Topics 3.1 to 3.3

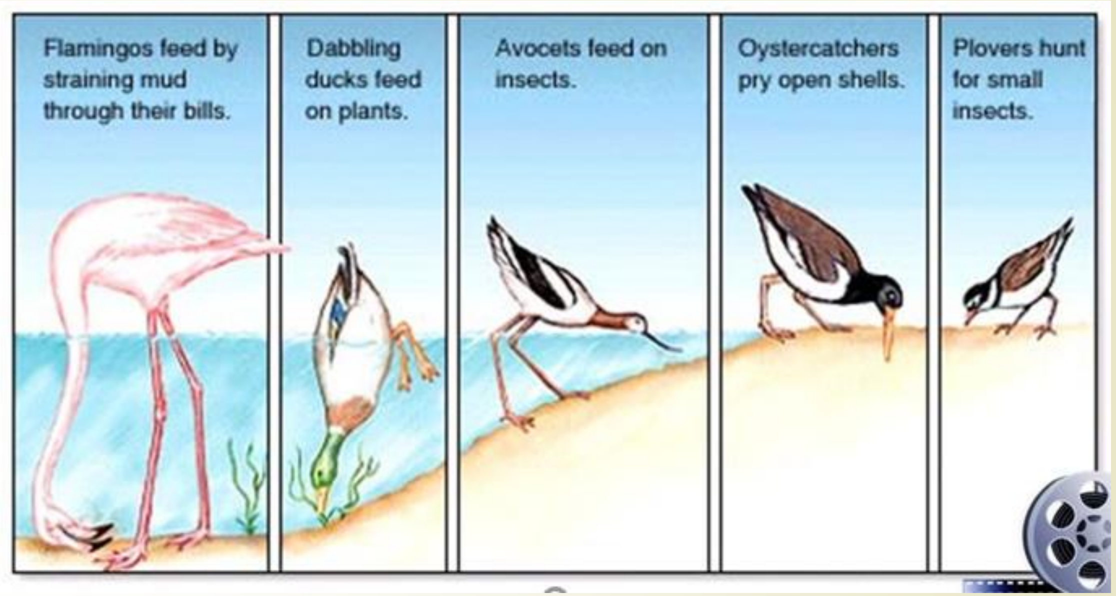
Generalist and Specialist Species, K-Selected and r-Selected Species, and Survivorship Curves

Enduring Understanding: Populations change over time in reaction to a variety of factors.

Learning objectives: Identify differences between generalist and specialist species, K-selected and r-Selected species, and explain survivorship curves

Each organism has habitat needs

- ***Niche***: an organisms functional role in a community; its job within its habitat
  - habitat use, food selection, role in energy and nutrient flow, interactions with other individuals
  - Species evolve to fill available niches and avoid competition for resources



- **Species survival depends on having suitable *habitat***
  - The specific environment in which a species lives including both living and nonliving characteristics. Rock, soil, leaf litter, humidity, plant life, etc.
  - Habitats vary with the body size and needs of species
    - A soil mite vs. an elephant, mobile vs. sedentary organisms
- **Species use different criteria to select habitat**
  - Provides a set of conditions within a species range of tolerance to abiotic conditions
  - Species are adapted to compete for resources in their given habitat and or avoid competition for a needed resource.
    - This competition helps shape a species niche

Organisms Vary in the Breadth of Their Niches

- Species with a broad niche are ***generalists.***
  - species who can use a broad range of resources
  - Opportunists who take advantage of favorable conditions, but who are generally weak competitors
  - Can live in many different places
- Species with a narrow niche are ***specialists.***
  - Species with specific resource needs
  - Extremely good at competing for the narrow range of resources they require.
  - But vulnerable when conditions change, limiting resource availability

