Unit 6: Adaptations and Limiting Factors

Target 1: Vocabulary
Review words: Population, community, ecosystem, species, biotic, abiotic

New words:
Adaptation – structures, functions, or behaviors that help an organism survive and reproduce in its environment.
- **Structural (physical) adaptation** - Something about an organism's features that helps it survive. This includes things like pointy beaks, flat teeth for grinding, sharp canine teeth for tearing, thick fur, sharp claws, spines on a cactus, bad flavor in a leaf, an unpleasant scent, delicious fruit that helps encourage seed dispersal, etc.
- **Behavioral adaptation** - an instinct or a learned behavior that helps an organism survive. This includes things like migrating south or hibernating to survive winter, building nests, hiding from predators, playing dead (possums), running away, growling or barking, etc.

Two main types of interactions among organisms:
- **Competition** - Two or more organisms (or species) needing to use the same resources.
- **Predation** - an organism eating another organism

**Population growth** – an increase in the size of a population caused by individuals being born or moving into the area.

**Interdependence** - When 2 or more organisms depend upon one another for resources. (bees need nectar from flowers, flowers need bees to transfer pollen)

**Limiting factor** – anything that acts in some way to limit the number of individuals that survive and reproduce in a population. Examples: weather conditions, space, food/water availability.

**Reproduction** - creating potential new members of the population, like an elephant having a baby or a plant producing seeds. Offspring may be produced sexually or asexually.

**Survival advantage**- any characteristic that lets an organism beat its competitors. Reproductive potential – the number of organisms a population would have if nothing stopped them from reproducing. The theoretical unlimited growth of a population.

**Feature** - a distinctive structure that all organisms of the same species possess (Example – black bears all have the same features: four legs, short tail, small ears, two eyes, long coarse fur, a brown nose...)
**Trait** – the way a feature shows up in an individual (Example – the color of the fur of a black bear can vary from jet black to honey yellow. Humans have the feature of hair on their heads, but some humans have the trait of black hair, some humans have blonde hair, some humans have curly/straight, etc.)

**Trait Variation** – Variation is the amount of difference in the traits exhibited by a population. Some giraffes, for example, have longer necks than others. There is variation in neck length.

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**Target 2: Explain how populations can change in size.**

Populations change size all the time. Birth rate and death rate can affect the size of a population. If birth rate is higher than death rate, the population will grow. If more organisms are dying than are being born, the population will decrease. Population size is also affected by individuals moving away from the area (emigration) or moving into the area (immigration).

Populations that get too small risk having all individuals die out before any new members can be added. If all members of a population die, there may be more populations of that species in other areas, but if all members of the species die, then the species is said to be extinct.

**Target 3: Give examples of factors that can limit population growth.**

Populations have the potential to grow at a specific rate. This rate is based on complicated math problems involving data about how long the organism lives, how old it is when it starts reproducing, how long it takes for the offspring to be born, how many babies are born at a time, how many babies survive to adulthood, and how many males and females there are.

You don’t always need to do the math to understand this concept. An elephant lives around 70 years. Female elephants start reproducing at around 12 years of age and stop around age 50, have 1 baby at a time, the pregnancy lasts about 2 years, and they wait about 4 years between babies. This gives the elephant the possibility of around 6 or 7 offspring over the life of 1 female.

An Atlantic Cod lives around 20 years, starts reproducing at the age of 2, and produces 200,000 eggs per year. This gives the cod a possibility of as many as 3.6 million offspring during the life of 1 female.

An Atlantic Cod clearly has a much higher reproductive potential than an elephant, but you could tell that just by looking at the numbers.

**Now the limiting factors part**—not every cod egg develops into a cod, and not every young cod lives to adulthood. If they did, the oceans would be quickly overrun by cod. Cod experience a lot of limiting factors in their environment. The female releases 200,000 eggs, but not all are fertilized by her mate. Some eggs are duds and some are
eaten by hungry predators. Young cod are constantly being eaten by predators, getting sick or injured, struggling to find food, etc.

**BIOTIC LIMITING FACTORS** - Disease, predation, starvation, competition, old age, injury

**ABIOTIC LIMITING FACTORS** – Freezing, drought, heat, flood, storms, brush fires, poisons, lack of space

Remember that all populations in an ecosystem are connected in some way. For example, the algae population in Mono Lake is directly affected by the brine shrimp population. During the warm summer months, the brine shrimp population increases. Since brine shrimp feed primarily on algae, this causes the algae population to decrease during the summer months.

**Can organisms choose to change in response to their environment?**
No, an individual organism cannot choose to change in response to its environment. However, populations can change over time. For example, if we were to have several years in a row with colder than normal winters, rabbits with thicker fur would survive the cold better than rabbits with thinner fur. Thick fur in this case is a trait that gives an advantage. The rabbits with the thickest fur would be most likely to survive and reproduce, and their babies would most likely have the trait of thicker fur also.

If the climate does make a permanent shift to cold, those rabbits that randomly happened to have thick fur will survive better, and in the long run, they will reproduce more rabbits like them. Therefore, in time, the population as a whole will have thicker fur on average.

**Why is variation in a population important?**
Variation in a population is important because it increases the chances that at least some members of the population will survive sudden changes in weather, an outbreak of disease, an invasion of predators, and so on.

**Target 4: Identify behavioral and structural adaptations that give organisms a greater chance of survival in their particular environment.**

An adaptation is something that gives an organism a survival advantage over the other organisms. Some examples:

Predators have adaptations that help them catch and kill their prey. Some have excellent night vision, super bursts of speed, sharp claws and teeth, etc.

Prey organisms have adaptations to help avoid being eaten.
bullet Warning coloration - Some organisms have colors that show they are poisonous to anything that tries to eat them.
bullet Camouflage - To help hide, some organisms have colors and markings that make them blend in with plants.
bullet Disruptive coloring - Colors and markings that confuse a predator, such as stripes on zebras, or a giant spot that looks like a huge eye.
bullet Mimicry - The ability to look like something the predator doesn't want to eat, like the way an octopus can imitate the swimming style of a poisonous fish to scare away predators.
bullet Protective covering - Like porcupine quills or a turtle's shell.
bullet Bad flavor
bullet Toxin
bullet Hard outer shell - Like on a seed or nut
bullet Other - Skunk smell