting adaptation to a brood parasitic way of life in the honeyguides is the evolution of bill hooks. There is one at the tip of each mandible, with which the honeyguide chick, is claimed to bite those of the host to death. These hooks are lost within a few days of hatching. Some parasitic brooders have a multitude of hosts while others may have only two or three and some are one host species.

- ❖ Some examples of brood parasites and some of their host species:

Brood Parasite Name	**Some of the host species**
African Cuckoo	Fork-tailed drongo
Red-chested cuckoo	Cape robin-chat, Chorister robin-chat, boulder chat, Kurrichane thrush, Cape wagtail and Dusky flycatcher.
Greater honeyguide (kills the chicks of the host).	Hoopoe, Green wood-hoopoe, Brown-hooded kingfisher, Stripped kingfisher, Little bee-eater, Barbets, Glossy staring and Southern black tit.
Pin-tailed whydah (reared together with chicks of host).	Common waxbill, Niddicky, Red-billed firefinch and tawny-flanked prinia
Purple indigo-bird (reared together with chicks of host species.	Jameson's, fire finch

- ❖ **Common bird behavior:**

    - **Preening** -The main function of preening is to restore and maintain the structure of the feathers with the bill and to dress them with the secretion **(preen oil)** from the preen gland. This secretion contains waxes, glycerides and fatty acids which serve to keep the feathers supple (make more flexible). To prevent the growth of fungi on the feathers and skin, and to act as a cleaning agent for fatty residues in the feathers.
    - Birds preen for long periods each day, especially when resting after foraging for food and before going to roost at night. Care of the head plumage is performed in some birds by another member of the same species. This is known as allopreening or mutual preening. Allo-preening among most non-passerines occurs only during when birds are breeding. It is therefore largely a social pattern and may have little to do with care of the feathers around the head. Allo-preening may be the strengthening of the pair bond in breeding birds.
    - **Scratching** - Birds scratch their heads with a foot in one of two ways; directly (under the wing) or indirectly (over the wing). Most non-passerines scratch directly, but a significant number of

waders and nearly all passerines scratch indirectly or over the wing, by means of lowering the wing on the side of the foot being used, and bringing the foot over the shoulder.

- The function of scratching is clearly to counter irritation (basic scratching) and to groom feathers (extended scratching) on the head, a region which the bill cannot reach. Preen oil is transferred to the head feathers by means of the feet; first the bill is oiled directly from the preen gland and then the oil is scratched off the bill and applied to the plumage of the head.
- **Shaking** - the most common shaking movement in birds is body-shake in which the plumage is first raised, called **rousing** and then the whole body vigorously shaken. Shaking movements in water fall may be used to rid the plumage of excess water, but in all birds, it serves to shake off any loose material disclosed during preening. Birds also shake their plumage during rain to remove droplets of water.
- **Bathing** - bathing in birds is of three kinds - **water bathing**, **dust bathing** and **sunbathing**:

  - **Water bathing** - is very wide spread in birds and occurs even in cold weathers. Land birds stand in the water, dipping head and shoulders whilst keeping the tail out of the water, and then the tail and body are dipped with head help up. The body feathers are then fluffed out and the wings are flapped to produce a vigorous splashing. The plumage may be quite soaked after a prolonged bout of bathing, but seldom to the extent of impairing flight too seriously. The wet bird then moves to a branch or other suitable standing place to preen, scratch and shake vigorously until it is dry.
  - In certain aerial feeders, such as flycatchers, drongos', swallows, bee-eaters and swifts, whose legs and feet are rather short and comparatively weak, resulting in a relatively slow take off from the ground; thus the risk of bathing in a standing position is avoided by plunge-bathing. The bird simply plunges into the water for a brief moment, either from a perch or while in open flight. Water birds bathe while floating on water, dipping the head and shoulders and throwing water over the back. This is followed by beating their wings on the surface, splashing water over the back. Water bathing is especially important in fishing birds whose plumage sometimes get soiled with mucus from their fish prey.
  - **Dust bathing** - is done much the same way as water-bathing, but it in fine soil. The bird will create a saucer-shaped depression in the ground by using the bill, scratching with the feet or rotating the body. The feathers are then ruffed and dust is thrown into them using either the feet or the wings. After dust-bathing, all species will fluff out the feathers and remove the dust with vigorous shaking of the body. It is prevalent in ground birds, sparrows and mouse birds. Bathing functions as a cleaning mechanism for the plumage and perhaps removes ectoparasites and unwanted feather lice as well
  - Many birds sun-bath, doves lie on the ground with wings and tail spread, either on both sides or just on one side, or they may learn to one side and raise a wing to irradiate (expose) the under surface. Immediately after sun-bathing the birds preen vigorously, possibly to remove parasites dislodged by the heat of the sun. Storks and Herons stand facing the sun and droop both wings to a partly folded position to irradiate the underside of the wings. A full wingspread posture is adopted by many birds of prey.