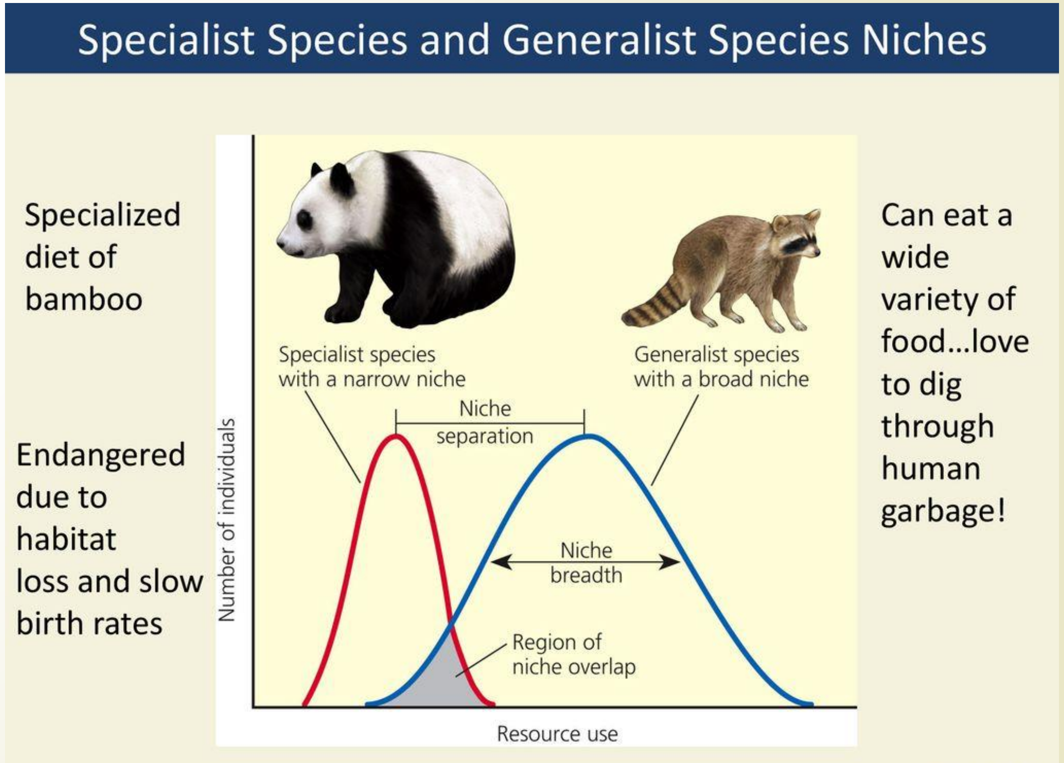
