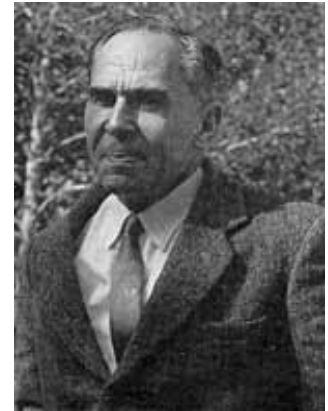
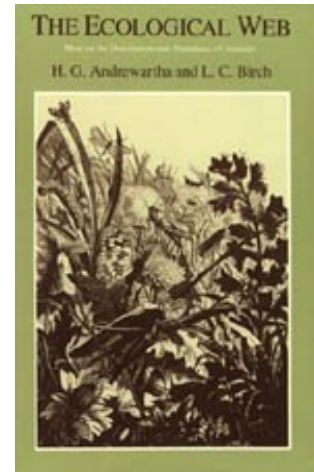


What is evolutionary ecology?

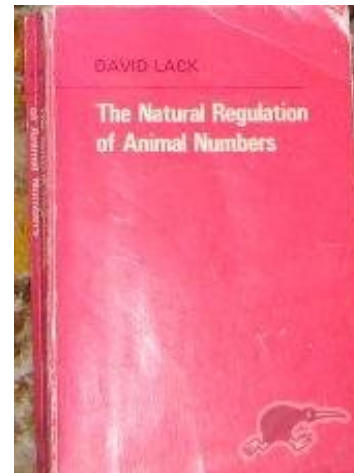
“Evolutionary ecologists consider both historical and contemporary influences on patterns of variation at all levels, from within individual variation to variation among communities or taxonomic groups”

Historical views

Andrewartha & Birch (1954)
The distribution and abundance of animals.



Lack (1954) *The natural regulation of animal numbers.*



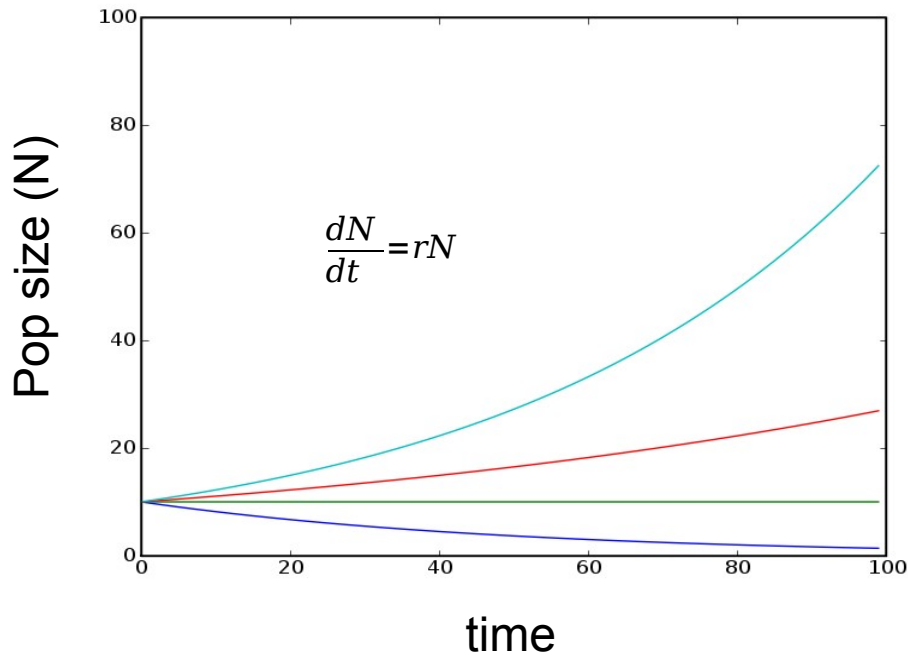
Andrewartha and Birch

- Economic entomologists
- Largely concerned with insect control in agricultural crops
- Studied insect 'pests' outside of their 'natural' environment

