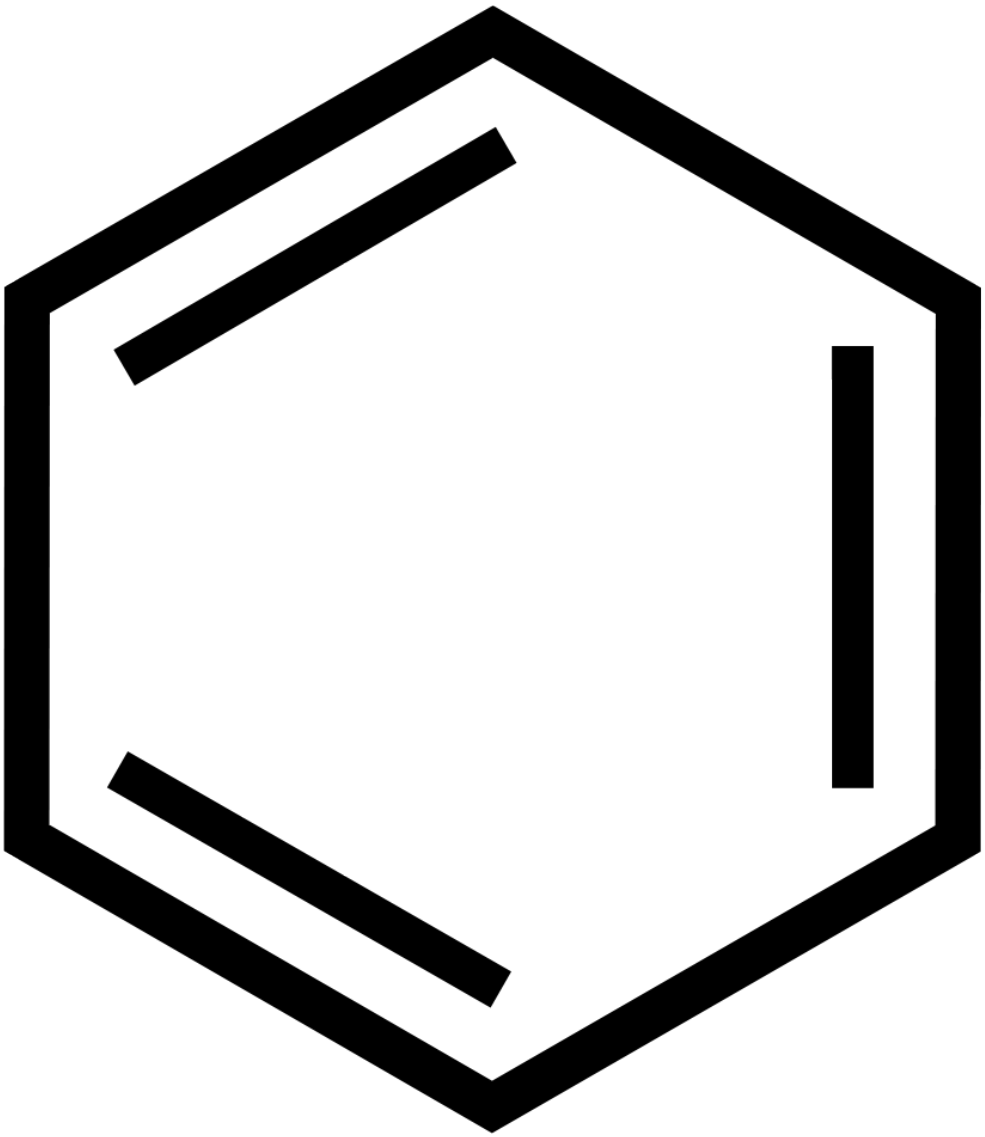


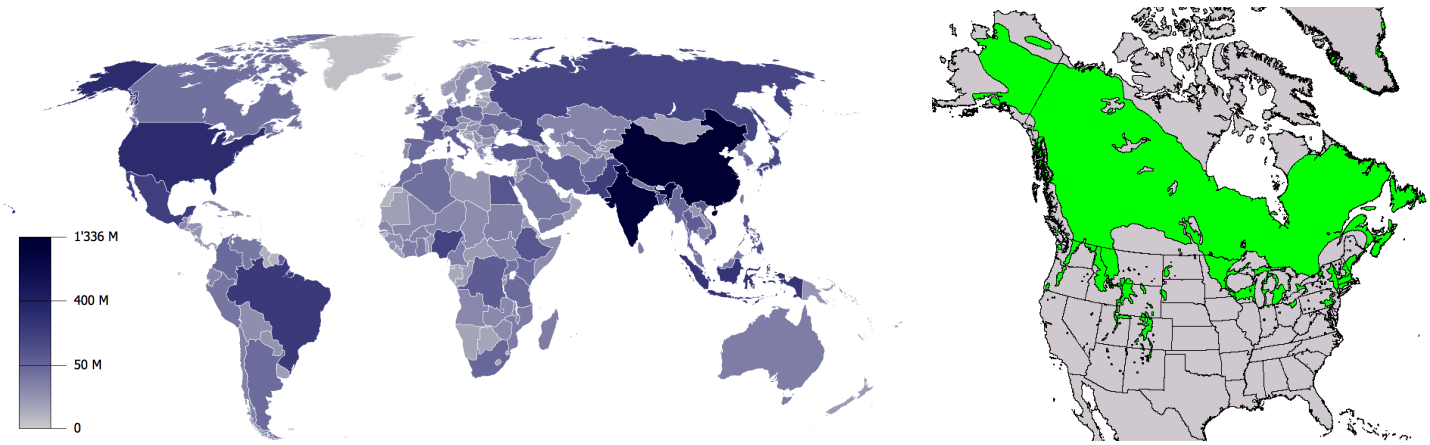
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CONCEPT: POPULATION ECOLOGY

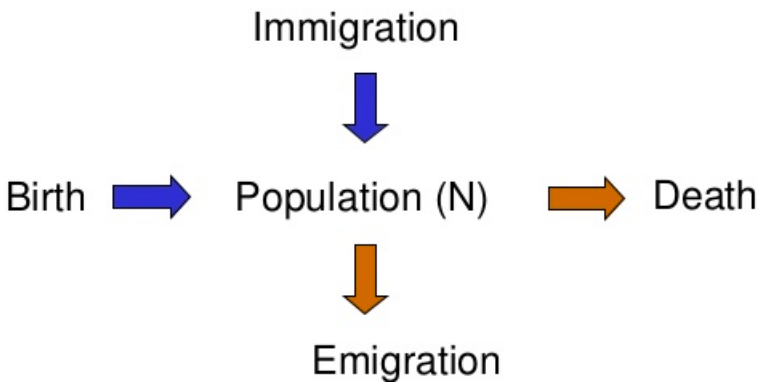
- Population ecology studies how the abundance and distribution of a population changes over time
- ***Population*** – organisms of the same species that inhabit an area
    - □ Size and density are important characteristics of a population of a population
        - ***Population size*** (***N***) – number of individuals in a population
        - ***Population density*** – number of individuals per area or volume
