

Life history variation

What is a life history?

- It is the schedule of an individual's life in terms of growth and reproduction.
 - It represents an organism's solution to the problem of allocating limited time and resources to achieve maximum reproductive success.

Components of life histories

- Maturity: age at first reproduction
- Parity: number of episodes of reproduction
 - Semelparity: reproduce only once
 - Iteroparity: repeated reproduction
- Fecundity: number of offspring produced per reproductive episode
- Aging
- Growth

Goals of life history research

- Identify the patterns of variation within and across taxa
- Unravel the causes of this variation
 - Observation
 - Mathematical modeling
 - Experimentation

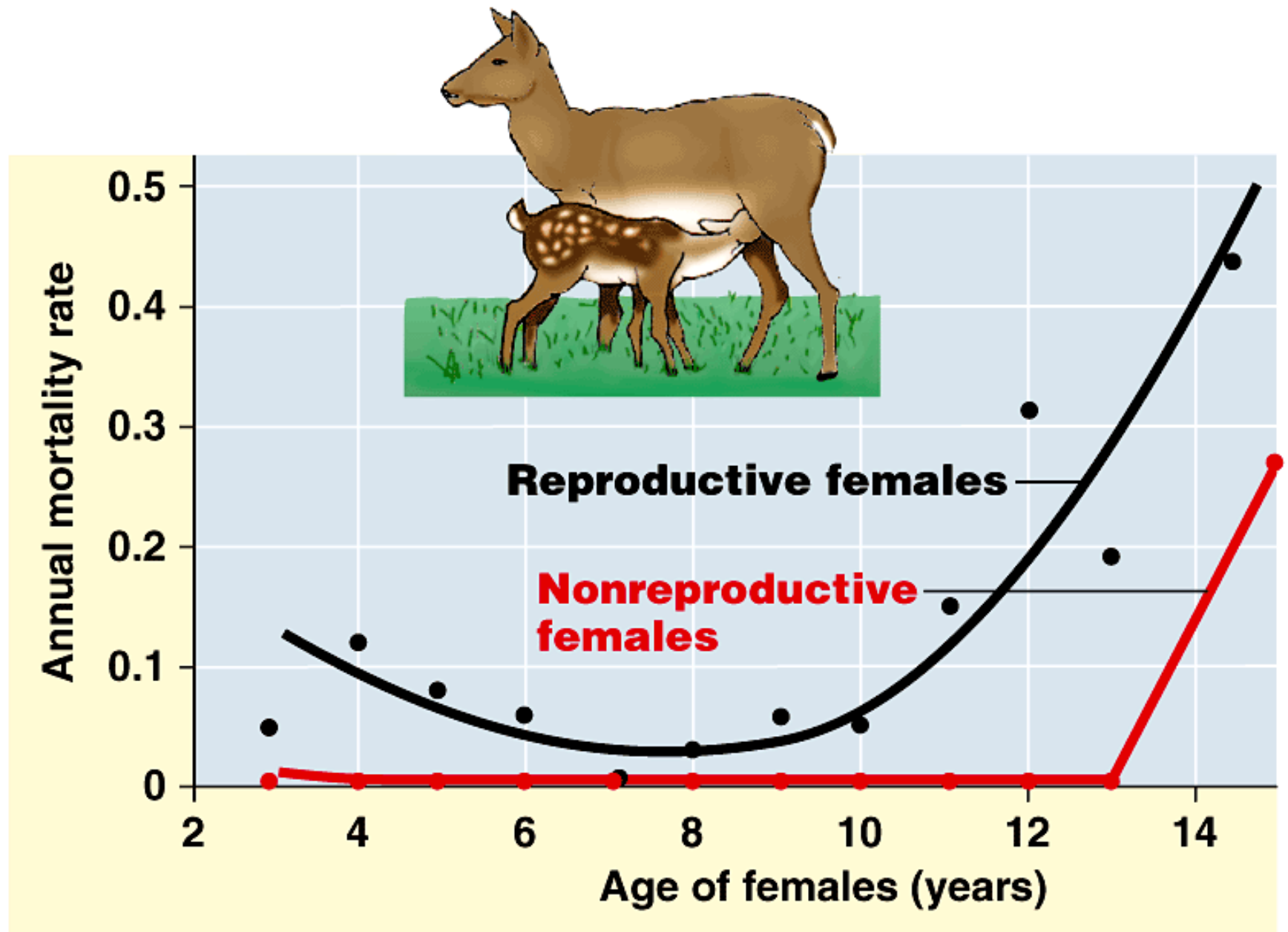
Consequences of life histories

- They influence evolutionary fitness
- Have an important effect on the abundance and growth of populations