  - **Anting** - Sometimes a bird adopts a variety of peculiar postures, some of them resembling sun bathing, while allowing ants to swarm over their plumage, or the bird may actually pick up an ant and pass it rapidly over the feathers, especially the wing and the tail. The formic acid and ants crawling over the body stimulates the skin. Up until now, no one has come up with a satisfactory explanation for this behavior. Some have theorized that the bird uses the formic acid to kill parasites, but there are too many arguments against this theory. Other say that the formic acid tones the feathers, but again there is no proof of this. Birds which lie on 'ants' nests appear to go into a coma, sometimes to the extent that the bird can be picked up. Because the formic acid and ants crawling over the body stimulate the skin, the bird being tickled by this is probably enjoying it.
  - **Thermoregulation** - This means temperature control and is needed for warming and cooling.

- **Warming** - is accomplished by birds huddling close together on branches at night or by utilizing nests throughout the year-enabling them to use less energy for heating and they then require about 30% less food. Many birds also sun bathe to heat up, especially after swimming or bathing and will hold the wings open to get the full impact of the sun. Smaller birds often lie on the ground with wings up to let the sun hit the underside.
- **Cooling** - is accomplished by bathing in water, by wading or plunge-diving from a perch. The beak is also often left open, enabling more air to move through the single air at a faster rate as the throat moves rapidly in and out (called gular fluttering). The wings are also held closely from the body (called wing- drooping) allowing cooling air to circulate more efficiently. Ground birds will 'stand tall' to get their bodies as high as possible from the hot ground.
- **Thermalling** - or spiraling-big birds-Mostly raptors, storks and pelicans need to cover big distances every day and locate foo on feeding areas by sight. This is best done from high in the sky. To save energy these birds make use of what are called **thermals,** - hot pockets or rising air (heated by the sun striking the ground). These pockets are narrow and the birds therefore have to turn in circles to stay in the rising air and get the best lift; this spiraling behavior is called **thermalling.** To cover distance the birds will leave a thermal, slowly descend, and then find another one to get height again-enabling them to cover many kilometers without flapping at all.

- **Plunge diving** - this is done by many birds that need to go into or under the water surface for food. They either hover (like kingfisher) or simply fly slowly over the water. The wings are then tucked in as the bird falls like an arrow into the water, grapping the prey below the surface. This plunge-dive could cause injury to the head and there are therefore adaptations like no bony ridge (supra-orbital ridge) above the eye, plastic eye lenses to allow for underwater focusing and absorption of impact and other 'shock absorbers' around the skull and brain to absorb the shock of impact and prevent injury.
- **Egg protection** - either by camouflage, by egg coloration, by pulling plant material over the nest when unoccupied, by kicking dirt or other debris over the eggs when on the ground or by disguising the nest itself so well that it becomes invisible and thereby hides the eggs. Ground nesting birds will also try to protect eggs from overheating by belly-wetting, where they sit in water to wet their feathers and then sit on the eggs. Predators are kept from nest with eggs by the common 'broken wing' display; a distressed animal being more tempting than eggs and by wings open flashing warning colors (aposematic coloration) with the bird hissing. These types of displays are called Epigamic behavior; e.g., owls
    1. **Anting** - this involves the bird using formic ants to cleanse the feathers; to clean them and rid the skin and feathers of parasites and can be accomplished in two ways:

        a. **Active anting** - the bird picks up the ants and vigorously rubs them through the feathers.
        b. **Passive anting** - the bird just lies there and lets the ants walk all over the body

    2. **Threat display** -Talon grappling occurs when one bird of prey attacks another in the air and they grab hold each other's feet to prevent injury. They then tumble to the ground (**called cart wheeling**) and sometimes die on impact. This is not a courtship display. Young birds, when confronted on the nest will hiss loudly (**epigamic**), while swaying from side to side with the feathers ruffled and wings open to make themselves look bigger.

- **Migration** - Occurs mainly because of a shortage of food. Most birds feed on seeds and insects; both of which are difficult to find in winter and they therefore need to move to areas where these foods are readily available. Competition for limited foo also forces many birds to migrate;

stay and die or leave and survive. Migration is triggered by shorter day length and a battle to find food. When this starts to happen the birds begin to feed for much longer periods laying down stores of fat for the trip (the can increase in weight by nearly 50%). Most birds migrate at night when it is cooler and there are less predators. They navigate by the stars, landmarks, winds, their internal compasses and clocks and by memory. The trip is not undertaken in one flight, the birds have to stop to refuel with energy (food) on several occasions resulting in about 70% (varies) of the total immigration time being spent on the ground. Types of migration;

- **Palearctic migrants** - long distance migration from Europe or Asia
- **Intra-African migrants** - within African continent
- **Altitudinal migrants** - movement from high altitude to lower altitude and back again example from low lying coastal regions to high mountains.