    - □ ***Range*** – geographic distribution of a species due to biotic and abiotic factors

EXAMPLE:



- ***Population dynamics*** – studies the size and age composition of populations, and the processes driving them
    - □ ***Immigration*** – influx of new individuals from another population
    - □ ***Emigration*** – movement of individuals away from a population
- ***Metapopulation*** – group of populations separated by space which interact in some capacity
    - □ Immigration and emigration link populations into a metapopulation
    - □ Populations in a metapopulation regularly go extinct, but individuals can colonize new territories

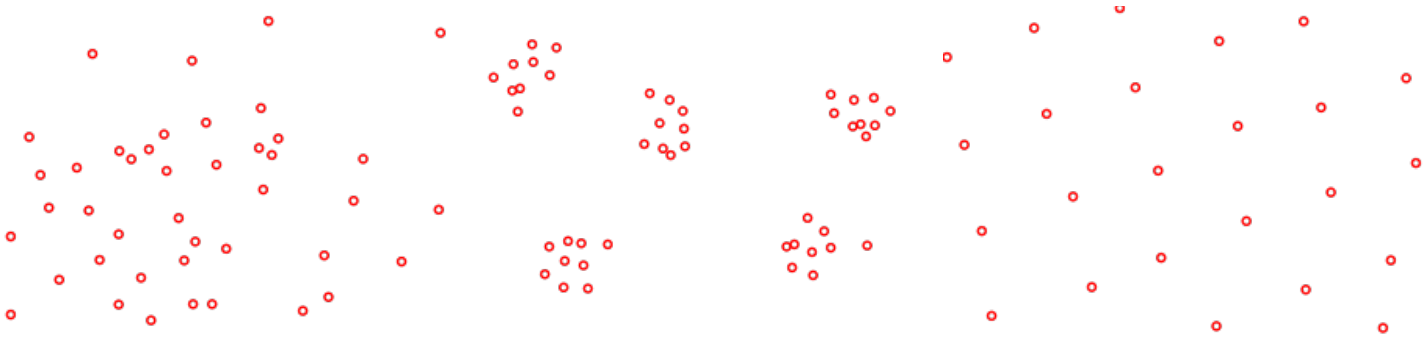
EXAMPLE:



CONCEPT: POPULATION ECOLOGY

- ***Dispersion*** – how individuals of a population are distributed throughout an area
    - □ Random – position of individuals is independent from one another, due to random factors like wind dispersal
    - □ Clumped – organisms grouped, due to social factors
    - □ Uniform – individuals are evenly spaced throughout the area, usually due to competition for resources
        - ***Territory*** – bounded space defended by an organism from outside competitors

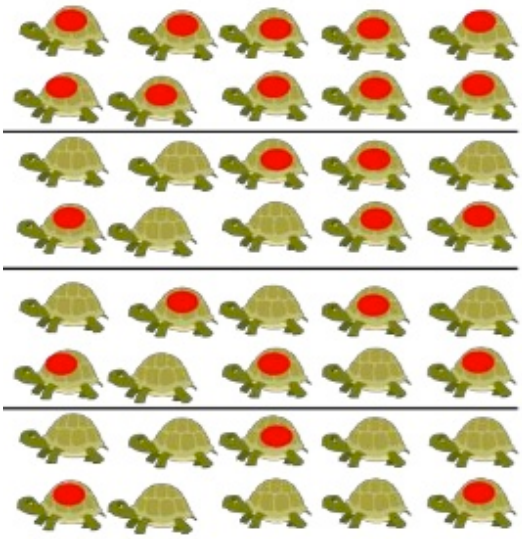
EXAMPLE:



- Mark-recapture method – technique used to estimate population size by capturing and marking individuals in a population
    - □ Marked individuals are released into the wild again
    - □ Ecologists later capture another group from the population, and look from recaptured, marked organisms

EXAMPLE:

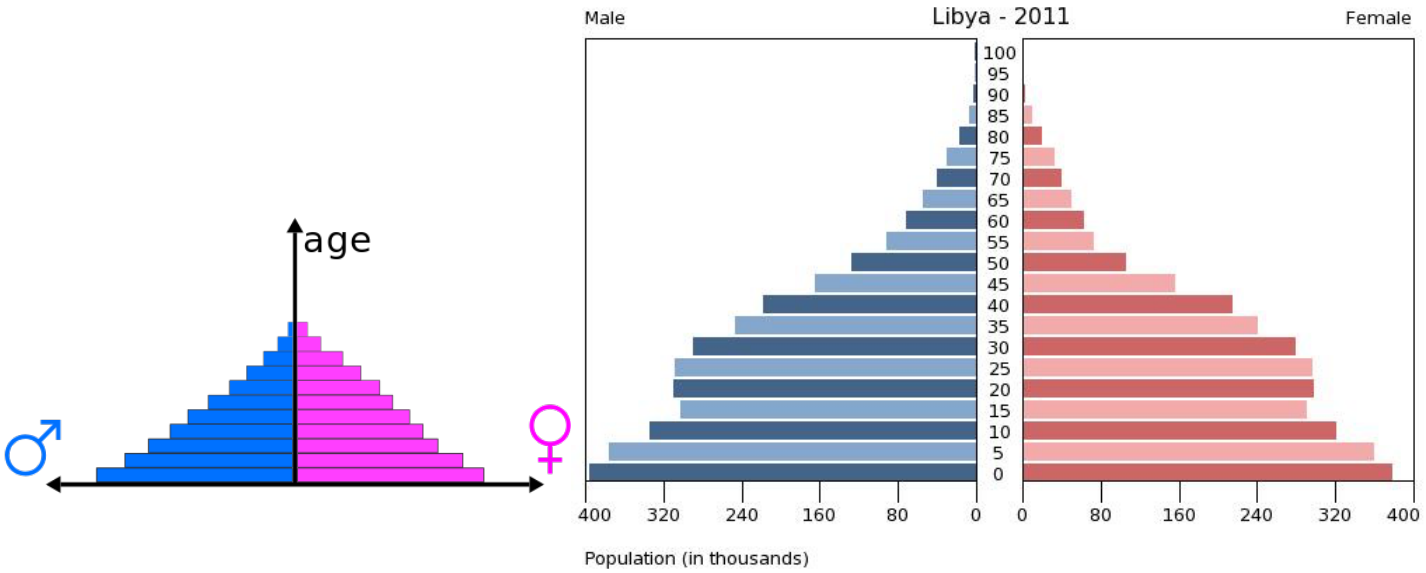




CONCEPT: POPULATION ECOLOGY

- ***Demography*** – statistical study of populations and how they change over time
  - □ Demographic – sector of a population
  - □ ***Age structure*** – number of individuals of each age that are alive
  - □ ***Generation*** – average age between mother's first offspring and daughter's first offspring

