

Lecture: Birds of the World

Class Business

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Reading for this lecture

Required. Gill: Chapter 1, and online at www.whfreeman.com/gill3e

1. Taxonomic organization

A) BASICS OF TAXONOMY - A taxonomy is an ordered (formal) system of classifying and naming organisms. A **taxonomy** is not necessarily a **phylogeny** (= a hypothesis about the pattern of evolution that produced the groups of organisms being named), but in practice in modern biology, all taxonomies are hypotheses about evolutionary history and relatedness.

i) Organisms are arranged in a hierarchical fashion with nested taxonomic levels. The basic levels are:

Kingdom, Phylum, Class, Order, Family, Genus, Species (in this hierarchy, organisms are increasingly closely related as you get closer to the species level. Are all individuals in a species equally closely related?) In addition, some taxonomists use intermediary levels, such as subfamilies, subgenera, superspecies, etc.

ii) In addition to their common names all birds also have scientific (“Latin”) names. These are given as a **binomial**, with the genus name first (and capitalized) and the species name second (not capitalized). E.g., the scientific name for Canada Goose is *Branta canadensis*. Subspecies names are given as a **trinomial**, with the third part identifying the subspecies. E.g., the subspecies of Canada Goose that occurs in the Aleutian islands (and which is endangered) is called *Branta canadensis leucopareia*. Why do we bother to do this?

iii) Birds are classified in the Kingdom Animalia, the Phylum Chordata, and the Class Aves. Within the Aves, the first major subdivision splits the birds into two superorders, the **Palaeognathae** (ratites and tinamous) and the **Neognathae** (all other modern birds).

B) WHAT YOU SHOULD LEARN

- i) There is variation in the ways that birds are grouped by different experts (there is also a lot that is consistent across taxonomies) and taxonomies do differ – a taxonomy is a hypothesis! For simplicity I will follow the taxonomy presented on the website for your textbook (whfreeman.com/Gill3E), but you should be aware that there is variation, and all taxonomies CHANGE over time.
- ii) During this lecture (and possibly part of another), I will simply provide an overview of the basic groups (orders) of birds in the world. There will be a lot of information that you will simply need to memorize; you should use this outline and the textbook web appendix as the source of that information. If you find any cases where the information does not match PLEASE LET ME KNOW and **assume that the web appendix is the last word**. The information I consider it particular important for you to know are: the names of each group (both common and scientific), approximately how many species are in each (I won't expect you to know exact numbers, but I will expect you to know things like the fact that Gaviiformes only have a handful of species (5), while Passeriformes have 1000s), and major characteristics of each group (e.g., where found, what type of bird, major defining anatomical and/or behavioral characteristics).

2. Superorder Palaeognathae

A) FEATURES

- i) The Palaeognathae consists of a relatively small number of species and includes all ratites, plus the tinamous.
- ii) The group dates back a long way and it has been suggested that they have a lot of “primitive” traits; this is misleading, since all living bird groups have been evolving for a long time, and it is not at all clear that Paleognathes are more like the ancestor of all birds than any other kind of bird.

- iii) Members of this group all have a distinctive arrangement of bones in their palates, and this arrangement is not found in other birds. This is a key trait that unites the group.
- iv) Most of the birds in this group (all of the ratites) are also flightless and have a number of anatomical features that are associated with flightlessness (e.g., reduced keel on the sternum, reduced wing bones). Tinamous can fly, but are very terrestrial.
- v) In this group **males** provide parental care, and the mating systems are often relatively unusual (e.g., polygynandry/promiscuity).
- vi) Exact details of taxonomy and relationships between subgroups are controversial, but the ratites are generally considered to be monophyletic, with tinamous their closest relatives (i.e., their “**sister**” **group**). The superorder is subdivided into 5 orders, or, by some authorities into a single order (Struthioniformes) with 5 families (in which case the name ends is “-idea” instead of “-iformes”).

B) TINAMIDAE (OR TINAMIFORMES) (TINAMOUS)

- 47 species.
- Neotropical.
- Able to fly (unlike ratites), and have well developed feathers.
- Glossy, well pigmented eggs.