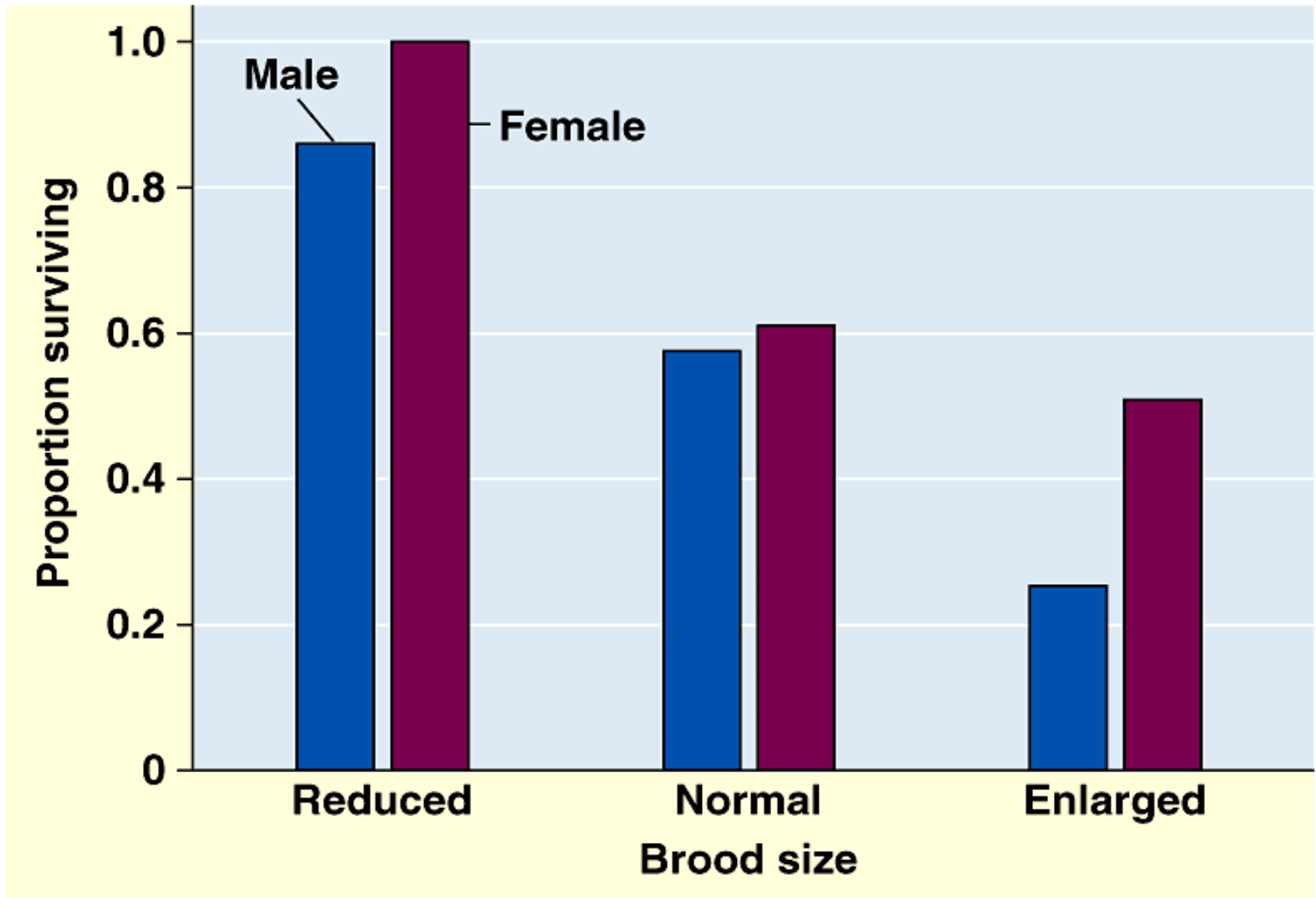
Trade-offs in allocation of resources

- Organisms have limited time, energy, and nutrients at their disposal
 - Many modifications of form and function involve trade-offs, meaning that limited time, energy, or materials devoted to one structure or function cannot be allotted to another

Cost of reproduction in female red deer on the island of Rhum, in Scotland



Probability of survival over the following year for European kestrels after raising a modified brood



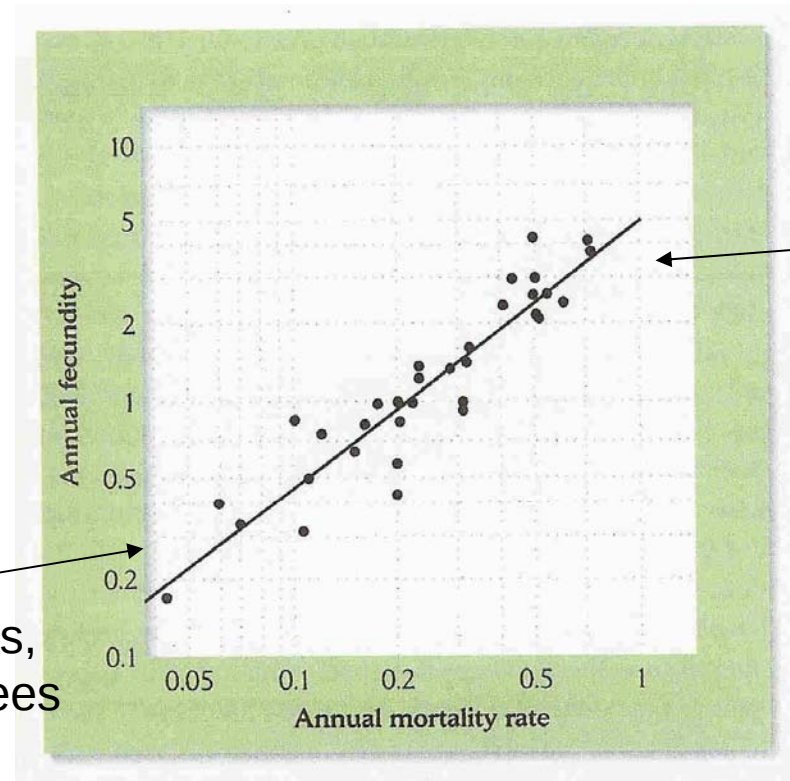
What determines an optimum life history?

- Life histories reflect the genotype, the environment and the interaction between the two
 - Individuals can have an immediate response to variation in the environment within the bounds set by their evolutionary history and physiology

Life history patterns across species

- Life history traits often vary consistently with respect to habitat or conditions in the environment
 - Seed size generally larger among plants in forests than among plants in grasslands
- Variation in one life history trait is often correlated with variation in other traits
 - Number of offspring produced each year is correlated with adult annual mortality rate

