Feeding and Digestion

- June 22nd, 2010

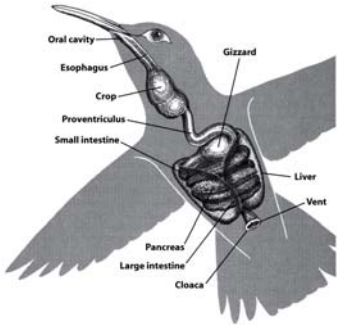
Feeding and Digestion.

- No teeth: bill mainly used to procure food, perhaps rip off chunks
- Little saliva, few tastebuds

Feeding and Digestion.

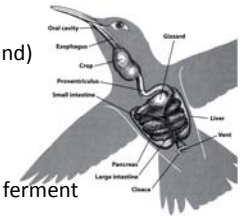
- Diverse tongue morphology

Feeding and Digestion



Feeding and Digestion.

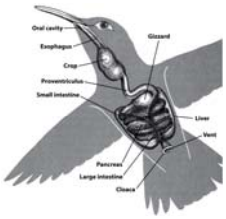
- Esophagus
  - Can be inflated (display, sound)
  - Pigeon "milk"
- Crop
  - Stores and softens food
  - In the hoatzin, expanded to ferment
- **Proventriculus**
  - Secretes gastric juices (0.2 – 1.2 pH)
  - Digest a cow vertebra in 2 days



Feeding and Digestion

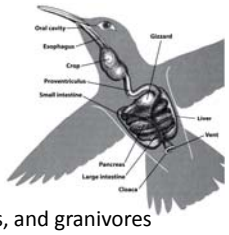
- **Gizzard**
  - Grinds food
  - Aided by stones

Black-sided Flowerpecker



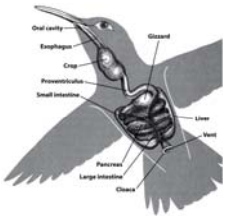
Feeding and Digestion.

- Gizzard
  - Grinds food
  - Aided by stones
- **Intestine**
  - Short in frugivores and carnivores
  - Long in herbivores, piscivores, and granivores
  - 3x to 20x body length (ave. 8.6x)
  - Food can go "backwards"



Feeding and Digestion.

- **Ceca**: Sacs off intestine
  - Bacteria aid digestion
  - Produce antibodies
  - Aid H_2O absorption
  - Metabolize uric acid into amino acids

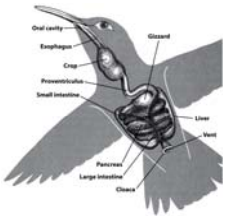


Feeding and Digestion.

- Rapid, efficient digestion
- Sugars, amino acids by active transport
- Other nutrients **passively**
  - Toxins included
  - Some birds eat clay

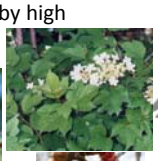
Feeding and Digestion.

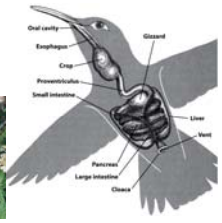
- Assimilation
  - Raptors: 66 - 88%
  - Herbivores
    - 60 - 70% young plants
    - 30 - 40% mature plants
  - Fruits "**predigested**"
    - Simple Sugars, individual amino acids
    - Gut passage in 20 minutes



Feeding and Digestion.

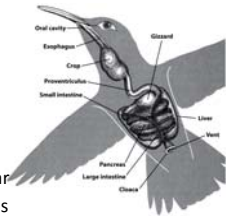
- **Balance**
  - High sugar foods must be accompanied by high protein foods





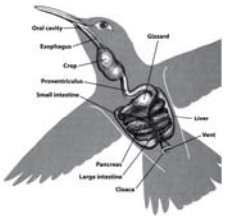
Feeding and Digestion.

- **Sucrose Digestion**
  - Disaccharide
    - Glucose + Fructose
  - Sucrase lacking
  - Hummingbirds have sucrase
    - 95 - 99% of the energy in nectar
    - Absorb glucose at highest levels among vertebrates



Feeding and Digestion.

- **Wax Digestion**
  - Seabirds
  - Yellow-rumped Warbler
  - Tree Swallow
  - Honeyguide

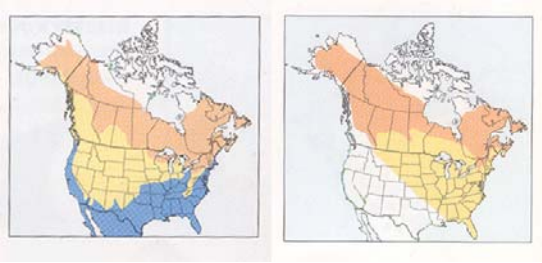


Similar Birds – Different Lives

Yellow-rumped Warbler
Dendroica coronata
9.25" wingspan, weighs 12.3 g

Blackpoll Warbler
Dendroica striata
9" wingspan, weighs 13g

Range



Yellow-rumped Warbler

Blackpoll Warbler

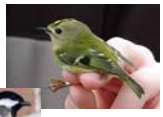
Maps taken from The Sibley Guide to Birds

Feeding and Digestion.