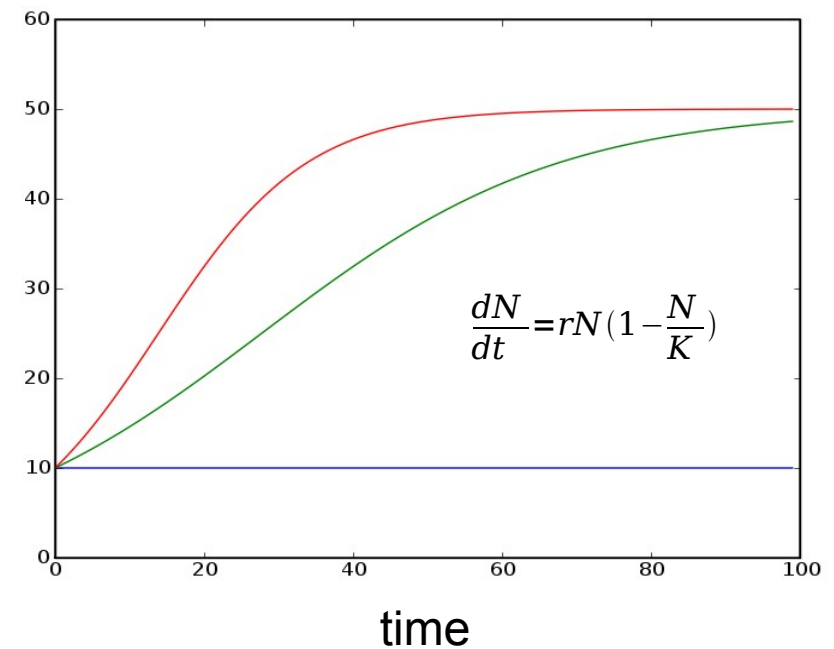
A&B believed that populations were limited largely in three ways

The reader may have anticipated the general conclusion that we have been leading up to. The numbers of animals in a natural population may be limited in three ways: (a) **by shortages of material resources**, such as food, places in which to make nests, etc.; (b) **by inaccessibility of these material resources** relative to the animals' capacities for dispersal and searching; and (c) **by shortage of time when the rate of increase (r) is positive**. Of these three ways, the first is probably the least, and the last is probably the most, important in nature. Concerning c, the fluctuations in the value of r may be caused by weather, predators, or any other component of the environment which influences the rate of increase.

Exponential and logistic growth of populations



No density dependence,
resource levels determine r



Density dependence, carrying
capacity limits growth through
intraspecific competition

Thus, goals of ecologist...

- Investigate physiology and behavior
- Investigate physiography, climate, soil, vegetation
- Estimate population sizes as accurately as possible
- Community studies...are rejected as being unlikely to contribute anything

Lack's view

- Was a field ornithologist
- Implicit acceptance of importance of community interactions
- Need to recognize the distinction of **proximate** and **ultimate** factors (note, A&B studied functional factors only, i.e. proximate factors).
- Research oriented toward evolutionary mechanisms in ecology
- Controlling factors must be density dependent, rejecting climate as a controlling factor
- Climate only sets species ranges

