*Assigned readings, 8th Edition pp. 1174-1181
7th Edition pp. 1136-1139

Dynamics of Populations

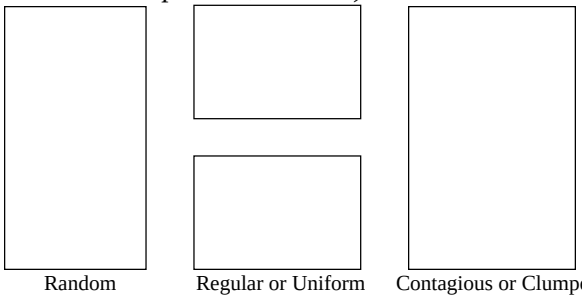
Outline of Lecture 3

- ***A. Density***
- ***B. Dispersion***
  - ***1. Random***
  - ***2. Uniform***
  - ***3. Clumped, contagious, and aggregated***
- ***C. Sampling effort to estimate population size***
- ***D. Density, dispersion, and statistical precision***
  - **** Three principles used in sampling effort***
- ***E. Demography***

A. Density: the number of individuals per unit area or volume; densities are determined using direct counts, quadrats, or indirect methods (e.g. mark-recapture)

$$N = \frac{\text{Number marked initially X total catch on second trapping}}{\text{Number recaptured in second trapping}}$$

B. Dispersion (degree of aggregation; spatial distribution, etc.): the pattern of spacing of individuals within the boundaries of a population *(see Fig. 53.4 on p. 1176, 8th Edit. or Fig. 52.3 on p. 1138, 7th Edit.)*.



Random Regular or Uniform Contagious or Clumped

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Dynamics of Populations

1. **Random**: spacing varies in an unpredictable way; the distribution of one individual doesn't affect the distribution of others; absence of repulsion and attractions.
2. **Uniform**: spacing is even; antagonistic behavior
3. **Clumped, contagious, aggregated**: individuals are aggregated in patches; habitat heterogeneity

Which type occurs most often?

C. Sampling effort (sample size requirements, number of required samples) needed to estimate population size is a function of the
   (1) Size of density mean
   (2) Dispersion pattern (spacing of individuals)
   (3) Desired precision (allowable error)

D. Density, dispersion, and statistical precision are related and can each be manipulated to solve for any of these population characteristics.

$$N = \frac{s^2 t^2}{\bar{x}^2 D^2}$$

$\bar{x}$ = mean
s^2 = variance
D = precision (expressed as a decimal)
t = constant

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Dynamics of Populations

1. As density increases, sampling effort decreases (assuming dispersion and precision are unchanged). *See formula above*.

2. As dispersion becomes more clumped (i.e. departs from random), the value of s^2/x^2 in the above formula increases; assuming density and precision are unchanged, sampling effort increases as clumping increases. *See formula above*.

3. As the desired precision [say, expressed as a percentage (20% error) but used as a decimal (0.2)] increases (which would be a 20% allowable error compared to 40% error) sampling effort increases. *See formula above*.

Why is it important to understand sampling effort and statistics?

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Dynamics of Populations

B. Demography

1. Population size increases from reproduction and immigration, and decreases from death and emigration.
2. Overlapping generations result when the average life span of an individual in a population is greater than the time it takes for that individual to mature and reproduce.

i. Co-existence of generations results in a specific age structure (e.g. Sweden, Mexico, and US differ in age structure; Japan's has changed over time).
ii. **Generation time**: average span between the birth of an individual and the birth of its offspring; shorter generation time, faster population growth because of compounding.
iii. Sex ratios
iv. Mortality and survivorship