Population Ecology – Part 2: Distribution and Life History Patterns

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*Number in outline corresponds to slide number the PowerPoint presentation.

1. Population Ecology – Part 2: Distribution Life History Patterns

2. Characteristics of a Population
- **a.** As we said in the last lecture, populations can be characterized in several ways, Now that we have looked at size and density, let's look at characteristics such as age structure and distribution.

3. Age Structure Diagrams.
- **a.** Age structure quantifies the relative proportion of a population that fall into each age category. Let's look at the different aspects of an age structure diagram.
- **b.** The three different colors represent the different reproductive phases of the species life cycle: Pre-, Peri-, and post-reproductive phases.
  - **1)** Pre- encompasses individuals that have not yet reached sexual maturity, i.e. the juveniles. In human populations, such as these diagrams are based on, this would include children that have not yet hit puberty.
  - **2)** Peri- are those individuals that are capable of reproducing, and
  - **3)** Post- are those individuals that are no longer capable of producing children. Note that in human populations, females lose the ability to reproduce once they hit menopause, whereas men are capable of reproducing as long as they can still produce sperm, which theoretically speaking, is possible throughout their entire lifetime.
  - **4)** These are often broken down into even more detail, measuring the ages that fall within these phases.
- **c.** Males vs. females are indicated on the diagram by the line transecting the graphic. For most animals, there is approximately the same number of each in a population, but often times, males and females have differing life expectancies. In humans, females tend to live slightly longer than males, so the post reproductive data tends to have more females. Can you tell which is which in these examples?
- **d.** The shape of the diagram can tell us whether the population is growing, shrinking, or staying about the same size throughout time. A population that is growing rapidly has a much larger base than apex. This means that there are a lot more individuals being born into the populations than those that are dying. Conversely, a diagram that is much larger on top than at the base means that there are more individuals dying than are being born, therefore the population is shrinking.

4. Distribution
- **a.** Distribution describes how a population space themselves in a habitat. As we learned in the previous lecture, in Malheur County, it can be said that the deer population is 1 deer per acre, but that doesn't mean that one deer can only be found in each acre. Distribution reflects not only how large the population and habitat is but instead reflects factors that influence where in the habitat the population resides.
- **b.** Factors that influence how a population distributes itself throughout an area are thing such as the social structure of the species in question, how the resources in the habitat are located, and the environmental conditions of the habitat. It reflects how the species interacts with each other and the environment. Three patterns of population dispersion are clumped, evenly spaced, and random.

5. Clumped Distribution.
- **a.** The most frequent pattern of distribution in a population is clumped. Individuals are clustered together in groups in response to uneven distribution of resources, tendency of offspring to remain with parents, or some type of social order. Clumping also may be linked with defense (safety in numbers) or mating behavior. In plants, soil type, availability of water or the manner in which the plant reproduces may favor clumped distribution patterns.

6. Uniform Distribution.

a. Evenly spaced distributions, in which members of the population maintain a minimum distance from one another, generally indicates strong competition for resources. This suggests that resources are extremely limited or difficult to obtain, In plant populations, this could result from competition for water, sunlight, or available nutrients, while among animals, even spacing indicates strong territoriality.

7. Random Distribution.

a. Random spacing is the least common pattern of distribution found in populations. It usually occurs because members of a species do not frequently interact with one another or resources are evenly spread bout though the habitat.

8. Survivorship

a. Survivorship curves represent age-specific patterns for a given population. Each species has its own characteristic curve, and demonstrates when, over the lifecycle of a given species, an individual is most likely to die. There are three basic survivorship patterns found in nature. Late, constant, and early loss.

b. Late loss represent species that have low death rates early in life, have only a few offspring at a time and invest a lot of time in parental care. You will see a sharp increase in death rates in older individuals, meaning the older you get, the more likely you are to die.

c. Early loss curves represent species that have high death rates early in life. They put an emphasis on quantity, over quality, producing a large amount of offspring at a time in the hopes that a few will survive into adulthood. Once adulthood is reached death rates drop significantly. Often times, the organism develops characteristics that protect it from predation as it matures into adulthood, such as the sea urchin. Urchins are born small, as tiny larvae, that are easily preyed upon by filter feeders (Animals that filter their food out of the surrounding water) As they grow into their adult form, they form large, menacing spokes that protect them from attack. Species with this type of survivorship often do not invest any time into parental care, and only a few offspring will survive beyond infancy.

d. Constant loss represents species that have a constant death rate throughout its life cycle, so you are just as likely to die young as you are old. Species in this group tend to not die of old age, but instead are susceptible to disease and predation, regardless of age. Parental care varies among organism ins this category. Birds, who do participate in parental care and reptiles, who do not, are both types of animals that exhibit a constant life survivorship.

9. What's the point of it all?

a. So, why should we look at life history patterns? In terms of conservation biology, we can use this type of data to study endangered species. For instance, knowing when the species is at its most vulnerable, biologists can create a conservation plan to target them at that stage in their life.

b. A great example is the sea turtle. This type of animal follows an early loss pattern, meaning that they are most vulnerable at the very beginning of their life. Sea turtles return to the beach that they were born to lay their eggs in the sand, and then return to the ocean, leaving their eggs to the mercy of the environment. The highest numbers of deaths occur in the very short amount of time that it takes for newly hatched turtles to cross the sand and reach the ocean. Once they reach the water, their potential for survival increases exponentially. So the main target of our conservation strategy is focused on those first few hours of life. Local tourism has even been enlisted into the efforts to save the sea turtle. Every year during the time that expectant mothers return to the beaches of south America, people gather and hold vigils, protecting the nest from predators that feed on the eggs, and dig channels to the water's edge, giving the youngsters a clear path to follow, and protect them from sea gulls looking for a snack.