UNIT- IV- ANIMAL BEHAVIOUR

Habitat Selection

Habitat selection is the process by which organisms actively select habitats (natural environment) to live. Eg. Mayfly nymphs inhabit the underside of stones in fast-flowing streams and burrow in sediments in still water.

Habitat is the natural environment where an animal usually lives.

Habitat provides shelter; food, protection, mates and space for breeding, feeding, resting, roosting, courtship, grooming, sleeping, etc.

Rich habitats give higher fitness" to the organisms living there.

Poor habitats give lower fitness.

The quality of the habitat consists of the following variables:

- Food availability
- Predator occurrence
- Ease of defense
- Likelihood of offspring survival
- Microclimate changes
- Distance to human settlements.

Habitats are heterogeneous. There are many factors that are involved in the organism's choice of habitat.

Animals must be able to tolerate two kinds of factors in the habitat,

namely: 1.Abiotic factors

2. Biotic factors

Abiotic factors are non-biological factor

Abiotic factors include temperature, humidity, salinity and pH.

Biotic factors include competition, predation and disease.

If both abiotic and biotic factors can be tolerated, the animal able to find the resources that it needs to survive.

Habitat selection is a hierarchical process.

Habitat selection is generated by foraging decisions. Foraging is the only process of driving habitat selection.

Heredity and experience play a role in determining selection It involves a series of innate and learned behavioural decisions made by an animal. It is an active behavioural process that may vary across spatial and temporal scales. It is more complex.

A species actively prefers or avoids certain types of habitat Evaluation of habitat selection is a hierarchical process coined by Johnson in 1980. It may result in the disproportionate use of habitats to influence survival and fitness of individuals. Habitat may be selected for the following purposes: Cover availability Forage quality and quantity.

Resting or denning sites. Each of these may vary seasonally. If an individual or species demonstrates disproportional use of any factor, then selection is inferred for those criteria. Hilden structured his ideas on habitat selection by categorizing the differences between proximate and ultimate factors.

Food Selection

Food selection is the ability of animals to select the beneficial food. Food is a source of energy. Food is required for movement, migration, courtship, performing various activities etc. All animals select specific food in their natural habitat. Food selection implies food ingestion. Food ingestion implies the presence of food.

Food selection includes food search process. The food search process is searching images and mechanisms for finding appropriate food stimuli in the environment.

Honey bees have highly developed food search system. Food selection also implies the ability to capture food and to assimilate it.

Food ingestion depends on an internal state indicating a need for the particular food. It also depends on the recognition of the potential food as the required food.

Omnivores, such as rats and humans, face with an enormous number of potential foods. They are always cautious of eating something harmful or eating too much of a good thing.

Types:

- Carnivores
- Scavengers
- Herbivores
- Saprophytes
- Omnivores

Frugivores eat mainly fruit.

Browsers eat mostly leaves.

Animals that eat mostly grass are grazing animals. Eg. Goat, elephant, cows, horses, deer, rhinoceros, wildebeest, monkey, sheep, rabbit, panda, koala, etc.

3.Omnivores

An omnivore is an animal that eats, both plants and animals. The food may include eggs, insects, fungi and algae. Many omnivores are opportunistic feeders. Eg. Cassowary, chickens, crows, rooks, emus, hummingbirds, ostriches, robins.

4.Scavengers

A scavenger is an organism that mostly consumes decaying biomass, such as meat or rotting plant material. Many scavengers are carnivores.

Optimal Foraging Theory

Optimal foraging theory (OFT) is a model that helps to predict an animal behaves when searching for food. Optimal foraging theory was first formulated by Robert MacArthur, JMEnilen and Eric Pianka in 1966.

It is an ecological application of the optimality model. Optimal foraging illustrates that the organisms forage in such a way to maximize their net energy intake per unit time.

Although the animal obtains energy from the food, searching for and capturing the food require both energy and time. This theory is based on a number of assumptions. This theory assumes that the most economically advantageous foraging pattern will be selected by a species through natural selection.

The theory was devised in an attempt to explain, why animals often restrict themselves to a few preferred food types, even though there is an

availability of wide ranges of food. The prediction is that an animal strikes a balance between two contrasting strategies:

Predators are categorized into two types, namely:

1. Searching predator

2. Sit-and-wait predator

Assumptions behind optimal foraging theory are as given during foraging.

