EDUGROSS
WISDOMISING KNOWLEDGE

EXERCISE PAGE NO.239-240

1. How is diapause different from hibernation?

Solution:

Diapause is a phase of suspended development to deal with undesirable conditions. Several species of Zooplankton and insects display diapause to pass through extreme climatic conditions while in their development stage. On the other hand, winter sleep or Hibernation is a resting phase wherein animals escape winters by hiding themselves in their shelters. They do so by entering a state of inactivity achieved by decreasing their metabolism. This process of hibernation is observed in squirrels, bats and some rodents.

2. If a marine fish is placed in a fresh water aquarium, will the fish be able to survive? Why or why not?

Solution:

The chances of survival of marine fish will reduce if placed in a fresh water aquarium as their bodies are altered to higher salt concentrations as provided by marine environments. In a fresh water environment, fishes fail to regulate the water which enters the body through the process of osmosis. Due to the presence of a hypotonic environment outside the fish's body, water enters their body which causes their body to swell leading to the death of the marine fish.

3. Most living organisms cannot survive at temperature above 45 degree C. How are some microbes able to live in habitats with temperatures exceeding 100 degree C?

Solution:

Thermophiles or Archaebacteria are ancient forms of bacteria that are present in deep sea hydrothermal vents and hot water springs. They are able to withstand the high temperature (exceeding 100 degree C) as their bodies have adapted to these extreme environmental conditions. Such entities comprise of specialized thermo-resistant enzymes that perform metabolic functions which do not get destructed at these extreme temperatures.

4. List the attributes that populations possess but not individuals.

Solution:

A group of entities belonging to the same species, residing in a specific geographical area at a particular time, together functioning as a unit can be termed as a population.
Listed below are the attributes that a population exhibits:

- Natality or Birth rate
  It can be given by the ratio of live births in a particular area to the population of that area. Birth rate can be expressed as the number of individuals added to the population in terms of members of the population
- Mortality or Death rate
  It is the ratio of deaths in a region to the population of a region. Death rate can be expressed as the loss of individuals in terms of members of the population
- Age distribution
  It can be given by the percentage of individuals of various ages in a given population. A population consists of individuals at any given time, and are present in different age groups. Typically, an age pyramid can be used to depict the age distribution pattern.
- Sex ratio
  It is the count of females or males per thousand individuals
- Population density
  It is given by the number of individuals of a population per unit are at a particular time.

5. If a population growing exponentially double in size in 3 years, what is the intrinsic rate of increase (r) of the population?

Solution:

If adequate quantity of food resources are available to individuals in a population, it grows exponentially. The integral form of exponential growth equation can be used to estimate the exponential growth, which is as follows:

$N_t = N_o e^{rt}$ ---------- equation (1)

Where, N_t is the population density after 't' time

N_o is the population density at time zero

e is the base of natural logarithm = 2.71828 r is the intrinsic rate of natural increase

Let the current population density be 'x'

∴ The population density after two years will be 2x and t given is 3 years

Substituting these values in equation (1)

$\rightarrow 2x = x\, e^{3r}$

$\rightarrow 2 = e^{3r}$

Applying log on both the sides, we get

$\rightarrow \log 2 = 3r \log e$

$\rightarrow r = \frac{\log 2}{3 \log e}$

$\rightarrow r = \frac{0.301}{3 \times 0.434}$

$\rightarrow r = 0.2311$

Therefore, the intrinsic rate of natural increase of the population is 0.2311

6. Name important defence mechanisms in plants against herbivory.

Solution:

A state of feeding on plants is known as herbivory. Many plants have evolved mechanisms both chemical and morphological, to safeguard themselves against the act of herbivory. Listed below are defence mechanisms of few plants:

Chemical defence mechanisms:

- Caffeine, nicotine, opium, and quinine are some chemical substances that are produced in plants in response as part of their defence mechanism
- All of the parts of Calotropis weeds consists of lethal cardiac glycosides that demonstrate to be fatal if consumed by herbivores.

Morphological defence mechanisms:

- Opuntia or cactus leaves are altered into thorns or sharp spines to prevent herbivores from feeding on it
- Margins of leaves in some plants are spiny, having sharp edges, preventing herbivores to feed on them
- Sharp thorns with leaves are found in Acacia to prevent herbivores from feeding on them

7. An orchid plant is growing on the branch of mango tree. How do you describe this interaction between the orchid and the mango tree?

Solution:

An epiphyte or air plants are entities growing on other plants. An orchid growing on the branch of a mango tree is an epiphyte. Such plants derive their nutrition and moisture from air, water and rain or from the debris around it and not from the plant on which it is growing. Hence, the relationship between a mango tree and an orchid is an example of commensalism wherein one species receives its benefits and the other stays unaffected. In the given interaction, the orchid is benefitted as it gets physical support from the mango tree but the mango tree is unaffected.

