# Reproduction and Age Structure

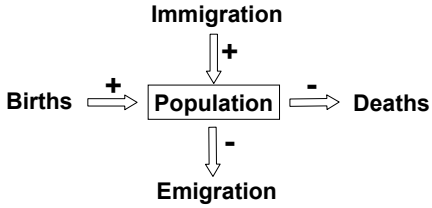
## Population

- **All individuals of <u>1 species</u> living in a particular area at a particular time**
- The most common unit of wildlife management
- Boundaries may be natural (e.g., on an island) or artificial (e.g., state borders)

## Population Characteristics

- Size (or abundance) = # individuals
- Density = # individuals / area
- Growth rate = change in size or density over time
- Sex & Age structure = % of population in each sex/age category
- Mortality & Reproductive Rates
- Gene pool

## Population Dynamics




**population size changes due to variations in the rates of birth, death and movement of individuals**

## Reproduction Terms

- **Fecundity =** offspring per unit of time an animal has the **<u>potential</u>** to produce
- **Fertility = <u>actual</u>** rate of offspring production
  - number of live young per unit time / **<u>adult female</u>**
- **Birth rate** (or **Natality**) = number of live young per unit time / **<u>population size</u>**
  - This is a ***<u>per capita</u>*** rate
- **Recruitment =** number of individuals reaching some critical age (e.g., maturity)
  - Involves both births and survival of young up to critical age

## Factors Influencing Natality

- **Clutch size or Litter size**
  - determined by both genetics and environment
  - more offspring means higher ***potential*** fitness
  - but... more offspring place greater demands on parents (especially with parental care)

## Factors Influencing Natality

- **Number of clutches or litters produced per year**
  - length of breeding season
  - time required for gestation / incubation / fledging
  - nature of the sexual cycle
  - response to loss of previous clutch or litter
- **Nest Success** -- proportion of nests that produce at least 1 live chick

## Factors Influencing Natality

- **Minimum and maximum breeding age for individuals**
  - elephant mature at 13 14, lives past maximum breeding age (**senescence**)
  - duiker, mature at 1, doesn't live past maximum breeding age

## Factors Influencing Natality

- **Sex ratio and mating system**
  - **Monogamous** species: natality depends on number of male-female pairs
  - **Polygynous** (one male has several mates): natality maximized when more females than males
    - very common in nature
  - **Polyandrous** (one female mates with several males): natality maximized when more males than females
    - » rare in nature

    example: phalaropes – female can lay several clutches, each tended by a different male

## Factors Influencing Natality

**Availability of Resources**

- **Reproduction is Costly**
  - Materials for eggs & embryos
  - Resources for feeding young
    - Reptiles & Amphibians: N/A
    - Mammals – Lactation
      - Can increase energy requirement by 25% to >100%
    - Birds
      - **Altricial** young: parent must collect food for them
        - » Exception: Pigeons & doves – crop milk
      - **Precocial** young: can feed themselves
  - Resources to incubate/defend young

## Factors Influencing Natality

- **"Capital" vs. "Income" Breeders**
  - **Drent & Daan 1980, Stearns 1992**
  - **Income breeders**: reproductive investment = current food/energy intake
    - Many songbirds – food on nesting grounds determines fertility
    - More variable natality, depending on current conditions
  - **Capital breeders**: reproductive investment = stored reserves
    - Emperor penguins, Elephant seals -- do not feed when rearing young
    - More stable natality
  - Two ends of a continuum

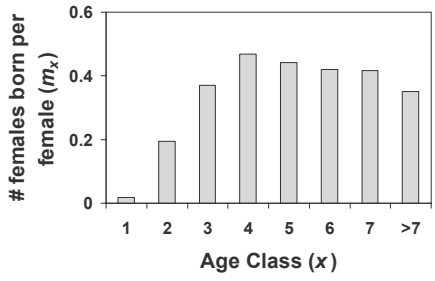
## Factors Influencing Natality

- **Population density**
  - affects amount of resources per individual

## Fecundity Schedule

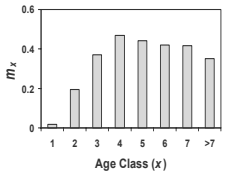
| Age class | # females | # offspring produced | # females born per female |
|---|---|---|---|
| $x$ | $f_x$ | $b_x$ | $m_x = \frac{1}{2}b_x / f_x$ |
| 0 | --- | --- | --- |
| 1 | 60 | 2 | 0.017 |
| 2 | 36 | 14 | 0.194 |
| 3 | 70 | 52 | 0.371 |
| 4 | 48 | 45 | 0.469 |
| 5 | 26 | 23 | 0.442 |
| 6 | 19 | 16 | 0.421 |
| 7 | 6 | 5 | 0.417 |
| >7 | 10 | 7 | 0.350 |
| TOTAL | 275 | 160 | 0.291 |

## Fecundity Schedule



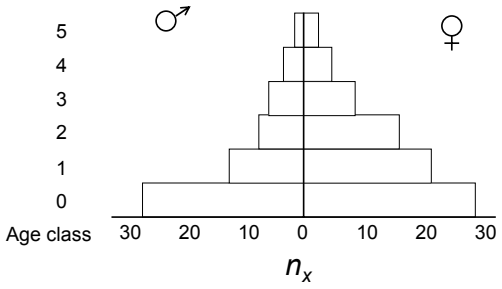

## Fecundity Schedule

**iteroparous**: repeated reproduction throughout life



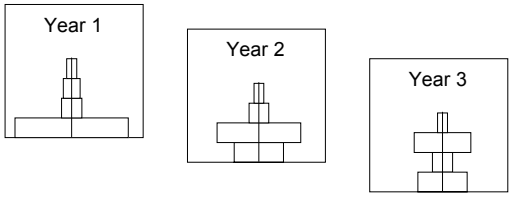

**semelparous**: reproduce once and then die


## Sex - Age Pyramid




## Age Structure and Natality

- **Years of high reproductive success can produce dominant cohorts**
- **"pig-in-the-python"**




## Age Structure and Natality

- **Show human population pyramid animation**
- **http://www.ac.wwu.edu/~stephan/Animation/pyramid.html**

## Things to Remember

- Definitions of terms
- Measures of reproductive output
- Factors influencing natality
- Mating systems
- Fecundity schedules
- Sex-age pyramids