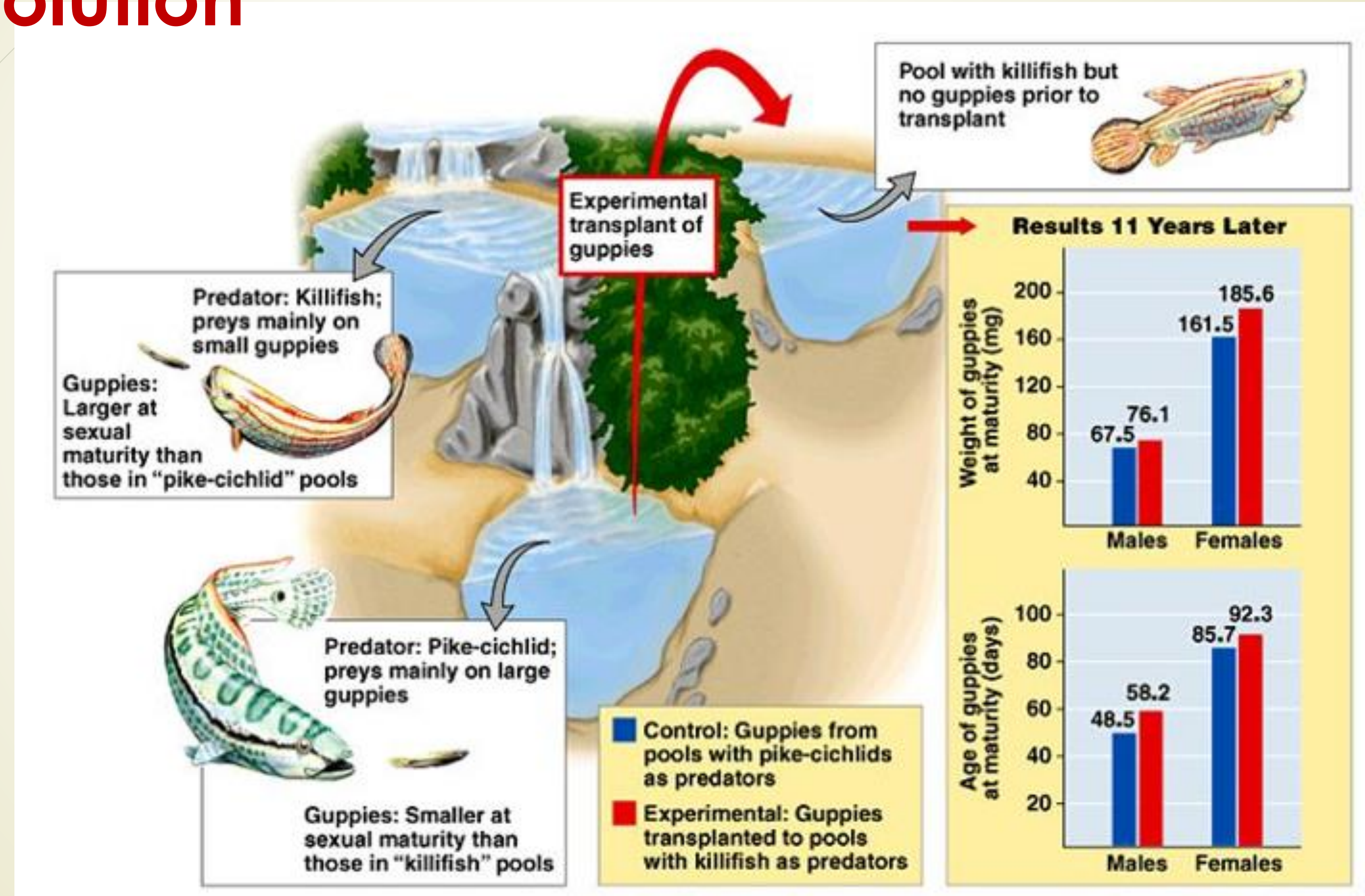


