Lecture 1

Populations Are Structured

Density and Dispersion

Preparatory Reading: Smith & Smith Chap. 8

Dall Sheep

Videos

- 2 kinds (a bit different than WTP's):
  - Textbook study directions
  - Sample exam problems

How to Succeed in the Last Half of Bio 221

Before each lecture:

- Watch textbook study directions video, then
- Do assigned reading
- Come to lecture; participate fully in clicker exercises

Before each exam:

- Watch video reviews

Overall:

- Spend ca. 3 hours outside of class per hour in class on Bio 221
- Do an ECO

How to enjoy Bio 221 again in 2017

- Skip class
- Never look at lecture or video materials online
- Do not practice problems or study for the exams
- Ignore ECOs

Bio. 221 on Facebook

- Search for Facebook group 'Bio 221 Spring 2016'
- Request membership; I will add you to the group
- Last yr, Facebook served as a forum for helping each other with problems prior to exams; virtual study groups.
- I will also use it to share news items I find relevant to class material

for exam questions – however – you will not need to read this material to answer the questions)

Biology 221 - Part Deux
Where have we been?
Where are we going?

Part 1: Ecosystems - Biomes - Biogeochemical Cycling - Energy Flow

Dr. Bill Peterjohn

Part 2: Populations - Interacting Populations - Evolutionary Processes - Biodiversity - Conservation Biology

Dr. Jim McGraw

Are you here?

- A. I am here today, and excited to be here
- B. I am not here, but my friend brought my clicker
- C. I didn't want to be here, but I am here, because my friend refused to bring my clicker, because she has read the student honor code, and she knows Dr. McGraw is a stickler for stuff like that.

Clicker test

Question: Where is the daily bad joke?

A. I'm waiting for one.
B. Please stop those!
C. He's not teaching this part of the class.
D. Other

Clicker Question 3

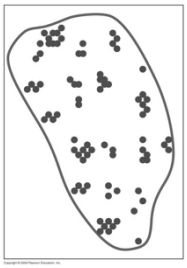
- What is a population? (i.e., have you read S&S Chapter 8 before lecture?)
- (A) all the individuals of all species within an area
- (B) the gene pool
- (C) a group of individuals of the same species that inhabit a given area
- (D) the definition differs for plants, animals, and other groups, so no single definition is possible

Density and Dispersion

➟What is a population?

Population Density

➟What is density?



Determining Population Density

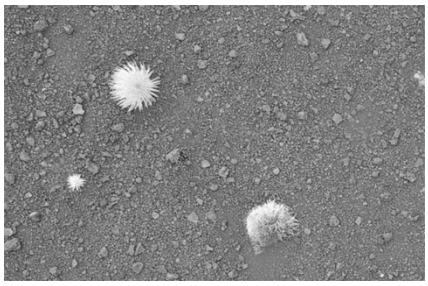
➟How do we determine attributes of a population?

Censusing Methods

- Method 1:_____
- When to use: _____ _____
- Examples: stationary bird groups, walruses, whales, small plant populations, etc.

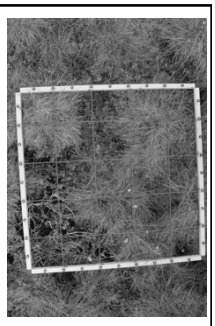
Gannets

Hawaiian silversword!



Determining Population Density

- Method 2: _____
- When to use: _____
- Examples: corals, large populations of plants



Population Censusing (cont' d)

- Method 3: _____
- When to use: _____
- Examples: Frog, fish, snails, butterflies!

The Principle of Mark-Recapture The Gumball Strategy

- A 1 m x 1 m x 1 m plexiglass square container is filled with gumballs. Joseph P. Knowitall has devised an excellent strategy for estimating the total number of gumballs. He first counts the number of gumballs (40) in a much smaller volume (10 cm x 10 cm x 10 cm), and knowing the proportion of the total he had counted, proceeded to estimate N in the large container.
- How many gumballs were in the large container?
- A. 40 B. 400 C. 4,000 D. 40,000 E. Impossible to determine.