- **Cainism/Silicide** - Where one chick (usually the older) kills its sibling-probably in order to get all attention and therefore survive more easily. After the bible story where the brothers Cain and Abel fought and one was killed. The parents lay two eggs as a guarantee against problems such as predation or not hatching etc. incubation starts with the first egg and because there are laid a few days apart, the first egg hatches days earlier ensuring that one chick is bigger and stronger. Major competition starts after about 4 days when the older either deprives the younger from food (out competes it) called **passive-cainism** or it actually attacks and severely or kills it, called **active cainism**.

- **Types Of Breeding:**

  - **Monogamy**
  - **Polygamy** - more than 1 male or female (multiple mates).
  - **Polygany** - 1 male for many females.
  - **Polyandry** - 1 female for many males.

HOW TO IDENTIFY BIRDS IN THE FIELD (13.1.4).

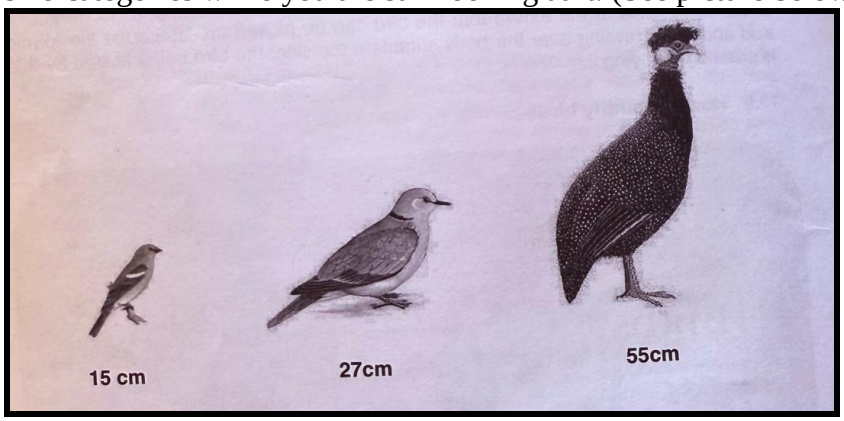
- Birds are a major part of a safari experience and for many people it is not just about seeing but also ‘identifying’ in order to better appreciate the overall experience. Being able to identify the species or at least the ‘bird group’ also allows the guide to better elaborate on specific principles or perceived behaviors. It is vital therefore that guides know the most common species and all the bird groups within their area of operation. A good bird field guide book or application) and a descent pair of binoculars (10x) are a necessity and must be taken on all game excursions to not only assist with identification but to enhance guest understanding and enjoyment.
- Most wildlife areas have many more birds than mammal species and one often only becomes aware of the presence of a bird by its call alone, a movement in a bush, a silhouette shape in poor light or as a fleeting glimpse. A technique has therefore been devised to enable observers to rapidly ascertain what bird group (at least) and what species (at best) is in question as follows:

- **What is the ‘GISS’ of a bird?**

  - This refers to the general appearance of a bird and derived from the acronym ‘GISS’ which stands for **General Impression of Size and Shape**. One of the biggest frustration birders have is the positive identification of a bird that has been seen only fleetingly or in poor light conditions. This is where knowing how to identify a bird group (chat, shrike or francolin etc.), or to identify a species by its GISS can help a tremendous amount. To effectively describe a bird’s GISS, therefore constitutes a comprehensive **7 points magic formula** of important facets that are to be addressed in a specific sequence

(systematically). Although the formula may seem tedious, with practice, it in fact, only take a few seconds while looking at the bird and is easy to apply in any birding situation-even with guests the 7 points are in fact simple questions that you need to ask yourself watching the bird as follows;

- **What is the general size of the bird?**
  - This is the first and most important question to answer. You need to choose a particular bird species for each of the 3 size-categories, namely small, medium and large. It does not really matter what species you choose within each category as long as your choice remains constant over time, allowing you to size birds effectively according to history as well. In other words, by keeping these size-defined birds constant, you can compare the size of the bird you are now trying to identify with those you have seen before and positively identified in the past.
  - **A small bird** - could possibly be a bird such as a waxbill, finch or sparrow
  - **A medium** - sized bird-could possibly be a starling, thrush or a dove.
  - **A large bird** - could possibly be a hornbill, Guinea fowl, Egret or Raptor
    NB//you need to make a calculated decision as to where the bird fits in on this scale of size-categories while you are still looking at it. (See picture below):



- **What is the general shape of the bird?**
  - Most bird groups, for example thrushes, chats, eagles, hornbills and herons have a specific "look" especially when seen in silhouette. Getting to know these shapes comes with experience and time in the field. This is especially true because it is not just the general shape' that is important but also field characters/traits that are not always evident in books. These traits are things such as postures when resting, flying or feeding and elaborate adornments such as wing-pennants, long tails and crests that may only be apparent seasonally. These affects the above in order to get the correct bird group that positively ties in with the size decided upon in question 1.
    - Wing shape will indicate how it flies and possibly, therefore how it gets its food.
    - Look at the tail, was it rounded, square or graduated? Were there long feathers and if so were they on the inside or outside?
    - Was the crest long, short, pointed or rounded and note its position on the head. These clues are particularly important and care must be taken to ensure that breeding plumages (adornments) are considered when cross-referencing in books.
- **What is the plumage (feathers) color and pattern?**
  - This is next in the sequence because plumage covers almost the entire bird and is therefore generally easier to see than the bill or legs. The decision taken thus far on size (first 2 questions) only gets you to the 'general bird group', and more information is now needed to make species identification or at least narrow the search down). It is important to now take careful note of the plumage coloration and to record where colors are on the body. It is not adequate for example to say that the bird was brown and black; was the black on the head, the whole wing, the wingtip or on the tail, and was the brown, light-brown, dark brown or red-brown.

