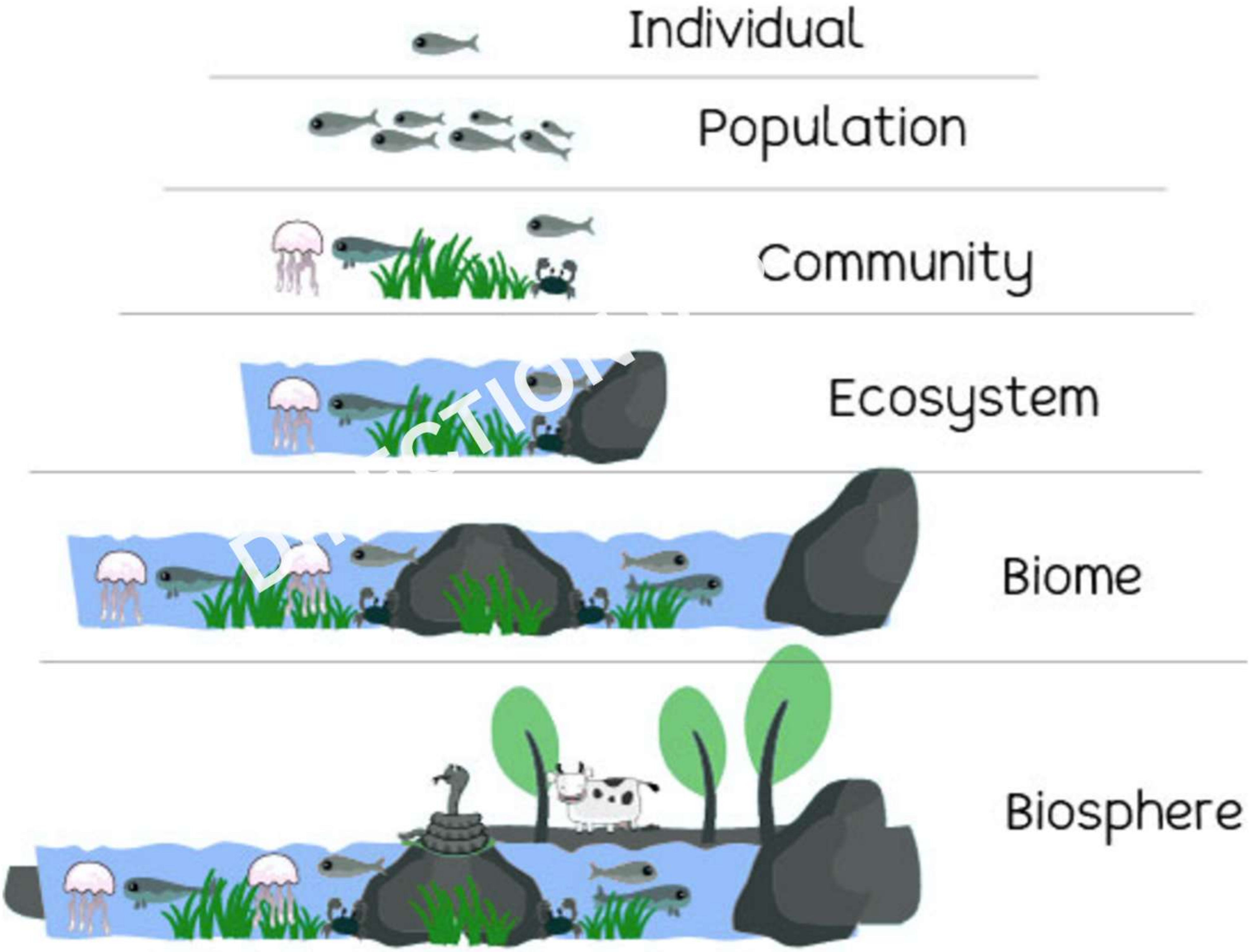
What is Ecology

The word ecology is a combination of the Greek 'oikos,' for house, and 'logy' for knowledge. Literally translated, ecology means 'the study of our house.' Our house is planet Earth.

Ecology is the study of every living thing in every environment, at every scale, from the bacteria living on your skin to a blue whale breaching in the Southern Ocean, It's the ocean itself and everything in it. It's vast and tiny, planet-wide and microscopic.


Individual
Population
Community
Ecosystem
Biome
Biosphere

Organismal ecology is all about looking at how individual organisms are shaped—both physically and behaviorally—to thrive in their environments.

For example:

Morphological adaptations: A cactus has thick, fleshy stems to store water and spines instead of leaves to reduce water loss.

Physiological adaptations: Arctic foxes can change their fur color seasonally—white in winter for camouflage in snow, brown in summer to blend with tundra.

Behavioral adaptations: Birds migrating to warmer regions during winter to access food and better living conditions.

Population Ecology

Population ecology is the study of how the number of individuals of a particular species in a given area changes over time, and the factors that influence these changes.
It focuses on population size, density, distribution, and the processes such as birth, death, immigration, and emigration that regulate population dynamics.

Community ecology It's the study of how different species interact within the same area and how those interactions shape the structure and dynamics of the community.

