

# CHAPTER 13

## ORGANISMS AND POPULATIONS

### Topics Discussed

INTRODUCTION

LEVELS OF ORGANIZATION

ORGANISM AND ITS ENVIRONMENT

HABITAT AND NICHE

POPULATIONS

INTERACTIONS

POPULATION ATTRIBUTES

### 1. Introduction

- In the previous chapter we have tried to analyze the organization of living organisms on a molecular, cellular, tissue, organ and organ system level.
- This chapter focuses on the interactions and various characteristics of organisms and their population.
- Ecology is the study of the interaction of organisms with their environment.

## Objectives

At the end of this chapter, you will be able to:

- To understand the concepts of population, habitat, niche etc.
- To study various interactions like mutualism, commensalism etc.
- To note the various aspects of the population, e.g., death rate, birth rate etc.

## 2. Levels of Organization

The various levels of ecological organization of organisms are- organism, population, community, biome and biosphere.

### 1. Organisms

Any living thing is an organism.

### 2. Population

A population is defined as a set of all organisms of a particular species or group which are capable of interbreeding and reside in a particular geographical area.

### 3. Community

A community (in terms of ecology) is an assemblage of population of two or more different species residing in a particular geographical area. The populations in the community may exhibit various levels of interdependence and various interactions like competition, predation, amensalism etc.

### 4. Biome

They are regions of the world with similar climate and flora and fauna.

### 5. Biosphere

The set of ecosystems on the earth is termed as a biome.



#### TRY IT YOURSELF

1. A set of all organisms of a particular species or group which are capable of interbreeding and reside in a particular geographical area is called \_\_\_\_\_ (Population/Biome)
2. Populations in a community never show any inter-dependence. (True/False)
3. Environment does not consist of abiotic factors. (True/False)

## 3. Organism and its Environment

- The set of biotic and abiotic factors around an organism is termed as its environment.
- These factors have a major impact on the various life processes and also the 'behavioral traits' exhibited by the organism.

- Regional and local variations within each biome lead to the formation of wide variety of habitats.
- Organisms thrive in soaked rainforests as well as in dry deserts. Living beings are found deep inside oceans as well as on high altitudes on mountains.
- Bacteria thrive inside the intestines of many animals.
- Abiotic environment includes three categories of factors- climatic, edaphic and topographic.
- Climatic factors are light, temperature, water and wind.
- Edaphic factors are factors related to soil.
- Topographic factors are the aspects related to altitude, slope etc., which are concerned with the surface of the earth.
- Many organisms from the environment may interact with an organism. Some interactions may be beneficial while some may be detrimental to an organism. Some interactions may even cause death (predation).
- Organisms generally adapt (or in a sense evolve in accordance with) the biotic and abiotic factors.
- Thus, it can be noted that biotic as well as abiotic factors have a great impact upon an organism.

### KNOWLEDGE BUILDER

Given is a short description of various types of environments/biomes/ecosystems

**Table 13.1:** Biomes and their brief description

Sr. No.	Biome	Location	Features
1	Tropical Rainforest	Equatorial and sub-equatorial region of central America, South America, parts of Africa, Southeast Asia.	<ul style="list-style-type: none"> <li>• Rich in biodiversity</li> <li>• 30-40 m tall trees</li> <li>• 4-5 strata</li> <li>• Buttress roots</li> <li>• Drip tips</li> <li>• <b>E.g. Woody climbers and Epiphytes</b></li> </ul>
2	Coniferous forest / Temperate needle leaf / Taiga	Cold temperate region of Asia, North America, Europe, South of tundra.	<ul style="list-style-type: none"> <li>• 30-35 m tall trees</li> <li>• Coniferous trees</li> <li>• Evergreen trees</li> <li>• Leaves long needle like</li> <li>• <b>E.g., Pine, (<i>Pinus</i>), Deodar (<i>Cedrus</i>), Cypress (<i>Cupressus</i>), Silver fir (<i>Abies</i>)</b></li> </ul>
3	Temperate broad leaf forest	Temperate areas of America, Europe, Asia, New Zealand, Australia	<ul style="list-style-type: none"> <li>• 25-30 m tall trees</li> <li>• Deciduous trees</li> <li>• Broad leaf</li> <li>• <b>E.g. Several species of oak..</b></li> </ul>



### KNOWLEDGE BUILDER

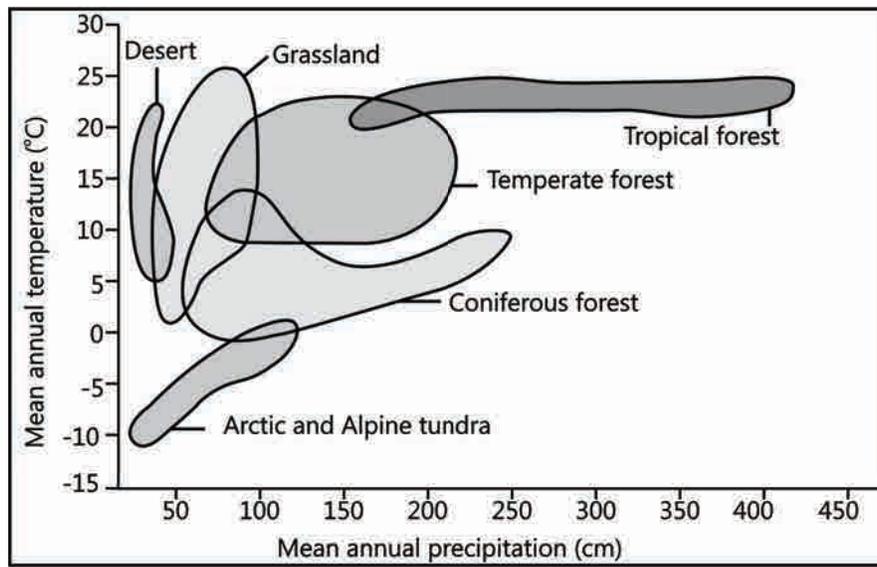
4	Grassland	Steppes – Russia Prairies – N. America Pampas – S. America Veldts – S. Africa Tussocks – New Zealand Dawns – Australia	<ul style="list-style-type: none"> <li>• Tree less biome</li> <li>• Grasses (Poaceae)</li> <li>• <b>E.g., Non graminaceous herbs mostly legumes.</b></li> </ul>
5	Tundra	North – Arctic tundra South – Absent	<ul style="list-style-type: none"> <li>• Permafrost (sub soil remains frozen)</li> <li>• Scantly vegetation</li> <li>• Trees absent</li> <li>• Grasses, sedges, mosses and lichens present.</li> <li>• <b>E.g., Birches (<i>Betula</i>) and Willows (<i>Salix</i>)</b></li> </ul>
6	Desert	Cold desert – Tibet, Gobi Hot desert – Thar, Sahara	<ul style="list-style-type: none"> <li>• Vegetation sparse. Three types of plants.</li> <li>• Ephemerals or short lived annuals herbs</li> <li>• Succulent xerophytes</li> <li>• Deep rooted shrubs and small trees <b>E.g., <i>Prosopis</i>, <i>Salvadora</i>, <i>Tamarix</i>, <i>Cenchrus</i> is a desert grass.</b></li> </ul>



These are some characters that highlight the difference between these environments.

**Table 13.2:** Some distinguishing characters of biomes

Sr. no.	Type of Biome	Mean Annual temperature (°C)	Mean annual rainfall (mm)	Important vegetation
1.	Tropical rain forest	23-27	2000-3500	<i>Dipterocarpus</i> , <i>Hopea</i>
2.	Tropical deciduous forest	22-32	900-1600	Sal, Teak, Tendu, Chiraunji, Khair.
3.	Temperate broad-leaf forest	6-20	1000-2500	Oak ( <i>Quercus</i> )
4.	Temperate needle leaf forest	6-15	500-1700	Pine, Deodar, Cypress, Spruce, Silver fir



**Figure 13.1:** Biomes represented with respect to temperature and rainfall



**Figure 13.2:** Tropical rainforest



**Figure 13.3:** Desert



**Figure 13.4:** Beach

## 3.1 Major Abiotic Factors

### 3.1.1 Temperature

- Temperature decreases as one moves away from the equator or the ground surface.
- Every organism has some structural proteins and enzymes.
- Enzymes display optimum activity in a certain temperature range. At temperatures below and above this range the enzymes are not efficient. At higher temperatures, proteins denature.
- This indicates that the temperature is an important aspect that will decide what type of organisms survive in an environment and also what type of organisms flourish.
- In recent years, there has been a growing concern about the gradually increasing average global temperatures (global warming).
- It is predicted that global warming will push tropics into temperate areas and temperate areas towards the poles and higher altitudes in mountains. This may bring about a change in species distribution across the biosphere.
- Thus temperature is an important factor of the environment.

Based upon thermal tolerance, organisms are classified into two categories-

- **Stenothermal organisms:** Stenothermal organisms live in areas where the temperature is uniform throughout the year. They cannot tolerate large temperature variation. Majority of organisms belong to this category.
- **Eurythermal organisms:** They can thrive in a wide range of temperature. **E.g., Desert pupfish** (can live in water at 4-45 °C.)

### 3.1.2 Water

- Water is one of the most important requirements of living organisms.
- The solvent properties of water are important for many biological processes.
- Water is an important part of the photosynthesis process.
- Aquatic organisms breathe via the oxygen dissolved in water.
- Water covers 70-71% of the earth's surface.
- Water also has a qualitative aspects associated with it. The pH, purity, temperature, salinity, flow or stagnation of water is also important.

Based up on salinity tolerance, organisms are classified into two categories:

- **Stenohaline organisms:** They are organisms which are restricted to a narrow range of salinity. Due to osmotic problems and lack of adaptations, many fresh water animals cannot live for long in sea water and vice versa. **E.g., Sharks (most species do not thrive in freshwater).**
- **Euryhaline organisms-**They are organisms which can tolerate a wide range of salinity. **E.g., Salmon.**

### 3.1.3 Light

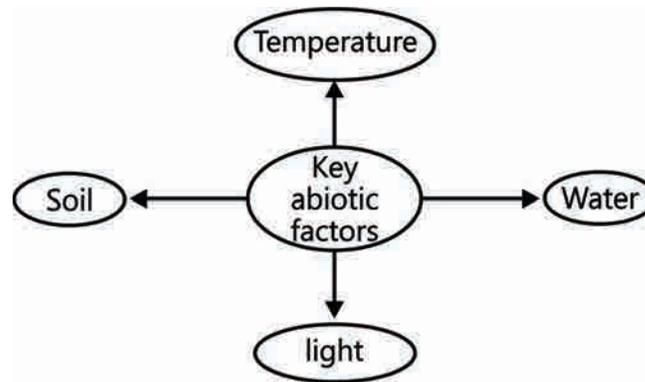
- Light is required for photosynthesis, which is perhaps the most important life process on the planet.
- Photosynthetically active radiations (PAR) have a range of 400-700 nm.
- Many plants depend on sunlight to meet their photoperiodic requirement for flowering.
- Light affects growth, movement and reproduction in plants.
- Marine plants thriving at different depths of the oceans, not receive all the components of the visible spectrum. The vertical and horizontal distributions of red, green and brown algae are dependent on the availability of sunlight.
- The vertical distribution of red, brown and green algae can be explained by their accessory photosynthetic pigments. These are the pigments which give the sea weeds their characteristic colours (chromatic adaptation).
- The accessory pigments of red algae absorb mostly green wavelengths. Blue-green light penetrates deepest in coastal waters and therefore it is seen that red algae extend to the greatest depths the oceans.
- Green algae have pigments absorbing mostly blue and red wavelengths that do not penetrate much in seawater. Hence green algae are found near the surface of the water.
- The accessory pigments of brown algae absorb intermediate wavelengths of light therefore brown algae would be expected to be most abundant at intermediate depths.
- Many animals use the diurnal and seasonal variations in light intensity and duration as parameters for various activities involved with reproduction, migration etc.
- X-rays, gamma rays, UV rays can harm organisms by causing mutations and by other mechanisms.

