Criteria of Sex and Age

How old is it?
I. Introduction

A. Why is it important?
How old or what sex is it?
Common questions asked of wildlife biologists by public.
Answer not only interesting but leads to better understanding of population
I. Introduction

Age and sex composition of population

• indices of habitat condition

• health factors

• estimate future declines or increases in populations
Many techniques used to estimate age and sex
Some simple – used by anyone
Some complex – require special training or equipment
B. Criteria for ideal technique

1. independence from irregular nutritional and physiological variations
2. Clear separation into age classes or year classes without subjective judgment
3. Suitability for living animals of all ages
4. Ease of application by semiskilled technicians
Some standard techniques meet these criteria, most do not.

Real world – one or more of ideals must be compromised.
II. Definitions

- **Prenatal age** – age of egg embryos and fetuses, usually expressed in days
- **Postnatal age** – follows birth or hatching
  - **Year-class** – actual chronological age in years
  - **Age-class** – breeding condition of the individual
    - Immature or juvenile – too young to breed but distinguished from adult
    - Subadult – has not bred but resembles adult
    - Adult – an animal which has bred
II. Definitions (cont.)

• Yearling – over 1 but under 2 years of age
• Two-year old – over 2 but under 3
• Population turnover – length of time for 1 year class to disappear from the population
III. Age determination

A. Embryonic Development

Stage of incubation in eggs or of development of fetus indicative of prenatal age.

1. Candling

determine if eggs are living
determine age of embryo

Fig 4. Proper positioning of a duck egg for field candling (Higgins et al. 1977).
III. Age determination

2. Flotation method –

Stage 1 (fresh laid eggs) – sinks to bottom of cup

Stage 2 (1-6 days since laid) – eggs sinks horizontally, egg is at an angle with egg tip touching cup bottom

Stage 3 (7-9 days) – eggs sinks vertically, egg is at angle with egg tip touching cup bottom

Stage 4 (10-16 days) – egg vertical but floats near water surface

Stage 5 (> 17 days) – egg bobs above water surface
Degree of fetal development indicative of age in mammals

• descriptions of physical development of characteristics
• measurements (crown-rump, forehead-rump, hind leg length)
III. Age determination

Mule Deer

57 days – eyelids cover eyes

61 days – C-R = 74.3mm

73 days – brown pigment on nose between nostrils

111 days – C-R = 252mm
B. Continuous morphological development

Techniques based on concept that animal body parts progressively change from birth to death and provide permanent record of attained age.
III. Age determination

1. Horns

Horns of Mountain Goats, sheep display alternation of smooth areas separated by ridges (checks)
III. Age determination

Smooth areas represent areas of rapid growth, checks represent areas of slow growth.

Related to seasonal changes in nutritional level or breeding activity - checks represent winter activity.

1\textsuperscript{st} winter check – difficult to detect

1\textsuperscript{st} obvious one forms at 1.5 years and then each year thereafter.
III. Age determination

Difficulty – growth is not even throughout life

Older animals have slower growth making checks difficult to separate after ~5.5 years (can be done with experience).
III. Age determination

2. Crystalline eye lens of vertebrates

Lens grows continuously throughout life and is only organ which does not shed cells

Thus good indicator of age in many birds and mammals
III. Age determination

Technique requires special preservation, drying, and weighing of lens (not good for small species, birds?). Best used for separating broad age classes.

Fig. 2. Eye lens weight-age relationship in 44 known-age black-tailed jack rabbits raised at Hopland, California from September, 1962 to June, 1967. The regression line and confidence limits are transformed from those shown in Figure 1. Confidence limits for age estimates are read vertically.
III. Age determination

3. Cementum layers of teeth

Cementum is deposited on roots of teeth each year in light (summer) and dark (winter) bands throughout life.

Bands close to dentine are from earlier years and those of recent years are more superficial.
III. Age determination

Tooth section of 4-yr old black bear killed in spring season
III. Age determination

Technique involves decalcify tooth, cut into thin histological sections, stain, read the layers.

All teeth have layers but some teeth are easier to extract.