Types of interactions:

Competition (species competing for the same resources)

Predation (one species feeding on another)

Mutualism (both species benefit, like bees and flowers)

Commensalism (one benefits, the other is unaffected)

Parasitism (one benefits at the expense of the other)

Consequences of interactions:

Influence on species diversity and abundance

Shaping of food webs and trophic structures

Driving adaptations and co evolution

Affecting ecosystem stability and resilience

Ecosystem Ecology the study of communities to include both the living components (biotic) and the non-living physical and chemical factors (abiotic) in a given area. It examines how organisms interact with each other and with their environment, creating a dynamic system.

The **environment** simply refers to the surroundings without necessarily emphasizing those interactions.

- **Interaction vs. Surroundings:** The environment is about the general surroundings, while the ecosystem highlights the interactions between organisms and their surroundings.
- **Functional Unit vs. Habitat:** An ecosystem is a functional unit of nature, whereas the environment is the broad habitat itself.
- **Interdependence:** An ecosystem emphasizes the interdependence of its components to maintain stability, a concept not necessarily implied in the broader environment.

Abiotic Factors

Physical Factors:

Temperature: The level of heat or cold in an environment.

Water: The availability of water, including precipitation, and its properties like salinity and dissolved oxygen.

Light: The amount of sunlight available for processes like photosynthesis.

Soil: The type, composition, and nutrient content of the soil.

Atmosphere: Gases in the air, humidity, and wind patterns.

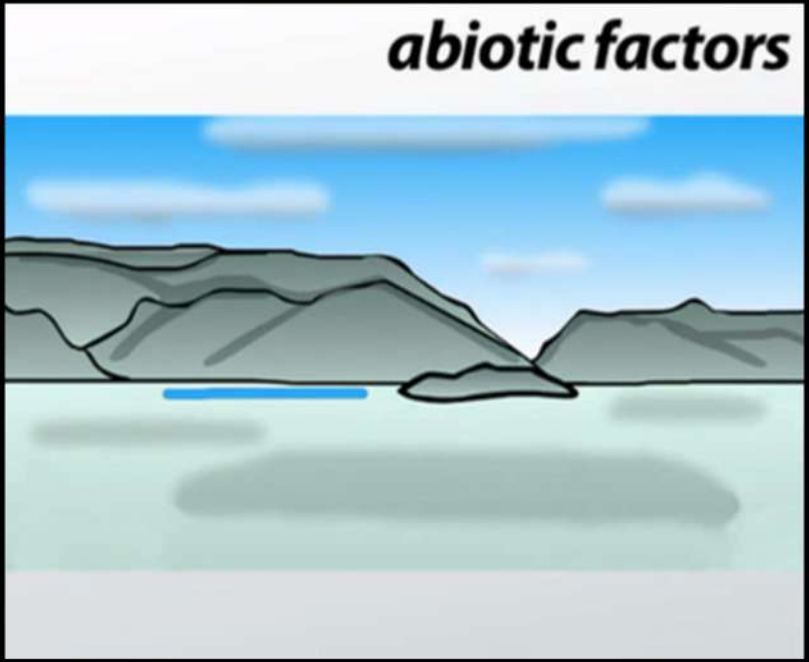
Elevation/Altitude: The height above sea level.

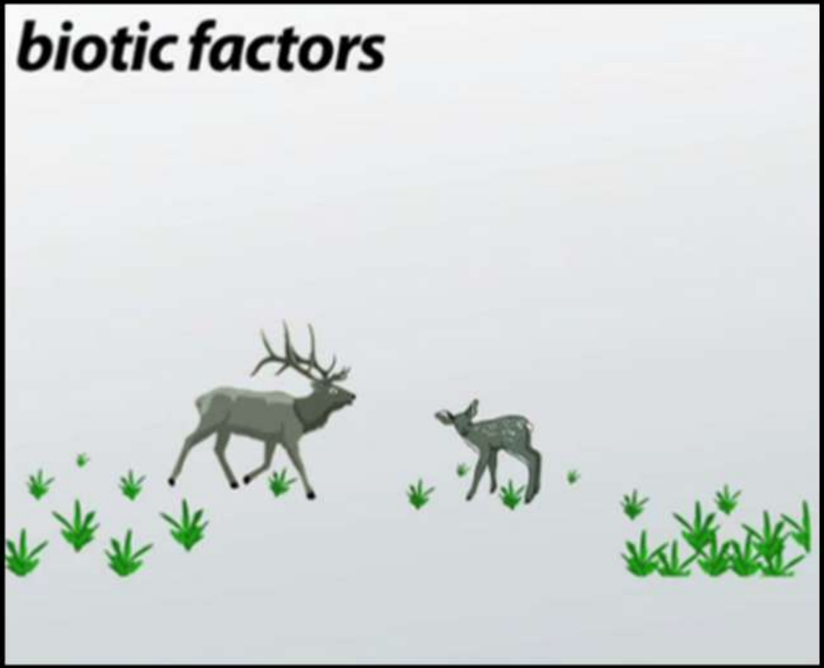
Chemical Factors:

pH: The acidity or alkalinity of the soil or water.

Salinity: The amount of salt in the water, especially relevant in marine ecosystems.

Nutrients: The mineral and organic compounds available in the soil or water.