- Note particular plumage patens such as spots, blotches, stripes, bars or scalloping, an again where they occur on the body.
- Markings on the wings and tail can be critical in the final identification various plumages for deafferent life-stages, for example, juvenile, adult female, breeding and non-breeding male as well as different morphs (color phases) must also be considered. It must also be remembered that poor light and wet plumage may also have drastic altering effect on perceived coloration.

- **What is the bill color?**
  - Because most people tend to focus on a bird's head, face and eyes (as they do with most animals), noting the details of the bill is the next part of the formula.it is true that the legs are also useful in the identification, but considering that they are often hidden in the water or vegetation, the bill takes preference in the sequence. When analyzing the bill, it is important to check the color and where on each mandible (if they are different) the color is for example, to say I saw a kingfisher with a red and black bill is of little help because whether the black was on the upper or lower mandible will change species.
    - Rictal and nasal bristles near base of the bill may help with identification
    - Check for the presence of a cere or casque (and the color of these) as well as where the nostril is.
    - The shape of the bill, which indicate diet that can then also be used to re-check decisions made in the first three questions. Again, it must be remembered that bad light, wet conditions and debris from feeding and breeding and immature bill colors may influence perception.
- **What is the leg color?**
  - The legs of many birds are very conspicuous and can most certainly assist in identification
    - Look where the color is situated, it is on the upper leg (tibia) or lower leg (tarsus)and what is the color of the knee (tibia-tarsal joint)
    - Note how much feathering, if any is present on the legs and feet and what type of scales there might be
    - If the toes are visible then note if the color is different from the rest of the leg
    - Check the presence, color and size of claws and webs and note the general shape of the toes. This, coupled to the overall length and design of the leg, will again confirm links to diet and habitat preference as hinted by the bill design. As with plumage and bill color, poor lighting, wet conditions, dirt and debris on the legs, and breeding plumage color-changes must all be taken into account when making decisions.
- **What Habitat was it in?**
  - This part of the formula is problematic because people cannot accurately discern or identify different habitat (it was in the bush seeming to apply to most habitats). They struggle, therefore to make identification based upon subtle variation in habitat preference. Another issue is that even if they do know one habitat-type from the next, the bird may be seen in an uncharacteristic or presumably unsuitable area. All that is required therefore is that one looks carefully at the locality of observation.
    - If its grassland, it's the grass long or short, dry or wet(marshy)
    - If its bush, is it thickets or open woodland or forest/ vachelia (acacia) thorn veld scrub or broad-leaved trees.
    - If there is water present, is it temporary pan, permanent lagoon or river etc.

- **What was the bird doing (habits)?**
  - Many identifications would already have been made using just the first five or six points of the formula, but every now and then, due to various factors, such as poor light conditions or when dealing with bird groups where many members appear similar and

may even be found in similar habitats, individual habits may well help in making a positive identification. Habits, is a broad reference to what the bird is doing, with the following categories being most important to make note of;

- Feeding-what foraging techniques was use? Was it probing in a tree, was it diving under water or merely up-ending etc.

- Locomotion- how was the bird moving, whether it be flying or walking? If flying, was it constant flight or a few flaps followed by a glide, and when not flapping were the wings left open or tucked Maintenance activities- this applies to behaviors relating to looking after or keeping the feathers and body in good condition. When preening, was it scratching the head and if so, was the foot lifted over or used below the wing?

- **Displays** - most displays are linked to breeding or territorial advertisement. For instance, was it using a distinct courtship flight or song (or were these linked) was it calling from a distinct song-post or was there duetting

- **Breeding** - casual observations by birders will generally not involve nest activities, but the type of nest being used and its locality may certainly assist in identification activities linked to courtship-feeding and male participation in nest building, may also be clues to species identification.

- **Sociability** - This basically refers to how a species lives. Was it seen alone or in a flock, and was the flock a mixed-species flock or all of same species? Does the bird appear to move in a cooperative family group or not? It is important to remember that sociability of many species changes seasonally with many becoming loners of forming pairs in the breeding season and then becoming sociable when not breeding (or vice versa). Local movements and migrations triggered by food supplies, will also affect sociability.

- The mastering of this formula will not certainly make bird identification easier and possibly even more enjoyable. With practice an initial guess should take no more than 10 seconds, but the simplification of the identification process by using the formula should reduce boo referencing time drastically.

