Time to Begin Exam Preparation

- NOTE: Sample exam problems on Bio. 221 web site; (a) exponential growth, (b) age structure, (c) logistic growth, (d) competition, (e) predator-prey.

Lecture 8

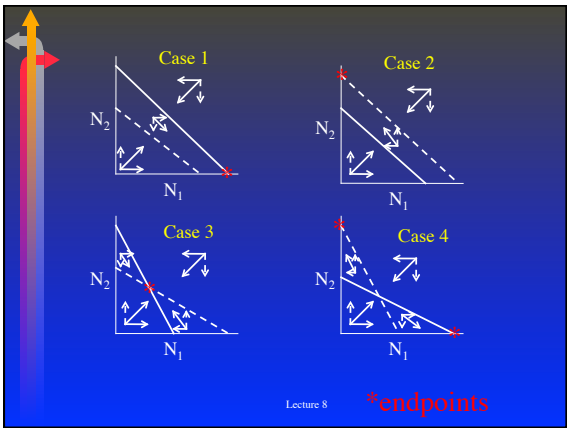
- Summary of interspecific competition
- Evolutionary predictions of Lotka-Volterra
- Begin predator-prey population dynamics

S&S, Chap. 14

(notation warning for predator-prey: variable names in S&S are nonstandard, so ours will be different…)

Interspecific Competition Review

- We 'solved' the competition equations with a graphical analysis
- Four outcomes possible:
  - Case 1: Species 1 wins
  - Case 2: Species 2 wins
  - Case 3: Coexistence
  - Case 4: Conditional competitive exclusion



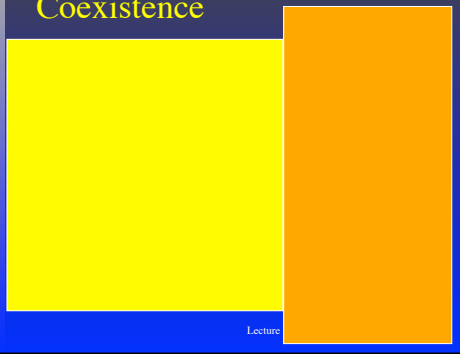
Graphical analysis - conclusions

- Qualitative outcome =f(K, α)
- r does not influence the outcome (exc. Case 4)
- Initial N does not influence the outcome (exc. Case 4)
- We can define the boundary conditions of stable coexistence - VERY IMPORTANT!

Practice Exam Problem

- *Wolves and coyotes have a somewhat odd form of competition. They eat a number of the same food items (e.g., hares, voles, etc.), but the coyote also scavenges food from wolf kills of larger prey. One might not think this is "competition" because clearly the coyotes are not allowed to come to the kill until the wolves are finished eating. However, the carcasses do disappear more quickly with coyotes around, such that wolves will have to find and kill another elk or bison more quickly when their food is eaten by coyotes. Occasionally wolves get rather feisty about the wily coyotes and will chase and even kill them. The other element is that wolves bring down food that coyotes could never kill themselves, potentially benefiting (not competing with) coyotes. But in general, we can treat this system like two competing species because of the aggressive territoriality wolves show toward coyotes. For Yellowstone Park, let us assume K for coyotes (species 1) is 500 while K for wolves (species 2) is 200. The competitive effect of wolves on coyotes 0.8 while the competitive effect of coyotes on wolves is 0.2.*

Boundary Condition for Stable Coexistence



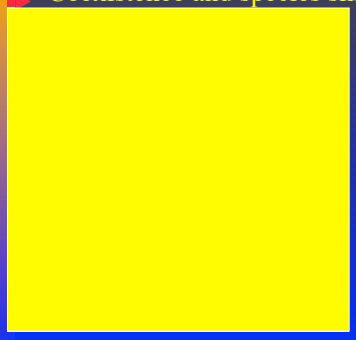
Lecture

Coexistence and species similarity

- Premise: Morphologically/physiologically similar species will compete strongly with each other

Lecture 8

Coexistence and species similarity



The greater the morphological or physiological difference between two species, the smaller the competition coefficient will be (or *vice versa*; the more similar two species are, the larger the competition coefficient)

Lecture 8

Limiting Similarity

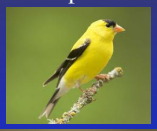
Limiting similarity is the **degree of difference (d)** which must exist between two species in order for them to coexist