EXAMPLE:



- ***Life table*** – statistical data for a population relating to life expectancy and death rate
  - □ ***Age class*** – group of individuals of a specific age
  - □ ***Cohort*** – a group of individuals that share a characteristic, and are generally studied over time

EXAMPLE:

Table 1. Life table for the total population: United States, 2003

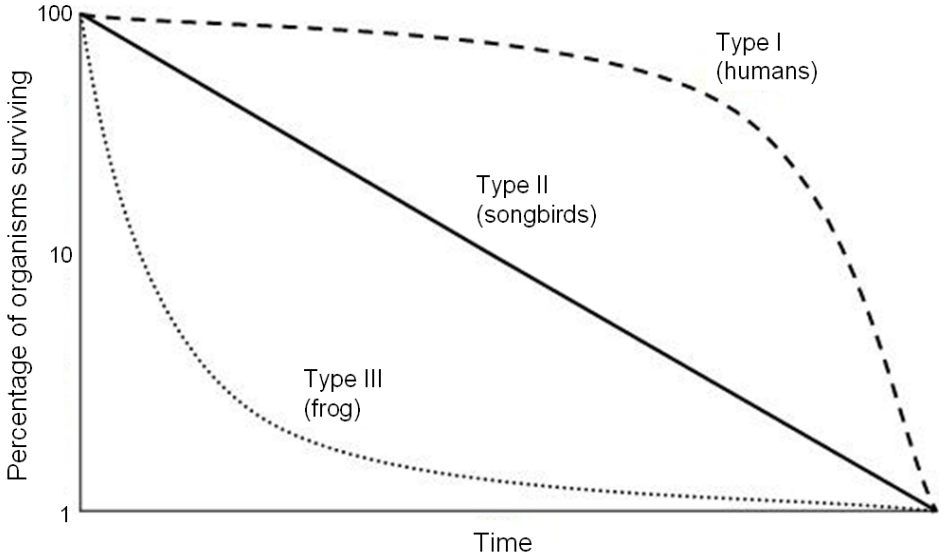
Click here for spreadsheet version

Age	Probability of dying between ages x to $x+1$ $q_{(x)}$	Number surviving to age x $l_{(x)}$	Number dying between ages x to $x+1$ $d_{(x)}$	Person-years lived between ages x to $x+1$ $L_{(x)}$	Total number of person-years lived above age x $T_{(x)}$	Expectation of life at age x $e_{(x)}$
0–1	0.006865	100,000	687	99,394	7,743,016	77.4
1–2	0.000469	99,313	47	99,290	7,643,622	77.0
2–3	0.000337	99,267	33	99,250	7,544,332	76.0
3–4	0.000254	99,233	25	99,221	7,445,082	75.0
4–5	0.000194	99,208	19	99,199	7,345,861	74.0
5–6	0.000177	99,189	18	99,180	7,246,663	73.1
6–7	0.000160	99,171	16	99,163	7,147,482	72.1
7–8	0.000147	99,156	15	99,148	7,048,319	71.1
8–9	0.000132	99,141	13	99,134	6,949,171	70.1
9–10	0.000117	99,128	12	99,122	6,850,036	69.1