8. What is the ecological principle behind the biological control method of managing with pest insects?

Solution:

Predation is the ecological principle behind the biological control method of managing with pest insects. Predation is referred to as the biological interaction between a predator and a prey wherein the predator feeds on the prey, thereby regulating the population of pest insects. Example – The Gawbusia fish checks the mosquito larvae in water bodies.

9. Distinguish between the following:
(a) Hibernation and Aestivation
(b) Ectotherms and Endotherms

Solution:

The differences are as follows:

(a) Hibernation and Aestivation

Hibernation	Aestivation
Also known as winter sleep, it is a state of reduced activity observed in some entities to escape the extreme cold climatic conditions	Also known as summer sleep, it is a state of reduced activity noticed in some entities to escape the dehydration as a result of heat in summers
Examples – Squirrels and bears found in cold regions hibernate in winters	Example – Snails and fishes aestivate in summers

(b) Ectotherms and Endotherms

Ectotherms	Endotherms

The body temperature varies with their surroundings	Body temperature remains constant
They are cold blooded-entities	They are warm-blooded entities
Examples – reptiles, fishes, amphibians	Example – mammals and birds

10. Write a short note on
(a) Adaptations of desert plants and animals
(b) Adaptations of plants to water scarcity
(c) Behavioral adaptations in animals
(d) Importance of light to plants
(e) Effect of temperature or water scarcity and the adaptations of animals.

Solution:

(a) Adaptations of desert plants and animals

Desert plants:
Some of the severe conditions typically found in a deserts are scorching heat and water scarcity. Plants that are found in deserts have suitably adapted to this as they have an extensive root system to tap the underground water. These plants possess sunken stomata on leaf surfaces and thick cuticles to decrease transpiration. A plant known as Opuntia has leaves that are completely alerted into spines where photosynthesis is performed by the green stems. These plants of deserts have specialized pathways known as CAM or the C4 pathway to manufacture food which facilitates the stomata to stay closed during the day to decrease the water loss caused through the transpiration process.
Desert animals:
Lizards, kangaroo rats, snakes are some animals found in deserts which have adapted appropriately to their habitat. For instance, the Kangaroo rat inhabiting the Arizona deserts never drinks water in its life and has the potential to concentrate its urine to conserve water. Snakes and Desert lizards have adapted in a way that they lounge in the sun early in the morning and burrow themselves in sand in the afternoons to escape the heat of the day, to prevent water loss.

(b) Adaptations of plants to water scarcity
Some of the severe conditions typically found in a deserts are scorching heat and water scarcity. Plants that are found in deserts have suitably adapted to this as they have an extensive root system to tap the underground water. These plants possess sunken stomata on leaf surfaces and thick cuticles to decrease transpiration. A plant known as Opuntia has leaves that are completely alerted into spines where photosynthesis is performed by the green stems. These plants of deserts have specialized pathways known as CAM or the C4 pathway to manufacture food which facilitates the stomata to stay closed during the day to decrease the water loss caused through the transpiration process.

(c) Behavioral adaptations in animals

Some entities that are affected by the fluctuations in temperature experience adaptations namely aestivation, hibernation, migration to escape environmental pressure to adapt to their natural habitat. These adaptations in the behavior of an entity is termed as behavioral adaptations. For instance, ectothermal and a few endothermal animals display these adaptations.

Some cold blooded animals, ectotherms such as amphibians, fish, reptiles have their temperatures varying with their surroundings as seen in Desert lizard, where they lounge in the sun in the early hours of the day and burrow themselves in sand when the temperature begins to rise in the noon. Some warmblooded animals or endotherms such as mammals or birds escape the hot and cold weather conditions by hibernating in winters and aestivating in summers. They take shelter in burrows, caves etc to safeguard against these temperature variations.

(d) Importance of light to plants

The ultimate source of energy for plants is sunlight. Plants are referred to as autotrophic entities. They require light to perform photosynthesis. Light has a critical role in producing photoperiodic response that takes place in plants. These plants respond to the changes in the light intensity in different seasons to be able to meet their photoperiodic requirements for the process of flowering. Also, light has a significant role in aquatic habitats for vertical distribution of plants in the sea.

(e) Effect of temperature or water scarcity and the adaptations of animals

One of the most important ecological factors is temperature which varies from place to place. The variation in temperature affects the distribution of animals on the planet. Eurythermals are the animals that can tolerate a range of temperatures while stenothermal animals are the ones which can withstand only a narrow range of temperature. In order to suit their natural habitats, animals also undergo adaptations. For instance, animals in cooler regions have short limbs and ears, helping to prevent heat loss from the body. Animals that are found in colder regions have thick fat layers underneath their skin, thick fur coats to prevent heat loss.