1.There should be a heritable component of foraging behaviour

2. The relationship between foraging behaviour and fitness is known.

3. Evolution of foraging behaviour is subject to functional not prevented by genetic

5. Evolution of foraging behaviour is subject to " functional', stants that have been realistically determined.

1. Searching Predator

A searching predator moves throughout its habitat and finds its Searching predators encounter and consume non-movingprey populatim The prey density must be low. The predator's energy requirements must be high.

2. Sit-and-wait Predator

A sit-and-wait predator waits for its prey to come close to its point of observation. It mostly relies on moving preys or that have high prey mobility. The prey density must be relatively high. The predator's energy requirements must be low. The sit-and-wait foraging mode is less common during periods of prey scarcity.

Building an Optimal Foraging Model An optimal foraging model generates quantitative predictions of how, animals maximize their fitness while they forage. The model building process involves identifying the following factors:

1. Currency

2. Constraints

3. Optimal decision rule

1. Currency is defined as the net energy gain that is optimized by the animal per unit time.

2. Constraints are hypotheses about the limitations that are placed on an animal. It can be due to features of the environment or plassilogy of the animal.

Feeding Systems and Classes of Predators Optimal foraging theory is applicable tofeeding systems throughout the animal kingdom. The optimization of these different foraging and predation strategies can be explained by the optimal foraging theory. There are different classes of predators. They are the following:

- ✓ True predators
- ✓ Parasites
- ✓ Grazers
- ✓ Parasitoids

1. True predators attack large numbers of prey throughout their life. • They kill their prey either immediately or shortly after the attack. • They may eat all or only part of their prey. • It includes tigers, lions, whales, sharks, seed-eating birds, ants and humans.

2. Grazers eat only a portion of their prey. They harm the prey, but rarely kill it. It includes antelope, cattle and mosquitoes.

3. Parasites eat only a part of their prey (host), but rarely the entire organism.

Antipredator Defences

Antipredator defence is the behaviour which provides protection the prey against the predator.

Defenses are the acts of animals that reduce the chances of it being harmed by another animal.

Animals have a wide range of defences against predators. Defense mechanisms are very important in the life of all animals. The most common system of defence is adaptation against predators.

Animals may also have defences against parasites and other members f their own species.

Defence against predators are of two types, namely:

1. Primary defences

2. Secondary defences

Primary Defences

primary defences are the protective mechanisms found in prey animals, which operate before a predator starts to catch the prey It is also a defense mechanism which operates, whether a predator is nearby or not. It reduces the probability that a predator.

It reduces the probability that a predator will encounter the prey. It includes the following methods:

- Hiding away

- Mimicry
- Crypsis
- Warning sounds
- Warning colouration
- Mimesis

1. Hiding Away Hiding away is the primary defence mechanism, in which prey animals stay out of the sight of predator.

Animals hide themselves by living in holes or crevices, ground or by being nocturnal. Nocturnality is an animal behaviour, in which an animal its activities during night and sleeps during day time. This is a behavioural form of detection avoidance us They cannot be seen unless the predator searches carefulled by animals The hidden animal, however has to come out into the open from their hidden place. , area But while hidden, it is relatively safe. Eg. Fruit bats forage during night, evening time emergence in echoloc bats, kangaroo rats exhibit moonlight avoidance to avoid predators.

Crypsis is the ability of a prey animal to conceal itself from its predator by having a colour, pattern and shape that allows, it to blend to its surroundings. It is also called cryptic coloration. It is a tactic that organisms use to disguise their appearance

Mimicry is the close external resemble mimic, to some different organism, the model. It is the similarity of one species to an odler which one It is a situation in which one species called the mimic, resembles in colour, form and behaviour of another species, called the rnodel The model and the mimic are not always closely related. The model and mimic usually live in the same area. The two most common types of mimicry are as follows.

- l. Batesian mimicry
- 2. Mullerian mimicry

Homing

Homing, ability of certain animals to return to a given place when displaced from it, often over great distances.