Correlation among life histories traits across species



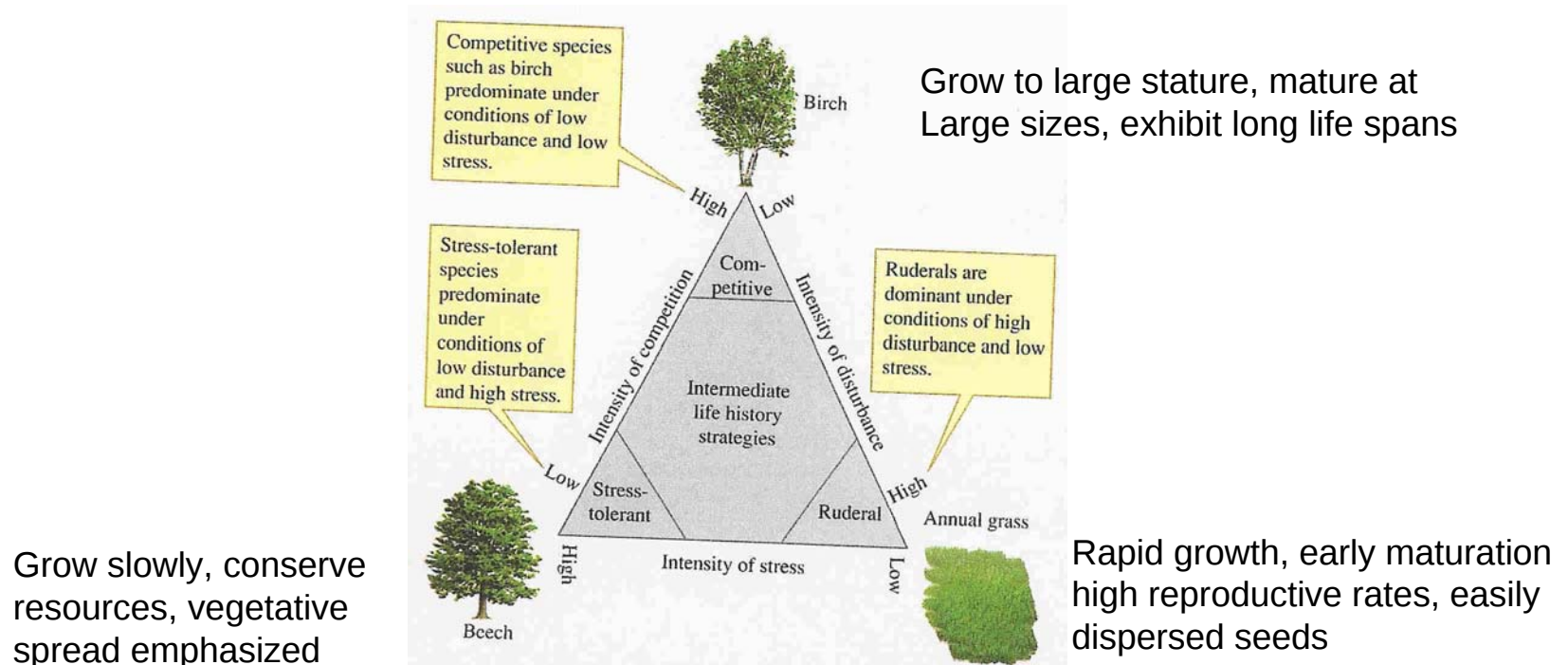
Elephants, albatrosses,
giant tortoises, oak trees

