

industrialized world.

# By Age

- At conception: 115 males to 100 females
- At birth: 105 to 100
- Male excess in spontaneous abortions, miscarriages, and stillbirths prior to birth and higher neonatal and infant mortality
- At 30: sex ratio is equal
- By 65: 84% females & 70% males still alive

# Y chromosome

- Maleness seems to carry intrinsic risk.
- Study of Amish families with and without long arm of Y chromosome
  - In families with: women died in mid-70's and men 5 or 6 years earlier
  - In families without: women died at ave. age of 77 while 14 men died at 82

# Hormones

- Androgen, lowers HDL and raises LDL.
- Hormones also affect the immune system.
- Animal and human studies show that females have greater immune responses than males:
- This is associated with higher female antibody responses and tumor resistance,
- but also higher female rates of autoimmune diseases (arthritis, lupus).

# **Examples in Birds**

- Sex ratio in young close to 50:50
- In adults it increases towards males
- Usual rationale for higher mortality in females is stresses and hazards of nesting

#### Male to female death ratio

- 3.9 to 1 for homicide in Alameda County, Calif.
- Also higher for lung cancer, suicide, pulmonary disease, accidents, cirhosis and heart disease (2 to1)

## Hormones

- Males and females have equivalent cholesterol levels until puberty.
- Males suffer an exponential rise in heart disease in their 40's, but female rise does not start till 50's after menopause.
- Animal and human studies show that estrogen protects against heart disease by lowering levels of low-density lipoproteins (LDLs, "bad" cholesterol) and keeping high-density lipoproteins (HDLs, "good" cholesterol) up.

# **Examples in Birds**

Table of Sex Ratio Changes

# **Examples in Birds**

- Pheasants in Wisconsin
  Wagner (1957) found:
  - Iate summer mortality higher in hens when nesting pushed later by poor spring
- Grouse in northern Wisconsin
- Dorney and Kabot (1960) saw
  - year to year sex ratio changes affected by spring weather (poor nesting weather killed the females)

## **Stress**

- Relating female losses to stress factors
- Stress is somewhat intangible and difficult to measure
- Can look at physiological condition

# **Physiological Condition**

- Most birds at peak physiological condition just prior to breeding season.
- After laying first egg females condition begins to decline.
- Extent of decline depends on severity of breeding season,
- *i.e. number of clutches , number of eggs.*

## Gallinaceous

- Large clutch or renesting leads to decline in condition
- In chickens, layers at end of season are skin and bones, breasts are hatchet shaped
- Deplete protein reserves
- Moult follows placing more stress on them

# Predation

- Females nesting on ground or low in vegetation and undertaking all of the incubation (typically) may suffer more predation than males.
- Keith (1961) studying waterfowl during nesting found:
  - 2% loss of drakes
  - 8% loss of hens (mostly due to predation while nesting)

# **Physiological Condition**

Peterson - Oldsquaws

# Energy

- Energy stored as
  - glycogen,
  - lipids,protein.
- During laying and incubation these stores are depleted.
  - Gallinaceous birds, hens start out with relatively little fat

## **Canada Geese**

#### Hanson and Raveling saw

- No food during egg laying and most of incubation
- Need large fat reserves for eggs and own energy requirements
- Every day that spring is late, bird burns up enough energy to lay one egg
- So ave. clutch size declines one egg

# Intraspecific competition

- Perhaps females lose out in competition for food.
  - S. Dakota, after a hard winter 75% of phesants found dead were females though they only made up 57% of population
  - On Protection Island sex ratio changed from 50:50 after introduction to 60:40 at high pheasant densities

# Examples from Mammals

- Higher mortality rates in males may be due to greater activity:
  - a. Larger home ranges
  - b. Reproductive behavior ungulates rut in late fall and go into winter in poor condition
  - c. Physiology testosterone in bulls inhibits fat deposition

# Ungulates

- Imbalance toward females accentuated when food shortages occur on overutilized range.
- Elk Cowan 1950, Flook 1970
- Reindeer Klein 1968

# Sex Ratios in Fish

- Vary considerably but close to 50:50 in most. - Nickolsky 1963
- In freshwater fishes most studies show more males in young of the year while very strong preponderance of females in older fish.

#### Significance of Sex Ratio

- Dependent on mating system
- Component of efficient herd management in mammals

#### Richardson's Ground Squirrels

- See table in class notes p. 54
- Juveniles 50:50 sex ratio
- 11 months 30:70
  - juvenile males hibernate 1 mo. later and emerge 2 wks. early - periods of no food and high predation
- 12 months 11:89
  - Males driven out by females and dominant males - to die in poor habitat

# **Snowshoe Hare**

No change in sex ratios apparent

# Sex Ratios in Fish

- Males produce many more sperm than females eggs
- If too biased, fertilization declines
- Trout on spawning grounds

# **Patterns in Mammals**

- Younger females produce more male offspring
- First offspring at any age is more likely to be male

# **Natality Patterns**

- 1. Youngest reproductive age classes have lower birth rate than adults
- 2. In less favorable environmental conditions, reproductive rates decline most in younger age classes.

# **Natality Patterns**

 3. In fish, reproductive success is extremely variable.