The major navigational clues used by homing animals seem to be the same as those used in migration (Sun angle, star patterns, Earth's magnetic field, etc.), but homing may occur in any compass direction and at any season.

Most of the best-known examples of strong homing ability are among birds, particularly racing, or homing, pigeons.

Many other birds, especially seabirds and also swallows, are known to have equal or better homing abilities.

A Manx shearwater (*Puffinus puffinus*), transported in a closed container to a point about 5,500 km (3,400 miles) from its nest, returned to the nest in 12 $^{1}/_{2}$ days.

Non-avian animals that have homing abilities include some species of reptiles and fishes.

When female loggerhead sea turtles (*Caretta caretta*) emerge from their shells, they imprint on the unique magnetic field signature of the beach on which they hatched and can navigate back to it as adults to lay eggs of their own.

In addition, experimental studies have shown that several species of salmon can navigate back to their spawning streams by using their olfactory senses to find the unique chemical signature of the waterway, and

juvenile sockeye salmon (*Oncorhynchus nerka*), like loggerhead sea turtles, also appear to navigate using magnetic fields, from the ocean back to their spawning streams

Biological Rhythms

Definition , a *rhythm* is a change that is repeated with a similar pattern. Humans, like all other organisms that inhabit this Earth, have a rhythmic order underlying life. Actually, change, not constancy, is the norm for life and the rhythmic timing of change makes predictability a reality.

A Time for Everything

The rhythmic nature of life influences the very existence of organisms, commencing before conception and extending beyond death. Rhythms may be the most ubiquitous, yet overlooked, phenomena of life (Luce, 1970). They are such an integral part of life that the absence or perturbation of specific oscillations (e.g.,brain waves and heart beats) in humans and other animals is used in the practice of medicine to distinguish between life and death, as well as between illness and good health

Three Rhythm Domains

Much of the early work on biological rhythms focused on cycles in which the *period* was 24 h. These rhythms are referred to as *circadian rhythms* because they reoccur with a period of 24 h during usual light–dark conditions, and can continue with a period close to 24.0 h when the organism is isolated from external cues. Thus, periods of about (*circa*) a day (*dies*) are present when organisms are isolated from environmental 24-h cycles, such as the alternating light and darkness of the solar day, and/or changes in temperature. This “free-running” period is an important characteristic of a circadian rhythm. In addition, the period is relatively consistent over a range of temperatures (temperature compensation). These and other characteristics are discussed more extensively in

General Features of Rhythms.

While the circadian rhythms represent the dominant cycle that has been studied relative to the activities of humans and other organisms, cycles having periods shorter or longer than circadian, such as 90-min or seasonal cycles, are also important. Biological cycles that have periods less than 20 h are called *ultradian rhythms*, while cycles with periods longer than 28 h are called *infradian rhythms*. Depending upon the variable, infradian periods can be measured in weeks, months, years (circannual), and longer. Collectively, these three rhythmic domains comprise a network or web of rhythmic oscillations that in many ways can be likened to the various chemical pathways that perform different functions, but occur simultaneously within the same organelle or cell.

Fishes migration

- In ecology, it is an animal behaviour of mass movement of animals from one place to another.
- The purposes for migration varies accordingly with the types of animals.
- Migratory behaviour of fish is a regular phenomenon. Their journey is purposed mainly for feeding and reproduction.

Types fish migration on the basis of needs:

1. **Alimentary or Feeding migration:** migration for search of feeding ground. It occur when food resources get exhausted.
2. **Gametic or spwaning migration:** it occur during breeding season in search for the suitable spawning ground.
3. **Climatic or seasonal migration:** migration in search for suitable climatic condition.
4. **Osmo-regulatory migration**: migration for water and electrolytes balance from sea to fresh water and vice-versa.
5. **Juvenile migration:** it is larval migration from spawning ground to the feeding habitats of their parent.