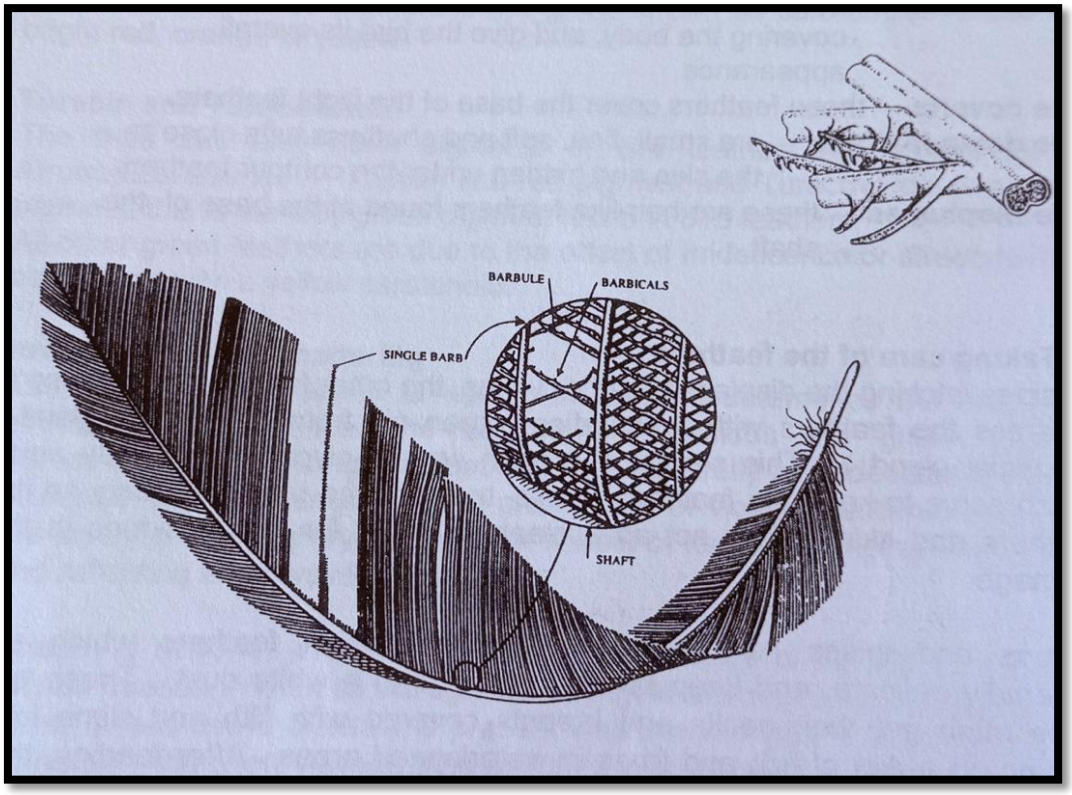
FEATHERS AND THEIR STRUCTURES (13.1.5).

- Flight is not limited to birds. Most insects and all bats are capable of it, and the ancient pterosaurs (ancient reptiles) rued the skies for millions of years. However, feather-powered flight is unique.

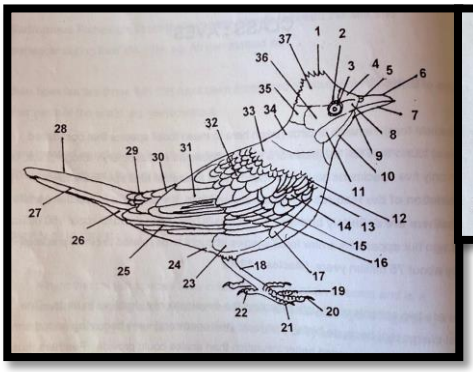
- Feathers are made of keratin, the same substance of which hair, hooves and beaks are all made of. It is the structure of the feather and not the material that lends its great efficiency. Feathers are very light, but are structurally strong. They are easily replaced and less prone to damage than bats wing structure for example the shaft is stiff but the tip is flexible for maneuvering.

- When examined microscopically, a feather shows how the barbs all hook together by means of barbules and barbicels. This structure forms an airtight seal for wind

resistance and is easily "repaired" by preening, which simply joins those barbs that have split apart. **See picture below (**feather barbs):



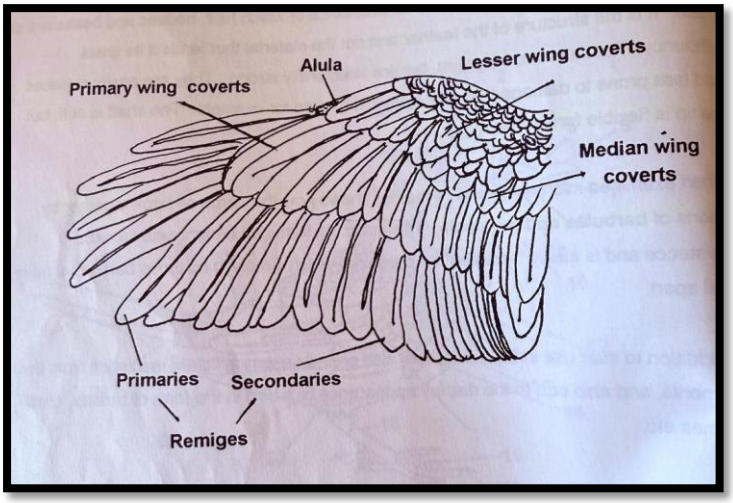
- In addition to their use in flight, feathers also provide a very efficient insulation from the elements and also add to the display appearance of a bird in the form of beards, crests, plume etc. See picture below:



1. Crest, 2. Eyelid, 3. Iris, 4. Forehead, 5. Nostril, 6. Upper mandible, 7. Lower mandible, 8. Lores, 9. Gape, 10. Throat, 11. Cheek, 12. Shoulder, 13. Breast, 14. Lesser wing coverts, 15. Median wing coverts, 16. Primary wing coverts, 17. Alula, 18. Tarsus, 19. Second toe, 20. Third toe, 21. Fourth toe, 22. First toe, 23. Flank, 24. Abdomen, 25. Primaries, 26. Vent, 27. Outer tail feathers, 28. Central tail feathers, 29. Upper tail covers, 30. Rump, 31. Secondaries, 32. Scapulars, 33. Mantle, 34. Neck, 35. Nape, 36. Ear coverts, 37. Crown.

- There are several types of feathers making plumage of birds, not all of which may be found on any given bird:
  - The **Rectrices** - large flight feathers on the tail
  - The **Tectrices**-contour feathers which are the main feathers which cover the body and lend a bird its overall appearance
  - **The Coverts** - these feathers cover the base of the flight feathers.
  - **Down feathers** - small, fine, soft and shaftless tufts found close to the skin of a bird and hidden away under the contour feathers.
  - **Filoplumes** - are hair like feathers at the shaft bases
  - **Remiges**, **rectrices** and **contour feathers** are all quill or vane feathers. Remiges are further divided into 3 types; primary feathers- form the point wing, secondary feathers

are situated on the fore arm and tertiary or scapular feathers occur from the fore arm to the shoulder. The upper wing surface of a typical bird (extended). See picture below:



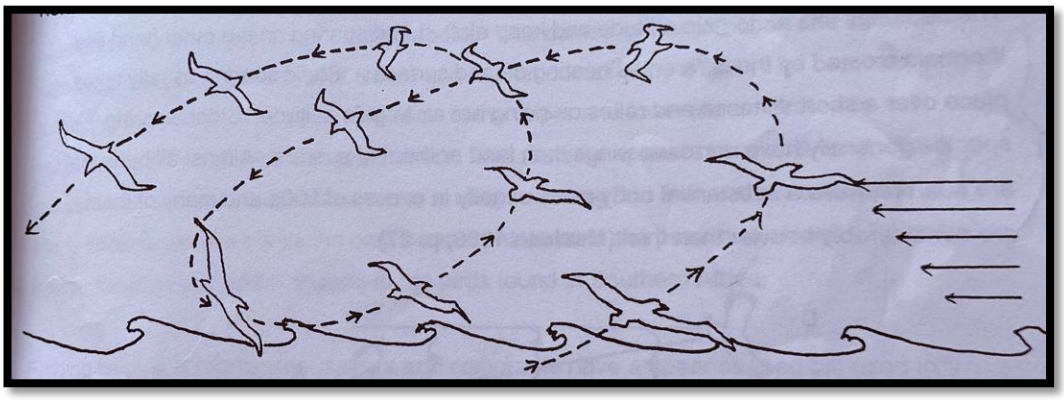
- Feathers, like hair and scales becomes worn with time and need to be moulted on a regular basis. This usually takes place once a year, but some species display a second complete moult or a partial moult at the start of nesting season.
- Feathers are shed in a definite order, with a balance being maintained for flight purposes. Therefore, two tail feathers may be shed, one from the left and another from the right. Only penguins moult all their feathers simultaneously and only ducks and geese are deprived of flight during moulting. During this time these birds these birds spend all their time on water until their flight feathers regrow.
- In addition, feathers contain the pigments that give their fantastic range of colors; structural composition also plays a part in this. The colors of birds may be caused by the light waves reflected from pigment cells, or maybe derived from structural means. The most common pigment in bird feathers is melanin. This is a dark pigment ranging from black (melanin) to Eumelanin (dark brown) to phaeomelanin (pale brown and rust). Carotenoids are other common pigments, giving birds their red, orange and yellow coloration. Turacin and Turacoverdin are other pigments found in any bird's feathers. All other green feathers are made up of a combination of factors such as iridescence, juxta positioning of yellow and black or structural blue associated with carotenoid pigments.
- Structural colors such as those seen on the starlings and kingfishers are created by very fine layers of overlapping keratin on the feathers.

FLIGHT (15.1.6).

