ENVIRONMENT NOTES – PART III

54. Increased temperature through global warming melts more of the ice in the polar ice caps and glaciers, leading to decrease in the Earth's albedo (reflection from the Earth's surface) -the Earth absorbs more of the Sun's energy which makes the temperature increase even more, melting more ice.

55. **BIOACCUMULATION** is the retention or build-up of non-biodegradable or slowly biodegradable chemicals in the body. Biomagnification or biological amplification is the process whereby the concentration of a chemical increases at each trophic level. The end result is that top predators may have in their bodies concentrations of a chemical several million times higher than the same chemical's concentration in water and primary producers.
Effects on Human Health: The effects of DDT on human health:
Farmers occupationally exposed to DDT had an increased incidence of asthma and diabetes
Some people exposed to DDT had a higher risk of liver, breast or pancreatic cancer

56. **SPECIES, HABITAT, AND NICHE:**
A species is a group of organisms sharing common characteristics that interbreed and produce fertile offspring
A habitat is the environment in which a species normally lives.
A niche describes the particular set of abiotic and biotic conditions and resources to which am organism or population responds.
A population is a group of organisms of the same species living in the same area at the same time, and which are capable of interbreeding.

57. **NICHE:**
An ecological niche is best described as where, when and how an organism lives. An organism's niche depends not only on where it lives (its habitat) but also on what it does. For example, the niche of an elephant includes everything that defines this species its habitat, interactions between members of the herd, what it feeds on and when it feeds and so on.
No two species can have the same niche because the niche completely defines a species.
A niche describes the particular set of abiotic and biotic conditions and resources to which an organism or population responds.
There are usually differences between the niche that a species can theoretically occupy and one that it actually occupies. Factors affecting how a species disperses itself and interacts with other species restrict the actual niche. The theoretical niche, which describes the full potential of where, when, and how a species can exist, is known as its fundamental niche. Where the species actually exists is known as its realized niche. The realized niche describes the actual conditions and resources in which a species exists due to biotic interactions.

58. **ABIOTIC FACTORS:**
The non-living physical factors that influence the organisms and ecosystem e.g. temperature, sunlight, acidity/alkalinity (pH) rainfall (precipitation) and salinity are termed abiotic factors. Abiotic factors also include the soil and topography (landscape)

59. **BIOTIC FACTORS**: Biotic factors are the living part of the environment. Interactions between organisms are also biotic factors. Ecosystems contain numerous populations with complex interactions between them. The nature of the interactions varies and can be broadly divided into specific types (predation, herbivory, parasitism, mutualism, disease and competition).

60. **CARRYING CAPACITY**:
Carrying capacity refers to the number of organisms-or size of population that an area or ecosystem can support sustainably over a long period of time.

61. **PARASITISM**:
Parasitism is a symbiotic relationship in which one species benefits at the expense of the other

62. **MUTUALISM**:
Mutualism is a symbiotic relationship in which both species benefit.

63. **LICHENS**:
Lichens consist of a fungus and alga in a symbiotic relationship. The fungus is efficient at absorbing water but cannot photosynthesize, whereas the alga contains photosynthetic pigments and so can use sunlight energy to convert carbon dioxide and water into glucose. The alga therefore obtains water and shelter, and the fungus obtains a source of sugar from the relationship. Lichens with different colours contain algae with different photosynthetic pigments.

64. **POPULATION GROWTH CURVES**:
If a population is introduced into a new environment it will grow. Imagine rabbits are introduced into a new meadow. After an initial rapid exponential growth, the rabbit population will eat the vegetation faster than it can grow, because of the large number of rabbits. Further increases in population will stop. In this situation the food supply has become a limiting factor in the growth of the rabbit population. Eventually the rabbit population will reach the carrying capacity of the meadow (the size of rabbit population that the meadow can support.

S Population Curve:
When a graph of population growth for such species is plotted against time, as S-curved is produced. This is also known as a sigmoid growth curve. An S-shaped population curve shows an initial rapid growth (exponential growth) and then slows down as the carrying capacity is reached.
Competition between the individuals of the same species increases as a population grows. Competition between the individuals of the same species increases as a population grows. Competition increases because individuals are competing for the same limiting factors, such as resources. Competition for limiting factors, known as environmental resistance, results in a lower rate of population increase later on in the curve. The population eventually reaches its carrying capacity.