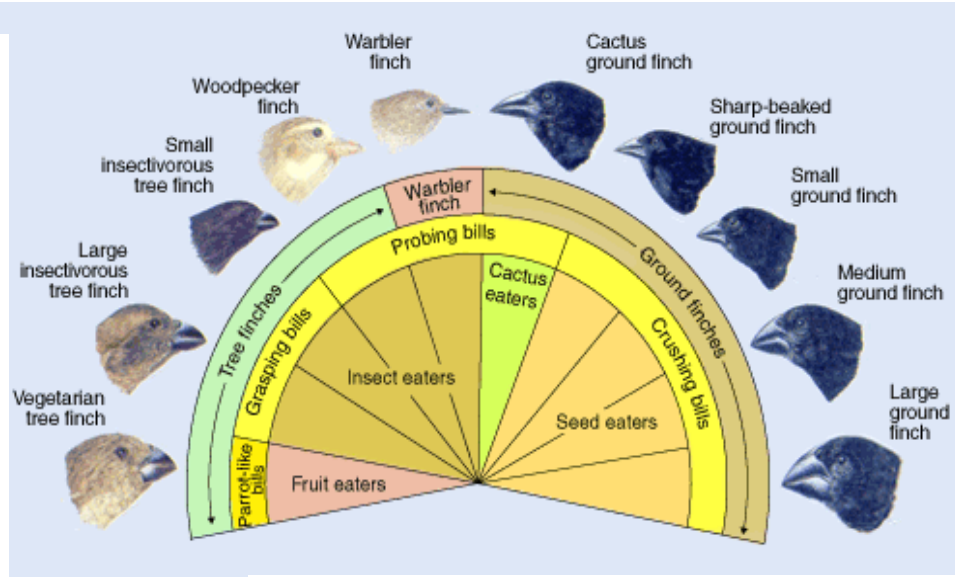
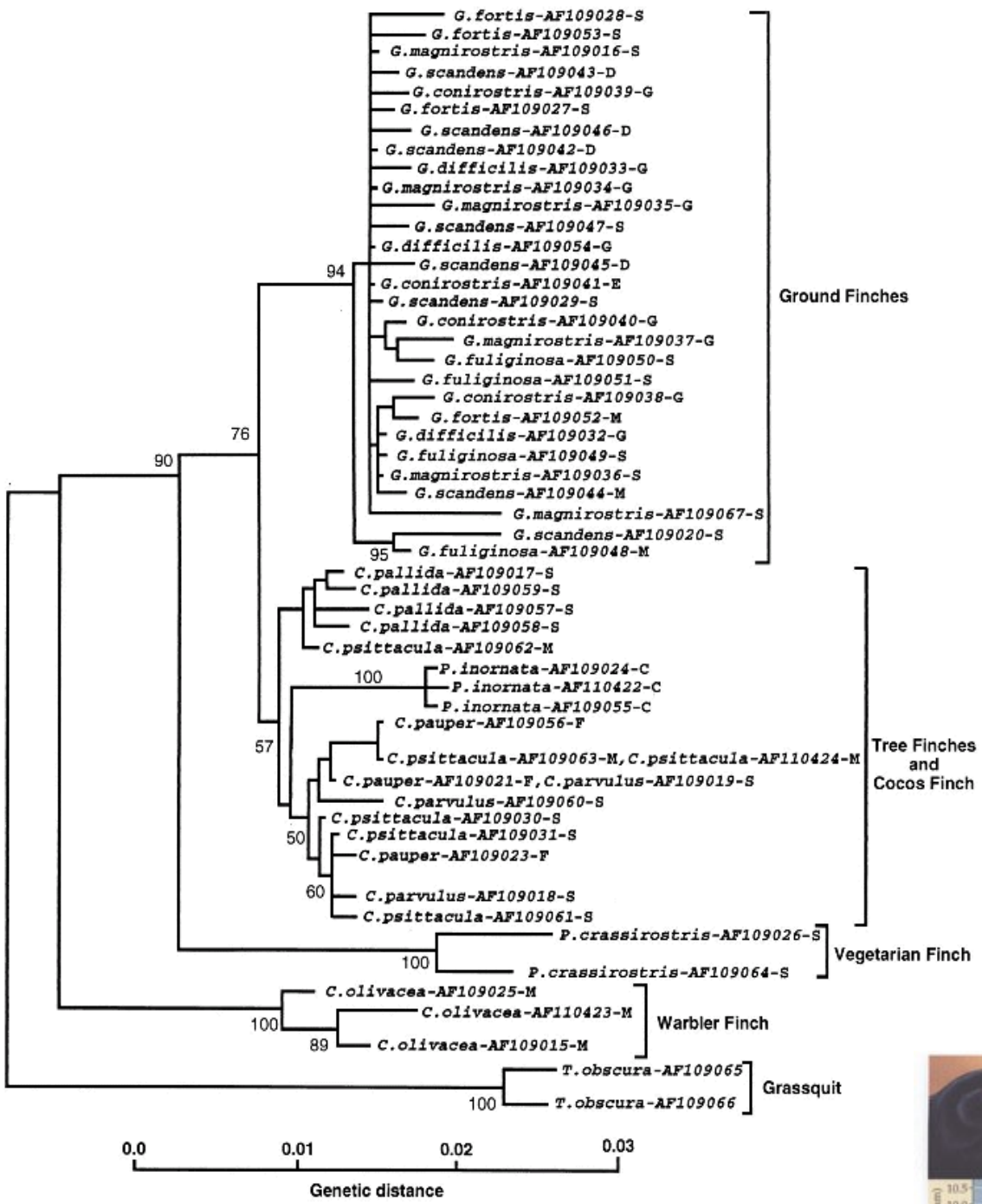
Lack (and others') view