Lecture 8

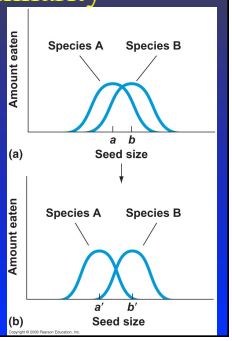
Evolutionary Prediction of Limiting Similarity

- Character displacement

e.g., goldfinch



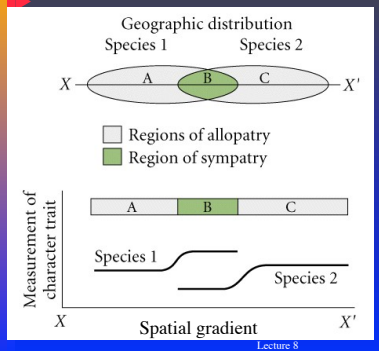
and housefinch…



Looking at the photos above and the graph at right, which species do you think is the house finch?

Lecture 8

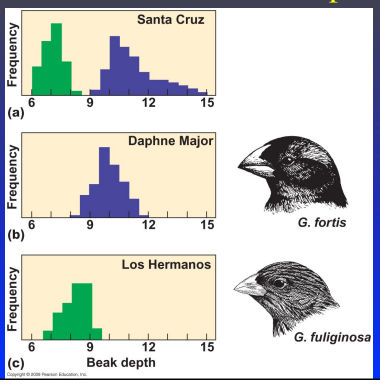
Graphic depiction of character displacement



Trait values diverge in the portion of the distribution where the two species overlap. This reduces competition such that coexistence is possible. The divergence is a product of natural selection.

Lecture 8

Real World Example

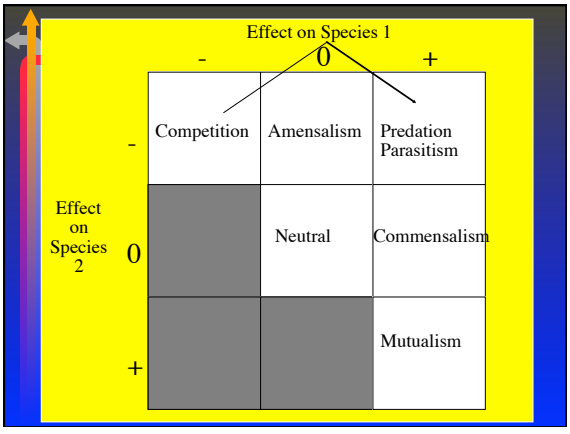


Darwin's Finches on Galapagos Islands

Two Similar Local Woodpeckers

- Hairy and downy woodpeckers are morphologically similar, however on average Hairys are 2x the weight of Downys

What would be predicted about these woodpeckers by the theory of character displacement? (A) In zones of sympatry, Hairys would be more than 2x larger than Downys (B) In zones of sympatry, Hairys would be 2x larger than Downys, (C) In zones of sympatry, Hairys would be <2x larger than Downys

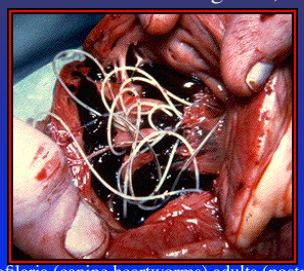


Control of N: Role of Consumers

- Predator - captures, kills, eats prey

Consumers

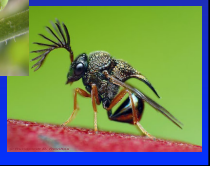
- Parasite - 'consumes' living host, may not kill



Dirofilaria (canine heartworms) adults (postmortem)

More 'Consumers'

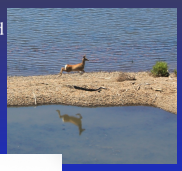
- Parasitoid -wasps/flies whose larvae consume tissues of host



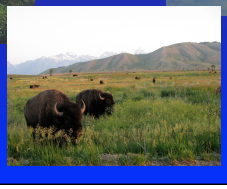
Consumers

- Herbivore - grazers, browsers of plants

White-tailed deer



Dall sheep



Bison

Consumers

- Detritivore - consumers of waste material of other species; e.g., leaf litter, feces, carcasses

Lecture 8

Predator-Prey Population Dynamics

- Predator-prey relationships are ubiquitous in nature.

Summary

- Competition problems involve understanding the zero growth isolines, the definitions of the competition coefficients, and inferring the outcome of competition from the zgi's
- Competition theory predicts character displacement in zones of species range overlap due to selection pressure to lower competition coefficients

Next lecture

- Develop Volterra Predator-Prey Equations
- Implications of predator-prey theory
- Correspondence with the real world
- Sample problems