J-Population Curve:
Exponential growth is an increasing rate of growth, is referred to as a J shaped population curve or J Curve. Growth is initially slow but becomes increasingly rapid and does not slow down as population increases. Ex. Insects such as locusts
Exponential growth occurs when:
1. Limiting factors are not restricting the growth of the population
2. There are plentiful resources such as light, space and food
3. There are favorable abiotic components such as temperature and rainfall

Sudden decrease in population is called a population crash.

65. **LIMITING FACTORS** are the factors that limit the distribution or numbers of a particular population.
Limiting factors are environmental factors which slow down population growth.

Limiting factors include:
for plants: light, nutrients, water, carbon dioxide and temperature
for animals: space, food, mates, nesting sites and water.

66. **COMMUNITY:**
A community is many species living together, whereas the term population refers to just one species. Communities include all biotic parts of the ecosystem, both plants and animals.

67. **ECOSYSTEM:**
An ecosystem is a community of interdependent organisms (the biotic component) and the physical environment (the abiotic component) they inhibit

Ecosystems can be divided into three types:
1. Terrestrial
2. Marine
3. Freshwater

Marine Ecosystem: include the sea, estuaries, salt marshes and mangrove.
Fresh water Ecosystem: include rivers, lakes, and wetlands
Terrestrial ecosystems: include all land-based ecosystems.

15. **PHOTOSYNTHESIS:**
Photosynthesis is the process by which green plants convert light energy from the Sun into useable chemical energy stored in organic matter.
carbon dioxide + water ---→ glucose + oxygen.
(In the presence of light and chlorophyll)
Respiration: is the conversion of organic matter into carbon dioxide and water in all living organisms, releasing energy.

Glucose + oxygen -------→ carbon dioxide + water

Output: release of energy for work and heat

The energy transformation is from stored chemical energy into kinetic energy and heat. During respiration large amounts of energy are dissipated as heat.

68. **PRODUCERS:**
Certain organisms in an ecosystem convert abiotic components into living matter. These are the producers, they support the ecosystem by constant input of energy and new biological matter - biomass. Producers are also called Autotrophs.

Plants, algae and some bacteria are producers. Organisms that use sunlight energy to create their own food are called photoautotrophs, all green plants are photoautotrophs, not all producers use sunlight to make food.

For example, some bacteria use chemical energy rather than sunlight to make sugars, chemosynthetic bacteria are part of the nitrogen cycle.

Giant tube worms Riftia pachyptila live on or near deep-sea hydrothermal vents they have a symbiotic relationship with chemosynthetic bacteria using hydrogen sulfide and carbon dioxide to produce sugars.

69. **CONSUMERS:**
Organisms that cannot make their own food eat other organisms to obtain energy and matter. They are consumers. Consumers pass energy and biomass from producers through to top carnivores.

70. **DECOMPOSERS:**
Decomposers obtain their food and nutrients from the breakdown of dead organic matter. When they breakdown tissue, they release nutrients ready for reabsorption by producers. They form the basis of a decomposer food chain. Decomposers also contribute to the build-up of humus in soil. Humus is organic material in soil made by the decomposition of plants or animal matter. It improves the ability of soil to retain nutrients. Decomposers are essential for cycling matter in ecosystems. Matter that is cycled by decomposers in ecosystems includes elements such as carbon and nitrogen.

71. **TROPHIC LEVELS FOOD CHAINS AND FOOD WEBS:**
The flow of energy and matter from organism to organism can be shown in a food chain. The position that an organism occupies in a food chain is called the trophic level.

Producers form the first trophic level in a food chain.

Food chains always begin with the producers usually photosynthetic organisms followed by primary consumers herbivorous. Secondary consumers omnivorous or carnivorous and then higher consumers tertiary, quaternary etc. Decomposers feed at every level of the food chain.

72. **EFFICIENCY OF ENERGY TRANSFERS THROUGH AN ECOSYSTEM**
The transformations of energy are inefficient, so energy is lost from the system at each stage of a food chain.

73. **PYRAMIDS OF NUMBERS, BIOMASS, AND PRODUCTIVITY:**
Pyramids are graphical models showing the quantitative differences between the trophic levels of an ecosystem and are usually measured for a given area and time.

There are three types:
Pyramid of numbers: It records the number of individuals at each trophic level coexisting in an ecosystem. Quantitative data for each trophic level are drawn to scale as horizontal bars arranged symmetrically around a central axis.

Pyramid of biomass: Represents the biological mass of the standing stock at each trophic level at a particular point in time measured in units such as grams of biomass per square meter. Biomass may also be measured in units of energy.