Depending upon requirement of light intensity, plants are of two types

- **Heliophytes:** They require high intensity light. **E.g., Sugarcane, Sunflower etc.**
- **Sciophytes:** They require low intensity light and grow in shaded areas. **E.g., Day blooming Jasmine (Din ka raja).**

### 3.1.4 Soil

- Soil is the combination of rock, mineral fragments, organic matter (dead and living), water and air.
- It is a nutrient medium for the growth of plants which are major food sources for humans and many other animals.
- The pH, composition and consistency of soil greatly influences the plants thriving in the region. This thereby influences the animals that thrive in the region (only those animals which can feed upon those plants and their predators).



Flowchart 13.1: Abiotic factors

### 3.2 Responses to Abiotic Factors

- Factors like temperature can vary across the year.
- An organism must ensure that its biochemical processes and physiological functions proceed at optimal rates.
- An organism can be classified as a regulator, conformer or a partial regulator based on the processes it carries out to ensure the above.
- If the organism fails to do so, it will have a low reproductive rate and its population will tend to decrease. It may not survive the conditions and even become extinct.

#### Types of organisms-

##### 1) Regulators-

- These are organisms that are able to regulate their body temperature and/or salt concentration.
- All birds and mammals and some lower vertebrate and invertebrate species, are able to maintain a constant body temperature (thermoregulation), constant osmotic concentration (osmoregulation) etc. by behavioral and/or physiological changes.
- Plants do not have mechanisms to maintain internal temperatures.
- In humans, evaporation of sweat cools down the body while shivering tends to heat it up.
- Some fishes migrate from freshwater to sea-water or vice versa. Some of them are able to maintain the salinity levels in their bodies with the help of kidneys and associated structures.
- Increase in metabolism also tends to heat the body up.
- These mechanisms are widely credited for the evolutionary success of mammals.

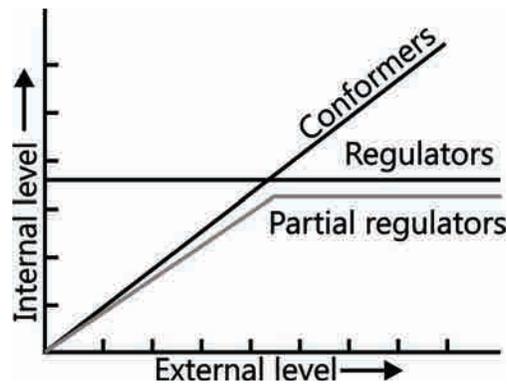
##### 2) Conformers-

- Majority of the organisms cannot regulate their physiological temperatures etc.

- It has to be noted that regulation is a metabolically and energetically expensive phenomenon.
- Its energetic requirements simply cannot be met by some organisms (mostly small organisms).
- This is the reason why conformers did not evolve to possess the abilities of regulators.

### 3) Partial regulators-

- Some species have evolved the ability to regulate only over a limited range of environmental conditions. Beyond these conditions they simply conform. These organisms are known as partial or limited regulators.



**Figure 13.5:** Responses to abiotic factors

Organisms follow two other alternatives to overcome adverse environmental conditions-

### 1) Migration-

- Some organisms move away from the stressful habitat for some period of time to a more hospitable area and return when the stressful period is over.
- During winter many animals and birds, undertake long distance migrations to move to hospitable areas.
- E.g., every winter the famous Keoladeo National Park (Bharatpur) in Rajasthan hosts thousands of migratory birds coming from Siberia and other cold northern regions.

### 2) Suspension-

- The organism changes its developmental, physiological, structural, and biochemical behavior to pass through unfavorable conditions during a stage called suspension.
- Perennating structures may be produced by organisms to overcome adverse environmental conditions.
- Thick-walled spores are formed in bacteria, fungi and lower plants (algae).
- Higher plants produce dormant structures like seeds and other vegetative propagules. These structures germinate and produce new organisms when conditions become favorable.
- Bears and some rodents undergo hibernation (winter sleep) and some organisms like snails undergo aestivation (summer sleep).
- Some zooplankton also undergo a process of metabolic suppression called diapause.

### 3.3 Adaptations

- Adaptations are changes in the physiology or biochemistry of an organism that help it to cope with the environmental condition. These changes may not be temporary as such. Examples of adaptations-
- Kangaroo rats, which live in North American deserts are capable of meeting their water requirements through their internal fat oxidation where water is released as a by-product. Its urine is concentrated to minimize water loss due to excretion.
- Mammals from colder regions have small ears (extremities) to minimize heat loss.
- Xerophytes have spines in place of leaves and deeply situated stomata to minimize water loss. **E.g., *Opuntia*.**
- A thick layer of fat (blubber) is found below the skin of polar seals. This layer acts as an insulator and reduces heat loss.
- Archaeobacteria synthesize special proteins which do not denature but on the other hand exhibit optimum functional efficiency at high temperatures. It should be noted that proteins are not the only adaptations.
- Antarctic fishes have body fluids containing antifreeze solutes due to which they can manage to keep their body fluids from freezing.

## 4. Habitat and Niche

### Habitat-

- It refers to the natural environment of an organism or species.
- A habitat is the specific physical place in which an organism lives.

### Niche-

- The ecological niche of an organism describes the role of the organism and how it interacts with the environment and other organisms.
- It is based on the physiology, the biochemical needs of an organism and the way in which they are met by it.

### Difference-

- The habitat of an organism is its preferred place of residence while the location as well as its role in the environment collectively form a niche.
- Every species has a unique niche in the environment.
- If organisms of different species occupy the same niche, one of them will cause the other to totally or partially leave the niche. This may not happen in case of occupying the same habitat.
- The survival of an organism depends on it having a unique niche or it being the 'fittest' one to occupy its niche.
- A habitat may have several niches. Organisms of more than one species may live in the habitat.

- The habitat of a red squirrel tends to be a coniferous forest. A red squirrel spends much of its time searching for nuts and seeds, builds its nest in trees, and functions as a food source for the great horned owl. It also fulfills an important role in the forest by spreading and burying seeds which later germinate into trees.
- Different species of trees growing in the same forest (having the same habitat) may occupy different ecological niches.

### TRY IT YOURSELF



1. Name the major abiotic factors affecting the environment.
2. Temperature increases as one moves away from the ground surface. (True/False).
3. Kangaroo rat meets its water requirements by internal \_\_\_ oxidization. (Salt/Fat).
4. Xerophytes have \_\_\_\_\_. (spines/broad leaves)
5. Red algae are found at intermediate ocean depths. (True/False)

### KNOWLEDGE BUILDER



- Mimicry is the resemblance of an organism to another or to natural objects which are commonly found in its environment. During mimicry the subject is known as mimic and the object it copies is called the model.
- In **Batesian mimicry**, the mimic is palatable and model is unpalatable. E.g. Viceroy butterfly mimics unpalatable toxic Monarch butterfly.
- In **Mullerian mimicry**, two or more unpalatable species attempt to resemble each other. For example, Monarch butterfly and Queen butterfly.
- **Edge effect** is the phenomenon where species of organisms have evolved which can live on the border between two ecosystems. These species are called as the edge species. (Not to be confused with EDGE species).
- Ecological equivalents are organisms that occupy similar ecological niches in different geographical regions.
- **Bergman's Rule**- Warm-blooded animals (birds and mammals) have larger body size in colder climates than in hotter areas.
- **Rensch's Rule**- In colder climate, birds possess narrow and acuminate wings as compared to broader wings of birds in warmer areas.
- **Jordan's Rule**- As the temperature is lowered, some meristic (countable) features of fish may increase. **E.g., scales fins etc.**

## 5. Population Attributes and Population Growth

- A population can be defined as a set of organisms of a species occupying a particular geographical area, at a particular point of time, sharing and/or competing for similar resources.
- These organisms have no restrictions on interbreeding.
- They are isolated to from other similar groups of organisms.
- Although the term interbreeding implies sexual reproduction, a group of organisms resulting from asexual reproduction is also considered as population.
- Natural selection operates at population level to select the desired traits. Population ecology is, therefore, an important area of ecology.

### 5.1 Population Attributes

A population has some characteristics termed as attributes. Some of them are-

#### 5.1.1 Birth Rate

- It can be loosely defined as the number of new organisms getting added to a population due to reproduction per total number of organisms in a population in a specific period.
- It indicates how fast or slow the population is growing.
- If in a pond there were 40 frogs last year. 10 new frogs got added due to reproduction, taking the current population to 50. The birth rate is  $10/40 = 0.25$  offspring per frog per year.
- Formula- **Birth rate** =  $\Delta N/(N \cdot \Delta t)$  Here,  $\Delta N$  is the change in population (number),  $N$  is the population (number) and  $\Delta t$  is the time period in which the change took place.

#### 5.1.2 Death Rate

- It can be loosely defined as the number of organisms getting reduced from a population due to deaths occurring, per total number of organisms in a population, in a specific period.
- It indicates how fast or slow the population is reducing.
- If in a pond there were 40 frogs last year. 10 frogs got reduced as they died, taking the current population to 30. The death rate is  $10/40 = 0.25$  frogs per frog per year.
- Formula- **Death rate** =  $\Delta N/(N \cdot \Delta t)$ . Here,  $\Delta N$  is the change in population (number),  $N$  is the population (number) and  $\Delta t$  is the time period in which the change took place

### 5.1.3 Sex Ratio

- In simple terms, it is the ratio of the number of females to the number of males.
- In most sexual species it is observed to be close to 1:1.
- Generally, having higher number of females may mean higher growth rate than higher number of males.
- In humans it is believed to be 1.06 (males): 1 (female) but these values are debated and may not be accurate.

### 5.1.4 Population Age Distribution Profiles

- There can be 3 stages in the life of an organism- pre-reproductive age, reproductive age and post-reproductive age.
- Age pyramids are commonly used to represent the age profile of the population.
- It is a graphic representation of proportion of various age groups of a population.
- Generally in human populations, males and females are not represented separately.
- The shape of the pyramids reflect the growth status of the population.
- There are three types of age pyramids.

#### 1) Triangular pyramid

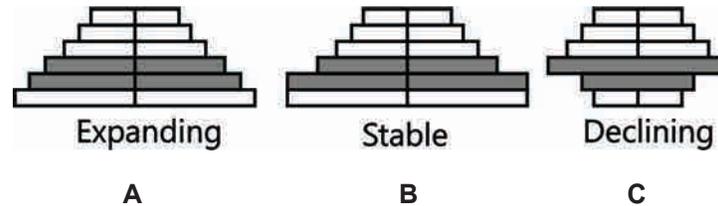
- The basal region of the triangle is the pre reproductive population.
- The region near the vertex opposite to the base is the post reproductive population.
- The region in the middle is the population in the reproductive age.
- It can thus be concluded that the birth rate will rise once the pre-reproductive population grows and the death rate will be relatively low.
- Thus the population will continue to grow.

#### 2) Bell- shaped diagram

- Here the base of the triangle is not very broad. Area wise, the basal region is marginally greater than the middle region.
- Thus, the number of pre-reproductive individuals is nearly equal to the number of reproductive individuals. Thus there will not be a significant increase in the birthrate.
- Thus, the population will be stable. Its growth rate will be less than that of the same number with a pyramidal profile.

### 3) Urn-shaped diagram

- The number of individuals in the pre-reproductive age is significantly lesser than the individuals in reproductive age.
- Thus the birth-rate can be predicted to decline.
- Thus the population may even reduce.



**Figure 13.6:** Representation of age distribution for human population. **A.** Pyramidal (left), **B.** Bell shaped (middle), **C.** Urn shaped (right)

### 5.1.5 Population Size

Can be defined with various parameters.

#### 1) Population number

- It is the number of organisms in a population.
- Change in the population size can be used to analyze the effects of various processes, for example the population of pests before and after the use of pesticides.

#### 2) Biomass or percent cover

- Some times the number of organisms is not the most appropriate measure of the population size. At such times, the biomass may be considered.
- E.g., the ecological significance of a huge banyan tree cannot be underestimated on the basis of a fact that other small plants greatly outnumber it.

#### 3) Relative density

- Relative density of a species =  $\frac{\text{Total number of individuals of the particular species}}{\text{Total number of individuals of all species}} \times 100$
- This parameter can be used to judge the ecological 'success' of the species in that particular habitat.