Movement of fishes during the migration

1. **Drifting movement:** It is a passive movement of fish along with water currents

2. **Dispersal movement:** It is a random locomotory movement of fish from a uniform habitat to diverse direction
3. **Swimming movement:** It is an orientated movement of fish either toward or away from the source of stimulus
4. **Denatant and Contranatant movement:** It is an active swimming movement. Denatant movement is swimming with the water current while contrantant movement is swimming against water current

<u>Types of fish migration</u>

The migration of some fishes is a regular journey and is truly an innate animal behaviour. Fish migration are classified into following types:

1. Diadromous migration:

- it is the migration of fish between sea and fresh water.
- As we know, most of the fishes are restricted to either fresh water or sea water. Changes in habitat may causes osmotic imbalance in those fishes. However some fishes regularly migrate between sea and fresh water and have perfect osmotic balance, they are the true migratory fish.
- This migration is of two types-

i. Anadromous migration:

- it is the migration of marine fishes from sea to fresh water for spawning.
- Fishes spend most of their life living and feeding in sea.
- They only migrate during breeding season to the river for spawning ground.
- Eg. *Salmon, Hisla, Lamprey* etc.
- Salmon migrate for breeding during winter from sea to river. While migrating, some physiological changes occurs:
- **–** stops feeding during journey
- **–** changes colour from silver to dull reddish brown
- **–** gonads mature
- They select suitable spawning ground and make a saucer-like nest in which female lays eggs and male releases smelt over them. Juvenile larva hatched out from the egg known as Alevins. Alveins then transform into parr and metamorphosed into adult when return to the sea.

ii. Catadronous migration:

- It is the migration of fresh water fishes from river to sea during breeding season for spawning. Eg. Eel (*Anguilla* spp)
- Both European eel *(Anguilla anguilla* or *Anguilla vulgaris)* and the American eel *(Anguilla rostrata)* migrate from the continental rivers to Sargasso Sea off Bermuda in south Atlantic for spawning, crossing Atlantic Ocean.

- Before and during migration some physiological changes occur in their bodies:
- – deposit large amount of fat in their bodies which serves as reserve food during the journey
- – Colour changes from yellow to metallic silvery grey.
- – Digestive tract shrinks and stops feeding
- – Eyes get enlarged and vision sharpens. Other sensory organs also become sensitive.
- – Skin serves respiratory organ.
- – Gonads get matured and enlarged.
- The lay eggs in suitable spawning ground and are fertilized by males. After spawning they die. The larva hatch out and develop into young ell and finally return to river.

2. Potamodromous migration:

- it is fresh water migration of fresh from one habitat to another for feeding or spawning.
- Eg. Carps, catfish

3. Oceanodromous migration:

- It is the migration of fish within sea in search of suitable feeding and spawning ground.
- eg. *Clupea, Thummus, Tuna*

4. Latitudinal migration:

- it is the migration of fish from north to south and vice-versa.
- It is a climatic migration.
- Eg. Sward fish migrate north in spring and south in autumn.

5. Vertical migration:

- it is a daily migration of fish from deep to the surface and vice-versa for food, protection and spawning.
- Eg. Sward fish usually move vertically downward to greater depth for food.

6. Shoreward migration:

- it is the migration of fish from water to land. However it is a temporary migration.
- Eg. Eel migrate from one pond to another pond via moist meadow grass.

Significance of fish migration

- to find suitable feeding and spawning ground
- for protection from predators
- survive from extreme climatic conditions
- increases genetic diversity
- it is an adaptational characters for survival and existences

Bird Migration

1. **Definition of Bird Migration:**

- The word **"migration"** has come from the Latin word migrara which means going from one place to another. Many birds have the inherent quality to move from one place to another to obtain the advantages of the favourable condition.
- In birds, migration means two-way journeys—onward journey from the 'home' to the 'new' places and back journey from the 'new' places to the 'home'. This movement occurs during the particular period of the year and the birds usually follow the same route. There is a sort of 'internal biological clock' which regulates the phenomenon.

Definition:

- According to L. Thomson (1926), bird migration may be described as **"changes of habitat periodically recurring and alternating in direction, which tend to secure optimum environmental conditions at all times"**.
- **2. Types of Bird Migration:**
- All birds do not migrate, but all species are subject to periodical movements of varying extent. The birds which live in northern part of the hemisphere have greatest migratory power.

- **Migration may be:**
- (i) Latitudinal,

- (ii) Longitudinal,

- (iii) Altitudinal or Vertical,
- (iv) Partial,
- (v) Total,
- (vi) Vagrant or Irregular,
- (vii) Seasonal,
- (viii) Diurnal and
- (ix) Nocturnal.