- The mechanics of flight in birds cannot be reduced to simple formulae as can the performance of an aircraft wing. Birds' wings are mobile in many directions, the feathers twist and bend, and the forces that act on them are often quite different to the forces acting on aircraft. One of the most critical aspects of the ability to fly is to have correct power; mass ratio. If the skeleton of the bird was too heavy flight would become impossible. Bird skeletons are thus a combination of lightness and strength, much like the modern alloys used today in aircraft manufacture. All flying birds have an extremely thin and light breakstone which has a deep kneel making it rigid and providing a large surface area for attachment of the powerful flight muscles. In addition, many of the bones normally found in the higher vertebrate animals are missing in birds, these having

been discarded through the evolutionary process of mass reduction of the skeleton. Birds' bones are usually hollow having honey comb structure which is stiffened by struts. The skeleton of a bird generally weighs less than the feathers.

- The wings of a bird are constructed on sound Aerodynamic principle-not only are they streamlined to cut through the air with little Drag but they are also curved to produce Lift-upper surface of the wing speeds up and tends to pull away thus creating a drop of pressure while pressure on the concave under surface remains fairly constant. It is the difference in the pressure above and below the wing that creates lift. Wing shape varies considerably amongst birds, reflecting the adaptations they have made to different niches in the environment. Soaring birds have evolved light, long, narrow wings whereas those of forest environments tend to have short, well-muscled wings which make powerful flyers. The second force required for flight is that of Thrust. In birds this is provided but the feathers at the tip of the wings known as the primary feathers. The power is applied on the down stroke. As the wing is pulled own against the resting air, the tips of the primaries are bent upwards and twisted at an angle to the wing as a whole. At the end of the down stroke, the wing tips are on a level with the bill. On the upstroke the primaries separate to permit easy passage of air. The wing tips move upwards and backwards against the air, still providing slight propulsion, while the inner part of each wing, close to the shoulder provides lift. Then the cycle begins again.
- The wings are flapped by means of the powerful flight muscles. There are two types: white flight muscles and red flight muscles. White muscle fiber is used for brief or explosive bursts of activity such as a ground bird taking flight from an enemy. Active flying birds like geese and migrant's species have red flight muscles which are plentifully supplied with blood vessels and do not tire very easily. Thus, constant activity of the wings generates great heat and speeds up the body metabolism. This heat would be killing, were it not regulated by the respiratory system, which is the most efficient of any of the vertebrates.
- In addition to their lungs, birds usually have at least nine thin walled air sacs connecting chambers throughout their body. These bring additional supplies of oxygen to the tissues for burning but also through evaporation of water they help to keep the temperature of the body within a reasonable limit.
- The dynamic soaring flight of albatrosses, gulls and gannets requires the horizontal movement of air over the wing surface. An albatross rises into the wind using the wind velocity for lift. This method allows the bird to soar for hours without having to flap its wings. (See picture below):

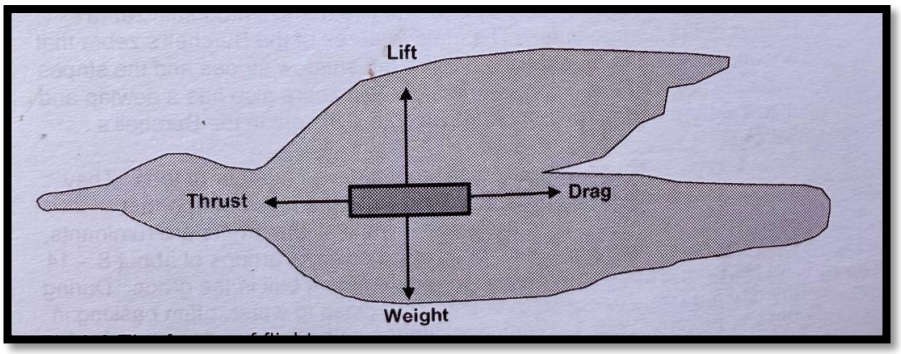


- Only small wing adjustments are required during flight. The muscular energy required for this flight is reduced significantly, because of the bird's ability to lock the wings in their fully extended position. This locking mechanism is provided by a fan shaped sheet of tendons originating along the knee of the sternum. The forces of lift and thrust are provided by the wing of gliding birds. These types of soaring birds are usually confined to areas which have a relatively high and constant amount of wind, i.e. mostly over the

sea. The other forms of soaring are slope soaring, land soaring and static soaring. Slope soaring is achieved when wind hits the slopes of a mountain and rises vertically. The bird uses this air to gain altitude and keep aloft. Land soaring on the other hand use thermals created by the differential heating of land surfaces. Static soaring usually takes place over a short distance and relies on rising hot to gain altitude. Slope soaring species generally have narrower wings than land or thermal soarers. Almost all birds that are soarers, have a substantial body mass usually in excess of 500g and many of them are considerably heavier than this.

❖ **The forces of flight.**

- Any flying object is subjected to four forces, namely: **lift, weight, thrust** and **drag**. When these forces are in balance, we have a stable flying object. (See picture below):



- Anybody has weight and this weight must be countered by an equal and opposite force to enable it to fly. This force is called lift. Lift is greater than weight, the object will climb. If weight is more it will descend. Forward movement of the flying object is made possible by thrust, and this in turn is balanced by Drag, which represents the resistance of the flying object. If thrust is greater than drag, the object will accelerate, and if Drag is greater it will decelerate.