Some entities that are affected by the fluctuations in temperature experience adaptations namely aestivation, hibernation, migration to escape environmental pressure to adapt to their natural habitat. These adaptations in the behavior of an entity is termed as behavioral adaptations. Example, the Desert lizards are ectotherms, this means to say they do not possess a temperature regulatory mechanism to escape the variations in temperature. These lounge in the sun in the early hours of the day and burrow themselves in sand when the temperature begins to rise in the noon.

Another factor that expels animals to experience several adaptations to familiarize to their natural habitats is water scarcity. Lizards, kangaroo rats, snakes are some animals found in deserts which have adapted appropriately to their habitat. For instance, the Kangaroo rat inhabiting the Arizona deserts never drinks water in its life and has the potential to concentrate its urine to conserve water. Snakes and Desert lizards have adapted in a way that they lounge in the sun early in the morning and burrow themselves in sand in the afternoons to escape the heat of the day, to prevent water loss.

11. List the various abiotic environmental factors.

Solution:

Abiotic environmental factors are formed by all the non-living components of an ecosystem which includes the following:

- Temperature –
  It is one of the most significant factors which varies seasonally on land, progressively decreases from the equator towards the poles, from plains to the mountain tops. From sub-zero levels in polar areas to temperatures greater than 50 degree Celsius in tropical deserts in summers, their range is wide. Some unique habitats such as deep sea hydrothermal vents, thermal springs sees average temperature exceeding more than 100 degree Celsius. Entities who can withstand a range of temperatures are termed as eurythermals example – birds and mammals whereas stenothermals are entities who can bear a narrow range of temperature, example – polar bears.
- Water –
  Life cannot sustain without water. For marine entities, pH, water temperature, chemical composition etc is significant. It is also affected by water salinity that is less than 5 parts per thousand in inland water, 30-35 parts per thousand in sea etc
  Euryhaline are entities which can bear a wide salinity range whereas stenohaline are entities that can tolerate a narrow range of salinity. Most of the fresh water animals cannot sustain in sea water for long due to osmotic issues that arise due to high salinity and vice-versa
- Soil –
  Properties and nature of soil varies from place to place, depending on the following factors - climate
  -soil development process
  -Weathering process
  Characteristics such as grain size, aggregation, soil composition determine the water holding capacity and percolation of soil. Along with these, some other features such as pH, topography, mineral composition etc determine the type of type of plant that can grow in a specific habitat.
- Light –
  All autotrophs depend on light to carry out photosynthesis, releasing oxygen during the process. In forests, small herbs and shrubs are adapted to photosynthesis under very low light intensities as they are overshadowed by tall trees. Also, most plants depend on sunlight to meet their photoperiodic necessities for flowering. Several animals are dependent on diurnal and seasonal differences in light intensity as prompts for timing their reproductive, foraging and migratory activities. Light availability on land is closely associated with that of temperature, as Sun is the ultimate source. In deep oceans, it is dark perpetually. Spectral quality of solar radiation is necessary for life. For many entities, UV component of light is harmful. Different components of visible spectrum is available for marine plants active at different oceanic depths. Hence, different algae types such as brown, green and red algae occur at various depths in the middle, upper and lowest levels of water respectively.

12. Give an example for:
(a) An endothermic animal
(b) An ectothermic animal
(c) An organism of benthic zone

Solution:

(a) An endothermic animal – Crows, sparrows, cranes, cows, rabbits, rats etc
(b) An ectothermic animal – Fish such as amphibians, sharks, frogs, snakes, tortoise, lizards
(c) An organism of benthic zone – decomposing bacteria is an organism of benthic zone

13. Define population and community.

Solution:

Population – it can be defined as a group of individuals of the same species inhabiting a particular geographical area at a given time, functioning as a unit.

Community – it can be defined as a group of individuals of various species, living in a certain geographical region. These individuals can be dissimilar or similar, but cannot reproduce with members of other species.

14. Define the following terms and give one example for each:
(a) Commensalism
(b) Parasitism
(c) Camouflage
(d) Mutualism
(e) Interspecific competition

Solution:

(a) Commensalism
The interaction between two species wherein one species is benefited and the other remains unaffected in known as commensalism. Examples – Barnacles attached to a whale's body and an orchid growing on the branches of a mango tree

(b) Parasitism

The interaction between two species wherein one species is positively affected (typically the smaller one) and the other is negatively affected (typically the larger one) is known as Parasitism. Example – Liver fluke is a parasite living within the body of the host and deriving nutrition from it. Here, the parasite benefits from the host, as it derives nutrition from it while the host is affected negatively as the parasite reduces the host fitness causing its body to get weak.