Pyramid of productivity: it shows the flow of energy the rate at which the stock is being generated through each trophic level of a food chain over a period of time. Productivity is measured in units of flow- mass or energy per metre squared per year. Pyramids of productivity show the flow of energy through an entire ecosystem over a year.

74. **THE GREENHOUSE EFFECT:**
Within the atmosphere, certain gases trap the radiation that heats the surface. Shortwave ultraviolet (UV) light from the Sun is reflected from the surface of the Earth as infrared (IR) light which has a longer wavelength. Atmospheric gases allow the incoming short-wave radiation to pass through but either trap or reflect back to Earth the outgoing long-wave radiation. This process is known as 'radiation trapping'.

This effect is caused mainly by water vapour and carbon dioxide. Other gases involved are methane, nitrous oxide and ozone. The gases create a 'thermal blanket' that maintains an average Earth temperature that can support life. Because these gases act in the same way that a glass acts in a greenhouse, they are called

greenhouse gases and the effect they have is called the greenhouse effect. Although greenhouse gases make up only about 1 % of the atmosphere, they regulate our climate and make life possible. Without greenhouse effect the average temperature on Earth would have been -30°C.
The greenhouse effect is natural and vital for life on Earth.

The enhanced greenhouse effect refers to the additional greenhouse gases added by human activity that are leading to climate change- global warming and having a serious impact on natural systems and life.

75. **THE GREAT PACIFIC GARBAGE PATCH:**

The Great Pacific Garbage Patch is an area of marine debris, approximately 135° to 155° W and 35° to 42° N . It shifts its exact position every year, it remains within the North Pacific Gyre (a system of circular ocean currents) as it is confined by ocean currents.
Estimates of its size vary from 7lakh km² to more than 150lakh km² . It suggests that it is at least three times the size of Spain and Portugal combined. The GPGP is also estimated to contain up to 100 million tons of rubbish. Plastic never biodegrade. They don't breakdown into natural substances. Instead they go through a photodegradation process, splitting into smaller and smaller particles that are still plastic.

76. **UV RADIATION and OZONE**:

Ozone is essential for sustaining life. The highest concentration of ozone occurs in the upper part of the atmosphere, the stratosphere. It is formed through the action of UV radiation on oxygen.

High-energy ultraviolet radiation strikes an oxygen molecule causes it to split into two free oxygen atoms
The free oxygen atoms collide with molecules of oxygen to form ozone molecules.

Most ozone is created over the equator and between the tropics because this is where solar radiation is strongest. However, winds within the stratosphere transport the ozone towards the polar regions where it tends to concentrate.

Ozone is constantly produced by sunlight and destroyed by nitrogen oxides in the stratosphere in a natural dynamic balance, constantly forming and being destroyed.

Ozone has the vital role of absorbing UV radiation (wavelength 0.1-0.4 μm. It also absorbs some outgoing terrestrial radiation (wavelength 10-12μm) -so it is a greenhouse gas.

However, human activities have altered the balance of equilibrium. There is clear evidence that human activities have led to the creation of a 'hole' in the ozone layer over Antarctica. Levels of ozone have been falling since 1965. The cause of depletion found to be the destructive role of oxides of nitrogen and chlorine, CFCs and halogens.

Ozone-depleting substances, including halogenated organic gases ex. CFCs. Are used in aerosols, gas blown plastics, pesticides, flame retardants, and refrigerants. Halogen atoms ex. Chlorine from these pollutants increase destruction of ozone in a repetitive cycle so allowing more ultraviolet radiation to reach the Earth.

The ozone hole is an area of reduced concentration of ozone in the stratosphere. Increasing measurements of CFCs correlate with declining ozone levels. Ozone Depleting Substances (ODS): CFCs, hydrochlorofluorocarbons (HCFCs), halons, and methyl bromide. Once they reach stratosphere and under the influence

of UV radiation, they breakdown and release halogens. The halogens atoms act as catalyst for the reaction that destroy ozone molecules.

Methyl-bromide is an odourless, colourless gas that has been used as a soil pesticide to control pests across a wide range of agricultural sectors.

77. **EFFECTS OF UV RADIATIONS ON PHYTROPLANKTON**:
Phytoplankton live in the upper layer of the water where there is sufficient light to support photosynthetic life. It is here that exposure to UV-B can occur. UV-B may damage those organisms that live at the surface of the water during their early life stages. The effects are particularly significant on phytoplankton, fish eggs and larvae, zooplankton etc.