Censusing by Mark-Recapture

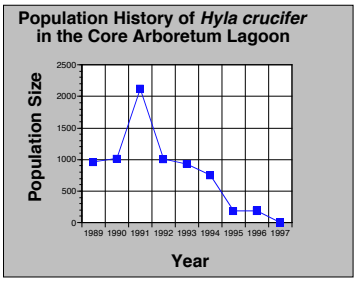
- M=
- R =
- n =
- Equation for estimating N_{total}:

Eco Demo

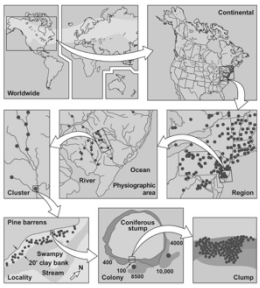
Sample Problem – try it on your own!

- A previous Biology 221 class captured, marked, and released 150 spring peepers ( ) from the arboretum lagoon. Two days later, they recaptured 100 spring peepers. Of these, 25 were marked from the previous capture. What was the peeper population density that year?

Data From Previous Bio. 221 Classes



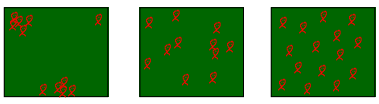
Distributions



Distribution of *Tetraphis pellucida*, a colonial moss of tree stumps

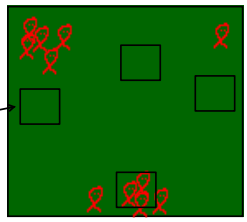
Dispersion

- Dispersion - the spatial distribution of individuals
- Patterns of dispersion
  - Clumped
  - Random
  - Uniform



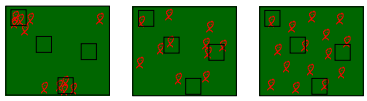
Dispersion (cont'd)

- Detecting dispersion patterns:
  - Index of Dispersion



Dispersion (cont'd)

- Clumped Random Uniform



I > 1 I = 1 I < 1

Thought Problem

If I threw four 3 m x 3 m quadrats randomly into the classroom, then counted the students in each, what dispersion pattern would I most likely detect?

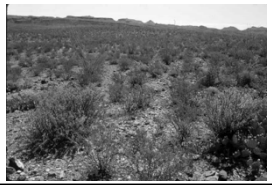
A. clumped B. random C. uniform D. no distribution pattern

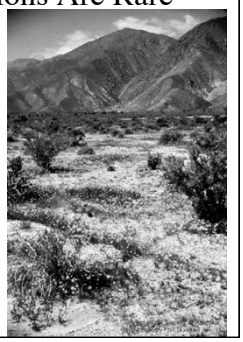
If I repeated this experiment and every seat in the classroom was occupied, what dispersion pattern would I most likely detect?

A. clumped B. random C. uniform D. no distribution pattern

Uniform Distributions Are Rare

- Shrubs in the genus *Larrea* show a spaced distribution in the desert southwest (US)



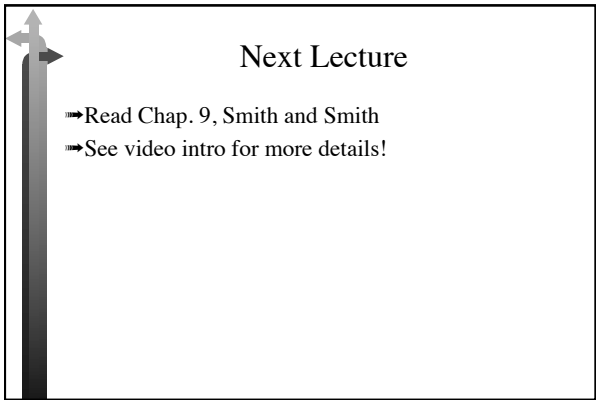


Applications: Rare Species

Density = 18.3 plants/hectare. WV = 4.8 million forested hectares. Total population of WV = 87.84 million plants. 4.3 million plants harvested per year. Harvest rate = 4.9%. Distribution = clumped.

Summary

- *Populations are structured*: Three attributes describe this structure:
  - Density; estimated by:
    - direct counts, quadrat method, mark-recapture
  - Distribution
  - Dispersion
    - clumped, random, uniform


Next Lecture
➟Read Chap. 9, Smith and Smith
➟See video intro for more details!