

LESSON NOTES

WEEK 1

YEAR 13 BIOLOGY

Strand 2	LIVING TOGETHER
Sub strand	2.1 Organisms and the Environment
Content Learning Outcome	Understand the relationship between biotic and abiotic environment as a system of inter-dependent components

2.1 Organisms and the Environment

What is Biological timing?

- Time of various biological processes
- Organisms have an internal clock, called a biological clock.
- This clock predicts the environmental changes and prepares the organism to respond to it.
- The clock can be set by **exogenous** (external) stimuli, or by **endogenous** (internal) rhythm.

Note

- Exogenous stimuli are called **Zeitgebers** and includes light, temperature, and length of day.
- Endogenous clocks are responses to an internal rhythm.
- The biological clock in birds, mammals and reptiles is located in the **hypothalamus** of the brain.

Examples of Biological Clocks

1. Daily cycle /circadian rhythms (linked to the day and night cycle -24 hr)

- Diurnal – active during the day
- Nocturnal – active at night
- Crepuscular – active at dawn and dusk
- Arrhythmic – no regular pattern (found where - changes in the microclimate are negligible).

2. Lunar cycle /circamonthly rhythm
(linked to the rotation of the moon)

- **E.g.** Entry of young salmon into saltwater from fresh water during new moon.
- The spawning behaviour of palolo worms and grunion fish
- The worms are vulnerable during mating and by coordinating their mating behaviour to an exogenous factor such as tides, they avoid predators and increase chances of their reproduction.

3. Annual cycle /circannual rhythm
(linked to seasonal changes)

- E.g.**
- Migration**- organisms migrate to warmer latitudes as winter approaches.
 - Dormancy**- growth/development temporarily ceases due to the unfavourable environmental conditions.
 - Hibernation**- lengthy period of inactivity (sleeping) in animals.
 - Brumation**- hibernation-like state that **cold-blooded animals** such as reptiles undergo during **cold weather**.
 - Aestivation/Estivation**- form of hibernation that animals resort to in order to help avoid damage from **high temperatures**.

Biological Orientation

In Plants

1.Tropisms	Growth response of plants in response to a stimuli (phototropism)
2.Taxes	Directional movement of plants/animals in response to a stimuli. (E.g. Euglena)
3.Nastic response	Response of a plant that does not depend on the location of the stimulus. (E.g. Venus fly trap)
4.Kinesis	Non directional movement of an organism in response to an external stimulus (E.g. Humidity)

In

- For example, certain wasps recognise landmarks around their nest, if their nest is moved they will still return to its original location.

In Animals

1. Migration

- Large scale seasonal movement of organisms from one place to another.
- Reason - Most species migrate in search of food, water or for mating.
- E.g. species of fish (salmon), birds

Advantage	Disadvantage
-Provides food for other organisms -Regulate the number of organisms in an ecosystem - Better breeding conditions - Favorable conditions for growth (temp, climate etc.)	-Predation -Cost of energy -Starvation during the journey

(geese), green turtles and Zooplanktons.

Significance of Migration

2. Homing

- The ability of an organism to return to its home/ nest site over unfamiliar territory
- Not clearly distinct from migration i.e. salmon fish might be homing in natal (birth) stream.
- Also a frequent activity for example, honeybees find their way back to the hives over distance of more than one kilometres.
- This distinguishes homing from migration.

3. Navigation

-Animals use multiple methods to determine direction.

Methods of navigation includes:

- **Visual Cues**

- Organisms remember familiar **landmarks**

- **Magnetic Fields**

- Act as a GPS unit for the homing pigeons

- Gives information about its position relative to the Earth's poles

- **Chemical navigation**

-requires smell to influence the behaviour of other members of the same species

-E.g. ants leaves a chemical trail for other ants to follow.

- **Solar Navigation**

-requires an internal biological clock that allows Bees and Birds to gauge the angle of the sun and use it as a compass

- **Star Navigation**

-migratory birds are able to orient themselves correctly to the arrangement/pattern of the stars

- **Sound Navigation/Echolocation**

-used by bats, dolphins and whales to determine the location of objects using reflected sounds.

Activity

1. Differentiate between Zeitgeber and Entrainment. (Pg. 93, Biology for All)

2. Some animals know it is time to migrate based on their body clock. What is the term for the clock used to determine migration times?

3. Which of the following describes the navigation technique of salmon fish?

- A. navigate by sensing magnetic fields
- B. use sun and stars

- C. use known landmarks
- D. navigate by smell

Strand 2	LIVING TOGETHER
Sub strand	2.1 Organisms and the Environment
Content Learning Outcome	B13.2 Understand the relationship between biotic and abiotic environment as a system of inter-dependent components

2.1 Organisms and the Environment

What is Photoperiodism?

