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4.5 Aquatic Ecosystem

**IDX G9 BIOLOGY H STUDY GUIDE**

**ISSUE 3**

**By Hayley and Ava**

1. Water Depth

* Photic zone
  + 1. Sunlight region near the surface ---> photosynethesis takes place
    2. May be as deep as 200 meters in seas or a few meters in rivers
    3. **Phytoplankton**: unicellular
    4. **Zooplankton**: plantonic animals
* Aphotic zone

1. Below photic, no photosynthesis ---> chemosynthesis

* Benthic zone

1. Bottoms of water bodies
2. **Benthos**: attached organisms or resting on bottom, mostly filter feeders
3. Freshwater Ecosystems

* Rivers & Streams

1. High oxygen level, running water
2. Water flows head to mouth
3. **Head**: underground springs or snowmelt
4. **Mouth**: where flowing water empties to

* Lake & Ponds

1. Inland body of standing water

* Wetland

1. A place where water covers soil or is present/near the surface for at least a part of the year
2. Good for agriculture
3. Breeding gorunds for many organisms
4. Purify water by filtering pollutants & help prevent floooding by absorb and slowly releasing large amounts of water
5. Bogs (decaying peat moss)
6. Marshes (variety of reeds & grasses)
7. Swamps (woody plants & trees)

* Estuaries (saltwater wetland)

1. where freshwater river meets salty sea
2. contain mixture of **fresh and salt** water
3. spawning and nursery gorunds for many ecologically & commercially important fish and shelfish species
   1. Salt Marsh (temperate estuaries)
   2. Mangrove Swamp (tropical estuaries) ---> tolerant to high salt concentration
4. Ocean

* Intertidal zone

1. A narrow band where ocean meets land
2. **Communities -- constantly changing** ---> disturbance such as daily tides
3. Organism submerge in sea water at hgh tide and exposed to air & sunlight at low tide
4. **Barnacles** & seaweed permanently attach themselves to the rocks
   1. a small saltwater animal with shell-like cover

* Coastal Ocean

1. Extends from low-tide mark to the outer edge of continental shelf
2. **Continental shelf**: the relatively shallow border that surrounds the continent
3. Kelp forest & coral reefs ---> important coastal community

* Open Ocean

1. Begin at the edge of continental shelf & extend outward
2. More than 90% of world’s ocean
3. Photic zone
   1. low nutrient level & support only smallest species of phytoplankton
4. Aphotic zone
   1. permanently dark
   2. deep-sea vents (deepest parts of ocean)

5.1 How Populations Grow

1. Describing Populations

* Researchers study 🡪 geo range, density and distribution, growth rate, age structure
  1. Geographic Range
     + area inhabited by a population, depending on species
     + Large/small + specific location
  2. Density and Distribution
     + Population Density: the number of individuals per unit area.
       - No unit conversation (4000 goats in 80 km^2 would just be 50 goats per km^2)
     + Coverage for plants 🡪 quadrats
     + Population size = [(mean number per quadrant) \* (total area)]/(area of each quadrat)
     + Random Quadrat sampling
       - Count number in small, randomly located squares within the total area
       - Results projected on total area
     + Capture-Mark-Release/ Lincoln Index
       - Population Size = (n1\*n2)/n3
         * Number of initially caught and marked 🡪 n1
         * Number of second caught 🡪 n2
         * Number of marked in second sample 🡪 n3
       - Could be inaccurate 🡪 emigration and immigration? Other factors
     + Spatial Distribution: the pattern of spacing of a population
       - Clumped/clustered: aggregate in patches (resource availability and behavior)
       - Uniform: evenly space (social interactions, Ex. Territory)
       - Random: independent position (no strong attractions or repulsions)
  3. Growth Rate
     + Determines whether population increases, decreases, or stays the same
     + Zero growth 🡪 no change, birth rate = death rate
     + Positive growth 🡪 increase, birth rate > death rate
     + Negative growth 🡪 decrease, birth rate < death rate
     + P = population, (Pfinal – Pintial)/ Pinitial = growth rate
     + Factors that can affect population size
       - Natality 🡪 number of births [per 1000 people per year]
       - Mortality 🡪 number of death [per 1000 people per year]
       - Immigration 🡪 members arriving
       - Emigration 🡪 members leaving
  4. Age Structure
     + Age structure: the number of males and females of each age a population contains

1. Population Growth

* Exponential Growth – J curve
  + Constant growth rate
  + Lag phase: slow growth period towards the beginning
  + Exponential growth: growth rate proportional to population
  + All populations grow exponentially until a limiting factor slows the population growth
* Logistic Growth – S curve
  + Occurs when populations’ growth slows/stops following exponential growth at the populations carrying capacity.
  + Carrying capacity: max number of individuals in a species that an environment can support long term
  + Carrying capacity is limited by energy, resources, predation, disease, disturbances
  + Oscillation 🡪 when the species reaches the carrying capacity and there’s an overshoot that causes fierce competition and other limiting factors push the population to die back and the process repeats.
  + Phases of growth
    - Exponential Growth: unlimited resources, so individuals reproduce and grow rapidly
    - Transitional Phase: the rate of population growth slows down, but the population size doesn’t decrease.
    - Plateau Phase: rate of population growth reaches zero, size levels off, population remains at this size or near this size.

5.2 Limits to Growth

* Population size is limited by competition, predations, parasitism, unusal weather, natural disaster
* Limiting factors:
  + Control growth of a population
  + Determine the carrying capacity of an environment for a species
  + Density dependent and Density independent
* Density-Dependent 🡪 operates strongly only when population reaches a certain level
  + Competition 🡪 compete for resources, lowers birth rate and increases death rate
    - Inter and intra
    - Can lead to resource division
  + Predation and Herbivory 🡪 populations of both groups cycle up and down over time
    - Predator mediated competition
  + Parasitism and Disease 🡪 the denser the host population, the more easily parasites or pathogens can spread from one host to another and the death rate increases
  + Stress from overcrowding 🡪 high levels of stress cause weakened immunity, females neglect/kill/eat their own offspring, birth rate declines and death rate increases, increased rates of emigration
* Density-Independent 🡪 affects all populations in similar ways, environmental changes regardless of population size, age and density
  + Top-down and bottom-up factors

5.3 Human Population Growth

- Demography: the study of human population

- Thomus Malthus

* War, famine, disease ---> will slow down population growth

- Demograhpic Transition (5 stages)

* Stage 1: birth & death rates **high**

1. harsh environment (poor sanitation & nutrients)

* Stage 2: birth rate high; **death rate falls rapidly**

1. better conditions

* Stage 3: **birth rate falling**; death rate falls slowly
* Stage 4: birth & death rates **low**
* Stage 5: birth rate **high? Or low?** death rate: low