Temperature

Temperature of the air and water affect animals, plants and humans in ecosystems. A rise in temperature has the potential to change the way a living thing develops, because it changes the metabolic rate of the organism. All living organisms have a tolerance level for temperature range. For example, a human being would die if he stood out in minus 50 degree temperatures for any length of time. Light exposure often affects the temperature. Areas with direct sunlight are warmer.

- Organisms which can tolerate wide fluctuations in temperature are termed - Eurythermal. Eg: Lizards, Birds and Mammal
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- Organisms which can tolerate only small variation in temperature are termed Stenothermal organisms Eg: Coral animals, Fishes
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- The number of hours of daylight triggers seasonal events, such as: -plants flowering -birds migrating

Homeothermic animals

The term ‘homeo’ derives from Greek and means ‘same’ or ‘similar’. This is because the definition of a homeotherm is:

An animal or organism that maintains a relatively constant body temperature.

The ability to maintain a relatively steady body temperature is due to internal physiological processes. Since these process are internal, it means they are endothermic (i.e. their heat comes from within). Such processes allow the organism to maintain their bodily functions, even when the external environment changes drastically.

Traditionally, homeothermic animals have been known as ‘warm-blooded animals’.

Only birds and mammals are currently considered true homeothermic animals. There is an exception in the reptile group of animals, specifically the Argentine black and white tegu (Salvator merianae). This homeothermic lizard has some endothermic behavior, but also relies on environmental temperature for survival.

Poikilotherm animals

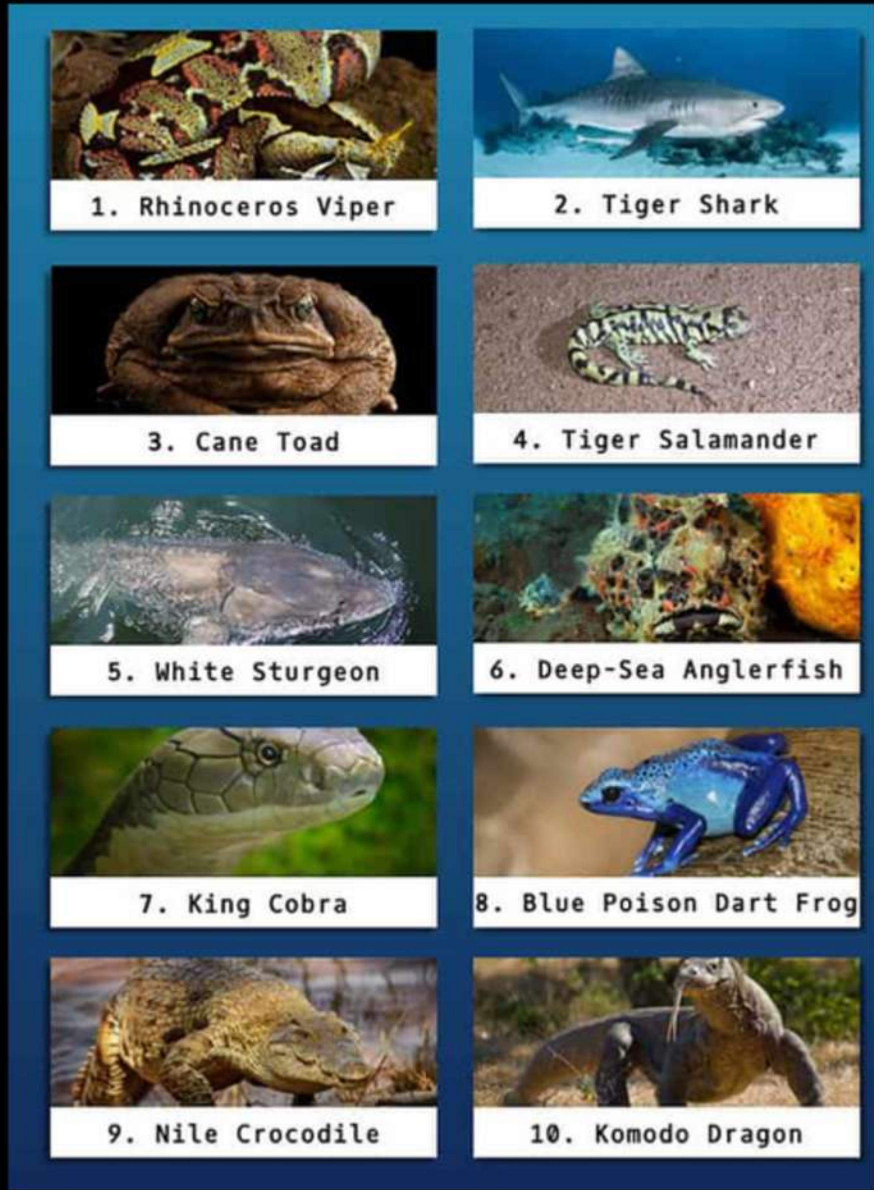
The term **'poikilo'** is also of Greek origin and means 'varied'. In this case, the definition of a poikilotherm is:

An animal or organism that has a considerably variable temperature.

The reason why poikilotherms have a highly variable temperature is because they cannot self-regulate it. Accordingly, their body temperature varies according to the environmental temperature. As a contract to endothermic behavior, this means that poikilotherms are exothermic since their heat comes from external sources. It is for this reason they are known as 'cold-blooded animals', despite this being and imprecise description of their type of thermoregulation.