- Plant development in response to day length
- Allows flowering or switch to reproductive mode
- Useful in keeping some **plants** in vegetative growth, to obtain higher yield of tubers, rhizomes etc.

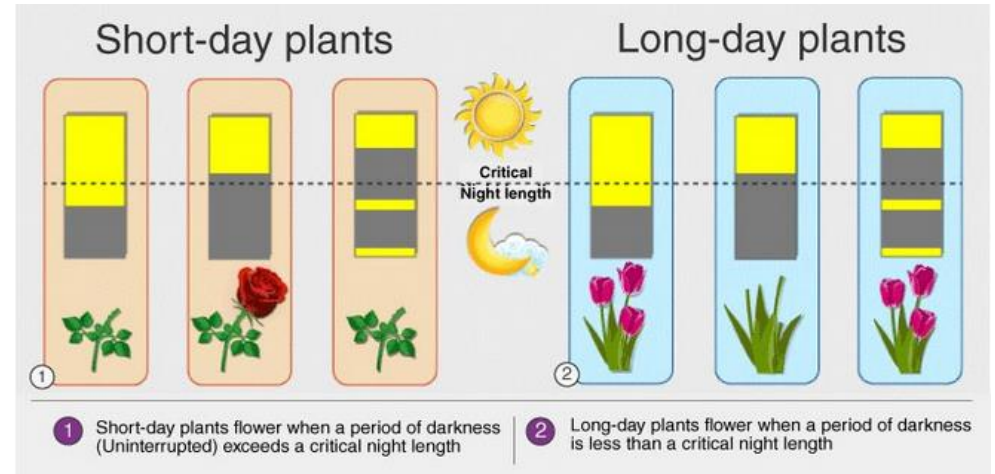
Example of Photoperiodism in Plants

1. Short day plants - plants flower only when the day length is less (longer period of darkness) e.g. strawberry, rice etc.

2. Long day plants - plant that flowers only after being exposed to light periods longer than a certain critical length (shorter period of darkness) e.g. Spinach, lettuce etc.

3. Day neutral plants- plants which flower independent of their day-length e.g. tomatoes, roses etc.

Study the image on Photoperiodism given below.



Source: <https://byjus.com/biology/photoperiodism/>

Note

- Photoperiodic Induction Involves Phytochrome (photoreceptors in plants used to detect light).
- In experiments, when the wavelengths of light were used to interrupt the night, **red light** was found to be most effective in preventing flowering in short-day plants and inducing flowering in long-day plants.

Post-germination changes in growth

1. Vernalisation – Plants rely on prolonged cold periods/ low temperatures for flowering or seed production.

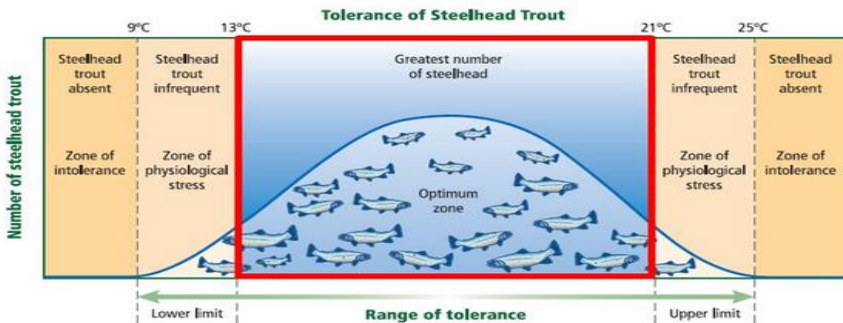
2. Diapause - period of arrested development, common in insects native to climate with a cold season e.g. black field cricket, eggs require several weeks of chilling before they hatch.

Law of Tolerance

- Each species has a set of environmental conditions within which it can best survive and reproduce.
- For each abiotic factor (temperature, light, pH and soil type), an organism has a range of tolerance within which it can survive.
- This range is known as the species **tolerance range**.
- Take temperature, for example. Polar bears survive very well in low temperatures (cold) but would die from overheating in the tropics.

Study the image given below on Tolerance range

➤ Steelhead trout live in cool, clear coastal rivers and streams with the ideal range of water temperature for steelhead trout is between 13°C and 21°C



Source: <https://slideplayer.com/slide/8944817/>

Biome

- Large community of vegetation and wildlife adapted to a specific climate
- Determined partially by altitude and primarily by temperature and precipitation.

Categorized into two major groups

1. Aquatic biome – water is the common link and it makes up the largest part of the biosphere.

Freshwater region	Plants and animals in freshwater regions are adjusted to low salt content e.g. ponds and lakes, streams and rivers, and wetlands
Marine region	Covers about three-fourths of the Earth’s surface including ocean, coral reefs, and estuaries.