❖ **Their Flight Patterns.**

- Some species feed in flight and each family has a flight pattern that differs from that of any family. Example: swallows flap their wings and have a distinct shoulder shape to the wings, whereas, swift have stiff, crescent-shaped wings which are used mainly for flying.

  - **Dipping flight** - hornbills
  - **Sailing** - doves
  - **Straight flight** - crested barbets
  - **Erratic flight** - hoopoe
  - **Gliding** - swift

❖ **Vocal communication (the voice).**

- Birds can be recognized and identified according to the species-specific sounds that they make. Birds produce sounds both vocally through Syrinx and mechanically through a variety of ways, including snapping of the bill (white storks) drumming the beak on wood (bearded woodpecker), clapping the wings together or against the body (flapped larks) or even stylized wind noise during flight (Ethiopian snipe). Vocalizations may be further divided into calls and songs, with calls generally being short and associated with a specific context and behavior, while songs are **generally longer, more complex and heard in the breeding season.**
- Calls are produced by both sexes at any time of the year and are simple notes. Songs on the other hand serves to advertise the ownership of territories. It is generally elaborate and musical

although this is not always the case. Usually, birds call when communicating with members of a flock or a mate when threatened by predators and whilst rearing a family:

- **Contact calls** - serve to keep individual birds in a flock aware of the position of others. In flocks of finches, it takes a call of one bird, for all others to stop feeding and take off. While contact calls are recognized by an individual in order that mates, parents and or offspring can keep together. Individual recognition is particularly important to large breeding colonies.
- **Alarm calls** - seem to attract the attention of all other birds within earshot. The object being to increase the number of birds to attack and mob the predator and to ruin its chances of a silent approach.
- Bird's song is at its strongest at dawn, being triggered by light intensity. One suggestion for this, is that sound travels farther in the still air of early mornings. Bird song is also affected by weather. Birds sing less in wind and more in warm weather. Song is often delivered from exposed positions such as from the top of trees. It serves to inform other birds of the individual's position and identity.
- Vocal mimicry still puzzles ornithologists (scientist that study birds). A possible function of mimicry could be to gain advantage over other males and to develop an extensive range of songs to impress females. The marsh warbler mimics around seventy-five other birds and its repertoire is complete within its first year of life. Thus, on reaching maturity it can imitate the songs of its father as well as neighboring males.

❖ **Birds Migration.**

- The word migration derives from the Latin MIGRARE, which means to go from one place to another i.e., to travel. Ancient students of bird behavior were unaware of the phenomenon of migration and hypothesized that birds either hibernated or underwent transmutation (form changing). The Roman Emperor Frederick 11 wrote the first major work on bird migration in 1245AD.
- Bird migration need not necessarily take place from one continent to another but must show regular seasonal movement from one specific area to another on the species.

❖ **Different types of migration include:**

- **Altitudinal migration** - which is most frequently practiced by mountain dwelling birds which move to lower altitude to escape harsh conditions. These migrations usually take place over a short distance.
- **Intra-African migration**- this involves migration species from one area to another within the continent of Africa. In southern Africa common examples are the Wahlberg's Eagle and Red chested cuckoo.
- The true long-distance migrations such as those exhibited by white stocks, steppe Eagles and European Bee-eaters are known **as Palearctic Migrations.** This migration take place from Africa to the Palearctic Zoogeographical area of the world (Eurasia). Other Zoogeographic areas of the world are the Nearctic which is North America, Canada and Alaska. Neotropical being South America, Afro tropical area being Africa and the near East, Australasian and the Indo Malayan which includes India and parts of the far East.
- To further complicate matters, one finds breeding and non-breeding migrants; these terms referring to whether or not a species breeds in southern Africa or not. Those that breed in southern Africa are referred to as breeding migrants and those that do not breed in southern Africa are referred to as non- breeding migrants. Prior to migration birds feed excessively in order to lay down extra layer of fat to provide an additional energy source. This layer of fat comprises of up to 50% or more of the total body mass of the bird prior to migration. In small species, this generally allows for a flight time of 100 hours during migration. Should the fat source be depleted, prior to reaching the final destination the bird must temporarily stop and replenish its energy supply.

❖ **Navigation and Orientation.**

- How birds find their way over long distances has often been considered a mystery but the following factors are known to be used by migrating birds. Astronavigation involves the use of the sun, moon and stars to orientate the bird in the correct direction. Learning and instinct also play a role in bird migration as do familiar landmarks, wind direction, the earth magnetism and even the sense of smell.

❖ **The whole image.**

- Try to form a visual imprint or image of the whole bird, its habitat, its behavior, the social status and its calls. Freeze the image of the bird in your mind as though you are taking a photograph. You should see the image well and remember details that will help you identify the bird. (See images below):