- **(i) Latitudinal migration:**
- The latitudinal migration usually means the movement from north to south, and vice versa. Most birds live in the land masses of the northern temperate and subarctic zones where they get facilities for nesting and feeding during summer. They move towards south during winter.

- An opposite but lesser movement also occurs in the southern hemisphere when the seasons are changed. Cuckoo breeds in India and spends the summer at South-east Africa and thus covers a distance of about 7250 km.

- **(ii) Longitudinal migration:**
- The longitudinal migration occurs when the birds migrate from east to west and vice- versa. Starlings (Sturnus vulgaris), a resident of east Europe and west Asia migrate towards the Atlantic coast. California gulls, a resident and breed in Utah, migrate westward to winter in the Pacific coast.

Conditioning

Conditioning is a learning behaviour in which an organism's behaviour becomes dependent on the occurrence of a stimulus in its environment.

It is a learned behaviour.

Classical Conditioning

Classical conditioning is a learning process by which an animal responds to a previously neutral stimulus, after the animal repeatedly encounters the neutral stimulus together with another stimulus that already elicited the response.

It is also called respondent conditioning.

In classical conditioning, two stimuli are given.

One of them will eventually induce a response resembling that of the other.

It is a traditional technique devised by Ivan P. Pavlov.

Classical conditioning is supported by the experiment ofPavlov on dogs.

• A dog is placed in a room.

• Food is given to the dog.

• The dog produces saliva to digest the food. The dog's response of salivation on eating food is an unconditioned response (UR) to food. The food is the unconditioned stimulus (US).

• Now, the food is given after ringing a bell. It is repeated for few days.

• The dog learns that food will be given after the bell sound.

• Now, the bell was rung; but food was not given.

• The dog salivates on hearing the sound of the bell itself.

• Here, the bell's sound is the conditioned stimulus (CS) and the salivation on hearing the sound is called conditioned response (CR).

Applications of Classical Conditioning

1. Classical conditioning is the basis of learning.
2. It helps in behavioral therapies such as aversion therapy

Aversion therapy is designed to make patients give up an undesirable habit by causing them to associate it with an unpleasant effect.

Systemic sensitization is a treatment for phobias in which the pa- tient is trained to relax while being exposed to progressively more anxietyprovoking stimuli (Eg. Angry words)

Flooding attempts to eliminate an unwanted CR.

3. It is used to bring conditioned drug response.
4. It is used to induce conditioned hunger.
5. It is used to create conditioned emotional response

Habituation

Habituation is the gradual decrease of response when the animal exposed to repeated harmless stimuli.

This concept states that an animal or human may ignore a stimulu

The organism decreases its response to a repeated stimulus, when the animal learns that the stimulus has no danger.

Thompson and Spencer (1966) first described the characteristics of habituation. Habituation is opposite to sensitization where the response increases on repeated stimulation.

The stimulus is received and perceived by the animal, but the animal has decided not to pay attention.

Habituation does not require the animal or person to be aware of this process. It may occur naturally or unconsciously.

Habituation is actually a basic process in animals. Without it, we would not have the ability to identify the meaningful and changing environment from relevant and irrelevant ones.

Habituation is present in every species of animal including man. In habituation, there is a gradual decline of behaviour.

Animals may neglect repeated sudden loud noises when they lean that this sound has no damaging effect.

This stimulus is not connected with any punishment or reward. Hence habituation is a non - associative learning.

It is a learned adaptation to the repeated stimulus and there is no reduction in sensory or motor ability.

Characteristics of Habituation

The key characteristics of habituation are the following:

1. Duration

If the stimulus is not presented for a long enough period, the response will once again reappear at full- strength, a phenomenon known as spontaneous recovery.

2. Frequency

The more frequently a stimulus is presented, a faster habituation will occur. An increase in the frequency of stimulation, will increase the rate of habituation. If you apply the same perfume every day, you're more likely to stop noticing it earlier each time.

3. Intensity

Very intense stimuli tend to result in slower habituation.

4. Change

Changing the intensity or duration of the stimulation may result in the reoccurrence of the original response.