Fig. 4-13, p. 95

A Species Life History are Shaped by Evolution

- ***Life history traits:*** describe traits that affect the growth, reproduction, and survivorship (chance of being alive as a function of age) of a species.
  - Examples of life history traits: age of first reproduction, average # of offspring produced, energy cost of reproduction, etc.
  - Life history traits are shaped by evolution, operating through natural selection.
    - Abiotic conditions (temperature, precipitation, seasonality, etc) and interactions with other species (predation, competition, etc) are selective pressures that shape life histories.
- ***Biotic potential*** is the maximum rate at which a population can grow under ideal conditions
  - The combination of life history traits found in a given species help maximize its biotic potential in a given environment.
- Life histories of species demonstrate a wide range of approaches to maximizing biotic potential, with many species falling in the middle.
  - Species at either end of this continuum are described as either ***r-selected*** or ***K-selected***

A Species Life History are Shaped by Evolution



Life History Traits

K-Selected Strategists	r-selected Strategists
Generally larger body size	Generally smaller body size
Long life expectancy, reach sexual maturity late in life span	Shorter life spans, reach sexual maturity early in life span
High energy cost of reproduction	Low energy cost of reproduction
Small and infrequent litters and strong parental care	Large litters and/or frequent litters, with little or no care invested in offspring
Mostly specialists that thrive in stable environments in which they are strong competitors	Mostly opportunistic generalists that thrive in disturbed environments with little competition
Demonstrate steady population growth, with little fluctuation	High biotic potential, with many populations showing very high growth rates (r)
Stabilize at a relatively constant carrying capacity (K) regulated by density dependent factors.	Populations fluctuate greatly, with irregular cycles of boom and bust regulated by density independent factors

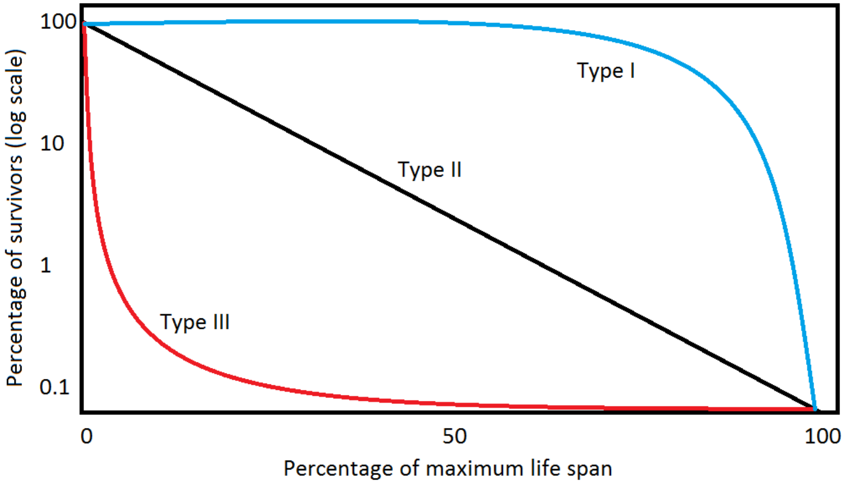
Purely r-selected and purely K-selected strategists demonstrate extremes of life history traits, most species demonstrate a combination of life history characteristics and fall in between these extremes.

Survivorship Curves

54.1 ***Life Table of the 1978 Cohort of Darwin's Ground Finch (Geospiza scandens) on Isla Daphne***

AGE IN YEARS (X)	NUMBER ALIVE	SURVIVORSHIP[a]	SURVIVAL RATE[b]	MORTALITY RATE[c]
0	210	1.000	0.434	0.566
1	91	0.434	0.855	0.143
2	78	0.371	0.898	0.102
3	70	0.333	0.928	0.072
4	65	0.309	0.955	0.045
5	62	0.295	0.678	0.322
6	42	0.200	0.545	0.455
7	23	0.109	0.651	0.349
8	15	0.071	0.944	0.056
9	14	0.067	0.776	0.224
10	11	0.052	0.923	0.077
11	10	0.048	0.396	0.604
12	4	0.019	0.737	0.263
13	3	0.014	0.714	0.004

[a]Survivorship = the proportion of newborns who survive to age x.
[propability of surviving to end of an age interval]
[b]Survival rate = the proportion of individuals of age x who survive to age $x + 1$.
[propabillity of surviving an age interval and entering a new age interval]
[c]Mortality rate = the proportion of individuals of age x who die before the age of $x + 1$.
[propabillity ofdying before the start of the nest age interval]



Three generic types of survivorship curve

- ***Life history tables*** record the probability of individuals in a population being alive as a function of their age.
  - Started by the life insurance industry, but since adopted by population ecologists.
  - Life history tables strongly reflect the life history traits that have evolved within a population.
  - ***Survivorship curves*** are the graphical representations of life history tables.
  - Although the exact survivorship curve will vary from population to population, 3 generalized types of survivorship curve are recognized:
    - ***Type I***: late loss, high survivorship
    - ***Type II***: constant loss
    - ***Type III***: early loss, high survivorship
  - What type of survivorship curve corresponds to K-selected species? To r-selected species?