- Examined aspects of life history that bear on abundance
 - Clutch size
 - Mortality of eggs and young
 - Adult mortality
 - Demographic structure
- For example, Lack's hypothesis:
 - Natural selection has caused clutch size in birds toward that which produces the most offspring (the upper limit set by the parents' ability to find food for young)

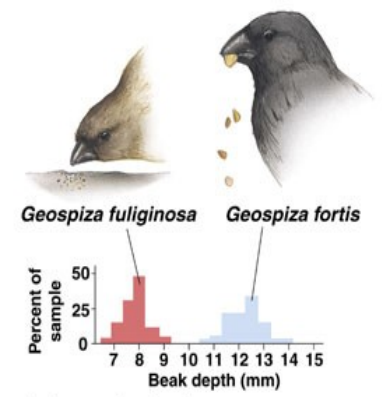
Modern studies

- Climate is a selective force, and animals evolve in response to it
 - e.g., climate change might cause shifts in species ranges, but shifts might not be as expected or occur at all if populations evolve to tolerate new conditions
- Density-dependence is important for determining population densities, as are other community interactions
- Traits evolve to increase ability to put offspring into future generations

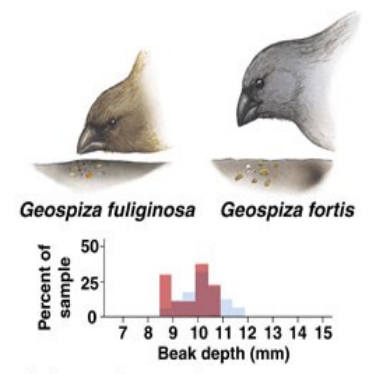
“Evolutionary ecologists consider both historical and contemporary influences on patterns of variation at all levels, from within individual variation to variation among communities or taxonomic groups”



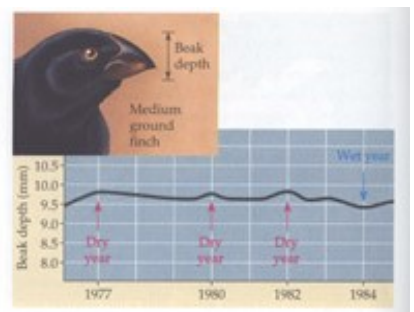
Tobin/Dusheck Asking About Life 2/a



A. Two species together



B. Two species separate



Variation in phenotypic traits occurs at every level of organization from within individuals to among species. As such, evolutionary ecologists need to know:

- 1) whether conditions are met under which selection can operate
components of phenotypic variance
heritability
- 2) whether and how the mean phenotype will change in a population under selection
relation to fitness (response to selection)
- 3) why a trait influences fitness
influences survivorship
influences reproduction
- 4) whether current phenotypic values represent past selective events
performance of phenotypes in different environments
plasticity (reaction norm) and adaptive plasticity
comparative methods

Topics in Evolutionary Ecology

- Natural selection in the wild
 - Adaptation
 - Phenotypic plasticity
 - Co- and counter-gradient selection
 - Adaptive radiations

Topics in Evolutionary Ecology

- Ecological Genetics
 - Genetic structure of populations
 - Inbreeding and outbreeding

Topics in Evolutionary Ecology

- Life history evolution
 - Demography
 - Age and size at maturity
 - Offspring size and number
 - Senescence
 - Life cycles
 - Sex ratios and sex allocation
 - Specialization versus generalization

Topics in Evolutionary Ecology

- Behavior
 - Game theory
 - Mating systems
 - Sexual selection
 - Cooperative behavior
 - Foraging behavior
 - Dispersal and migration

Topics in Evolutionary Ecology

- Interspecific interactions
 - Ecological character displacement
 - Predator-prey interactions
 - Host-parasite interactions
 - Mutualisms
 - Co-evolution
 - Disease ecology

Topics in Evolutionary Ecology

- Interspecific interactions
 - Pesticide resistance
 - Invasive species
 - Biological control
 - Consequences of management actions