

Lecture 5: Feeding structures and behavior

Class Business

- If you are interested in summer employment in Ornithology, check the “Useful and Amusing Links” section of the class website.

Reading for this lecture

Required. Gill: Chapter 1 (pgs. 13-15)

Optional. Procter & Lynch: Pages 122-130, 152-154

1. Importance of feeding

A) BIRDS FEED CONSTANTLY

- i) Fundamental requirement for life is that you need to obtain enough energy to balance your energy expenditures
- ii) Birds have a high metabolic rate and have energetically costly activity (e.g., flight).
Consequently, they need a lot of energy to stay alive.
- iii) Most of the time birds are looking for food or actually feeding.

B) MANY WAYS OF FEEDING

- i) Flight gives birds access to nearly all habitats (and many different types of food) in 3 dimensions.
- ii) Beak is highly modifiable structure (perhaps because of loss of teeth?)
- iii) Birds do not have hands, and their forelimbs are sufficiently modified that they cannot be used to handle food. Therefore, their mouth parts need to do much food manipulation – this is quite different from many mammals (if you don’t believe me, just try eating a steak with just your face and your feet).

2. Feeding structures

A) BASIC MORPHOLOGY

Basic parts of a bill are the **mandible** (lower jaw), **maxilla** (upper jaw – sometimes called the “upper mandible”), and the **rhamphotheca** (a keratin sheath that encloses the jaw bones). The jaw muscles also influence what a bird can eat, and how.

B) BIRDS BEAKS COME IN A WIDE VARIETY OF FORMS AND ARE USED FOR MANY DIFFERENT THINGS

- i) There are many examples. Here’s a few. Read about some in more detail in the text book. If you want a visual on some of these, check out any standard field guide to birds (there’s lots in the library).
 - seed crushing (finches): stout, with strong muscles
 - insect gleaning (warblers): typically thin and pointed
 - aerial insect capture (flycatchers): often wide based, but still pointed
 - flesh-ripping (hawks): sharp edges, hooked, often heavy
 - mud-probing (shorebirds): long, skinny and pointed
 - catching fish (merganser): serrated edges to help grip slippery prey
 - filtration systems (flamingo): really bizarre!
 - chiseling wood (woodpeckers): strong, straight, chisel-shaped
 - nectar feeding (hummingbirds): long and very skinny
 - etc., etc., etc.
- ii) Three key ways that birds transport food from their bill into their mouth are “**head-throwing**” (or cranioinertial feeding), **lingual transport** (which uses the tongue to move the food back into the mouth), and **filter feeding** (which requires modifications to the bill to filter prey items out of the water).
- iii) Beak size and shape can also vary within species, e.g., depending on the bird’s sex, age, diet, or genetic make-up. These differences can result in different diets.

3. Behavior

A) ENERGETICS

- i) Foraging behavior is driven by the need to obtain enough energy. To feed efficiently, birds need to maximize the amount of energy they get from eating something and minimize the amount of energy they expend searching for food.
- ii) Certain activities are especially expensive energetically, and require increased food intake. These include: breeding (displays, nest building, egg production, raising young), growth and development, molt (feathers can constitute up to 17% of a bird's mass, so replacing them is somewhat like growing a new head!), migration, surviving especially cold weather.

B) UNUSUAL FEEDING BEHAVIORS

- i) **Tool use.** A few species of birds use tools to obtain food. New Caledonian Crows make tools out of the edges of screw pine leaves, which they then use to get insects from the vegetation. A recent study has shown that there is "laterality" ("handed-ness") in the way these tools are made. Bristle-thighed Curlews, pick up stones in their bills and smash seabird egg shells with them in order to get inside and eat the egg.
- ii) **Caching.** Quite a few birds will store food in "caches" for later use. Acorn woodpeckers will drill holes in trees and use them to store acorns (1000s of acorns may be stored in a single tree). Chickadees will often take a seed from a bird feeder and fly off into the woods to cache it in a crevice in the bark of a tree. Shrikes will impale small birds, mice and insect prey on thorns or barbed wire for later retrieval.