Suva Sangam College
Year: 13
Biology

Strand 2: Living Together
Sub-strand: Organism and the Environment

Week 1: Monday (05/07/21)-Friday (09/07/21)

Achievement Indicators:

1. *Explain with examples and differentiate between environment and ecosystem, habitat and niche, population and community.*

Revision of terms

Environment	Biotic and abiotic surrounding of an organism or population.
Ecological niche	A role of and position of a species in its environment: how it meets its need for food and shelter, how it survives and how it reproduces.
Habitat	The area or natural environment in which an organism or population lives.
Population	A group of organism which lives in a particular geographical area at any given time and have the capability to interbreed.
Community	A group of organisms or populations living and interacting with one another in a particular environment.
Ecosystem	A biological community of interacting organisms and their physical environment.
Gause's Exclusion Principle	States that two species that compete for the exact same limiting resources cannot stably coexist.
Zeitgeber	Any external or environmental agent such as light and temperature that synchronises an organisms biological rhythms to the earths.
Entrainment	The process by which the internal clock becomes reset by rhythmic environmental influences. It allows: ➢ Organisms to adjust to seasonal changes in the time of dawn or dusk. For example, as the day lengthens the diurnal animals would become active while nocturnal animal become active at night. ➢ Migratory organisms to continually update their clock which would otherwise get out of the phase.

Exercise:

1. Arrange these levels of organization in order from 1 to 4 starting with the simplest.

   Organism Community Ecosystem Population

   _____ _____ _____ _____

2. Identify the level of organization.

   a. Group of bats living in a cave _____

   b. Red-eyed tree frog _____

   c. Insects, fish and algae in a lake _____

   d. An ocean _____

3. State the examples of the following:

   i. Ecosystem-

   _____

   _____

   ii. Habitat-

   _____

   _____

   iii. Niche-

   _____

   _____

   iv. Population-

   _____

   _____

   v. Community-

   _____

   _____

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Week 2: Monday (12/07/21)-Friday (16/07/21)

Achievement indicators:

1. *Describe different rhythmic processes that result due to change in season, time and environment.*

1. BIOLOGICAL TIMING

- is the responses of organisms in harmony with cyclical changes in the environment.

Organisms synchronise its activities to these rhythms:

i. **Exogenous**: A rhythm that is control by the external, environmental stimuli detected by the organisms.
ii. **Endogenous**: A rhythm that is controlled by an internal biological clock.
iii. **Combination**: of both endogenous and exogenous.

Biological clock

- An internal timing system which continues without external time cues, and controls the time of activities of plants and animals.

- The biological clock in animals is found in the hypothalamus of the brain and are:
  -
  Sensitive to environmental cues - very accurate
  - Can be stopped and reset - inherited
- Biological clock control certain regularly, repeated, rhythmic, cyclic, or periodic occurrences like:

Daily cycle (circadian rhythms)

Linked to the day – night cycle which responds to the revolution of the earth on its own axis. For example, blooming of various flowers at particular times of the day and activity of animals at different times of the day.

i. **Diurnal** – active during the day, inactive at night
ii. **Nocturnal** – active at night, inactive during the day
iii. **Crepuscular** – active at dawn and dusk
iv. **Arrhythmic** – no regular pattern – tend to be found where changes in the microclimate are negligible

Lunar cycle (circamonthly rhythm)

- Linked to the rotation of the moon around the earth.

For **example**: Entry of young salmon into saltwater from fresh water during new moon.

Annual cycle (circannual rhythm)

Linked to seasonal changes in the environment occurring due to tilting of the earth which rotates around the sun; examples are migrations and dormancy

Exercise:

1. Where is the biological clock found in animals? And what are the functions?

   _____

   _____

   _____

   _____

   _____

2. What is the name given to external events that play a role in rhythmic activities? Give an example.

   _____

   _____

   _____

3. Give an example of the following rhythms.

   i. Diurnal- _____

   ii. Nocturna- _____

   iii. Crepuscular- _____

   iv. Arrhythmic - _____

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Week 3: Monday (19/07/21)-Friday (23/07/21)