#### 4) Indirect count

- Indirect counts are used when it is not possible to measure the population by direct counting.

**E.g. pug marks or fecal pellets for estimating the count of tigers.**

## 5.2 Population Growth

- There are various parameters that can offer clues regarding the fate of a population in the near future. These parameters can also be used to analyze the causes and/or effects of certain phenomena.
- **Natality** is the number of individuals added to a population due to new births.
- **Mortality** is the reduction in population number due to deaths.
- **Emigration** is the reduction in population due to individuals moving out of the particular geographical area.
- **Immigration** is the increase in population occurring due to moving in of individuals of the same species from another geographical area.
- Natality and mortality are generally more significant than immigration or emigration except in cases where the original population itself is very low.
- Density of a population ( $N_0$ ) at time  $t_0$  can be expressed after a period of time  $t_1$  as :

$$N_1 = N_0 + [(B+I)-(D+E)]$$

B- Number of births,

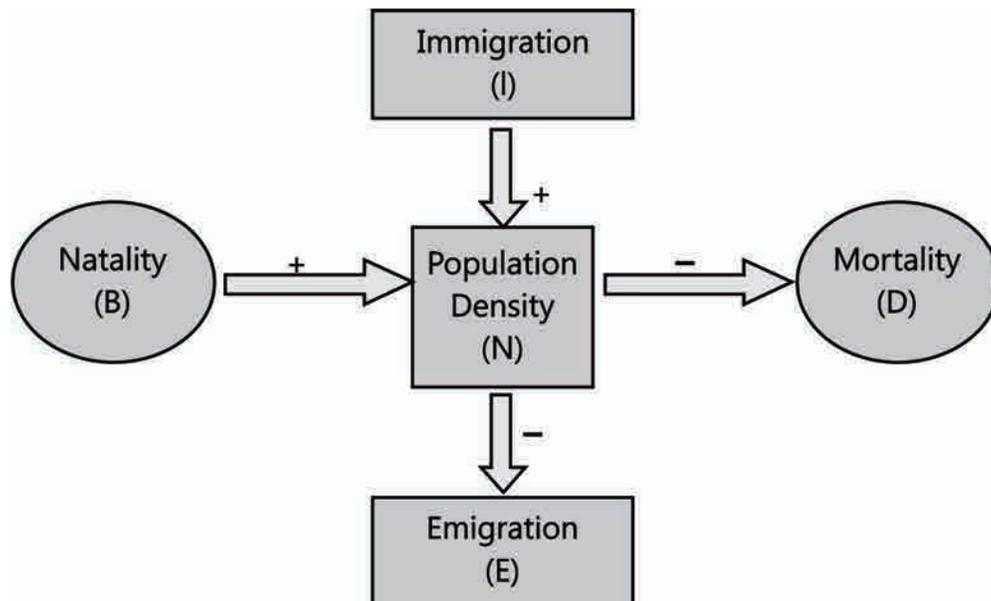
D-Number of deaths,

I-Number of immigrants,

E-Number of emigrants

Population size will increase; if number of (B+I) > number of (D+E)

Population size will reduce; if number of (B+I) < number of (D+E)



**Flowchart 13.2:** Representation of effect of births, deaths, immigrations and emigrations.

## 5.2.1 Growth Models

### 1) Exponential growth

- The population of a species grows exponentially when the habitat has unlimited resources and no competition.
- The intrinsic rate of natural increase is called as biotic potential ( $r$ ). The value of  $r$  is an important parameter to assess impact of environmental factors on population growth.
- Any species growing exponentially under non-limiting resource conditions can reach enormous population densities in a short time.

#### Important aspects of exponential growth-

Any increase or decrease in a population ( $N_0$ ) during time  $t$  will be

$$dN/dt = (b-d) \times N_0,$$

$b$  = per capita birth rate,

$d$  = per capita death rate,

If  $(b-d) = r$ , then

$$dN/dt = rN$$

In case when  $dN/dt = rN$ , a J-shaped curve may be obtained

The integral form of exponential growth equation will be

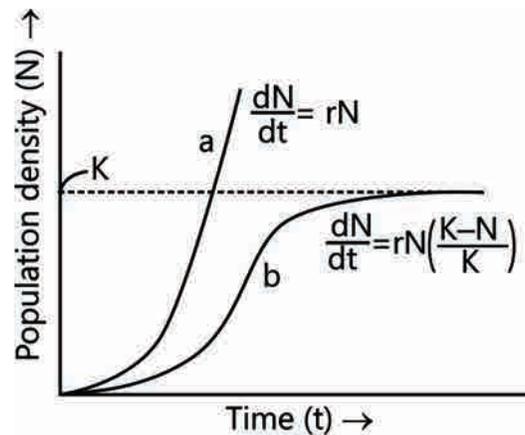
$$N_t = N_0 e^{rt},$$

Where,  $N_t$  = Population density after time  $t$

$N_0$  = Population density at time zero

$e$  = The base of natural logarithms (2.71828)

The magnitude of  $r$  was 0.0205 in 1981 for human population in India while it reached 0.0176 in 2001. The magnitude of  $r$  values for Norway rat is 0.015 and flour beetle it is 0.12.



**Figure 13.7:** Population growth curve (a) when resources are not limiting the growth, plot is exponential, (b) when resources are limiting the growth, plot is logistic, K is carrying capacity

## 2) Logistic growth

- This type of growth is seen when the habitat provides limited resources.
- The population number cannot cross a specific higher number. This natural limit for that species in that habitat is called carrying capacity (K).
- It influences the growth rate in a manner of  $(K-N)/K$ . N is the population. Thus the resistance to growth increases as the population increases.
- Limited resources may also mean competition between individuals. Thus only the fit individuals will survive and reproduce.
- The sum of environmental factors that limit the population size is called environmental resistance. Environmental resistance rises with the increase in population size.
- Since natural resources required for the growth of most animal populations are not unlimited and become limiting sooner or later, the logistic growth model is considered a more realistic one.

### Important aspects of logistic growth-

- Any population generally shows an initial lag phase in its growth. This may happen because the individuals have to get adjusted to the new habitat.
- Followed by the lag phase is the phase of accelerated growth.
- After the lag phase arises a stationary phase where the population number does not vary greatly. It may be observed that in this phase the birth rate and death rate are approximately equal.
- Following the stationary phase may be a decline phase where the population reduces. (May not always be seen).

- Logistic growth is thus represented by a sigmoid curve where the base is the lag phase and the top is the stationary phase.
- This type of population growth is called Verhulst Pearl Logistic Growth.
- It is described by the equation-  
 **$dN/dt = rN (K-N)/K$**

Where,

N= Population density at time t

r= Intrinsic rate of natural increase

K= Carrying capacity

The integral form of logistic growth equation will be

$$N_1 = N_0 e^{r[(K-N)/K]t}$$

### 5.2.2 Variations in Modes of Reproduction

- Organisms vary with respect to their modes of reproduction.
- Some organisms breed only once in their lifetime **E.g., Pacific salmon.**
- Some others can breed nearly throughout their lifespan. **E.g., Humans.**
- Some organisms produce several large sized offspring. **E.g., Pelagic (open sea) fishes.**
- Some others produce less number of large sized offspring. **E.g., Mammals.**
- All this is done in accordance to the biotic and abiotic factors influencing the organism.
- The organism tries to keep its reproductive rate at the maximum. This is called maintenance of Darwinian fitness.



#### Did You Know

- The (human) population of the world is estimated to be 7265 million.
- The (human) population of India is estimated to be 1252 million.

**TRY IT YOURSELF**

1. \_\_\_\_\_ leads to increase in population. (Immigration/Emigration).
2. Theoretically number of males should be more than females in any sexually reproducing organism. (True/False).
3. If birth rate is less than death rate, the population will \_\_\_\_\_. (Increase/Decrease)

## 6. Population Interactions

- It should be noted that very rarely do organisms live completely isolated from other organisms.
- In nature, many niches may exist with the same habitat.
- Organisms tend to interact with other organisms of their own or of other species.
- These interactions may be- 1) Beneficial (positive interaction). 2) Detrimental (negative interactions), 3) Neutral (neither beneficial nor harmful) to one of the species or both.

Some of these interactions are-

### 6.1 Mutualism

- This interaction is beneficial to both the interacting organisms.
- In general the interacting organisms are in close association with each other.
- Examples of plant and fungal mutualism-
  - 1) **Lichens-**  
A fungus and photosynthesizing green algae and/or cyanobacteria form a close association where the Algal partner (phycobiont) produces food through photosynthesis whereas fungal partner (mycobiont) absorb nutrients from soil.
  - 2) **Mycorrhizae:** It is a relationship between fungi and roots of higher plants. Fungi absorb phosphate nutrients from soil while the plant in turn provides carbohydrates to the fungi.
- **Examples of Plant-animal mutualism:** Plants need help of animals for pollinating their flowers (**zoophily**) and dispersing their seeds (**Zoochory**). Plants in turn offer pollen and nectar for pollinators and nutritious fruits for seed dispersers.
- Co-evolution is often seen in plant – animal interactions. Co-evolution is an evolutionary mechanism where the evolution in one species is triggered by the evolution in another.
- The evolution of the flower and its pollinator species are tightly linked with one another. E.g.-

### Fig and Fig wasp

For each species of fig there occurs a partner wasp species without which pollination cannot occur. Female wasp uses the fig fruit as an egg laying or oviposition site. It also caters to nourishing its larvae. The wasp thus pollinates the fig inflorescence while searching for suitable egg-laying (oviposition) sites.

## 6.2 Competition

- It is the interaction of organisms striving to utilize the same resource.
- Competition amongst the individuals of same species for one or more common resources is termed as **intraspecific competition**.
- Competition between the organisms of different species is called **interspecific competition**.
- Intraspecific competition is more acute because all organisms of the same species have similar requirements for food and other resources. They also employ the same processes to utilize the resources.
- Gause, a Russian biologist carried out experiments to study competition.
- Sometimes, competition may exist even when the resources are not limiting.
- Sometimes the feeding efficiency of an organism may drop down due the presence of its competitor. This is called interference competition.
- Competition can also be termed as a process in which fitness of one species (measured in terms of its 'r') is significantly lower in the presence of another species.
- It is seen that plants and herbivores are affected more due to competition.
- Competition can take two forms.
  - (a) Competitive exclusion
  - (b) Competitive co-existence

### a) Competitive exclusion-

- In this case the organism and species completely inferior to the stronger one is not able to survive after some period of time.
- **Example- Gause's experiment** with ciliates. *Paramecium caudatum* and *Paramecium aurelia*, two closely related ciliate protozoans, when grown in separate cultures exhibited sigmoid population growth. When both protozoans were inoculated in the same culture, *P. aurelia* alone survived after 16 days and thus 'out competed' or 'excluded' *P. caudatum* for the limited resources.
- Introduction of goats on Galapagos islands in 1958, resulted in exclusion of Abingdon tortoise as goats ate up vegetation faster.

### b) Competitive co-existence-

- Sometimes the weaker organisms may be able to co-exist without getting extinct due to the stronger species.
- Most notable examples of this phenomenon are the 'Darwin's finches'. They finches have developed different feeding habits to co-exist without getting extinct.
- Warblers also avoid competition by changing foraging patterns.

### 6.3 Predation

- It is the act in which a predator organism feeds on a victim called prey. It may or may not result in the death of the prey. (Mostly it does).
- It is a mechanism by which energy fixed by plants moves to the higher trophic levels.
- Example- tigers feed on deer.
- Predators play important roles in ecosystem.
- They help to keep the prey population under check.
- They help to maintain species diversity in a community by reducing the intensity of competition among competing prey species.

#### Examples-

- Grazers of a grassland may prevent a single dominant species from taking over.
- The elimination of wolves from Yellowstone National Park led to herbivores over-grazing many woody browse species, affecting the area's plant populations.
- In addition, wolves often kept animals from grazing in riparian areas, which protected the food of beavers. The removal of wolves had a direct effect on beaver populations, as their habitat became territory for grazing.

#### Some aspects of predation-

- **Prudent-predators:** The predators that succeed in refraining from over- exploitation of their prey, are described as "prudent" - and making "efficient" use of their prey. If they fail to do so, the prey will become extinct and so will the predator.
- **Evolution of various defenses (adaptations) in prey:** With an aim to escape predation, preys develop different defense mechanisms.