Poikilothermic animals are exposed to various temperatures in their environment.

Unlike homeotherms, poikilothermic animals can survive without eating for much longer periods. This is because they do not depend on metabolizing



Water

Precipitation: Fog, Mist, Rain, Snow, Sleet, Hail
Runoff: Brook, Creek, Stream, River Water Table: Puddle, Pond, Lake (Ocean not freshwater)
Soil Water: Most useful for plants Aquifers: porous rock, wells, artesian wells, springs
• All living things need water to carry out life processes”
• Plants need water for photosynthesis • Animals need water to digest food and release energy stored in the food
• Desert Oasis: forms when underground water comes to the surface
•Ecosystesm with lots of water can support a large number of different types of plants, which in turn support a variety of types of animals

Types fish migration on the basis of needs:

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

Types of fish migration

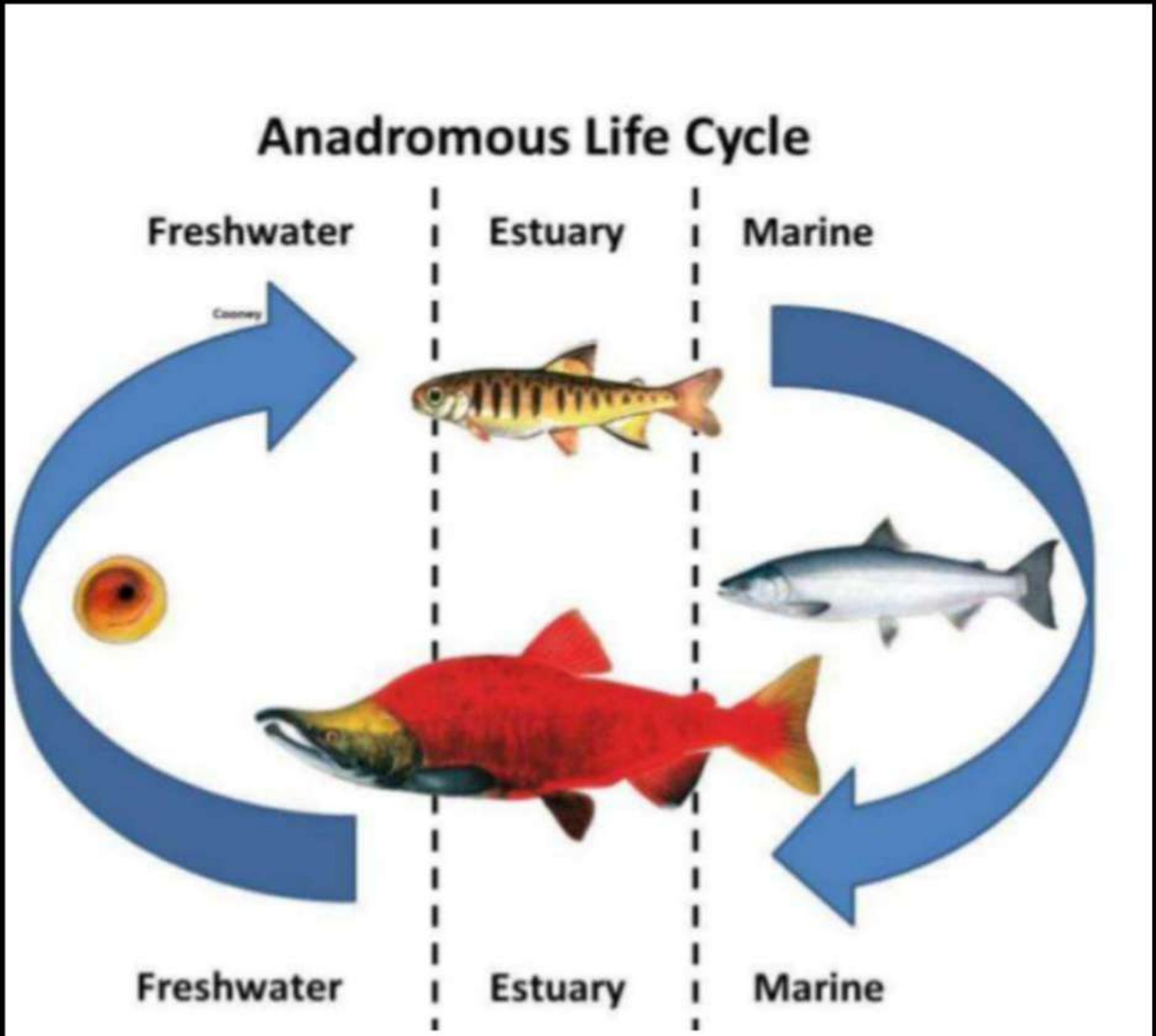
1. Diadromous migration 2. Potamodromous migration 3. Oceanodromous migration

1.Diadromous migration: It is the migration of fish between sea and fresh water.