Many can be removed from live animals without adverse affects.
III. Age determination

4. Periosteal layers of bones

Layers deposited similar to cementum in periosteal layer of bone.

Easier to obtain teeth so technique not detailed for most species
III. Age determination

C. Growth Maturation

During the period of growth from birth to sexual maturity certain bones can be used to estimate relative stages in this process.

As mammals grow, bones lengthen from tips
III. Age determination

Each long bone has, while growing, a cartilaginous zone at each end covered by a bony cap, the epiphysis. Bone deposited at inner side of cartilaginous zone, pushing cap further out as cap grows.

When growth complete, cartilage replaced by solid bone so cap and shaft fused firmly together.
III. Age determination

Some species, bears, and members of dog and weasel families males have a bone in the penis (baculum). Baculum changes with age and is good indicator of age.
III. Age determination

D. Wear and replacement

Number of aging techniques based on fact that certain body parts (teeth, feathers) are replaced in a predictable age-related sequence. Often parts become worn over time and degree is indicator of age.
III. Age determination

1. Replacement of deciduous teeth and subsequent wear of permanent teeth.

Tables developed for many species
III. Age determination

2. Change in pelage

Can be used as index to mammal age

e.g. spotted fawns, pattern of primeness in the skin side of stretched muskrat pelts
Figure 1. Sex and age can be determined from the stretched raw pelt. Blotchy patterns are typical of adults. Immatures show blocks of color ventrally. Teat marks are clearly visible in both the adult and immature females while the two males show no teat marks.
III. Age determination

3. Change in plumage

Young birds there is a rapid succession of molts as natal down is lost

Change in both size and appearance of young
III. Age determination

In gallinaceous birds, a rather accurate method of aging juveniles is based on replacement and growth of primaries and secondaries.
III. Age determination

Primaries are numbered 1 – 10, corresponds to general sequence in which they are molted.
III. Age determination
III. Age determination

Most gallinaceous birds molt only through # 8 in 1st fall (except pheasant)
III. Age determination

During fall harvest age can be determined by examining the condition of the 9\textsuperscript{th} and 10\textsuperscript{th} primaries.

AHY – 9\textsuperscript{th}, 10\textsuperscript{th} primaries fresh, rounded

HY - 9th, 10th primaries worn, pointed
**III. Age determination**

USFWS Age Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>L</td>
<td>Local, yg bird incapable of flight</td>
</tr>
<tr>
<td>HY</td>
<td>Hatching Year, capable of flight and known to have hatched during calendar year</td>
</tr>
<tr>
<td>AHY</td>
<td>After Hatching Year, a bird known to have hatched before calendar year, year of hatch unknown</td>
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<tr>
<td>SY</td>
<td>Second Year, A bird known to have hatched in the calendar year preceding year of banding, second calendar year of life</td>
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III. Age determination

Some species can be difficult

Sharp-tailed Grouse
III. Age determination

Can also use wing coverts and scapulars to assign age
III. Age determination

Waterfowl can be aged by the appearance of the tips of rectrices.

HY birds – there is a notch at the tip of the tail caused by the breaking off of a short section of the shaft

Fig. 11.12. Tail feathers as age criteria in waterfowl. Left: Juvenile tail with down attached at tip of shaft. Center: Juvenile tail with characteristic “V” notch. Right: Adult tail with pointed tip (from Godin 1990).
III. Age determination

E. General Development

When populations well studied, it is possible to establish criteria of weight or measurement that serve to indicate age (up to point rapid growth has finished)

Should be used only with caution!
III. Age determination
III. Age determination
III. Age determination

General characteristics

• Gallinaceous birds – strength of lower jaw

Hold bird by lower jaw and shake, if it breaks then generally HY bird

(only use dead birds!)
III. Age determination

- flexibility of breastbone
  HY birds – tip can be easily bent with one finger
- flexibility of cranium (Ptarmigan)
  Press thumb against forehead, if it breaks HY bird
III. Age determination

F. Sexual Maturation

Closely related to many indices of age

Development of primary and secondary sexual organs are indicators of age
III. Age determination

For example, cloacal characteristics can be used to age waterfowl.
Tooth section of 4-yr old black bear killed in spring season.