Ecology & wild Life Biology; ZooG-DSE-B-6-2-TH

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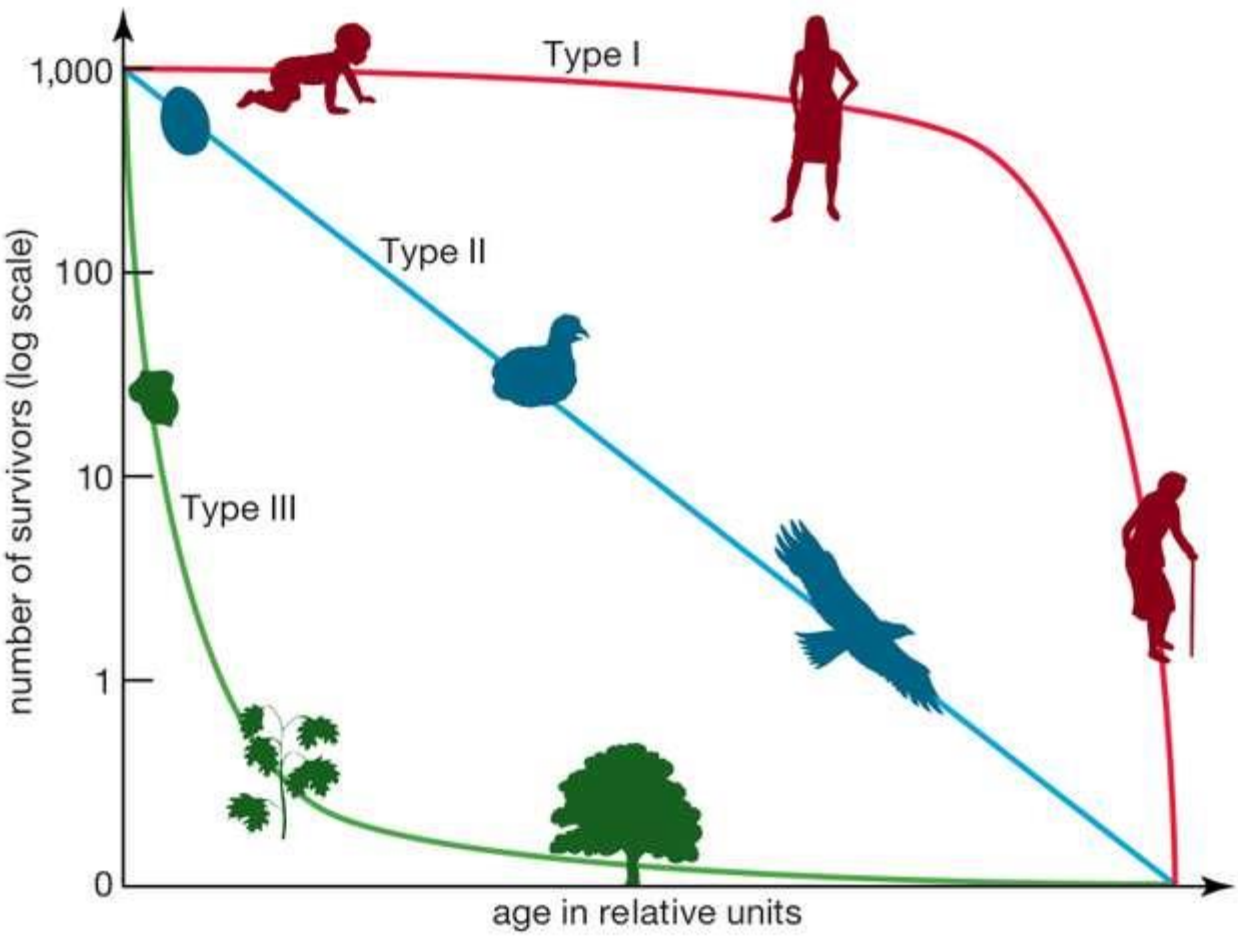
Unit 2: Population : Life Table, Survivorship Curve, Fecundity, Density dependent & Density independent factor.

Life tables and the rate of population growth:

Differences in life history strategies, which include an organism's allocation of its time and resources to reproduction and care of offspring, greatly affect population dynamics. As stated above, populations in which individuals reproduce at an early age have the potential to grow much faster than populations in which individuals reproduce later. The effect of the age of first reproduction on population growth can be seen in the life tables for a particular species. Life tables were originally developed by insurance companies to provide a means of determining how long a person of a particular age could be expected to live. They are used not only by demographers of human populations but also by plant, animal, and microbial ecologists to make projections about the life expectancies of nonhuman populations, as well as the effects of variation on demography and population growth. The number of individuals in a closed population (a population in which neither immigration nor emigration occurs) is governed by the rates of birth (natality), growth, reproduction, and death (mortality). Life tables are designed to evaluate how these rates influence the overall growth rate of a population.