(c) Camouflage

It is a tactic taken up by the prey to escape from predators. Intrinsically, organisms are colored to easily blend with their surroundings and escape from their predators. Several insects and frog species camouflage to escape their predators.

(d) Mutualism

An interaction between two species wherein both species involved are benefited is Mutualism. Example – lichens exhibit a mutual symbiotic relationship between blue green algae and fungi. Here, both are equally benefited from each other.

(e) Interspecific competition

An interaction between individuals of different species wherein both are negatively affected is interspecific competition. Example – The competition between resident fishes and flamingoes in South American lakes for shared food resources, that is, zooplankton

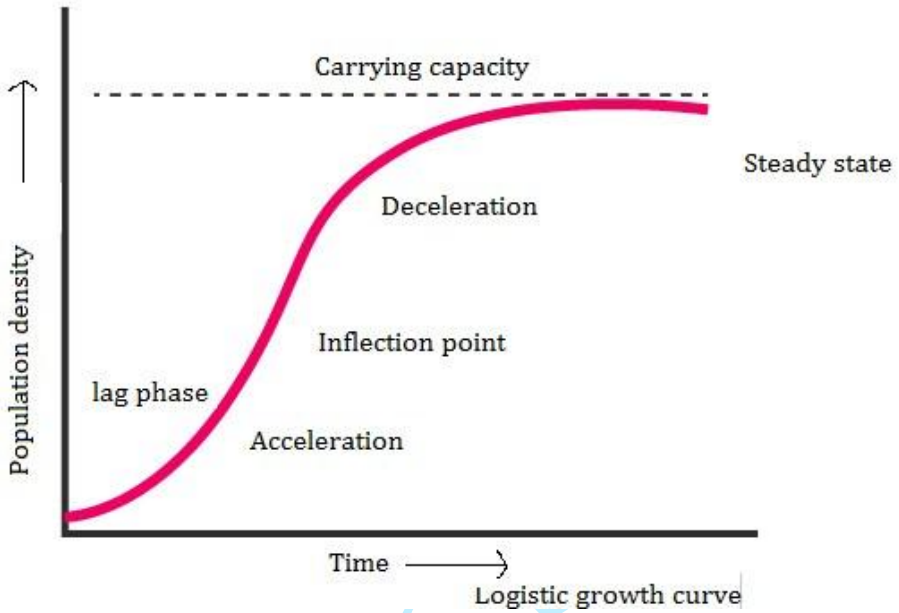
15. With the help of suitable diagram describe the logistic population growth curve.

Solution:

The logistic population growth curve is usually observed in yeast cells cultivated in laboratory conditions and includes five phases, namely:

- The lag phase – the population of yeast cell is small initially as resources are limited in the habitat
- Exponential phase – in this stage, the population of the yeast cell suddenly rises as a result of rapid growth leading to an exponential population growth due to availability of enough food resources, consistent favorable environmental conditions without any interspecific competition. This results in the curve rising upwards steeply.
- Positive acceleration phase – at the start of this phase, the cell growth is limited. The yeast cell adjusts to the new environment and grows its population
- Negative acceleration phase – the environmental resistance increases and the growth rate of the population declines as a result of an increased competition between the yeast cells for shelter and food.
- Stationary phase – The population is stable in this phase. The count of cells generated in a population is equivalent to the number of cells that die out. Additionally, the species' population

is said to have touched nature's carrying-capacity in its habitat. S-shaped growth curve is also referred to as the Verhulst- pearl logistic curve.



16. Select the statement which explains best parasitism.
(a) One organism is benefited.
(b) Both the organisms are benefited.
(c) One organism is benefited, other is not affected.
(d) One organism is benefited, other is affected.

Solution:

(d) One organism is benefited, other is affected
Parasitism is a type of interaction between two species wherein one species (parasite) gets benefited while the other species or the host is negatively affected/harmed. Example – Lice or ticks(parasites) found on human body(host) is an example wherein lice derives its nutrition by feeding on the humans' blood causing the fitness of the individual(host) to reduce, harming the human body.

17. List any three important characteristics of a population and explain.

Solution:

A group of entities belonging to the same species, residing in a specific geographical area at a particular time, together functioning as a unit can be termed as a population. Example – All humans living in a particular area at a specific time comprise the population of humans.
Listed below are the attributes that a population exhibits:

- Natality or Birth rate
  It can be given by the ratio of live births in a particular area to the population of that area. Birth rate can be expressed as the number of individuals added to the population in terms of members of the population
- Mortality or Death rate
  It is the ratio of deaths in a region to the population of a region. Death rate can be expressed as the loss of individuals in terms of members of the population
- Age distribution
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