**Camouflage-** The organism visually resembles various natural objects commonly found in their environment. It occurs in some species of insects and frogs to avoid their easy detection by the predator. This also may help a predator achieve stealth.

**Chemical defense-** Some prey species are poisonous or have chemicals that make them distasteful. Monarch butterfly is avoided by its predators because of a special chemical in its body which makes it highly distasteful. This chemical is acquired from a poisonous weed.

**Presence of thorns in plants-** Such features make the plant highly less desirable for consumption.

E.g., cactuses

**Production and storage of toxins-** The herbivore may fall ill or even die when these plants are consumed making them less likely to be eaten.

## 6.4 Parasitism

- Parasitism is an interaction between two organisms, where one organism spends a part or whole of its life, on or inside the body of other organism for getting nourishment and shelter.
- The feeder organism is termed as parasite and the nutrition source organism as the host.
- Only one species benefits (parasite) while the interaction is detrimental to the other species (host).
- Many parasites are host-specific (they can parasitize only a single species of host).
- Parasites and hosts tend to co-evolve
- If the host evolves special mechanisms for defense against the parasite, the parasite in turn evolves to gain mechanisms to counteract and neutralize the host defense in order to be successful with the same host species.
- Parasites which parasitize other parasites are called hyperparasites.

### Adaptations shown by parasites-

1. Loss of unnecessary sense organs.
2. Presence of adhesive organs or suckers to cling on the host
3. Loss of digestive system as they may feed on processed form of nutrients
4. High reproductive capacity
5. Complex life cycle involving one or two intermediate hosts or vectors to facilitate parasitization of its main hosts e.g., *Plasmodium* used mosquitoes to infect humans.

It can be noted that points 1 and 3 help to reduce the energy requirements of the organism, thereby contributing to the improvement in reproductive rate.

### Impact that a parasite may have on hosts-

1. They may end up leaving the host dead.
2. They may also reduce the growth and reproduction of host thereby reducing their population density.
3. They may render the host more vulnerable to predation by making it weak.

### An ideal parasite may thrive within the host without adversely harming it.

Based upon their occurrence with respect to the host body, parasites can be of two types-

**1) Ectoparasites:** They interact with the external surface of the host organism. They do not live inside the host. E.g., lice on humans, ticks on dogs, copepods on marine fishes, *Cuscuta* (a non-green colour plant) on hedge plants. It has lost its chlorophyll and leaves in the course of evolution.

**2) Endoparasites:** Parasites that live inside the host body are termed as endoparasites. They generally have developed highly specialized life processes as they need to survive inside hosts some of which have a very potent immune system. Their life cycles may be complex. E.g., liverfluke

**3) Brood Parasitism:** Some birds lay their eggs in the nests of other birds which incubate them. E.g., cuckoo lays its eggs in a crow's nest. The eggs of the parasite birds resemble the host's eggs in size and colour thereby reducing the chances of the host bird detecting the foreign eggs and ejecting them from the nest. This is an evolutionary mechanism.

## 6.5 Commensalism

- Commensalism is the interaction in which one species benefits and other is neither harmed nor benefited.
- The species which is benefitted is termed commensal and the other species is called host.
- Commensalism is observed in diverse type of animals and plants.
- Some examples of commensalism are as follow-
  1. **Barnacles** growing on the back of a whale benefits in the form of shelter. Whale remains unaffected.
  2. **Epiphytes** (orchids) growing on larger plants like mango (host) gets benefits like shelter but host neither derives any benefit nor suffers a loss.
  3. **Cattle egrets** (birds) forage close to where cattle are grazing because the cattle as they move, stir up and flush out insects from the vegetation that otherwise might be difficult for the egrets to find and catch.
  4. **Clown fish** that lives among sea anemone gets protection from predators which stay away due to the stinging tentacles of sea anemone, while the anemone remain unaffected

## 6.6 Amensalism

- It is an interaction between two organisms of different species in which one species inhibits the growth of other species by secreting certain chemicals.
- The organism which inhibits the growth of another organism is called amensal.
- Amensalism is also called allelopathy in plants, or antibiosis or biological antagonism in general.
- Chemicals isolated from amensals are used as antibiotics for curing various diseases caused by bacteria in humans.
- Examples of amensalism-
  1. **Penicillium** produces penicillin that inhibits the growth of large number of bacteria.
  2. Different species of **Streptomyces**, an actinomycete, produce wide range of chemicals which inhibit the growth of other bacteria.

3. Roots of **black walnut** (*Juglans regia*), secrete a chemical called Juglone which is toxic to other plants like apple, alfalfa etc.
4. **Convolvulus arvensis** a bindweed inhibits the growth of wheat.

## 6.7 Protocooperation

- Protocooperation is an association interaction between individuals of two species where each organism is benefitted by the interaction with the other but can live equally well without association.
- It must be noted that in mutualism the individual organisms cannot live well in isolation or without their partners.
- Some examples of protocooperation are as follows-
  1. **Red billed ox-pecker** and **yellow billed ox-pecker** sit on the back of **black rhinoceros** and feed on the **ticks**. The birds also warn the rhinoceros of approaching danger. Both the partners are benefitted. Both organisms are not obligatorily dependent on the other and both can live separately.
  2. The **crocodile bird** feeds on **leeches** in the mouth of a **crocodile**. This interaction is beneficial to both but not an absolute necessity.
  3. **Sea anemone** gets attached to the body of **hermit crab**. It tends to protect it from the enemies with its nematocysts (teeth-like structures which may be venomous). The anemone can consume pieces of food dropped by the crab. It also is carried to new places by the crab.

**Table 13.3:** Population interactions

Name of interaction	Species A	Species B
Mutualism	+	+
Competition	-	-
Predation	+	-
Parasitism	+	-
Commensalism	+	0
Amensalism	-	0
Protocooperation	+	+

'+' → Beneficial interaction, '-' → Detrimental interaction, '0' → Neutral interaction

**TRY IT YOURSELF**

1. One organism suffers in mutualism. (True/False)
2. Insectivorous plants grow in soil which is deficient in \_\_\_\_\_.
3. Aquatic animals that are incapable of living in narrow range of salinity are called as \_\_\_\_\_.
4. Penicillin production comes under \_\_\_\_\_. (Predation/Amensalism).

**DID YOU KNOW**

- All orchids do not offer rewards to their insect pollinators. For example, the Mediterranean orchid employs a mechanism called 'sexual deceit' to get pollination done by a species of bee. One petal of its flower appears like a female of the bee. The male bee perceives it as female covered with pollen dust. It tries to mate carries out pseudo-copulation. When same bee pseudo-copulates with another flower, it transfers pollen to it and thus pollinates the flower.
- It should be noted that change in appearance of the female bee will lead high reduction in the pollination of the plant. The plant will then have to co-evolve.

## Summary

- Ecology deals with the various principles which govern the relationships between organisms and their environment.
- The various levels of ecological organization of organisms are- organism, population, community, biome and biosphere.
- The set of biotic and abiotic factors around an organism is termed as its environment.
- These factors have a major impact on the various life processes and also the 'behavioral traits' exhibited by the organism.
- Abiotic environment includes three categories of factors- climatic, edaphic and topographic.
- Climatic factors are light, temperature, water and wind.
- Edaphic factors are factors related to soil.
- Topographic factors are aspects related to altitude, slope etc. which are concerned with the surface of the earth.
- Stenothermal organisms live in areas where the temperature is uniform throughout the year. Regulators are capable of homeostasis in the face of changing external environment. Others either partially regulate their internal environment or simply conform.
- Eurythermal organisms can thrive in a wide range of temperature.
- Heliophytes require high intensity light.
- Sciophytes require low intensity light and grow in shaded areas.
- The responses to ecological factors include- Regulation, Conformation, Partial regulation, Migration and Suspension of some life processes.
- The habitat of an organism is its preferred place of residence while the location as well as its role in the environment collectively form a niche.
- Death rate, birth rate, sex ratio, age distribution and population size are the various attributes of populations.
- Population growth is exponential when resources are unlimited but is logistic (sigmoidal curve) when the resources are limiting. Generally logistic growth is observed in nature.

**Table 13.4:** Population interactions

Name of interaction	Species A	Species B
Mutualism	+	+
Competition	-	-
Predation	+	-
Parasitism	+	-
Commensalism	+	0
Amensalism	-	0
Protocooperation	+	+

'+' Beneficial interaction, '-' Detrimental interaction, '0' Neutral interaction

## EXERCISE

### Objective Questions

**Q. 1** Autoecology is the:

- (A) Relation of a population to its environment
- (B) Relation of an individual to its environment
- (C) Relation of a community to its environment
- (D) Relation of a biome to its environment

**Q. 2** Ecotone is:

- (A) A polluted area
- (B) The bottom of a lake
- (C) A zone of transition between two communities
- (D) A zone of developing community

**Q.3** Biosphere is:

- (A) A component in an ecosystem
- (B) Composed of plants present in the soil
- (C) Life in the outer space
- (D) Composed of all living organisms present on earth which interact with the physical environment

**Q.4** Ecological niche is:

- (A) The surface area of the ocean
- (B) An ecological adapted zone
- (C) Physical position and functional role of a species within the community
- (D) Formed of all plants and animals living at the bottom of lake

**Q.5** According to Allen's Rule, the mammals from colder climates have:

- (A) Shorter ears and longer limbs
- (B) Longer ears and shorter limbs
- (C) Longer ears and longer limbs
- (D) Shorter ears and shorter limbs



**Q.14** Which of the following would necessarily decrease the density of a population in a given habitat?

- (A) Natality > mortality  
(B) Immigration > emigration  
(C) Mortality and emigration  
(D) Natality and immigration

**Q.15** A protozoan reproduces by binary fission. What will be the number of protozoans in its population after six generations?

- (A) 128  
(B) 24  
(C) 64  
(D) 32

**Q. 16** In 2005, for each of the 14 million people present in a country, 0.028 were born and 0.008 died during the year. Using exponential equation the number of people present in 2015 is predicted as:

- (A) 25 millions  
(B) 17 millions  
(C) 20 millions  
(D) 18 millions

**Q.17** Amensalism is an association between two species where:

- (A) one species is harmed and other is benefitted  
(B) one species is harmed and other is unaffected  
(C) one species is benefitted and other unaffected  
(D) Both the species are harmed.