UV-A wavelength 315-400 nm more penetrating. Does tanning
UV-B wavelength exports. The expansion of the money supply can cause inflation, which can erode a nation's export competitiveness just as much as currency appreciation would.
280-315 nm affects skin's top layer

78. **BIODIVERSITY**: Biodiversity is a broad concept encompassing total diversity, including species diversity, habitat diversity and genetic diversity. Species diversity in communities is a product of two variables, the number of species and their relative proportions.

A habitat is the environment in which a species normally lives. Habitat diversity refers to the range of different habitats in an ecosystem or biome. Genetic diversity refers to the range of genetic material present in a population of a species.
Conservation of habitat diversity usually leads to the conservation of species and genetic diversity.

Evolution is the cumulative, gradual change in the genetic composition of a species over many successive generations, ultimately giving rise to species different from the common ancestor.

79. **DARWIN'S THEORY OF NATURAL SELECTION**:
Natural selection occurs through the following mechanism:
Within a population of one species there is genetic diversity which is called variation.

Because of natural variation, some individuals will be fitter than others

Fitter individuals have an advantage and will reproduce more successfully.

The offspring of fitter individuals inherit the genes that give the advantage, these offspring therefore survive and pass on the genes to subsequent generations.

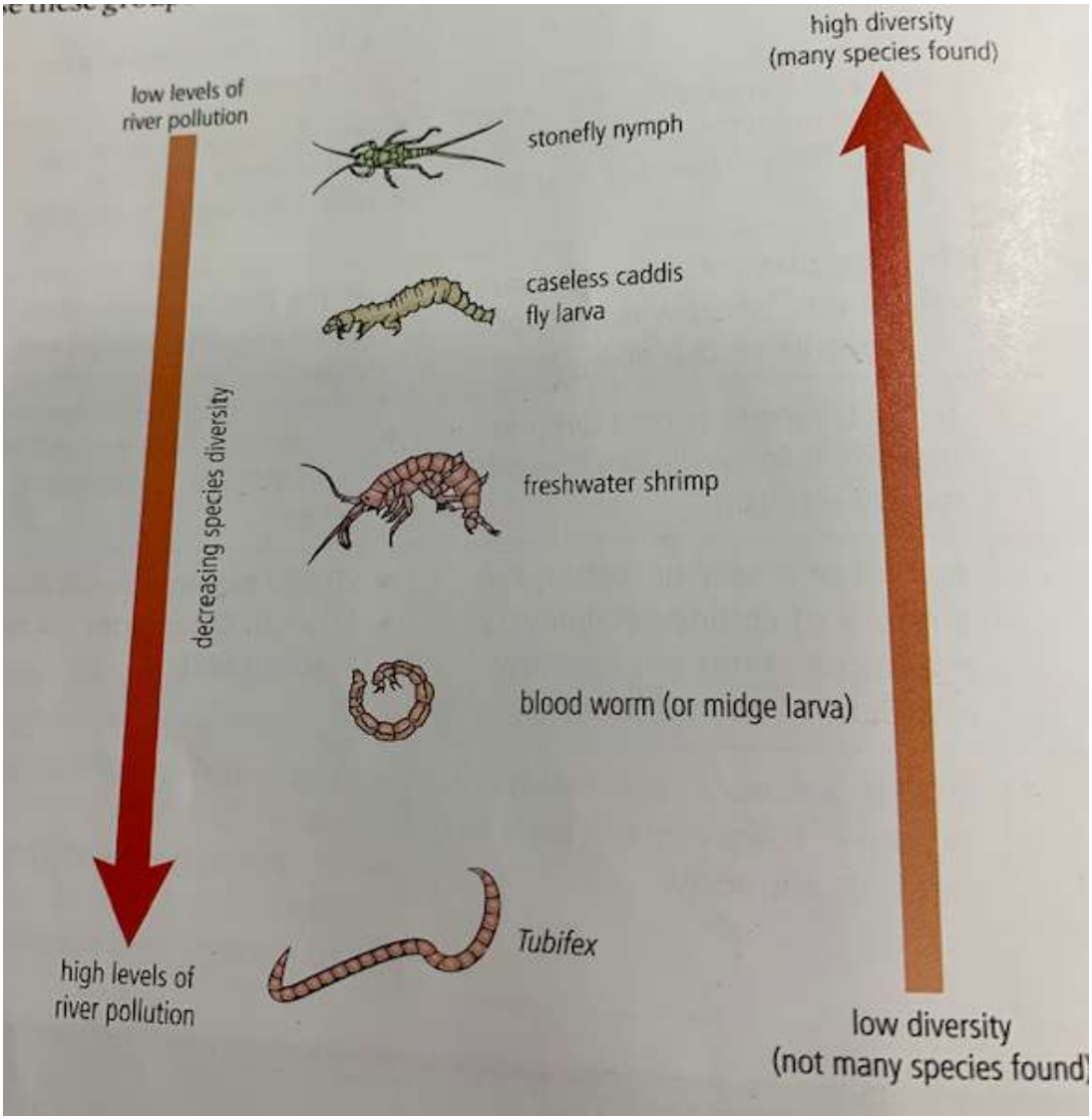
80. **SPECIATION** is the formation of new species when populations of a species become isolated and evolve differently.