2. Terrestrial biome – based on land and each biome has a distinct type of plants and animals. Distribution is determined by three factors: temperature, water, and sunlight

Activities

Q1. Explain the following terrestrial biomes (Year 13, Biology for All Pg. 103-104)

Tundra biome	
Forest biome	
Dessert biome	
Grasslands	

Q2. What two factors define a Biome?

LESSON NOTES

WEEK 3

YEAR 13 BIOLOGY

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Content Learning Outcome	Explain tolerance and its role in creating biomes and distribution of plant and animal species in Fiji.

2.1 Organisms and the Environment

The following factors influence Biomes

- **Altitude** - different plants grow at different **temperatures** within the same biome - the higher the altitude the lower the temperature.
- **Rainfall** - different types and amounts of plants grow in different parts of the biome due to the amount of rainfall received.
- **Light**- sunlight hours also vary with latitude and plants are entirely dependent on sunlight for growth and development.
- **Continental drifts**- alters ocean current, heat transport, global atmospheric circulation (more glaciers over land, higher albedo and cooler temperatures).

Note - The movement of the earth's **tectonic plate** causes the continents to move or shift.

This results in a change in ocean current which in turn generates more heat e.g. the creation of the volcanic eruptions increases the degree of carbon dioxide (CO₂) and sulfur dioxide (SO₂) in the atmosphere leading to a rise in the temperature levels globally.

Climate

- The long-term pattern of weather (min 30 years) in a given area.

Plants and animals are distributed in the following zones:

- 1. Wet zone** - the windward climate with high rainfall that is on the southern and eastern lowlands of larger islands
- 2. Dry zone** - leeward climate with low rainfall and marked dry season that is on the northern and western lowlands of mainlands.

Soil type in Fiji

1. Young sandy soils- found in the coastal areas of the islands and are derived from sea deposits.
2. Soils derived from river deposits - **alluvial soils**, generally fertile, deep, and **agriculturally very valuable**.
3. Shallow and black soils- formed from the parent materials that are rich in nutrients (magnesium and calcium). It is good for pastures or vegetable cultivation.
4. Sandy or silt soils- derived from **volcanic ash**. They are very fertile, often acidic and occur in high rainfall areas.
5. Clay soils- derived from basic materials and often acidic. They are low in nutrient status however, can be cultivated if properly fertilized.
6. Gravel and clay soils- covered with ferns, derived from strongly decomposed materials.
7. Sandy and clay sub soils - derived from acidic parent materials.

Flora and fauna distribution in Fiji

- The **flora** comprises hardwood trees (mahogany), mangroves, bamboo, balabala, yaka and palms.
- The **fauna** is made up of native mammals like bats, crested iguanas and geckos.

Read/Research more on the flora and fauna distribution in Fiji. It explains about the endemic and exotic species. (Year 13 Biology for All -Pg. 106-109)

Community Interactions

1. Interspecific Relationships - occurs between members of different species.

Interspecific competition can lead to:

- a) Extinction of the weaker species
- b) Species diversification which will diversify their requirements and minimise competition.

2. Intraspecific Relationships - occurs between members of the same species

Intraspecific competition can lead to:

- a) Decrease in reproductive rate: due to competition for mates, breeding sites and indirectly due to competition for food.
- b) Decrease in population density: due to weaklings are eliminated during intense competition and an increase in death rate.
- c) Reduced niche diversification. **The competitive exclusion principle states:** no two species can occupy the same niche in the same habitat.

Competition

- Rivalry among or different species for natural resources
- Affects population size

Examples of Competition

- Competition for **Food**

- **Mates**- males compete for females either by aggressive behaviour or display.
 - **Aggressive behaviour:** males fight to win over females.
 - **Display:** defined as the prominent exhibition of special markings or parts of the body, stereotyped movement and posturing. For example male peacock has bright and attractive feathers, hence wins the females (dull feathers).

- **Territory** - an area defended by an animal, a pair or a group for food source, to build a nest or to obtain a place for mating.
- **Competition during succession**- For example, a forest fire which destroyed all organisms. Competition would begin and one species after the next would dominate the area in succession until stability is established.
- **Competition during obstruction**- compete by actively inhibiting the growth of the other species e.g. fungi produce antibiotics which inhibits the growth of bacteria.
- **Competition during exploitation**- organisms interact indirectly as they compete for resources.

Example

1. Parasitism- parasites live at the expense of the host, exploiting and harming the organism.
2. Predation - Predators show skills e.g. a spider spins almost invisible webs to trap insects.
 - Plants also exhibit predatory behaviour- these plants are known as carnivorous (Venus fly trap).

Activities

Q1. Which of the following resources is not relevant for interspecific competition?

- A. food
- B. mate
- C. territory
- D. water

Q2. Explain how the fauna and flora of an area near volcanic eruption change in the years to come.