Diadromous migration is of three types

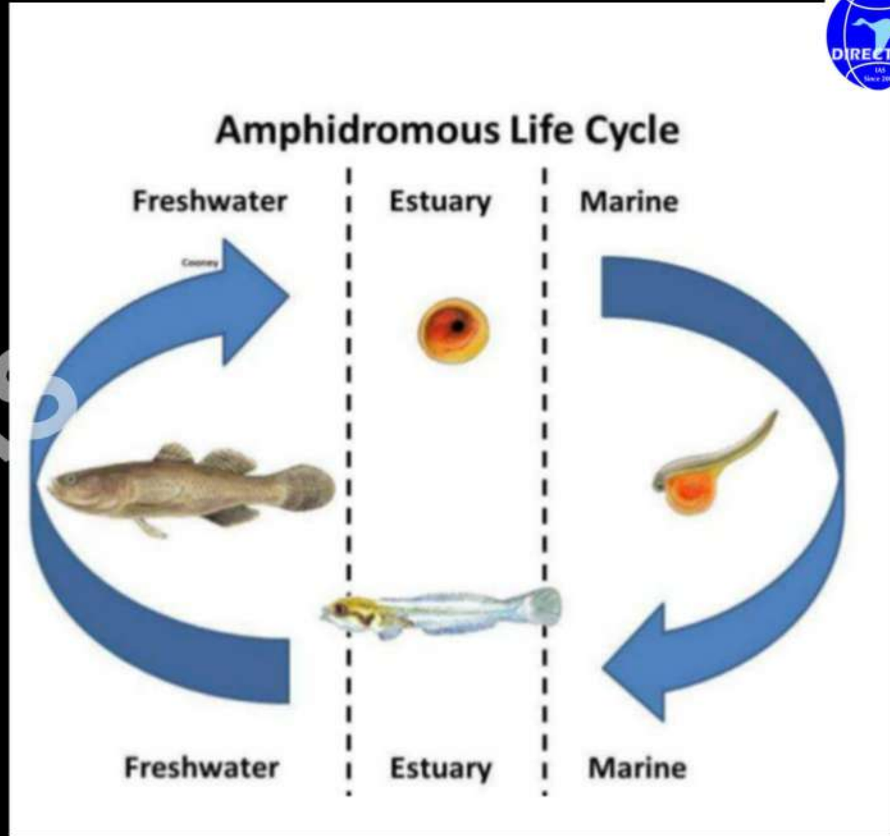
Anadromous migration

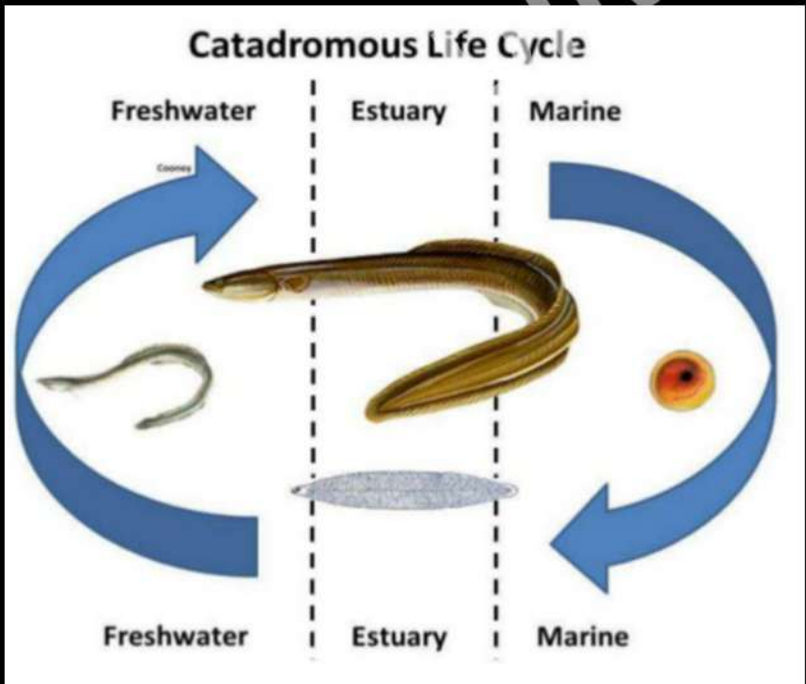
- It is the migration of marine fishes from sea to fresh water for spawning.
- Fishes spend most of their life living and feeding in sea.
- They only migrate during breeding season to the river for spawning ground. Eg. Salmon, Hilsa etc.