**Q.18** Lichens are the associations of:

- (A) Bacteria and fungus  
(B) Algae and bacterium  
(C) Fungus and algae  
(D) Fungus and virus

**Q.19** Which of the following is a partial root parasite?

- (A) Sandal wood  
(B) Mistletoe  
(C) Orobanche  
(D) Ganoderma

**Q.20** Which one of the following organisms reproduces sexually only once in its life time?

- (A) Banana plant  
(B) Mango  
(C) Tomato  
(D) *Eucalyptus*

**Q.21** *Magnolia* and oaks occur in the following zone:

- (A) Tropical  
(B) Sub-tropical  
(C) Alpine  
(D) Temperate

**Q.22** Plant groups growing in zones where high temperature alternates with low temperature as called as:

- (A) Megatherms  
(B) Mesotherms  
(C) Microtherms  
(D) Hekistotherms

- Q.23** According to Mr. Dougal, the parasitism caused due to fungi and bacteria represent interspecific relationship which is:
- (A) Social and antagonistic (B) Nutritive and antagonistic  
(C) Social and reciprocal (D) Nutritive and reciprocal
- Q.24** When one population is harmed and the other remains unaffected the relationship is called as:
- (A) Amensalism (B) Predation  
(C) Protocooperation (D) Parasitism
- Q.25** The relationship between a climber and the host corresponds to:
- (A) Neutralism (B) Commensalism  
(C) Parasitism (D) Mutualism
- Q.26** The relationship between the alga *Cladophora* and the snail shell on which it grows corresponds to:
- (A) Neutralism (B) Predation (C) Commensalism (D) Mutualism
- Q. 27** The device or structure where plants are grown in a controlled environment:
- (A) Culture chamber (B) Inoculation chamber  
(C) Phytotron (D) All of these
- Q.28** The air density is maximum:
- (A) Above 32' (B) At the soil surface  
(C) Between 32' - 64' from soil level (D) In the hydrosphere
- Q.29** Plants growing in oxygen deficient soils have:
- (A) No roots (B) Longer roots system  
(C) Aerial roots system (D) Shallow roots system
- Q.30** 'Flag trees' are formed due to:
- (A) Lodging (B) Erosion and evaporation  
(C) Unidirectional wind (D) Salt spray
- Q.31** Plants growing on burnt soil are called as:
- (A) Heliophilous (B) Hydrophilous  
(C) Pyrophilous (D) Pyriform

**Q.32** As a result of fire there is destruction of the following components of soil:

- (A) Litter (B) Organisms (C) Inorganic matter (D) All of these

**Q.33** Plants growing on desert and steppe are called as:

- (A) Oxylophytes (B) Lithophytes (C) Eremophytes (D) Psilophytes

**Q.34** Plants growing on rocks are called as:

- (A) Psychrophytes (B) Lithophytes (C) Halophytes (D) Sciophytes

**Q.35** Plants growing on cold soil are called as:

- (A) Oxylophytes (B) Sciophytes (C) Psammophytes (D) Psychrophytes

**Q.36** Mark the rooted submerged hydrophyte:

- (A) *Ranunculus* (B) *Najas* (C) *Potamogeton* (D) None of these

**Q.37** The mesophytes are characterized by:

- (A) Uniform mesophyll (B) Absence of cuticle  
(C) Well developed root-shoot systems (D) All of these

**Q.38** Mark the true xerophyte:

- (A) *Capparis aphylla* (B) *Solanum xanthocarpum*  
(C) *Euphorbia milli* (D) All of these

**Q.39** The seeds of *Rhus* can endure a temperature as high as :

- (A) 40 °C (B) 60 °C (C) 65 °C (D) 80 °C

**Q.40** The serotinous cones show

- (A) In situ seed germination (B) Longer viability  
(C) Early cone separation (D) All these characters

**Q.41** As an adaptation to fire, some plants produce lignotubers which are:

- (A) On the leaves (B) Present on the main stem  
(C) Underground (D) Suspended from the branches

**Q.42** In which of the following groups, all the plants belong to the same category?

- (A) *Nymphaea, Potamogeton, Victoria*
- (B) *Utricularia, Typhar, Aponogeton*
- (C) *Lemna, Spirodela, Azolla*
- (D) *Ranunculus, Vallisneria, Hydrilla*

**Q.43** When a plant first begins to wilt permanently in a pot, its 54.5 gm of soil has 4.5 gm of water. The PWP of this soil is:

- (A) 4.5%
- (B) 9%
- (C) 8.25%
- (D) 16.5%

**Q.44** Plants growing on sand and gravel are called as:

- (A) Eremophytes
- (B) Psammophytes
- (C) Psilophytes
- (D) Oxylophytes

**Q.45** Adaptation to low temperature and freezing in animals occurs due to the production of:

- (A) Antifreeze proteins
- (B) Chaperonins
- (C) Proline
- (D) Aniline

**Q.46** The rate of individuals taking birth per 1,000 per year is called:

- (A) Mortality rate
- (B) Vital rate
- (C) Natality rate
- (D) Growth rate

**Q.47** Growth of the population of an area depends upon:

- (A) Natality rate
- (B) Immigration
- (C) Environmental resistance
- (D) All of these

**Q.48** In terms of land area, India occupies in the world:

- (A) 7<sup>th</sup> position
- (B) 8<sup>th</sup> position
- (C) 9<sup>th</sup> position
- (D) 6<sup>th</sup> position

**Q.49** "Theory of Human Population" was written by:

- (A) Charles Darwin
- (B) A.R. Wallace
- (C) T.R. Malthus
- (D) Lamarck

**Q.50** The main factor for the growth of human population in India is:

- (A) High birth rate
- (B) Low death rate
- (C) Lack of education
- (D) All of these

**Q.51** What are organisms that can tolerate a wide range of salinity?

- (A) Stenohaline                      (B) Durohaline                      (C) Euryhaline                      (D) Haline

**Q.52** Select the correct order of the phases.

- (A) Exponential phase, lag phase and steady state phase  
(B) Lag phase, log phase and steady state phase  
(C) Steady state phase, lag phase and log phase  
(D) Slow growing phase, lag phase and steady state phase

**Q.53** Which of the following is true?

- (A) Exponential curve of population growth is the one is commonly seen in nature.  
(B) High death rate and low birth rate in absence of immigration or emigration will lead to an increase in population.  
(C) Log phase occurs before the lag phase.  
(D) Carrying capacity is a barrier or the specific number which the population number does not cross.

## Previous Years' Questions

**Q.1** The concept that population tends to increase geometrically while food increases arithmetically, was put forward by: **(CBSE 1995)**

- (A) Stuart Hill                      (B) Adam Smith                      (C) Thomas Malthus                      (D) Charles Darwin

**Q.2** The measure of maximum rate of reproduction under optimal conditions is called: **(MP-PMT1995)**

- (A) Ultimate level                      (B) Carrying capacity  
(C) Proximal level                      (D) Biotic potential

**Q.3** Rapid decline in the population due to high mortality rate is called: **(BHU1996)**

- (A) Population density                      (B) Population crash  
(C) Population explosion                      (D) All of these

**Q.4** Which of the following is most convincing reasons for increasing population growth in a country? **(AIIMS 1996)**

- (A) High birth rate                      (B) Low mortality rate  
(C) Low population of old persons                      (D) High population of youth

**Q.5** Study of trends of human population is: **(MP-PMT1996)**

- (A) Demography      (B) Biography      (C) Kalography      (D) Psychology

**Q.6** The present world human population is about: **(CBSE1997)**

- (A) 500 million      (B) 100 million      (C) 15 million      (D) 6 billion

**Q.7** What is the most important factor for the success of animal population? **(CBSE 1997)**

- (A) Natality      (B) Adaptability      (C) Unlimited food      (D) Interspecific activity

**Q.8** If the rate of addition of new members increases with respect to the individuals lost from the same population the graph obtained has: **(AIIMS 1997)**

- (A) Declined growth      (B) Exponential growth  
(C) Zero population growth      (D) None of these

**Q.9** Average ratio of men and women in human population is : **(Har. PMT1997)**

- (A) 3 : 4      (B) 1 : 1      (C) 3 : 5      (D) 1:2

**Q.10** Two opposite forces operate in the growth and development of a population one of these is ability to reproduce at a given rate. The force opposite to it is called : **(CBSE 1998)**

- (A) Biotic potential      (B) Mortality  
(C) Fecundity      (D) Environmental resistance

**Q.11** Different life forms, among organisms in relation to environment were given by: **(BHU1998)**

- (A) Reiter      (B) Odum      (C) Raunkiers      (D) Warming

**Q.12** Zone of atmosphere that lies near the ground is: **(AFMC 1998)**

- (A) Troposphere      (B) Stratosphere      (C) Homosphere      (D) All of these

**Q.13** The population explosion has occurred in the last: **(AFMC 1998)**

- (A) 500 years      (B) 300 years      (C) 100 years      (D) 250 years

**Q.14** The part of earth and atmosphere supporting life is: **(CPMT1998)**

- (A) Biota      (B) Biome      (C) Ecotone      (D) Biosphere

**Q.15** One of the critical mechanisms by which environment controls the population of a species is:

**(Har. PMT 1998)**

- (A) Biotic control      (B) Mortality      (C) Fecundity      (D) Environmental resistance

**Q.16** The exponential growth is maximum in:

**(CBSE 1999)**

- (A) Tissue culture cells      (B) Embryo  
(C) Unicellular organisms      (D) Multicellular organisms

**Q.17** In a population curve, the rate of growth becomes steady towards the end of exponential curve due to:

**(CET Chd. 2000)**

- (A) Reproductive power is reduced      (B) Environmental stress  
(C) Migration      (D) All of these

**Q.18** When the number of immigration and births is more than emigration and deaths. Growth curve of population will show:

**(Har PMT 2000)**

- (A) Exponential phase      (B) Lag phase  
(C) Declining phase      (D) Steady phase

**Q.19** Human population follows:

**(MP-PMT2000)**

- (A) J-shaped growth curve      (B) Z-shaped growth curve  
(C) S-shaped growth curve      (D) All of these

**Q.20** Organisms living at the bottom of a lake are called:

**(MP-PMT 2000)**

- (A) Nektons      (B) Benthos      (C) Planktons      (D) Pelagic

**Q.21** Animals have shorter and smaller extremes in colder region. It is :

**(JIPMER 2000)**

- (A) Allen's rule      (B) Cope's rule      (C) Dollo's rule      (D) Bargman's rule

**Q.22** Which one is exclusive xerophytic adaptation?

**(Har. PMT 2000)**

- (A) Absence of stomata      (B) Long tap root system  
(C) Stipular leaves      (D) Spines

**Q.23** World Population Day is on : **(Manipal 2000)**

- (A) 5<sup>th</sup> June                      (B) 11<sup>th</sup> July                      (C) 4<sup>th</sup> October                      (D) 21<sup>st</sup> March

**Q.24** What is best pH of soil for cultivation? **(CBSE 2000)**

- (A) 3.4-5.4                      (B) 4.5-5.5                      (C) 5.5 - 6.5                      (D) 6.5 - 7.5

**Q.25** Niche of a species is : **(DPMT 2001)**

- (A) Place of living                      (B) Specific function and competitive power  
(C) Habitat and specific function                      (D) None of these

**Q.26** First human population explosion took place due to: **(BV-Pune2001)**

- (A) Agriculture                      (B) Industrialization                      (C) Technology                      (D) Changes in culture

**Q.27** Natality is balanced by mortality. There will be: **(MH-PMT 2001)**

- (A) Decrease in population growth                      (B) Zero population growth  
(C) Increase in population growth                      (D) Overpopulation

**Q.28** Ozone layer is found in: **(Kerala 2001)**

- (A) Thermosphere                      (B) Stratosphere                      (C) Mesosphere  
(D) Lithospherer                      (e) Troposphere

**Q.29** Ability to produce maximum offspring is: **(CBSE 2002)**

- (A) Biotic potential                      (B) Carrying capacity  
(C) Environmental resistance                      (D) None of these

**Q.30** Which one of the following is important for speciation? **(CBSE 2002)**

- (A) Seasonal isolation                      (B) Reproductive isolation  
(C) Behavioral isolation                      (D) Temporal isolation

**Q.31** Shallow lakes with abundant of organic matter are called: **(BHU 2002)**

- (A) Saprotrophic                      (B) Oligotrophic                      (C) Eutrophic                      (D) Heterotrophic

**Q.32** When births are equal to deaths, it is: **(AFMC 2002)**

- (A) Plateau stage (B) Exponential stage  
(C) Early growth stage (D) Acceleration stage

**Q.33** Abundance of a species population within its habitat is called: **(AUMS 2002)**

- (A) Absolute density (B) Regional density  
(C) Relative density (D) Niche density

**Q.34** Field capacity consist of: **(DPMT2002)**

- (A) Capillary water (B) Gravitational water  
(C) Hygroscopic water (D) Both (A) and (C)

**Q.35** Plants growing in saline soil with high salt concentration are: **(CPMT 2002)**

- (A) Xerophytes (B) Halophytes (C) Heliophytes (D) Hydrophytes

**Q.36** In asymptote state, population is: **(MP-PMT 2002)**

- (A) Increasing (B) Decreasing (C) Changing (D) Stabilized

**Q.37** Least porous soil is: **(Har. PMT 2002)**

- (A) Clayey soil (B) Sandy soil (C) Loamy soil (D) Gravelly soil

**Q.38** Two opposite forces operate in growth and development of a population. One of them relates to ability to reproduce at a given rate. The force opposite to it, is called: **(CBSE 2003)**

- (A) Fecundity (B) Biotic potential  
(C) Environmental resistance (D) Morbidity

**Q.39** Mechanical tissue is best developed in: **(CPMT 2003)**

- (A) Hydrophytes (B) Hygrophytes (C) Xerophytes (D) Mesophytes

**Q.40** Maximum amount of humus occurs in: **(CPMT 2003)**

- (A) Lowermost layer (B) Upper layer (C) Middle layer (D) Same everywhere

**Q.41** July 11 is observed as: **(AIIMS 2003)**

- (A) World Population Day (B) No Tobacco Day  
(C) World Environmental Day (D) World Health Day