Causes of Habituation

There are two theories for the causes of habituation. They are

1. Single factor theory
2. Dual factor theory

1.Single factor theory

It suggests that the constant repetition of a stimulus changes the efficacy of that stimulus. The more we hear it, the less we notice it. It becomes uninteresting to our brains, in a way.

2.Dual-factor theory

It suggests that there are underlying neural processes that regulate responsiveness to different stimuli. So, our brain decides for us that we don't need to worry about that useless stimulus because we have more valuable things on which to focus our attention

Insight Learning (Reasoning)

Insight learning refers to the sudden realisation of a solution a problem by thought without any real trial and error.

It is also known as reasoning.

It is a type of problem solving that happens all of a sudden by standing the relationship of various parts of a problem.

It is the most complicated form of learning. Insight learning was first researched by Wolfgang Kohler.

It is a form of cognitive learning, where animals use insighttl accomplish something.

It is achieved through cognitive processes.

It occurs when one suddenly realizes, on how to solve a problem It involves gradual shaping. It results in a long-lasting change.

Properties of Insight Learning

Insight learning has the following properties:

1. Insight learning is sudden and complete.
2. Performance is smooth without errors.
3. Principles learned by insight can be easily applied to other problems.
6. It leads to change in perception.
7. With insight, the organisms tend to perceive a pattern or organization.
8. It is related with higher order animals and not with lower animals.
9. Age influences insight learning.

Insight Learning by Kohler's Experiment

Kohler's experiments demonstrate the role of intelligence and cognitive abilities in higher learning and problem solving situation. He devised a number of experiments, A few of them are the following:

Kohler's Experiment 1

1.Kohler put the chimpanzee, Sultan inside a cage.

2.A banana was hung from the roof of the cage.

3.A box was placed inside the cage.

4.The chimpanzee tried to reach the banana by jumping, but could not succeed.

5.Suddenly, he got an idea and used the box as a climbingplatform.

6.He placed it just below the hanging banana, climbed on it and reached the banana.

Kohler's Experiment - 2

1. Kohler put the chimpanzee, Sultan inside a cage.
2. A banana was hung from the roof of the cage. 3. He placed two to three boxes inside the cage. The chimpanzee placed one box over the other and reached the banana.

Kohler's Experiment - 3

1. In a more complicated experiment, the banana was placed out. side the cage of the chimpanzee.
2. Two sticks, one longer than the other were placed inside the cage.
3. One stick was hollow at one end so that the other stick could be thrust into it to form a long stick.
4. The banana was kept at a distance that it could not be picked up by any one of the sticks.

Associative Learning

Associative learning is the ability of animals to associate one environmental feature with another. Memory is the key to all associative learning. Associative learning is a learned behaviour.

It is a learning to associate one stimulus with another. In one type of learning, an animal learns to link a particular lus to a particular outcome.

For example, a dog may expect to go for a walk, when the owner picks up the leash.

In trial and error learning, an animal learns to associate one of its behaviour with a positive or negative effect.

Eg. A white footed mouse will avoid eating caterpillars with spe. cific colours after getting a bad experience with a distasteful monarcJ butterfly caterpillars. It occurs when you learn something based on a new stimulus.

Types of Associative Learning

There are two types of associative learning. They are as follows:

l. Classical conditioning

2. Operant conditioning

Classical Conditioning

The components of classical conditioning are as follows:

Unconditioned stimulus (UCS)

Unconditioned response (UCR)

Conditioned stimulus (CS)

Conditioned response (CR)

Neutral stimulus (NS)

Unconditioned stimulus - The unconditioned stimulus is one that unconditionally, naturally and automatically triggers a response. Eg. Food given to unconditioned dog.

Unconditioned Response - The unlearned response that occurs naturally in response to the unconditioned stimulus. Eg. Salivation by unconditioned dog on eating food Conditioned stimulus - A previously neutral stimulus that, after becoming associated with the unconditioned stimulus eventually comes to trigger a conditioned response.

Salivation on hearing the sound of a bell.

Neutral stimulus - A stimulus initially does not elicit respo be conditioned. Eg. Bell sound before conditioning

Principles of Classical Conditioning

The following are the principles of classical conditioning Acquisition Stimulus generalization Discrimination Extinction Spontaneous recovery