Achievement indicators:

1. *Explain the types of dormancy and hibernation in plants and animals*

Annual cycle (circannual rhythm)

Examples are:

i. **Migration**: some birds migrate to warmer latitudes as winter approaches and back to temperate lands in spring.

ii. **Dormancy**: refers to the state of reduced metabolic activity that many organisms enter; either while facing environmental stress or when likely to face such stress.

a. **Dormancy in plants:**

- period in which a plant stops growing in order to survive inhospitable conditions such as water shortage and freezing temperatures.
- For **example**, frangipani plant, *Plumeria rubra* sheds its leaves annually and displays its stark branches.

b. **Hibernation:**

- refers to a lengthy period of inactivity (sleeping) in animals.
- Animals undergoing hibernation phase will have a lower body temperature, slower breathing and conserves food by living off fat deposits.
- This prevents damage from low temperatures.

Biological clocks are used for:

- Control of daily rhythms of the body
- Reproduction timing

- For **example**: Some animals sheds fur in summer and grows thick warm covering fur in winter.

c. **Brumation:**

- is a term used for the hibernation-like state that cold-blooded animals such as reptiles undergo during cold weather.
- However, it differs from hibernation in the metabolic processes involved.

d. **Aestivation/Estivation-**

- a form of hibernation that animals resort to in order to help avoid damage from high temperatures.
- Aestivators are snails, earthworms, bees, toads, lizards, crocodiles etc.

- Preparing for migration by eating plenty of food
- Preparing for winter by storing food, increasing thickness of coat and hibernating
- Navigating by the sun or stars

Examples of Circadian Rhythms in Humans

1. Sleep – awake rhythms: these vary in individuals with age. For example, children sleep for long hours compared to adults.
2. Heart rate: keeps in step with the temperature.
3. Pain: sensitivity to pain varies during the day. For instance, we are more sensitive to the pain of cold at night than to the pain of a needle at noon.
4. Kidney excretions: follows rhythm of excretion of chemicals such as calcium and potassium.
5. Birth and death: birth or death rate is high during early mornings.

Exercise

1. Differentiate between estivation and brumation with an appropriate example of each.

_____

_____

_____

_____

_____

2. The increased movement of fireflies and mosquitos just before sunrise and just before sunset is an example of _____.

3. The innate mechanism which controls fat deposits in polar bears before hibernation is a result of the exogenous clock.

   i. Name an exogenous cue that results in this physiological change.
   _____
   _____

   ii. Describe how endogenous clocks differ from the exogenous clocks.
   _____
   _____
   _____
   _____

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Week 4: Monday (26/07/21)-Friday (30/07/21)

Achievement indicators:
1. *Identify and describe different movements in organisms as a response to stimulus.*
2. *Differentiate between homing and migration with examples*

2. BIOLOGICAL ORIENTATION

Orientation is the act of turning or moving in relation to an abiotic factor in the environment.

A) Biological Orientation in Plants

Type	Description	Example
Tropisms	refers to the growth response of plants towards or away from environmental stimulus coming from one direction.	Growth of plant shoot towards light is positively phototropic.
Taxes	refers to the movement of the whole organism towards or away from the stimulus coming from one direction. This is usually associated with the animals which are free to move. Single-celled or simple algae which swim with flagella or cilia show taxic movements.	Euglena (a green flagellate) swims towards light, so we say it is positively phototaxic.
Nastic Responses	these are responses of plant to stimuli that do not come from any particular direction. The direction of the response is not dependent on the direction of the stimuli.	collapsing of Mimosa pudica leaves when disturbed
Kinesis	is a movement or activity of a cell or an organism in response to a stimulus. Unlike taxis, the response to the stimulus is non-directional	The locomotion of woodlice in relation to humidity. With increased humidity there is an increase in the percentage time that the wood lice will remain stationary.

B) Biological Orientation in Animals

i) Migration
Migration is a behavior in which animals move from one location to another in a seasonal pattern.

Features of migratory animals include:
- They are usually active.
- They usually migrate over long distances.

- They often makes two way trip.

They usually migrate on either regular or seasonal basis.