**Q.42** Loss of forests, urbanization and increasing pollution are due to: **(KCET2003)**

- (A) Ozone depletion (B) Population explosion  
(C) Global warming (D) Greenhouse effect

**Q.43** Plants adapted to grow in shade are called: **(CMC Ldh. 2003)**

- (A) Psammophytes (B) Sciophytes (C) Mesophytes (D) Xerophytes

**Q.44** Water holding capacity is maximum in: **(CMC Ldh. 2003)**

- (A) Clay (B) Sand (C) Silt (D) Gravel

**Q.45** Submerged hydrophytes have dissected leaves for: **(Har. PMT 2003)**

- (A) Decreasing surface area (B) Increasing surface area  
(C) Reducing effect of water currents (D) Increasing number of stomata

**Q.46** Certain characteristic demographic features of developing countries are: **(CBSE 2004)**

- (A) High infant mortality, low fertility, uneven population r growth and a very young age distribution  
(B) High mortality, high density, uneven population growth and a very old age distribution  
(C) High fertility, low or rapidly falling mortality rate, rapid population growth and young age distribution  
(D) High fertility, high density, rapidly rising mortality rate and a very young age distribution

**Q.47** The maximum growth rate occurs in: **(CBSE 2004)**

- (A) Lag phase (B) Exponential phase  
(C) Stationary phase (D) Senescent phase

**Q.48** A terrestrial animal must be able to: **(CBSE 2004)**

- (A) Actively pump salts out through the skin (B) Excrete large amount of salts in urine  
(C) Excrete large amount of water in urine (D) Conserve water

- Q.49** In which one of the following habitats, does the diurnal temperature of soil surface vary most? **(CBSE 2004)**
- (A) Shrub land            (B) Forest            (C) Desert            (D) Grassland
- Q.50** Broad-leaved oak forests are found in: **(AFMC 2004)**
- (A) Tropical deciduous forest            (B) Mediterranean evergreen forest  
(C) Temperate deciduous forest            (D) North coniferous forest
- Q.51** Greatest biological problem faced by humanity is of: **(MP-PMT 2004)**
- (A) Population explosion            (B) Depletion of ozone shield  
(C) Depletion of natural resources            (D) Land erosion
- Q.52** Instrument used to measure the wind velocity is: **(MP-PMT 2004)**
- (A) Anemometer            (B) Hydrometer            (C) Lactometer            (D) Photometer
- Q.53** Science linking heredity with environment is: **(MP-PMT 2004)**
- (A) Ecology            (B) Ecophysiology            (C) Genecology            (D) Genetics
- Q.54** Halophytes are: **(Orissa JEE 2004)**
- (A) Salt resistant            (B) Fire resistant            (C) Cold resistant            (D) Sand loving
- Q.55** A plant living for a few days is: **(Orissa JEE 2004)**
- (A) Annual            (B) Ephemeral            (C) Biennial            (D) Perennial
- Q.56** Animals have innate ability to escape from predation. Select the incorrect example: **(CBSE 2005)**
- (A) Colour change in Chameleon  
(B) Enlargement of body by swallowing air in Puffer fish  
(C) Poison fangs of snakes  
(D) Melanin in moths
- Q.57** At which latitude, heat gain through insolation approximately equals heat loss through terrestrial radiation? **(CBSE 2005)**
- (A) 22.5° N and S            (B) 40° N and S            (C) 42.5° N and S            (D) 60° N and S

**Q.58** Which is not true for species? **(CBSE 2005)**

- (A) Members of a species can interbreed
- (B) Gene flow does not occur between populations of same spp.
- (C) A species is reproductively isolated from other species
- (D) Variations occur among members of a spp.

**Q.59** Which one represents correct match between organism and its ecological niche? **(AIIMS 2005)**

- (A) Vallisneria and pond
- (B) Desert locust (*Schistocerca*) and desert
- (C) Vultures and dense forest
- (D) Plant lice (aphids) and leaf

**Q.60** Plants growing in average conditions of temperature and moisture are: **(Manipur 2005)**

- (A) Hygrophytes
- (B) Hydrophytes
- (C) Mesophytes
- (D) Epiphytes

**Q.61** Habitat together with functions of a species constitute its: **(CPMT2005)**

- (A) Topography
- (B) Trophic level
- (C) Boundary
- (D) Ecological niche

**Q.62** Ozone protects biosphere from high energetic: **(DPMT2005)**

- (A) Infra-red rays
- (B) Ultraviolet rays
- (C) X-rays
- (D) Gamma rays

**Q.63** Which one is a xerophyte? **(KPMT 2005)**

- (A) Capparis
- (B) Lotus
- (C) China rose
- (D) Casuarina

**Q.64** Waxy coating on the surface of floating leaves prevents: **(Orissa JEE 2005)**

- (A) Respiration
- (B) Photosynthesis
- (C) Clogging of stomata
- (D) Transpiration

**Q.65** Avicennia, Rhizophora and Atriplex are: **(Orissa JEE 2005)**

- (A) Xerophytes
- (B) Halophytes
- (C) Hydrophytes
- (D) Mesophytes

**Q.66** Plants which behave as mesophytes in rainy season and xerophytes in summer are: **(Pb-PMT2005)**

- (A) Xerophytes
- (B) Phreatophytes
- (C) Mesophytes
- (D) Tropophytes

**Q.67** An orchid resembling the female of an insect so as to be able to get pollinated is due to phenomenon of: **(Pb-PMT2005)**

- (A) Mimicry (B) Pseudo-copulation  
(C) Pseudo-pollination (D) Pseudo-parthenocarpy

**Q.68** Which mammal excretes solid urine to avoid water loss? **(HP-PMT 2005)**

- (A) Crow (B) Kangaroo rat (C) Camel (D) Squirrel

**Q.69** In India, human population has higher number of younger age group due to: **(Pb. PMT 2005)**

- (A) Long life span and low birth rate (B) Short life span and high birth rate  
(C) Short life span and low birth rate (D) Birth rate is equal to death rate

**Q.70** Which of the following is wrongly matched? **(Kerala PMT 2005)**

- (A) Temperate zone - 20° to 40° latitude (B) Ozone layer - Stratosphere  
(C) Profundal zone - Dark zone (D) Ectotherms - Cold blooded animals

**Q.71** Niche overlap is: **(CBSE 2006)**

- (A) Mutualism between two species (B) Active cooperation between two species  
(C) Two different parasites on same food (D) Sharing resources between two species

**Q.72** Annual migration does not occur in: **(CBSE 2006)**

- (A) Arc tern (B) Salamander (C) Salmon (D) Siberian crane

**Q.73** Praying mantis is a good example of: **(CBSE 2006)**

- (A) Camouflage (B) Mullerian mimicry  
(C) Warning coloration (D) Social insect

**Q.74** Animals undergo inactive stage during winters. It is called; **(BHU 2006)**

- (A) Acclimatization (B) Hibernation (C) Aestivation (D) Adaptation

**Q.75** Soil transported by air is: **(BHU 2006)**

- (A) Alluvial (B) Glacial (C) Colluvial (D) Eolian

**Q.76** Warm blooded animals of cold climate have small extremities. This was stated by : **(CET Chd. 2006)**

- (A) Bargmen                      (B) Gloger                      (C) Dollo                      (D) Allen

**Q.77** Excessive aerenchyma is characteristic feature of : **(BV-Pune 2006)**

- (A) Heliophytes                      (B) Xerophytes                      (C) Mesophytes                      (D) Hydrophytes

**Q.78** Which plant is found in mangrove zone? **(RPMT2006)**

- (A) *Rhizophora*                      (B) *Acacia*                      (C) *Pinus*                      (D) *Tectona grandis*

**Q.79** Micro-organisms having optimum temperature for growth below 15 ° C and cannot grow above 20 ° C are called : **(AMU 2006)**

- (A) Mesophils                      (B) Thermophiles                      (C) Psychrophiles                      (D) None of these

**Q.80** Functional aspect of a species with reference to its place of occurrence is called: **(Orissa JEE 2006)**

- (A) Ecology                      (B) Environment                      (C) Ecological niche                      (D) Species

**Q.81** Sunken stomata occur in : **(Orissa JEE 2006)**

- (A) Xerophytes                      (B) Hydrophytes                      (C) Mesophytes                      (D) Opsanophytes

**Q.82** Biological organization starts with: **(CBSE 2007)**

- (A) Atomic level                      (B) Submicroscopic molecular level  
(C) Cellular level                      (D) Organismic level

**Q.83** If the mean and median pertaining to a certain character of a population are of the same value, the following is most likely to occur : **(CBSE 2007)**

- (A) A skewed curve                      (B) A normal distribution  
(C) A bi-modal distribution                      (D) A T-shaped curve

**Q.84** Two plants can be conclusively said to belong to the same species if they: **(CBSE 2007)**

- (A) Have same number of chromosomes  
(B) Can reproduce freely with each other and form seeds  
(C) Have more than 90 per cent similar genes  
(D) Look similar and possess identical secondary metabolites



**Q.94** Genetic drift operates in: **(Haryana PMT 2007)**

- (A) Large isolated population                      (B) Fast reproductive population  
(C) Small isolated population                      (D) Slow reproductive population

**Q.95** Root cap is absent in: **(Haryana PMT 2007)**

- (A) Xerophytes                      (B) Hydrophytes                      (C) Mesophytes                      (D) Halophytes

**Q.96** The zone of atmosphere in which the ozone layer is present is called: **(AIPMT 2014)**

- (A) Stratosphere                      (B) Troposphere                      (C) Ionosphere                      (D) Mesosphere

**Q.97** More than 70% of world's fresh water is contained in : **(JIPMER 2007)**

- (A) Antarctica                      (B) Glaciers and mountains  
(C) Greenland                      (D) Polar ice

**Q.98** Which of the following is not true for a species? **(JIPMER 2007)**

- (A) Members of a species can interbreed  
(B) Variations occur among members of a species  
(C) Each species is reproductively isolated from other species  
(D) Gene flow does not occur between the populations of a species

**Q.99** Biological species concept is mainly based on: **(BVP2007)**

- (A) Reproductive isolation                      (B) Morphological features only  
(C) Methods of reproduction only                      (D) Morphology and methods of reproduction

**Q.100** Edaphology is: **(KCET2007)**

- (A) Study of elephants                      (B) Study of snakes  
(C) Study of amphibians                      (D) None of these

**Q.101** Population density of terrestrial organisms is measured in terms of individuals per : **(KCET2007)**

- (A) Meter<sup>2</sup>                      (B) Meter                      (C) Meter<sup>3</sup>                      (D) Meter<sup>5</sup>

**Q.102** Top layer of soil is rich in: **(CPMT 2007)**

- (A) Minerals                      (B) Humus                      (C) Litter                      (D) None of these

**Q.103** Study of ecology of population is called: **(MP-PMT 2007)**

- (A) Autoecology      (B) Synecology      (C) Ecotype      (D) Demecology

**Q.104** Psammophytes are plants which grow where soil is: **(MP-PMT2007)**

- (A) Alkaline      (B) Sandy      (C) Acidic      (D) Alluvial

**Q.105** Species can be identified on the basis of: **(MP-PMT2007)**

- (A) Interbreeding      (B) Species diversity  
(C) Reproductive isolation      (D) None of these

**Q.106** Ecological study of single species is called: **(Orissa JEE 2007)**

- (A) Synecology      (B) Limnology      (C) Autoecology      (D) None of these

**Q.107** *Nicotiana sylvestris* flowers only during long days and *N. tobacum* flowers only during short days. If raised in the laboratory under different photoperiods, they can be induced to flower at the same time and can be cross fertilized to produce self-fertile offspring. What is the best reason for considering *N. sylvestris* and *N. tobacum* to be separate species? **(AIIMS 2007)**

- (A) They are physiologically distinct      (B) They are morphologically distinct  
(C) They cannot interbreed in nature      (D) They are reproductively distinct