Survivorship curves:

Life tables follow the fate of a group of individuals all born within the same population in the same year. Of this group, or cohort, only a certain number of individuals will reach each age, and there is an age above which no individuals ever survive. Plotting the number of those members of the group that are still alive at each age results in a survivorship curve for the population. Survivorship curves are usually displayed on a semi logarithmic rather than an arithmetic scale.



survivorship curve Type I, II, and III survivorship curves.

A survivorship curve: is the graphic representation of the number of individuals in a population that can be expected to survive to any specific age.

Types:

TYPE-I: There are three general types of survivorship curves. Species such as humans and other large mammals, which have fewer numbers of offspring but invest much time and energy in caring for their young (*K*-selected species), usually have a Type I survivorship curve. This relatively flat curve reflects low juvenile mortality, with most individuals living to old age.

TYPE-II: A constant probability of dying at any age, shown by the Type II survivorship curve, is evident as a straight line with a constant slope that decreases over time toward zero. Certain lizards, perching birds, and rodents exhibit this type of survivorship curve. In some species that produce many offspring but provide little care for them (*r*-selected species), mortality is greatest among the youngest individuals.

Type III survivorship curve: indicative of this life history is initially very steep, which is reflective of very high mortality among the young, but flattens out as those individuals who reach maturity survive for a relatively longer time; it is exhibited by animals such as many insects or shellfish. Many populations have survivorship patterns that are more complex than, or fall in between, these three idealized curves. For example, passerine birds (perching birds such as finches) commonly suffer high mortality during the first year of life and a lower, more constant rate of death in subsequent years.

Fecundity Definition:

Fecundity is a measure of the number of offspring produced by an organism over time. It is also called the reproductive rate of an organism. Fecundity is measured by the number of offspring that are created successfully. In sexually reproducing organisms, two gametes must meet and the process of fertilization must occur. This embryo must then be developed, and birthed into the world, either directly from the zygote, or from a seed, an egg, or directly from the mother. Fecundity is a measure of the number of viable offspring, or offspring that have the potential to continue on reproducing. Fertility, on the other hand, is simply the ability to sexually reproduce successfully.

A population exhibits more fecundity when each organisms produces more offspring successfully, and the population grows. Fertility is simply a description of whether or not individual animals are able to reproduce. An organism can produce many gametes ready for fertilization, but may never get the chance to reproduce. This organism would be fertile, but would show no fecundity. Fecundity can be measured in individual organisms, or in entire populations. The study of human demographics uses the measure of fecundity to help determine the rate of change a population is experiencing. Ecologists also use measures of fecundity to study reproductive rates in animal populations.

Density Dependent and Density Independent:

Density dependent factors influence a population differently if the population is crowded than if it is not crowded. The effects of predators, disease and competition vary with the concentration of the population. For example, a disease spreads more rapidly through a crowded population severely. The biotic factors influence all population than through a sparse one.

The loss of a food source affects a crowded population, regardless of their density, and is called density-independent. For example, a forest fire affects the food supply and shelter of all organisms in the areas whether they are crowded or not crowded.

Density dependent factors:

In nature, limiting factors affecting population sizes include how much food and/or shelter is available, as well as other density-dependent factors. Density-dependent factors are not relevant to populations that are below "carrying capacity," (i.e., how much life a habitat can support) but they start to have to become noticeable as populations reach and exceed that limit. The degree of control imposed by a density-dependent factor correlates to population size such that the effect of the limitation will be more pronounced as population increases. Density-dependent factors include competition, predation, parasitism and disease.

Competition

Habitats are limited by space and resource availability, and can only support up to a certain number of organisms before reaching their carrying capacity. Once a population exceeds that capacity, organisms must struggle against one another to obtain scarce resources. Competition in natural populations can take many forms. Animal communities compete for food and water sources whereas plant communities compete for soil nutrients and access to sunlight. Animals also vie for space in which to nest, roost, hibernate, or raise young, as well as for mating rights.

Predation

Many populations are limited by predation; predator and prey populations tend to cycle together, with the predator population lagging somewhat behind the prey population. The classic examples of this are the hare and the lynx: as the hare population increases, the lynx has more to eat and so the lynx population can increase. The increased lynx population results in more predatory pressure on the hare population, which then declines. The drop in food availability in turn causes a drop in the predator population. Thus, both of these populations are influenced by predation as a density-dependent factor.

Parasitism

When organisms are densely populated, they can easily transmit internal and external parasites to one another through contact with skin and bodily fluids. Parasites thrive in densely packed host populations, but if the parasite is too virulent then it will begin to decimate the host population. A decline in the host population will in turn reduce the parasite population because greater distance between host organisms will make transmission by more difficult.

Disease

Disease is spread quickly through densely packed populations due to how close organisms are to one another. Populations that rarely come into contact with one another are less likely to share bacteria, viruses and fungi. Much like the host-parasite relationship, it is beneficial to the disease not to kill off its host population because that makes it more difficult to for the disease to survive.