Mice, fruit flies, weedy
plants

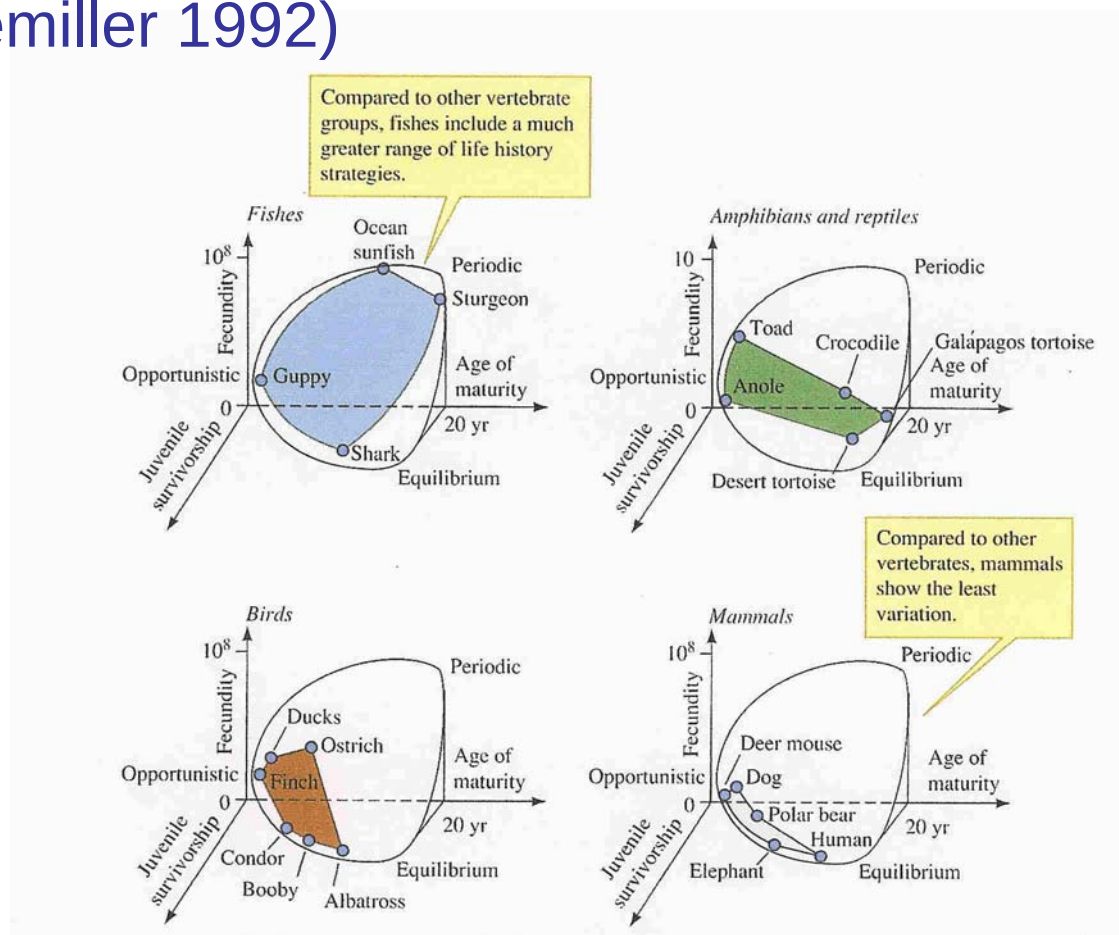
Variation in seed crop size in plants: Dandelion and coconut palm



Life history variation in plants (Grimme 1979)



Variation in life histories within vertebrate animals (Winemiller 1992)



Life history strategies:

- Opportunistic: low juvenile survival, low numbers of offspring, early reproductive maturity
- Equilibrium: high juvenile survival, low numbers of offspring, late reproductive Maturity
- Periodic: low juvenile survival, high numbers of offspring, late maturity

Trade-offs between current and future reproduction

- Age at first reproduction
 - In species that continue to grow until they reach sexual maturity, it is optimal to start reproducing at the age where growth maximizes fecundity;
 - in organisms that do not grow after their first year, the decision to breed may reflect a trade-off between current reproduction and survival
- Trade-off between fecundity and survival
 - High mortality in adults favor increase in current fertility
 - Life span potentially long favors no increase in current fertility
- Trade-off between growth and fecundity
 - Long life expectancy favors growth over fecundity during each year
 - less chance of living favors fecundity over growth