**Q.108** What is a keystone species? **(AIIMS 2007)**

- (A) A species which makes up only a small proportion of the total biomass of a community, yet has a huge impact on the community's organization and survival  
(B) A common species that has plenty of biomass, yet has a fairly low impact on the community's organization  
(C) A rare species that has minimal impact on the biomass and on other species in the community  
(D) A dominant species that constitutes a large proportion of the biomass and which affect many other species

**Q.109** Consider the following four statements about certain desert animals such as kangaroo rat:

- (1) They are dark colored and have high rate of reproduction and excrete solid urine  
(2) They do not drink water, breathe at a slow rate to conserve water and have their body covered with thick

hair

(3) They feed on dry seeds and do not require drinking water

(4) They excrete highly concentrated urine and do not use water to regulate body temperature Which two of the above statements for such animals are true? **(CBSE 2008)**

- (A) 1 and 3                      (B) 1 and 2                      (C) 3 and 4                      (D) 2 and 3

**Q.110** A free living nitrogen-fixing cyanobacterium which can also form symbiotic association with the water term Azolla is : **(AFMC2008)**

- (A) *Tolypothrix*                      (B) *Chlorella*                      (C) *Nostoc*                      (D) *Anabaena*

**Q.111** The maximum growth rate occurs in : **(AFMC2008)**

- (A) Stationary phase      (B) Senescent phase      (C) Lag phase                      (D) Exponential phase

**Q.112** The presence of diversity at the junction of territories of two different habitats is called : **(BHU2008)**

- (A) Bottle neck effect      (B) Edge effect                      (C) Junction effect                      (D) Pasteur effect

**Q.113** July 11 is observed as: **(AIIMS 2008)**

- (A) World Population Day                      (B) No Tobacco Day  
(C) World Environment Day                      (D) World Health Day

**Q.114** Study of ecology of a population is called: **(Han PMT 2008)**

- (A) Autoecology                      (B) Synecology                      (C) Ecotype                      (D) Demecology

**Q.115** The amount of freshwater of the earth frozen as polar or glacial ice is : **(Kerala PMT 2008)**

- (A) 0.5%                      (B) 0.02%                      (C) 0.01%                      (D) 1.97%

**Q.116** The change in population size at a given time interval  $t$ , is given by the expression  $N_t = N_0 + B + I - D - E$ , where  $I$ ,  $B$  and  $D$  stand for : **(Kerala PMT 2008)**

- (A) Immigrate rate, mortality rate, natality rate                      (B) Emigration rate, natality rate, mortality rate  
(C) Mortality rate, natality rate, immigration rate                      (D) Mortality rate, immigration rate, natality rate  
(E) Immigrate rate, natality rate, mortality rate

**Q.117** The plants of this group are adapted to live partly in water and partly above substratum and free from water: **(Orissa JEE 2008)**

(A) Xerophytes            (B) Thalophytes            (C) Helophytes            (D) Hydrophytes

**Q.118** Which one represents a mutualistic association of a fungus with roots of higher plant?

**(Orissa JEE 2008)**

(A) Mycorrhiza            (B) Mycoplasma            (C) Lichen            (D) Myxomycetes

**Q.119** If the stronger partner is benefited and the weaker partner is harmed, it is known as :

**(J&KCET2008)**

(A) Symbiosis            (B) Predation            (C) Allelopathy            (D) Commensalism

**Q.120** The equation  $\Delta N_r / \Delta N_t = B$  represents which of the following?

**(WB-JEE 2008)**

(A) Natality            (B) Growth rate            (C) Mortality            (D) All of these

**Q.121** Identify which one of the following is an example of incomplete ecosystem?

**(WB-JEE 2008)**

(A) Grassland            (B) Cave            (C) River            (D) Wetland

**Q.122** Reduction in vascular tissue, mechanical tissue and cuticle is characteristic of:

**(CBSE2009)**

(A) Xerophytes            (B) Mesophytes            (C) Epiphytes            (D) Hydrophytes

**Q.123** If in a population, natality is balanced by mortality, then there will be:

**(AFMC 2009)**

(A) Decrease in population growth            (B) Zero population growth  
(C) Increase in population growth            (D) Over population

**Q.124** Xerophytes are mostly:

**(AFMC 2009)**

(A) Succulents            (B) Water related            (C) Mesophytes            (D) None of these

**Q.125** Halophytes are grown in:

**(CPMT2009)**

(A) Salty soil or saline soil            (B) Near the river  
(C) Rainy water            (D) Desert

**Q.126** Niche is defined as:

**(DPMT2009)**

(A) Position of a species in a community in relation to other species

- (B) Place where an organism lives  
 (C) Place where an organism lives and performs its duty  
 (D) Place where population performs its duty

**Q.127** The assemblage of all the populations of different species that function as an integrated unit through co-evolved metabolic transformation in a specific area is called: **(J&K-CET2009)**

- (A) Biome                      (B) Biotic community                      (C) Population                      (D) Ecosystem

**Q.128** The species of plant that play a vital role in controlling the relative abundance of other species in a community are called: **(J&K-CET2009)**

- (A) Edge species                      (B) Keystone species                      (C) Pioneer species                      (D) Serai species

**Q.129** Which one is the edaphic factor in biosphere? **(J&K-CET2009)**

- (A) Light                      (B) Temperature                      (C) Water                      (D) Soil

**Q.130** Genetically-adapted population to a particular area is called: **(J & K - CET 2009)**

- (A) Ecotone                      (B) Biome                      (C) Ecotype                      (D) Niche

**Q.131** Ratio between mortality and natality is called: **(MP-PMT2000 & J&K-CET2009)**

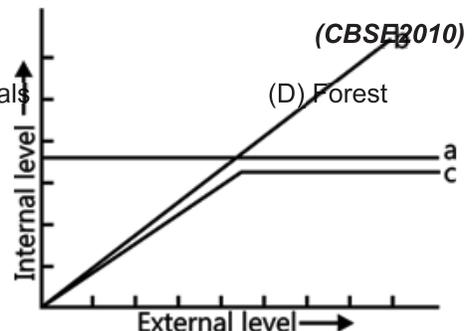
- (A) Vital index                      (B) Population ratio                      (C) Density coefficient                      (D) Census ratio

**Q.132** The figure below is a diagrammatic representation of response of organisms to abiotic factors. What do a, b and c represent respectively? **(CBSE2010)**

- | a                     | b                 | c                 |
|-----------------------|-------------------|-------------------|
| (A) Conformer         | Regulator         | Partial regulator |
| (B) Regulator         | Partial regulator | Conformer         |
| (C) Partial regulator | Regulator         | Conformer         |
| (D) Regulator         | Conformer         | Partial regulator |

**Q.133** A renewable exhaustible natural resource is:

- (A) Coal                      (B) Petroleum                      (C) Minerals                      (D) Forest



**Q.134** Which one of the following is a xerophytic plant in which the stem is modified into flat green and succulent structure? **(CBSE Main 2010)**

- (A) *Opuntia* (B) *Casuarina* (C) *Hydrilla* (D) *Acacia*

**Q.135** In cold climate, the animals have short tail, shorter limbs and ears, this is called: **(AFMC 2010)**

- (A) Allen's law (B) Bergman's law (C) Cope's law (D) Jordan's law

**Q.136** Which of the following is a long day plant? **(AFMC2010)**

- (A) Glycinmax (B) Spinach (C) Chrysanthemum (D) Tobacco

**Q.137** The species, though insignificant in number, determine the existence of many other species in a given ecosystem. Such species is known as: **(KCET2010)**

- (A) Endemic species (B) Sacred species  
(C) Extinct species (D) Keystone species

**Q.138** Which of the following soil is transported by air? **(CPMT2010)**

- (A) Alluvial (B) Aeolian (C) Elluvial (D) Glacial

**Q.139** The timing of seasonal activities of plants in relation to change in environmental conditions is termed as: **(DPMT2010)**

- (A) Dendrochronology (B) Biological clock (C) Lapse rate (D) Phenology

**Q.140** Who is considered as Father of Ecology in India? **(DPMT 2010)**

- (A) Ramdeo Misra (B) M. S. Swaminathan (C) P. Maheshwari (D) S.L. Mehta

**Q.141** A common means of sympatric speciation is : **(DPMT 2010)**

- (A) Polyploidy (B) Temporal segregation of breeding season  
(C) Spatial segregation of mating sites (D) Imposition of geographical barrier

**Q.142** Many fresh-water animals cannot live for long in sea water and vice versa mainly because of the: **(Kerala PMT 2010)**

- (A) Change in N-levels                      (B) Variations in light intensity  
 (C) Osmotic problems                      (D) Special quality of solar radiations  
 (E) Change in level of thermal tolerance

**Q.143** The formula of growth rate for population in given time is:

**(Kerala PMT2010)**

- (A)  $dt/dN = rN$                       (B)  $dt/rN = dN$                       (C)  $rN/dN = dt$   
 (D)  $dN/rN-dt$                       (E)  $dN/dt = rN$

**Q.144** An evolutionary pattern characterized by rapid increase in the number and kinds of closely related species is called:

**(AMU2010)**

- (A) Convergent evolution                      (B) Divergent evolution  
 (C) Adaptive radiation                      (D) Parallel evolution

**Q.145** The volume and surface area of a deer are  $150,000 \text{ cm}^3$  and  $19,000 \text{ cm}^2$ , and those of a squirrel are  $625 \text{ cm}^3$  and  $530 \text{ cm}^2$ . The area available for heat loss per  $\text{cm}^3$  volume of the squirrel will be approximately:

**(AMU 2010)**

- (A) Seven times more than the deer                      (B) Five times less than the deer  
 (C) Three times more than the deer                      (D) Eleven times more than the deer

**Q.146** Consider the following four conditions (1-4) and select the correct pair of them as adaptation to environment in desert lizards. The conditions:

- (1) Burrowing in soil to escape high temperature  
 (2) Losing heat rapidly from the body during high temperature  
 (3) Bask in sun when temperature is low  
 (4) Insulating body due to thick fatty dermis

**(CBSE 2011)**

- (A) (3), (4)                      (B) (1), (3)                      (C) (2), (4)                      (D) (1), (2)

**Q.147** Inter-breeding animals belong to the same:

**(CBSE 2011)**

- (A) Genus                      (B) Family                      (C) Species                      (D) Order

**Q.148** Lichens represent symbiotic relationship between:

**(AMU 2011)**

- (A) Alga and bacteria                      (B) Fungi and higher plants

- (C) Alga and fungi (D) Viruses and bacteria

**Q.149** Select the incorrect statement: **(Kerala PMT 2011)**

- (A) An overwhelming majority of animals and nearly all plants maintain a constant internal environment  
(B) An orchid growing as an epiphyte on a mango branch is an example of commensalism  
(C) In brood parasitism, the parasite bird lays its eggs in the nest of its host and lets the host to incubate them  
(D) Very small animals are rarely found in polar regions  
(E) In amensalism, one species is harmed whereas the other is unaffected

**Q.150**  $-1^{\circ}\text{C}$  to  $13^{\circ}\text{C}$  annual variations in the intensity and duration of temperature and 50 cm to 250 cm annual variation in precipitation, account for the formation of a major biome as : **(Kerala PMT 2011)**

- (A) Temperate forest (B) Coniferous forest (C) Tropical forest  
(D) Grassland (E) Desert

**Q.151** Which is referred to as "Lungs of the Planet Earth"? **(Kerala PMT 2011)**

- (A) Western Ghats (B) Lake Victoria (C) Greenland (D) Amazon rainforest  
(E) Himalayas

**Q.152** The study of the relation of an organism with its environment is called: **(J&K CET2011)**

- (A) Synecology (B) Bionomics (C) Autoecology (D) Herpetology

**Q.153** Maximum survival and reproductive capacity shown by a population under optimal environmental conditions is called: **(J&K CET2011)**

- (A) Carrying capacity (B) Natality (C) Biotic potential (D) Vitality

**Q.154** Pedology refers to study of: **(J&K CET2011)**

- (A) Soil (B) Water (C) Population (D) Fossils

**Q.155** The basic unit of study in ecology is : **(DUMET 2011)**

- (A) Population (B) Organism (C) Community (D) Species

**Q.156** The most important factor which determined the increase in human population in India during the 20th century was: **(DUMET 2011)**