- Yellow-rumped Warblers can feed on wax-coated berries; the Yellow-rumped's unique ability allows it avoid the dangers of a long migration.
- **Trade-offs**: Extreme, sometimes unexpected temperatures, winter predators

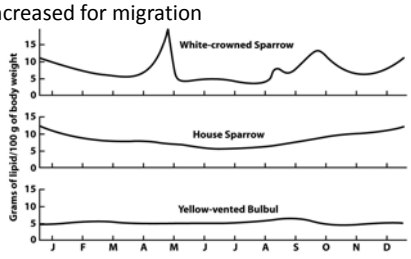
Feeding and Digestion.

- **Foraging Effort**
  - 90% of the day
  - 1,100 trees/day
  - 24 insects/minute
  - Tropical frugivores
    - May only forage for 10% of the day



Feeding and Digestion.

- **Fat Reserves**
  - Minimized, reduce weight
  - Increased for migration

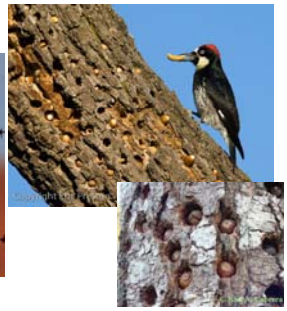


Feeding and Digestion.

- **Fat Reserves**
  - Larger birds able to survive longer
  - Emperor Penguins: 120 days

Feeding and Digestion.

- **Storing Food**



Feeding and Digestion.

- **Storing Food**
  - Crested Tits, up to 60% of food consumed in winter comes from stored provisions
  - Requires good spatial memory

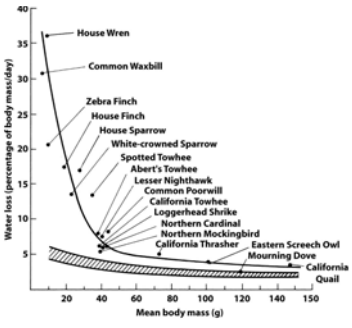
Feeding and Digestion.

- **Water**
  - California Towhee water use quadruples when temperature goes from 30 ° to 40° C

  - Some species obtain all water from food (fruits and insects)
  - Metabolic Water
    - Zebra Finch

Feeding and Digestion.

- **Water**



Feeding and Digestion.

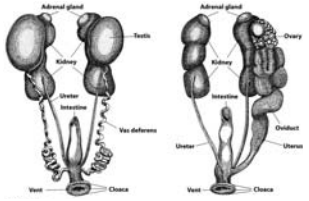
- **Water**

Feeding and Digestion.

- **Water**

Feeding and Digestion.

- **Excretion**
  - Uric Acid (more efficient than mammals' urea)
    - Mammal requires 18x as much water to excrete same amount of nitrogenous waste
  - Urine and feces combine, exit cloaca

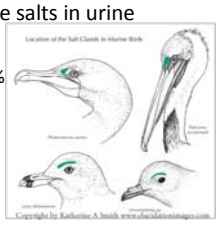


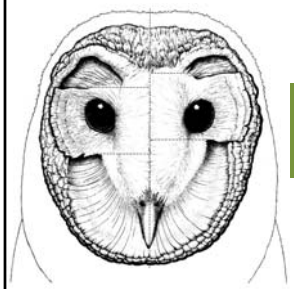
Feeding and Digestion.

- **Hummingbirds have <u>too much</u> water**
  - Anna's Hummingbird consumes and secretes 3.3x body mass in one day
  - High rates of evaporation
  - Absorb sugar without filtering through kidneys

Feeding and Digestion.

- **Salt Excretion**
  - Birds are unable to concentrate salts in urine
  - Short Henle's loops
    - Seawater 3% salt, body fluids 1%
  - Salt Glands
    - Empty from nostril
    - Concentrate salt up to 5%
      - Increases metabolic rate up to 7%
      - No Passeriformes have salt glands





Senses, Brains, and Intelligence

Chapter 7

Birds Aren't People.

- UV vision
- Magnetism, polarized light, celestial compass
- Acute, directional hearing
- Birds are very intelligent

Vision.

- Up to 3 times better resolution than humans
- Large eyes
  - Ostrich eyes largest of any land vertebrate
- American Woodcock can see 360°
- Many birds use one eye at a time
  - Bob head to gain depth perception

Vision.

- Binocular Vision

Vision.

- Eyelids
  - Birds have three
    - Upper
    - Lower
    - Nictitating

Heather Uphilldowndale

Magnetic Fields

- Can navigate based on magnetic field detection
  - Small scale movements and migrations
- Unknown how
  - Magnetite-like compounds are found in the nerves and bones in the head
- Magnetite also found in pineal gland, helps determine daily cycles