Catadromous migration

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



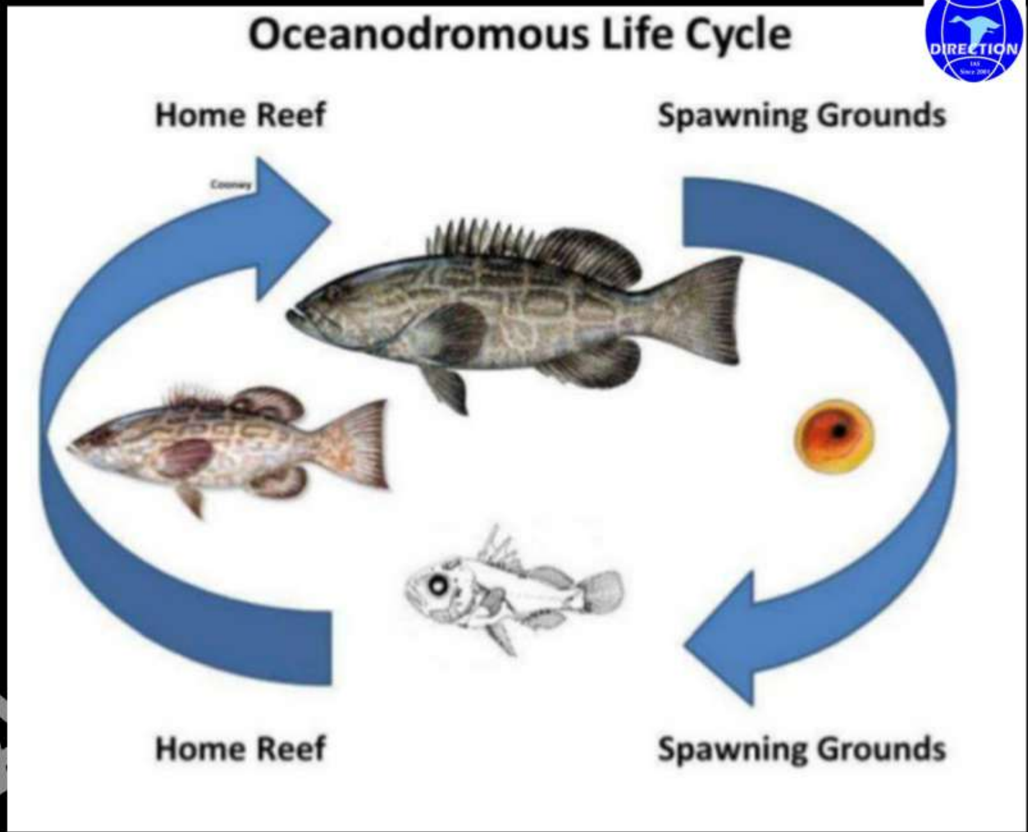


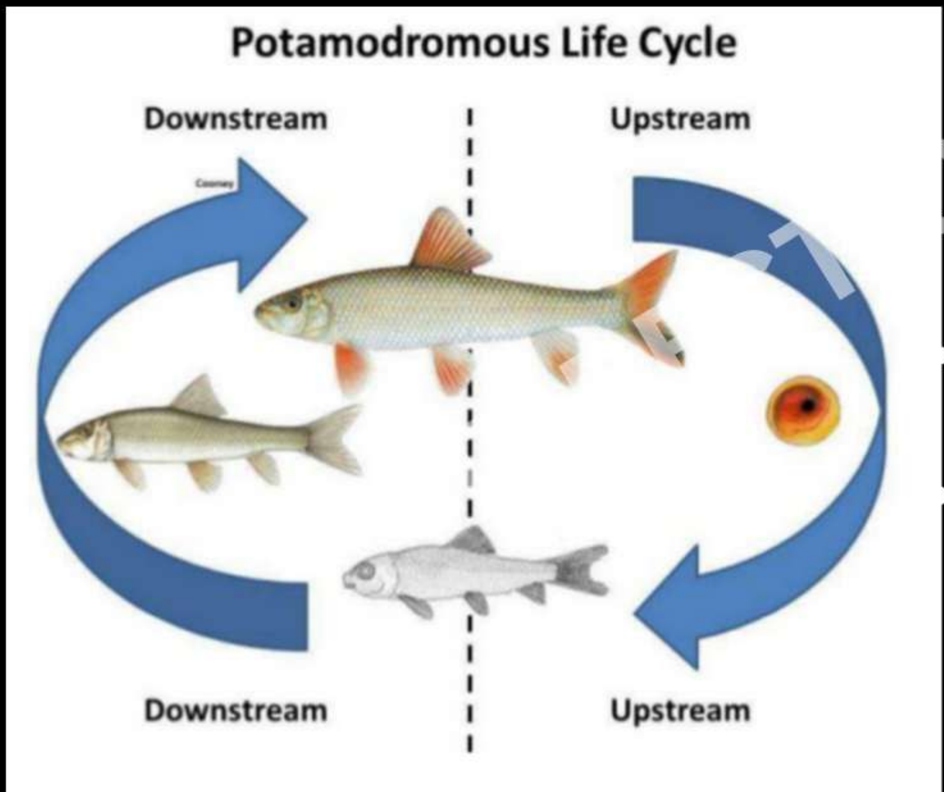
1. Amphidromous migration

Type of migration which involves movement from fresh water to the sea or vice versa, is not for the purpose of breeding. But this migration occurs regularly at some definite stage of the life cycle. examples includes Bigmouth sleeper, mountain mullet, torrentfish, Dolly Varden

2. Potamodromous migration:

- Movement is confined to fresh water . These species travel long distances in river to locate suitable spawning grounds .
- Fish are born in upstream freshwater habitats, then migrate downstream (still in freshwater) as juveniles to grow into adults before migrating back upstream to spawn.
- Examples: catfish, cyprinidies, etc.





3. Oceanodromous migration:

- Truly migratory fishes which live and migrate in the sea.
- Many marine fishes like the cod , the herrings (Clupea), mackerels (Scomber) and the tunnas (Thunnas) travel long distance in the sea to deposit their eggs, and later return to the feeding grounds.

Light

Light is a complex environmental factor that produces diverse ecological effects. Light energy (sunlight) is the primary source of energy in nearly all ecosystems. It is the energy that is used by green plants (which contain chlorophyll) during the process of photosynthesis; a process during which plants manufacture organic substances by combining inorganic substances.

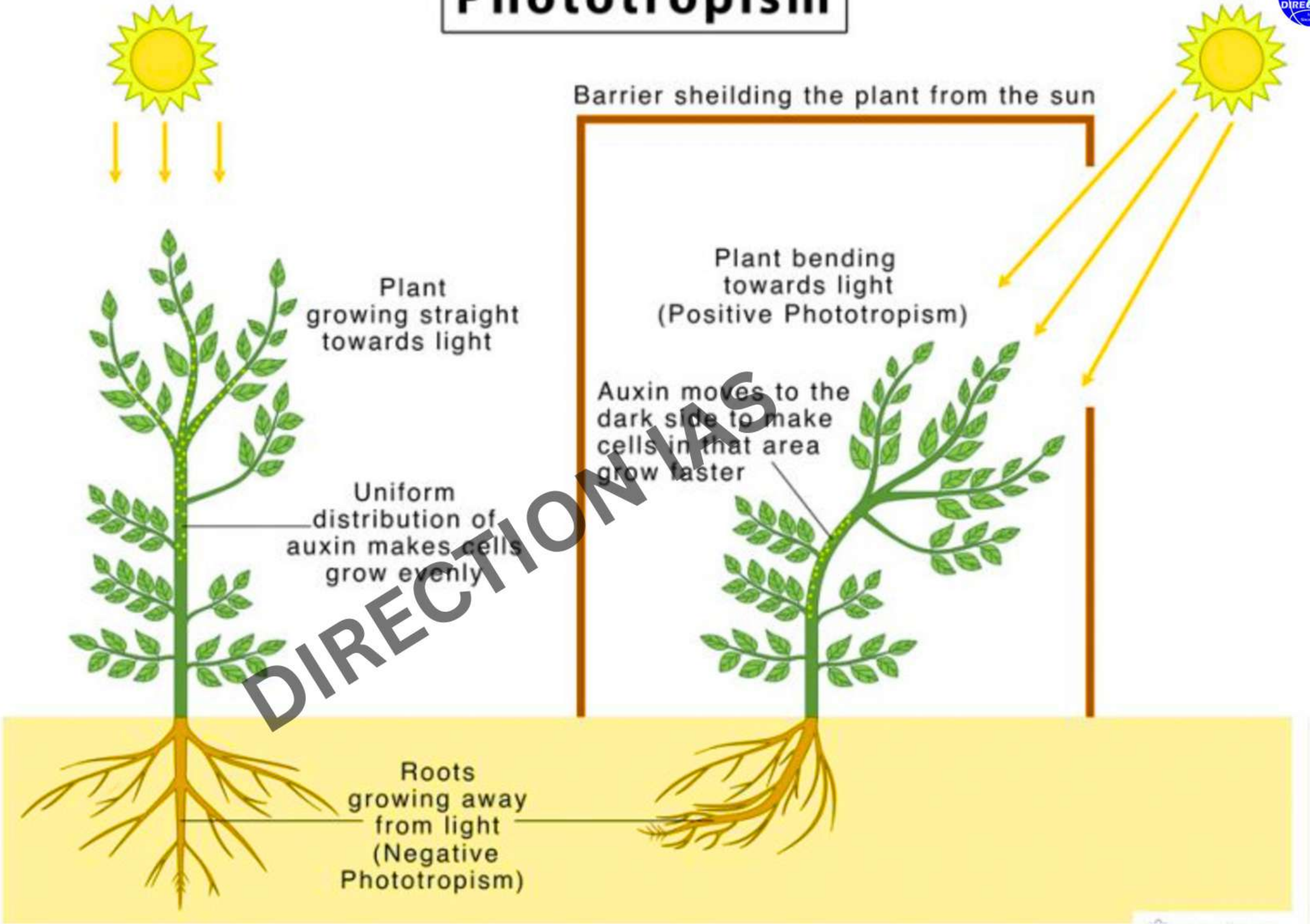
Photoperiodism can be defined as the relative lengths of daylight and darkness that effect the physiology and behaviour of an organism.

Phototropism is the directional growth of plants in response to light where the direction of the stimulus determines the direction of movement; stems demonstrate positive phototropism i.e. they came towards the light when they grow.

- Light requirements of plants differ and as a result distinct layers, or stratification, can be observed in an ecosystem.

Plants which grow well in bright sunlight are called **heliophytes** (Greek helios, sun) and plants which grow well in shady conditions are known as **sciophytes** (Greek skia, shade)

Phototropism

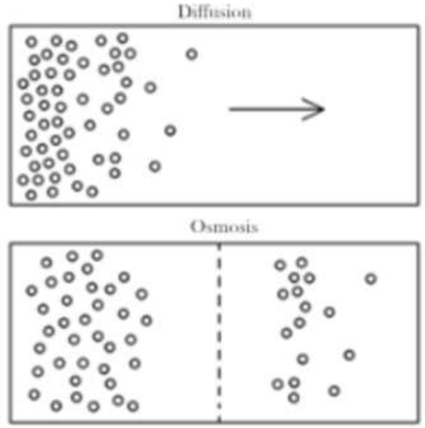


Salinity

Salinity is an important abiotic factor because the normal functioning of animals depends on the regulation of the water and ions in their internal environment, which is influenced by the water and ions in their external environment .