- They often occur at a definite stage in the life cycle.

Example of Migration

1. Salmon: are anadromous, spending most of their adult life in the sea and migrating up river to spawn. Salmon return to the same river in which they hatched as a fry. They identify their natal steam by its unique chemical properties.

ii) <u>Homing</u>

Homing is the ability of animals to finds its way home over the unfamiliar territory.

Homing is not clearly distinct from migration. From example, the journey of salmons could be regarded as migration and homing as well.

Examples of homing

1. Frogs and toads make their way back every breeding season to the same pond in which they hatch.

Significance of Migration

Migration costs energy however, it provides benefit to whales and marine life.

For example:

1. Compensating advantage: waste product of humpback whales stimulates the growth of phytoplanktons which is a food source to many marine life.

   Humpback whales benefit by moving away from its predators and is able to provide its offspring an opportunity to be born in a secured environment.

<u>Exercise</u>

Describe plant and animal orientation responses and explain how they contribute to the animal's survival:

1. tropism (plant)

   _____

   _____

2. nastic response (plant),

   _____

   _____

3. homing (animal).

   _____

   _____

4. migration (animal)

   _____

   _____

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Week 5: Monday (02/08/21)-Friday (06/08/21)

Animal Navigation
In order for animals to navigate, they need to have a sense of direction or location.

Some of the methods used by animals to navigate are:

Cue	Explanation	Example
Visual cues:	Many animals learn their surrounding just as we learn the routes of streets, shops and our home. Birds that migrate learn the shape of coastlines and other topography of their route. Other animals learn signs such as streams, trees or any other object that would direct them towards their home.	A digger wasp always memorises the landmarks around its burrow.
Chemical navigation	Sensitivity to a chemical or chemical gradient that allows an organism to find it way back to nesting sites/home.	Dogs follow scent to find home and ants leave chemical trails for other ants to follow.
Solar navigation	Using the position of the sun as a compass also requires a sense of timing, as the sun will move throughout the day and the organism will need to adjust its path accordingly. Polarised light at sunrise and sunset may play an important role especially in calibrating organisms' compasses.	Many birds and other animals such as honeybees use the sun as a compass which suggests that they have an in-build clock.
Magnetic fields:	This requires an organ capable of detecting the earth's magnetic field. Iron-rich magnetite crystals which orient themselves according to the earth's magnetic field are often found in specialised brain cells of animals that use the earth's magnetic field as a compass for navigation.	Homing pigeons have an ability to follow the magnetic field lines of the earth. If a magnet that deflects the normal magnetic field, is attached to the head of the homing pigeons, the birds can be made to fly by the same degree of deflection.
Star navigation	Involves using the position of the stars as a compass and a sense of timing to navigate.	This was showed by placing the bird into a planetarium, a dome

	A sense of timing is required as the stars will move throughout the night so that the organism needs to be able to adjust its path accordingly.	like theatre that has star projected on its roof. The birds in their cage orientated to the artificial sky. Further experiments showed that birds only oriented to the bright northern stars as these move the least during the night.
Sound used as sonar	is a system that sends sound waves to locate objects under the surface of the water.	bats navigate by using high pitched squeaks which bounce off objects in their path. Similarly, humpback whales orientate by sonar since they have excellent hearing

Suggested Readings/Videos

https://www.pathwayz.org/Tree/Plain/METHODS+OF+NAVIGATION
https://www.youtube.com/watch?v=EbHSkZySTBw
https://www.youtube.com/watch?v=sHmdzXjgrHA
https://www.youtube.com/watch?v=J_XaHppsBWU

Exercise

In North America, monarch butterflies perform one of the longest migrations known in insects. They spend the northern hemisphere in the northern United States, but migrate south to Mexico for the winter. The butterflies feed extensively during the migration.

1. Describe a change in an environmental cue that could trigger the monarchs migrations.

   _____

   _____

   _____

2. Discuss how this migration is of benefit in the life cycle of the monarch butterflies.

   _____

   _____

   _____

3. Explain how the monarch butterflies can follow the precise route every time they migrate.

   _____

   _____

   _____