81. **BIOCHEMICAL OXYGEN DEMAND**
Aerobic organisms use oxygen in respiration. The more organisms there are at a particular site ex. Lake, pond, river and faster their rate of respiration, the more oxygen they will use. So, the biochemical oxygen demand (BOD) at any particular point in the river is determined by the number of aerobic organisms at that point and their rate of respiration.

Biochemical oxygen demand (BOD) is a measure of the amount of dissolved oxygen required to break down the organic material I a given volume of water through aerobic biological activity. BOD is used to indirectly measure the amount of organic matter in a sample.

BOD can indicate whether or not a particular part of the river is polluted with organic matter e.g. sewage, silage. This is because the presence of an organic pollutant stimulates an increase in the population of organisms that feed on and breakdown the pollutant. In doing so, they respire and use up a lot of oxygen. This could eventually lead to a lack of oxygen and subsequent anaerobic decomposition which then leads to formation of methane, hydrogen sulfide, and ammonia (toxic gases).
ENDEMIC SPECIES means species not found anywhere else.

82. **RIVER POLLUTION:**
Certain species are tolerant of organic pollution and the low oxygen levels associated with it. They are found in high population densities where an organic pollution incident occurs. Other species can not tolerate low oxygen levels and if organic pollution enters the river where they live, they move away or die.



Organic pollutants in water can be more dangerous in summer. This is because the solubility of oxygen decreases as the water temperature increases. So, on warm days there is less available oxygen in the water. Fish is cold bloodied animal. Its body temperature rises with rise in temperature. It increases their rate of respiration. They need more oxygen but the amount of dissolved oxygen going down.

83. **EUTROPHICATION**

Eutrophication refers to the nutrient enrichment of streams, ponds and groundwater. It is caused when increased levels of nitrogen or phosphorous are carried into water bodies which result in an excess growth of plants and phytoplankton. It can cause algal blooms, oxygen starvation and eventually the decline of biodiversity in aquatic ecosystems. Fish population is adversely affected by reduced oxygen availability.

84. **RED TIDE**:

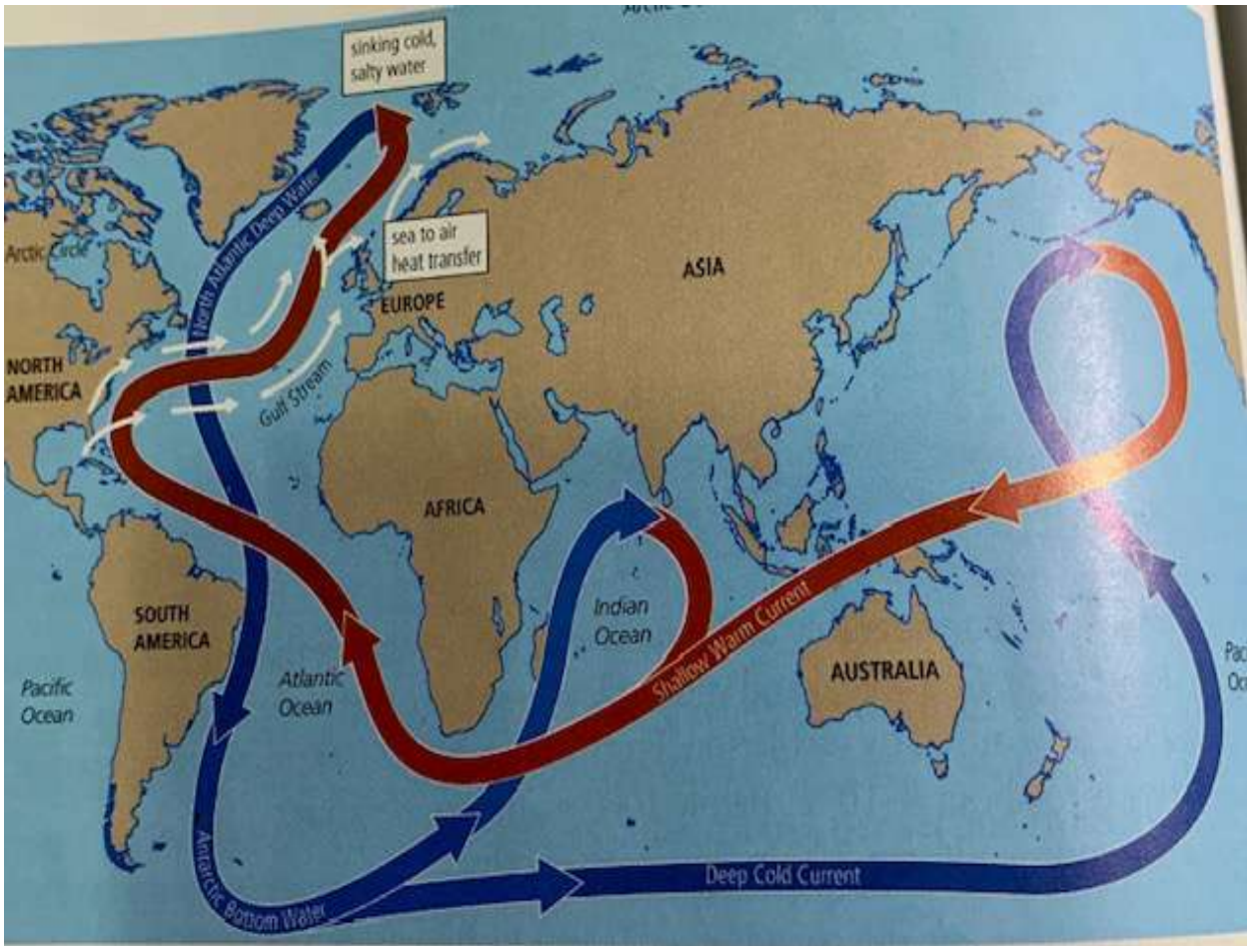
Red tide is a phenomenon caused by algal blooms during which algae become so numerous that they discolor coastal waters (hence the name "**red tide**"). The algal bloom may also deplete oxygen in the waters and/or release toxins that may cause illness in humans and other animals.

Red tides and similar blights are increasing in both size and number. Dead zones have been reported now more than 400 all over the world. Many of the dead zones were traditional fishing grounds.

85. **PLASTIC WASTE IN SEA**:

It is estimated that every square kilometer of sea has 18,000 pieces of floating plastic.

86. **THE GREAT OCEAN CONVEYOR BELT**



The oceanic conveyor belt is a global thermohaline circulation, driven by the formation and sinking of deep water and responsible for large flow of upper ocean water. In addition to the transfer of energy by wind and the transfer of energy by ocean currents, there is also transfer of energy by deep sea currents. In polar regions, cold salty water sinks to the depths and makes its way towards the

equator. It then spreads into the deep basins of the Atlantic, the Pacific, and the Indian Oceans. Surface currents bring warm water to the North Atlantic from the Indian and Pacific Oceans. The waters give up their heat to cold winds which blow from Canada across the North Atlantic. This water then sinks and starts the reverse convection of the deep ocean current. The amount of heat given up is about a third of the energy received from the Sun.

87. **SPECIFIC HEAT CAPACITY:**
The specific heat capacity is the amount of energy it takes to raise the temperature of a body. It takes more energy to heat up water than it does to heat land. However, it takes longer to lose heat. This is why the land is hotter than the sea by day, but colder than the sea by night. Places close to the sea cool by day, but mild by night. With increasing distance from the sea this effect is reduced.

88. **CRITICALLY ENDANGERED**:
A critically endangered species is one that has been categorized by the International Union for Conservation of Nature IUCN as facing an extremely high risk of extinction in the wild.

89. **ENDANGERED SPECIES**:
An endangered species is a species which has been categorized as very likely to become extinct in the near future. Endangered as categorized by the IUCN Red List, is the second most severe conservation status for wild populations after Critically Endangered

90. **EXTINCTION**:
Extinction is the termination of an organism or of a group of organisms usually a species. The moment of extinction is generally considered to be the death of the last individual of the species, although the capacity to breed and recover may have been lost before this point.

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