Chan's ENVS200 Review

Chapter 5 - Birth, Death, and Movement

POPULATIONS, INDIVIDUALS, BIRTHS, AND DEATHS

- Population - group of individuals of the same species
- Births, deaths, and movement (immigration and emigration) all affect the size of a population
- Unitary individuals are all about the same as they grow up (most animals)
- Modular individuals are ones that can vary greatly (grow by repeated addition of modules, like sprouting a new shoot or growing a new polyp)
  - A genet is short of genetic individual - starts life a single-celled zygote, and is considered dead when all of its component modules are dead
  - An individual module starts life as a multi-cellular growth spawning off an existing being
- Sometimes counting the numbers of a particular species can be extremely difficult
  - Usually make estimates from representative samples
  - ex. 5 aphids on a sample of 10 leaves, a tree has 10,000 leaves, so we can estimate the tree has 5,000 aphids
  - The mark-recapture method helps prevent double counting the same individual

LIFE CYCLES

- Birth -> Pre-reproductive period -> Reproductive period -> Post reproductive period -> death
  - This model usually fits for most unitary organisms
- Both growth and reproduction require energy, so it's rare that they happen at the same time
- Iteroparous species - breed more than one time in their life (ex. humans)
- Semelparous species - breed once in their life (and usually die right after, ex. some salmon)
- Perennial plants live for more than two years
- Annual plants live for less than two years
- Many annual zygotes can remain dormant for many years until the conditions are right for them to begin growing
  - Large populations of dormant seeds in the soil are called a seed bank
    - Composition of the seed bank may be very different from the actual vegetation growing on top of it
- Many animals have a specific mating period in the year, triggered by the length of the photoperiod
  - Common in biomes where seasons change
  - Coincides birth of offspring with when resources are most abundant
- Continuous breeders usually exist where there is little seasonal variation in temperature/ rainfall/photoperiod
- Size is generally a better indicator of reproductive capability than age

MONITORING BIRTH AND DEATH

- Cohort - all individuals born within a particular time period
- Cohort life table - records how many of a cohort are still living over time
  - a_x - number of individuals alive
  - l_x - proportion of cohort alive at a certain time
  - f_x - total number of female young produced
  - m_x - average number of female young produced per SURVIVING individual
  - l_x * m_x - average number of female young produced per individual (regardless of life/death)
- Static life table - when cohorts aren't known, simply write down the ages of everyone still living in the population
- Age-specific fecundity schedules - track how may births individuals have at different ages
- Basic reproductive rate (R_o) - average number of offspring produced by individuals in a certain population over the course of their entire life
- Survivorship curves - general trends that show the mortality rate of a species versus the age of an individual
  - Type 1 - mortality concentrated to the end
    - ex. humans in developed countries
  - Type 2 - mortality constant with time
    - ex. seeds buried in a seed bank
  - Type 3 - extensive early mortality, rate goes down as time goes on
    - ex. common amongst plants/animals in nature, especially those who produce large numbers of offspring

DISPERSAL AND MIGRATION

- Spacial distribution patterns
  - Random - as the name implies
  - Regular - spread out from each other in fairly regular patterns
  - Aggregated - in groups
  - Which description to use is dependent on the scale of what we're looking at
    - ex. Aphids are aggregated when you look at where they are in the country, but perhaps regularly distributed on a single leaf
- Dispersal is when individuals move away from each other
- Migration is when individuals move as a group
- Average density is # individuals divided by size of the habitat
- A key force that may initiate dispersal is intense competition by crowded individuals
  - ex. Moving to Beijing because there are more jobs, and it's too hard to find a job here
  - Emigration is commonly density-dependent, though it can be from both high density (to avoid competition) and low density (to avoid inbreeding)
- Immigration/emigration also affect the composition of a population
  - Dispersers are often young, and males usually disperse more than females

- Migration is almost always from areas of declining resources to areas of abundant resources

IMPACT OF INTRASPECIFIC COMPETITION

- Carrying capacity (K) - maximum population that can be supported indefinitely given the environmental resources
  - Just a theoretical thing, doesn't really exist in real life because of the dynamic nature of ecosystems
  - Occurs at the intersection of density-dependent birth rates and density-dependent mortality rates
  - More of a range of densities than a specific number
- A population's intrinsic rate of natural increase is usually exponential, and continues this way until crowding and competition reduces it
  - Creates an s-shaped curve of population vs. time (sigmoidal)
- Net recruitment - number of births minus deaths in a given time period
  - Graph of net recruitment vs. density is roughly dome-shaped
  - As such it is low when the population density is both low and high, and highest at somewhere near the middle