- (A) Natality                      (B) Mortality                      (C) Immigration                      (D) Emigration

**Q.157** A population growing in a habitat with limited resources shows four phases of growth in the following sequence: **(DUMET 2011)**

- (A) Acceleration → Deceleration → Lag phase → Asymptotic  
 (B) Asymptotic → Acceleration → Deceleration → Lag phase  
 (C) Lag phase → Acceleration → Deceleration → Asymptotic  
 (D) Acceleration → Lag phase → Deceleration → Asymptotic

**Q.158** Sigmoid growth curve is represented by: **(DUMET2011)**

- (A)  $dN/dt = rN$                       (B)  $dN/dt = rN (1 - N/K)$   
 (C)  $N_t = N_0 + B + I - D - E$                       (D)  $dN/dt = 1 - N/K$

**Q.159** Age pyramid with broad base indicates: **(DUMET 2011)**

- (A) High percentage of young individuals  
 (B) Low percentage of young individuals  
 (C) High percentage of old individuals  
 (D) Low percentage of old individuals

**Q.160** Term "niche" was first used by: **(UP CPMT 2011)**

- (A) Clements                      (B) Grinnell                      (C) Warming                      (D) Odum

**Q.161** An interaction favorable to both the populations, but not obligatory to either is : **(UP CPMT 2011)**

- (A) Proto-cooperation      (B) Mutualism                      (C) Commensalism                      (D) Parasitism

**Q.162** Mass of living matter at a trophic level in an area at any time is called: **(CBSE 2011)**

- (A) Detritus                      (B) Humus                      (C) Standing state                      (D) Standing crop

**Q.163** Mycorrhiza promotes plant growth by: **(Manipur Board 2014)**

- (A) Absorbing inorganic ions from soil  
 (B) Helping the plant in utilizing atmospheric nitrogen  
 (C) Protecting the plant from infection  
 (D) Serving as plant growth regulator

**Q.164** In a population, unrestricted reproductive capacity is called: **(WBJEE2011)**

- (A) Biotic potential                      (B) Fertility                      (C) Carrying capacity                      (D) Birthrate

**Q.165** The interaction where one species is benefitted and the other is neither benefitted nor harmed, is called: **(J&K CEE 2012)**

- (A) Amensalism      (B) Commensalism      (C) Mutualism      (D) Predation

**Q.166** The vertical distribution of different species occupying different levels is called as: **(J&K CEE 2012)**

- (A) Stratification      (B) Fragmentation      (C) Mobilization      (D) Mineralization

**Q.167** The population limited to a particular geographical area is called: **(J&K CEE 2012)**

- (A) Pandemic      (B) Endemic      (C) Alien      (D) Natural

**Q.168** The carrying capacity of environment for a given population can be represented by the equation: **(AMU 2012)**

- (A)  $dN = rN - N/K$       (B)  $dN/dt = rN - N/K$       (C)  $dN/dt = rN - 1/K$       (D)  $dN/dt = rN - (1 - N/K)$

**Q.169** In fish *Catla catla*, the specific name is identical with the generic name. It is an example of: **(AMU 2012)**

- (A) Autonym      (B) Tautonym      (C) Synonym      (D) Homonym

**Q.170** Some organisms are tolerant to a narrow range of salinity and are termed as: **(AMU 2012)**

- (A) Euryhaline      (B) Stenohaline  
(C) Neither (A) nor (B)      (D) Saline

**Q.171** Biologist who has been called the "Darwin of the 20 century" was: **(AMU 2012)**

- (A) Linnaeus      (B) Ernst Mayr      (C) Diener      (D) Whittaker

**Q.172** Organisms capable of maintaining constant body temperature are: **(AFMC 2012)**

- (A) Stenothermal      (B) Homeothermal      (C) Poikilothermal      (D) Conformers

**Q.173** Which of the following causes parasitic castration of crab? **(BHU 2012)**

- (A) *Sacculina*      (B) *Adamsia*      (C) *Spongilla*      (D) None of these

**Q. 174** The stage of suspended development shown by zooplanktons is called : **(Kerala PMT 2012)**

- (A) Desiccation      (B) Diapause      (C) Hibernation      (D) Homeostasis  
(E) Aestivation

**Q.175** Which of the following statements is false regarding predators? **(Kerala PMT 2012)**

- (A) Predators keep prey population under control
- (B) Predators help in maintaining species diversity in a community
- (C) If a predator is not efficient, then the prey population would become extinct
- (D) Herbivores (predators) have a greater advantage since the plants cannot run away to avoid predation
- (E) Tiger is an example of a predator

**Q.176** Lichen is an example of: **(Haryana Board 2012)**

- (A) Mutualism
- (B) Commensalism
- (C) Predation
- (D) Competition

**Q.177** Orchid growing on a mango branch is example of: **(Haryana Board 2012)**

- (A) Mutualism
- (B) Commensalism
- (C) Predation
- (D) Competition

**Q.178** *Cuscuta* is an example of: **(Haryana Board 2012)**

- (A) Mutualism
- (B) Commensalism
- (C) Parasitism
- (D) Competition

**Q.179** A biologist studied the population of rats in a barn. He found that average natality was 250, average mortality 240, immigration 20 and emigration 30. The net increase in population is: **(NEET2013)**

- (A) 10
- (B) 15
- (C) 05
- (D) Zero

**Q.180** A sedentary sea anemone gets attached to the shell lining of hermit crab. The association is:

**(NEET 2013)**

- (A) Ectoparasitism
- (B) Symbiosis
- (C) Commensalism
- (D) Amensalism

**Q.181** Full name of Professor Misra who is known as the "Father of Ecology" in India is: **(AMU 2013)**

- (A) Ramesh Misra
- (B) Ramavtar Misra
- (C) Ramakant Misra
- (D) Ramdeo Misra

**Q.182** Population growth curve is sigmoid, if the growth pattern is: **(AMU 2013)**

- (A) Logistic
- (B) Geometric
- (C) Exponential
- (D) Accretionary

**Q.183** Temperature increases with height in which of the following? **(AMU 2013)**

- (A) Troposphere
- (B) Stratosphere
- (C) Mesosphere
- (D) None of the above

**Q.184**  $(dN/dt) \times rN$  equation is applicable to.....population growth. **(Jharkhand Board 2013)**

- (A) Exponential (B) Logistic  
(C) Both (A) and (B) (D) Not related to population

**Q.185** A few normal seedlings of tomato were kept in a dark room. After a few days they were found to have become white- colored like albinos. Which of the following terms will you use to describe them?

**(AIPMT 2014)**

- (A) Etiolated (B) Defoliated (C) Mutated (D) Embolised

## ANSWER KEY

### Objective Questions

Q.1 A	Q.2 C	Q.3 D	Q.4 C	Q.5 D	Q.6 D
Q.7 A	Q.8 C	Q.9 C	Q.10 D	Q.11 B	Q.12 C
Q.13 B	Q.14 C	Q.15 C	Q.16 B	Q.17 B	Q.18 C
Q.19 A	Q.20 D	Q.21 D	Q.22 B	Q.23 B	Q.24 A
Q.25 B	Q.26 C	Q.27 C	Q.28 B	Q.29 D	Q.30 C
Q.31 C	Q.32 A	Q.33 C	Q.34 B	Q.35 D	Q.36 C
Q.37 C	Q.38 A	Q.39 D	Q.40 B	Q.41 C	Q.42 C
Q.43 B	Q.44 A	Q.45 A	Q.46 C	Q.47 D	Q.48 A
Q.49 E	Q.50 D	Q.51 C	Q.52 B	Q.53 D	

### Previous Years Questions

Q.1 C	Q.2 D	Q.3 B	Q.4 B	Q.5 A	Q.6 D
Q.7 B	Q.8 B	Q.9 B	Q.10 D	Q.11 C	Q.12 A
Q.13 D	Q.14 D	Q.15 D	Q.16 A	Q.17 B	Q.18 A
Q.19 C	Q.20 B	Q.21 A	Q.22 D	Q.23 B	Q.24 C
Q.25 C	Q.26 A	Q.27 B	Q.28 B	Q.29 A	Q.30 B
Q.31 C	Q.32 A	Q.33 D	Q.34 D	Q.35 B	Q.36 D
Q.37 A	Q.38 C	Q.39 C	Q.40 B	Q.41 A	Q.42 B
Q.43 B	Q.44 A	Q.45 C	Q.46 C	Q.47 B	Q.48 D
Q.49 C	Q.50 C	Q.51 A	Q.52 A	Q.53 C	Q.54 A
Q.55 B	Q.56 C	Q.57 D	Q.58 B	Q.59 D	Q.60 C
Q.61 D	Q.62 B	Q.63 A	Q.64 C	Q.65 B	Q.66 D
Q.67 A	Q.68 B	Q.69 B	Q.70 A	Q.71 D	Q.72 B
Q.73 A	Q.74 B	Q.75 D	Q.76 D	Q.77 D	Q.78 A
Q.79 C	Q.80 C	Q.81 A	Q.82 C	Q.83 B	Q.84 B
Q.85 C	Q.86 D	Q.87 C	Q.88 B	Q.89 A	Q.90 B

<b>Q.91 A</b>	<b>Q.92 D</b>	<b>Q.93 B</b>	<b>Q.94 C</b>	<b>Q.95 B</b>	<b>Q.96 A</b>
<b>Q.97 D</b>	<b>Q.98 D</b>	<b>Q.99 A</b>	<b>Q.100 D</b>	<b>Q.101 A</b>	<b>Q.102 B</b>
<b>Q.103 D</b>	<b>Q.104 B</b>	<b>Q.105 C</b>	<b>Q.106 C</b>	<b>Q.107 C</b>	<b>Q.108 A</b>
<b>Q.109 C</b>	<b>Q.110 D</b>	<b>Q.111 D</b>	<b>Q.112 B</b>	<b>Q.113 A</b>	<b>Q.114 D</b>
<b>Q.115 D</b>	<b>Q.116 E</b>	<b>Q.117 C</b>	<b>Q.118 A</b>	<b>Q.119 B</b>	<b>Q.120 B</b>
<b>Q.121 B</b>	<b>Q.122 D</b>	<b>Q.123 B</b>	<b>Q.124 A</b>	<b>Q.125 A</b>	<b>Q.126 C</b>
<b>Q.127 B</b>	<b>Q.128 B</b>	<b>Q.129 D</b>	<b>Q.130 C</b>	<b>Q.131 A</b>	<b>Q.132 D</b>
<b>Q.133 D</b>	<b>Q.134 A</b>	<b>Q.135 A</b>	<b>Q.136 B</b>	<b>Q.137 D</b>	<b>Q.138 B</b>
<b>Q.139 D</b>	<b>Q.140 A</b>	<b>Q.141 B</b>	<b>Q.142 C</b>	<b>Q.143 E</b>	<b>Q.144 C</b>
<b>Q.145 A</b>	<b>Q.146 B</b>	<b>Q.147 C</b>	<b>Q.148 C</b>	<b>Q.149 D</b>	<b>Q.150 B</b>
<b>Q.151 D</b>	<b>Q.152 B</b>	<b>Q.153 C</b>	<b>Q.154 A</b>	<b>Q.155 B</b>	<b>Q.156 A</b>
<b>Q.157 C</b>	<b>Q.158 B</b>	<b>Q.159 A</b>	<b>Q.160 B</b>	<b>Q.161 A</b>	<b>Q.162 D</b>
<b>Q.163 A</b>	<b>Q.164 A</b>	<b>Q.165 B</b>	<b>Q.166 A</b>	<b>Q.167 B</b>	<b>Q.168 D</b>
<b>Q.169 B</b>	<b>Q.170 B</b>	<b>Q.171 B</b>	<b>Q.172 B</b>	<b>Q.173 A</b>	<b>Q.174 B</b>
<b>Q.175 C</b>	<b>Q.176 A</b>	<b>Q.177 B</b>	<b>Q.178 C</b>	<b>Q.179 D</b>	<b>Q.180 B</b>
<b>Q.181 D</b>	<b>Q.182 A</b>	<b>Q.183 B</b>	<b>Q.184 A</b>	<b>Q.185 A</b>	