The relative concentration of salts inside organisms compared to their external environment affects biophysical processes such as diffusion and osmosis, which impacts chemical reactions including metabolism.

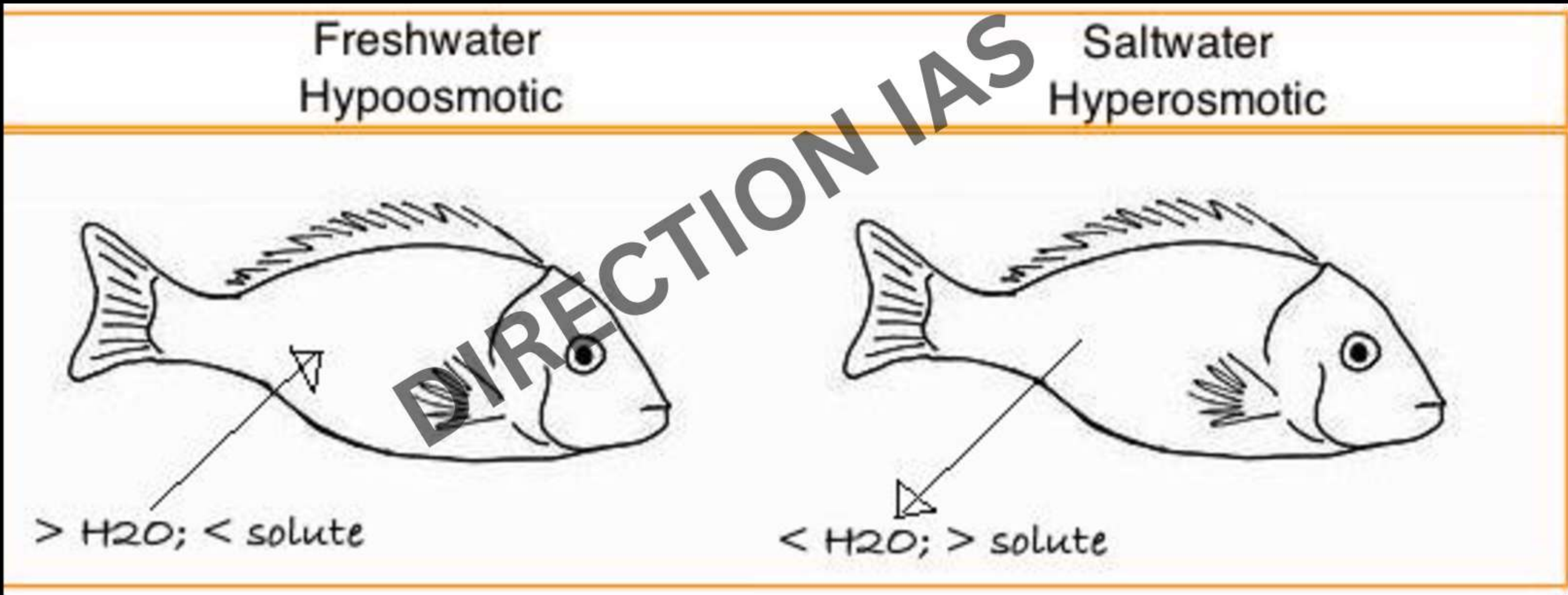
Diffusion is the natural movement of all molecules, including water, from an area of high concentration to an area of low concentration.



Osmosis refers to the movement of water through a membrane. When two solutions with different concentrations of solutes (compounds dissolved in a liquid) are separated by a membrane, water will move from the side with a lower solute concentration to the side with a higher solute concentration.

In a hyposmotic environment, such as a lake, the solute concentration in the environment is typically lower than in the cells. Cells will swell up due to the osmotic influx of water.

In a hyperosmotic environment, such as ocean, the solute concentration in the environment is often higher than in the cells. This causes water to move out of the cells.



Variations in salinity could cause osmotic stress to animals. Osmotic stress occurs when organisms are exposed to water and solute concentrations that are different from their normal internal concentrations . Animals use two general strategies for coping with variations in salinity — osmoconformation and osmoregulation

Osmoconformers, such as most marine invertebrates (e.g. marine sponges, jellyfish, and flatworms), exhibit an internal water and solute concentration that is similar to that of their external environment. They do not expend a lot of energy to move solutes in response to changes in environmental salinities; instead, their internal solute concentration changes to be the same as the salinity of the environment. The resulting increases or decreases in salt concentrations in cells can affect their metabolic rate. Osmoregulators, such as most marine vertebrates (e.g. bony fish, sea turtles, and sea otters), maintain an internal water and solute concentration that is within a narrow range independent of the external environment. Considerable energy is required to control water and salt balance during the process of osmoregulation. This could reduce the amount of energy available for other normal activities and behaviours.

Some animals (e.g. some species of crabs) use a combination of both osmoregulation and osmoconformation depending on the salinity of the environment.