CONCEPT: POPULATION ECOLOGY

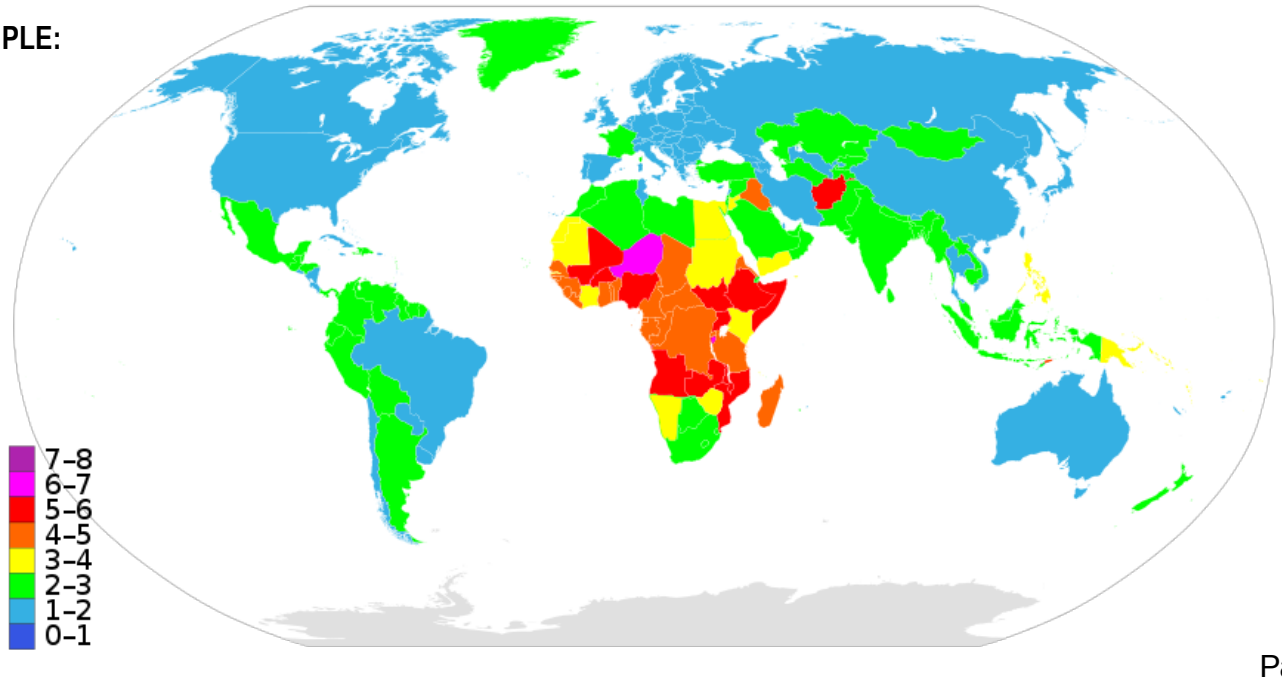
- ***Survivorship*** – average ratio of offspring that survive to a certain age compared to those that don't
- ***Survivorship curve*** – number of individuals, or cohort, surviving to each age for a specific species
    - □ Type I – mortality increases later in life
    - □ Type II – constant mortality rate
    - □ Type III – high mortality early in life

EXAMPLE:



- ***Reproductive table*** – table of fertility and reproductive rates in a population
- ***Fecundity*** – reproductive rate of an organism of population
    - □ ***Age-specific fecundity*** – average number of female offspring produced by each age class
- ***Net reproductive rate*** – average number of female offspring from a mother passing through life conforming to age-specific fecundity and average mortality rates.

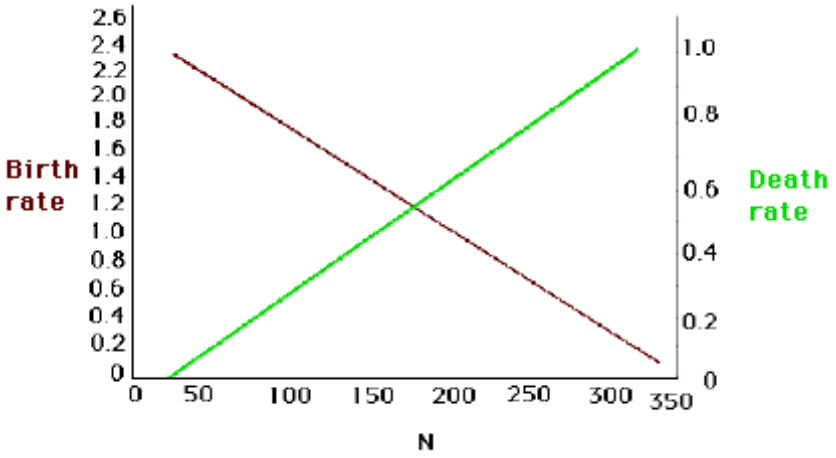
EXAMPLE:



CONCEPT: POPULATION ECOLOGY

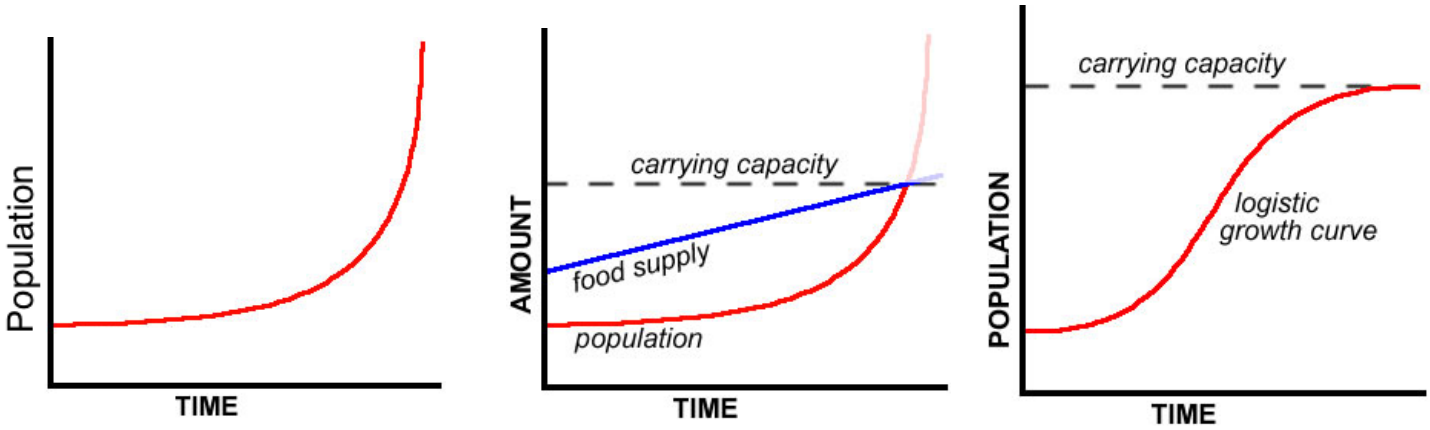
- Per capita birth rate – number of offspring produced per unit time by an average member of a population
- Mortality rate – average number of deaths per unit time in a population
- ***Per capita rate of increase*** (***r***) – difference between per capita birth rate and mortality rate

EXAMPLE:



- ***Zero population growth*** – birth and mortality rates are equal, r = 0
- ***Exponential population growth*** – birth rate exceeds mortality rate, r > 1, J-shaped curve
  - □ Density independent growth does not depend on the number of individuals in the population
  - □ ***Intrinsic rate of increase*** (r_{max}) – birth rate is as high as possible, and death rate is as low as possible
- ***Logistic population growth*** – population growth slows as the population nears their carrying capacity, S-shaped curve
  - □ ***Carrying capacity*** (***K***) – maximum population size an area can sustain
    - Limited by competition for resources and space, influenced by waste production
  - □ Density dependent growth in which r approaches zero
  - □ r is greatest when N = ½K

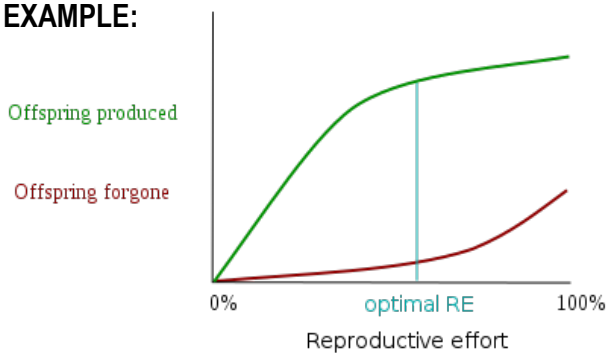
EXAMPLE:

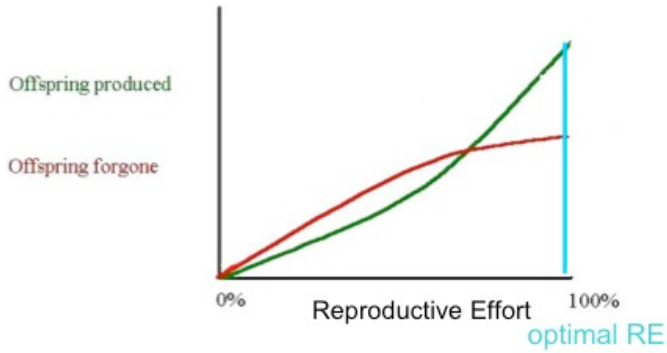


CONCEPT: POPULATION ECOLOGY

- ***Life history*** – traits and characteristics of a life table that affect an organism's survival and ability to reproduce
  - □ Results from natural selection to optimize fitness, with trade-offs between reproduction and survival
  - □ ***Semelparity*** – reproductive strategy of having many offspring once before death
  - □ ***Iteroparity*** – reproductive strategy of having offspring multiple times throughout life

EXAMPLE:

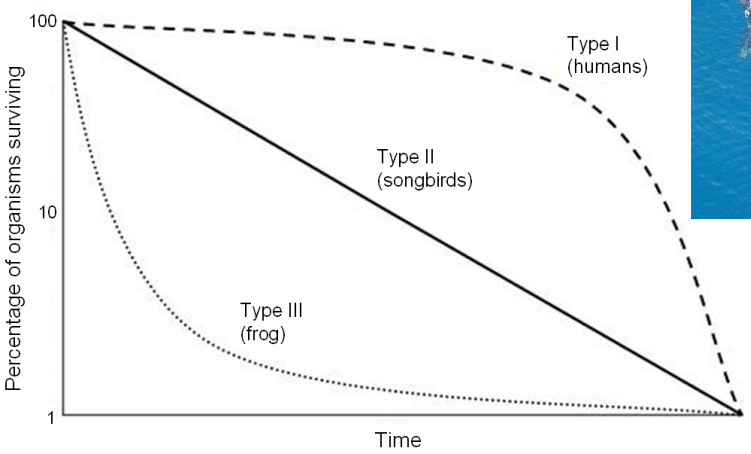




- ***r/K selection theory*** – relates traits of an organism to a trade-off between quantity and quality of offspring
- ***K-selection*** – invest more heavily in fewer offspring, so each has a higher probability of surviving to adulthood
  - □ These species tend to live close to carrying capacity, and live in more predictable environments
  - □ Offspring often require extensive parental care, and take longer to mature to adulthood
  - □ Organisms are generally larger, and live longer
- ***r-selection*** - produce many offspring with a low probability of surviving to adulthood
  - □ These species tend to live in less stable environments, where being able to reproduce quickly is important
  - □ Species have high fecundity, have short generation time, and offspring mature quickly
  - □ Organisms tend to be smaller, and have shorter lifespans

EXAMPLE:





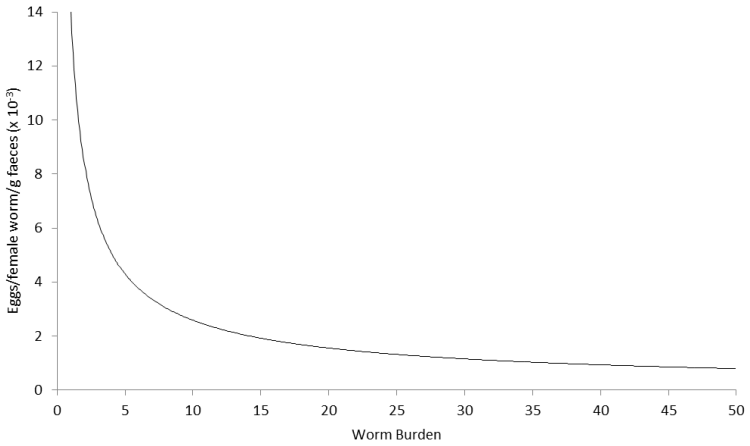


CONCEPT: POPULATION ECOLOGY

- Density independent factors change per capita growth rate independently of population density
    - □ Include things like severe weather and natural disasters
- Density dependent factors change per capita growth rate depending on changes in population density
    - □ Competition with other organisms in the population for resources, mates, space, etc.
    - □ Diseases spread more easily in denser populations
    - □ High density populations can attract, and better sustain predators
    - □ Intrinsic factors – internal changes in an organism that affect its ability to reproduce
    - □ Toxic wastes can accumulate to the point of affecting population growth

EXAMPLE:

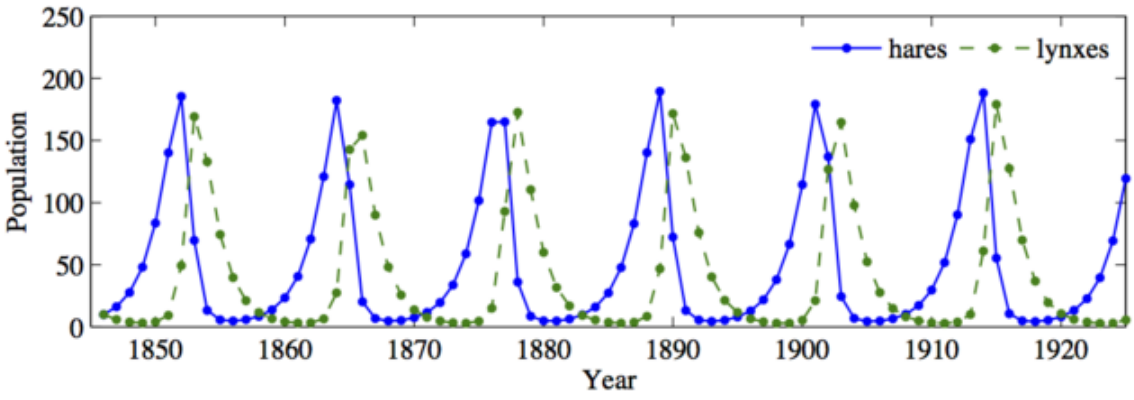




- Some population experience regular fluctuations, or population cycles
- Snowshoe hare and lynx populations in Canada cycle based on interactions between the species
    - □ Hare populations grow, allowing lynxes to exploit their availability as a food source
    - □ Abundant food allows lynx population to grow, which leads to over predation, and a crash in hare population
    - □ Scarce hares means less food for lynxes, leading to a decrease in their population
    - □ Smaller lynx population means less predation, allow the hare population to grow again

EXAMPLE:

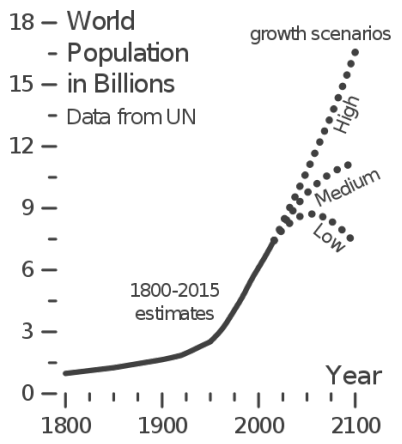


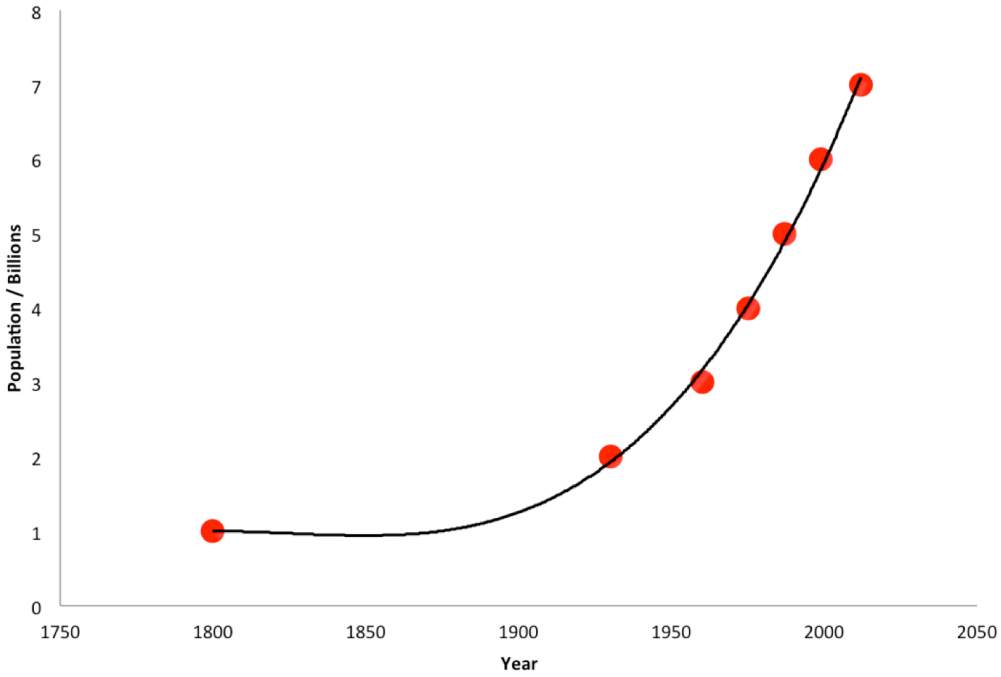


CONCEPT: POPULATION ECOLOGY

- Human population has exploded in the last century, human population growth, and population size is ASTOUNDING
  - There is a limit to the global carrying capacity for the human population, although estimates vary
  - ***Ecological footprint*** – the amount of land needed to sustain an individual's, or population's use of resources

EXAMPLE:





- ***Demographic transition*** – transition from high birth and death rates, to low birth and death rates
  - Age pyramids with many more younger than older people tend to be more common developing nations
- ***Fertility rate*** – average number of surviving children each woman has in her lifetime
- ***Replacement rate*** – fertility rate at which women give birth to enough children to sustain the population

EXAMPLE:

