

BIOLOGY 115 EXAM 4 REVIEW

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CHAPTER 16 - POPULATION ECOLOGY

- **Demography** is the science of statistically studying populations. The total number of individuals in the population is the **population size**. **Population density** is the number of individuals divided by the area they occupy.
- High population density leads to overcrowding, poor sanitation, diseases, parasites, and starvation. Predators can find the prey with less effort. Starvation comes from competition for food. There is also competition for safe breeding and resting locations (housing). Competition between conspecifics is called **intraspecific competition**.
- Low population density can lead to problems finding conspecifics (individuals within the same species) for mating and reproduction. Problems finding a mate can lead to inbreeding and genetic drift making low-density populations more likely to go extinct.
- In **clumped** dispersion the individuals are not evenly spread out. The individuals are congregating in groups in association with a vital resource within the habitat.
- In **uniform** dispersion, the individuals are evenly spread out with each individual having the same size territory. The resources necessary for life and reproduction are also evenly disperse are at a high quantity.
- In **random** dispersion, there is no pattern to how individuals are spread out in a habitat.
- A **cohort** is a group of individuals within the population of the same age, but not necessarily the same generation. Demographers define the cohorts in a population and then total the individuals by sex in each cohort to create the **age structure** of the population, and is shaped like a pyramid.
- **Fecundity** is the potential level of reproduction in a population. It depends on age of sexual maturity, maximum frequency of reproductive events, and maximum number of eggs released by female at each event.
- **Fertility** is the realized level of reproduction in a population. The actual number of offspring produced per female per unit time. Changes in food supply and nutritional development can affect when an individual becomes sexually mature.
- Clutch or brood size is the number of offspring per reproductive event.
- If the location that will result in greatest survival of offspring happens to be deadly for parents, then parents will put everything into one event. Ex. salmon
- If a female starts having offspring earlier, then the probability that she will have more reproductive events during her lifetime is higher.
- **Population Dynamics** Equations:

- **R-adapted** species have exponential growth (graph has an increase phase, peak phase, decline phase, and low density phase), so their adaptations include:
 - Many offspring per reproductive event
 - Early sexual maturity
 - Polygyny
- Consequences of r-adapted species are:
 - Short life span
 - Population cycles are boom and bust
- **K-adapted** species are all about sustaining populations while living at carrying capacity, so their adaptations include:
 - Few offspring per reproductive event
 - Delayed sexual maturity
 - Monogamy
- Consequences of k-adapted species are:
 - Long lifespan
 - No population cycles

CHAPTER 17 - COMMUNITY AND ECOSYSTEM INTERACTIONS

- Populations exist within ecological communities and coevolve with all the other species in their communities. A new adaptation in one species will likely be a selective pressure for other species.
- Within all communities there is interspecific competition. No two species can occupy the same niche within a community.
- **Parasitism** is when one species lives off another to the detriment of the host species
- **Commensalism** is when one species derives a benefit from the work of another species but the “host” species is neither harmed nor helped
- **Mutualism** is when two species interacting both derive benefits from the interaction
- Relationships between predators and their prey are best represented by **food webs**. What you eat determined your **trophic level**:
 - **Producers** capture energy from sunlight or other exothermic sources such as deep sea vents and through photosynthesis or chemosynthesis use that energy to make energy containing molecules such as carbohydrates.
 - **Primary consumers** eat producers
 - **Secondary consumers** eat primary consumers
 - **Tertiary consumers** eat secondary consumers
 - **Quaternary consumers** eat tertiary consumers
 - **Nutrient Recyclers**
 - **Detritivores** eat organic matter, ex. Worms, slugs, and some crabs
 - **Decomposers** live off dead or decaying things at a molecular level, ex. Bacteria, fungi, and protists
 - **Scavengers** are animals that eat dead animals, ex. vultures and most crabs
- The **gross productivity** is the rate at which energy is taken up by organisms, usually expressed at a specific trophic level such as producers. **Net productivity** is gross

productivity minus the metabolic costs of the organisms, it is the energy that would be available for consumption by a higher consumer.

- *The maximum amount of energy transferred between trophic levels is 10%.* It takes 10 prey individuals to support one predator.
- The **biomass** is determined by removing all the water from a biotic sample (total dry weight)
- When an individual ingests a toxin that it cannot excrete, then the toxin accumulates in its body tissues, the toxin passes undiminished (100%) to the predator. The toxin **bioaccumulates** in the food web.
- As a community ages, the species within the community change-there is **succession** of community types.
- After a fire nutrients that were in living organisms are recycled back into the soil. This opens the habitat for colonization by r-adapted species. As time progresses, the nutrients are transferred into living organisms leading to k-adapted species predominating.
- The communities that live in nutrient and resource rich habitats are called **pioneer communities** (grasslands, marshes, and arctic tundra). Those on the other end of the continuum are called **climax communities** (conifer forests, deciduous hardwood forests, tropical rainforests, and deserts)
- To maintain a parcel of land as a prairie, the habitat has to be disturbed such that resources are recycled back into the soil. Fire is the most usual mechanism for restarting succession back to the pioneer stage.

CHAPTER 18 - ECOLOGY OF BIOMES AND THE BIOSPHERE

- **Biomes** are defined as the world's major ecosystems
- Primary productivity is the net productivity of all the producers
- Tropical versions of similar biomes will always have higher annual productivity because there is no winter decline. Aquatic biomes will always have lower biomass.
- Estuaries occur where freshwater rivers meet the saltwater of the oceans. *Estuaries are the most productive ecosystems and are probably the most important biome on Earth.*
- **Water Cycle**
- **El Niño/La Niña phenomena**
- **Carbon Cycle**

CHAPTER 19 - THINKING GREEN HERE, THERE, AND EVERYWHERE

- Types of biodiversity
 - **Species diversity**
 - **Genetic diversity**
 - **Ecological diversity** - variety of ecosystems. Ecological diversity is what we should try to preserve.
- Characteristics of a species that make it more likely to have problems recovering from a decline in numbers
 - **Low reproductive rate** - if a species is k-adapted then it will take time for

- population to increase
 - **Specialized feeding behavior**
 - **High trophic level** - it takes many individuals in a food web under an apex predator to support one apex predator, so the apex predator will be hurt most by toxins.
 - **Large size** - it takes time to grow a big thing
 - **Found in only one location**
 - **Limited or specialized breeding area**
 - **Fixed range of occurrence or migration route** - not only the wintering and breeding areas need to be preserved but also the route the species uses
 - **Preys on human resources** - We selectively breed most domestic animals to be slightly stupid so they are easier to control.
- Factors that may put many species at risk for extinction:
 - **Habitat fragmentation, degradation, and loss.** Ex. building roads creates more “edge” habitats. Edges make it easier for predators to find prey.
 - **Overexploitation by hunting, fishing and poaching**
 - **Introduction of non-native species** - wherever we travel we take along species that can escape into new ecosystems. **Feral** is the term used to describe an animal that was under human control but is not just fine in the wild.
 - **Pollution and climate change** - chemicals we released into nature that have caused long-term problems
 - **Predators and pest control programs**
 - **Pet and decorative plant trade**
 - **Overall competition with humans for finite resources.** We are the walmart of the biosphere. *Nature knows no human imposed political boundaries.*
- Endangered ecosystems list in packet