C) RHEIDAE (OR RHEIFORMES) (RHEAS)

- 2 species.
- South American (“New World ostriches”).
- Smaller than ostriches, emu, etc.
- Flightless, with loose, “fluffy” feathers.

D) STRUTHIONIDAE (OR STRUTHIONIFORMES) (OSTRICH)

- 1 species.
- Largest living bird (though lots of competition for this claim in the past).
- African.

- Flightless, no feather tracts, feathers “fluffy”.
- Very strong/fast runner, only 2 toes.

E) EMU [FAMILY DROMAIIDAE] + CASSOWARY [FAMILY CASUARIIDAE] (OR, COMBINED, CASUARIIFORMES)

- 1 species of Emu; 3 species of Cassowary
- Emu in Australia only; Cassowaries in Australia and New Guinea
- Flightless.
- Cassowaries have a head casque (functions poorly known, but may include: pushing through dense vegetation without injuring head, shoveling in forest floor to look for food, indicating dominance/age), and a sharp, elongate inner toe that acts like a 10 cm long dagger (and is used in defense).

F) DINORNIDAE (OR, DINORNITHIFORMES) (KIWIS)

- 3 species.
- New Zealand.
- Largest eggs relative to body size of all birds.
- Flightless, hair-like feathers.
- Nocturnal; feed by probing in ground; have amazing sense of smell and nostrils are located on bill tip (unlike any other bird).

3. Superorder Neognathae

A) FEATURES

- This group includes all other modern birds.
- The group is united, and distinguished from the paleognathous birds by a different arrangement of bones in the palate.
- The neognathous birds are subdivided into approximately 24 orders.
- Some authorities divide the Superorder into two “infraclasses”: the **Galloanserae** (containing the Galliformes and Anseriformes) and the **Neoaves** (all other modern orders).

GALLIFORMES (PHEASANTS, QUAIL, GROUSE, TURKEY, ETC.)

- Approx. 258 species.
- Nearly worldwide.
- Terrestrial.
- Eat grains, invertebrates, some eat leafy plant matter.
- Have a large gizzard and a large intestinal tract.
- Feathers have a large, distinct aftershaft.

ANSERIFORMES (WATERFOWL: DUCKS, GEESE, SWANS; PLUS SCREAMERS)

- Approx. 161 species.
- Found worldwide (screamers in South America only).
- Mostly aquatic (except the screamers).
- Front three toes are webbed, hind toe is elevated.
- Unlike most birds, the males have a penis (may facilitate sperm transfer since these birds copulate on the water).

SPHENISCIFORMES (PENGUINS)

- 17 species.
- Mostly found in Southern Ocean, but 1 species is tropical.
- Highly aquatic, wing-propelled underwater swimmers, with wings so modified that they cannot fly.
- Many adaptations to life in very cold conditions (e.g., dense feather coat, no apteria, thick fat layer).

GAVIIFORMES (LOONS)

- 5 species.
- Holarctic (northern hemisphere).
- Aquatic, underwater foot-propelled divers: have webbed, laterally compressed feet and legs to facilitate underwater swimming.
- Eat fish.

- Monogamous, with long-term pair bonds.

PROCELLARIFORMES (TUBE-NOSED SEABIRDS: ALBATROSSES, PETRELS, SHEARWATERS, ETC.)

- Approx. 115 species.
- All oceans.
- Tubes on top of bill are unique to this order: direct salt excretions away from salt glands, may also play a role in sense of smell.
- Highly pelagic: spend entire life at sea, except when nesting.
- Huge range in size, from 6 inches long to birds with a 12 foot wing span.

PODICIPEDIFORMES (GREBES)

- 21 species.
- Found worldwide.
- Aquatic birds, feed by diving and swimming underwater using feet.
- Distinctive lobed toes.
- Build floating nests on aquatic vegetation.

PHOENICOPTERIFORMES (FLAMINGOS)

- 5 species.
- Tropics and subtropics worldwide (except Australia; also extending to southern South America).
- Aquatic, typically found in salt lakes and shallow lagoons; usually colonial, often with immense numbers.
- Filter feeders – that's what those funky bills are for (not croquet!).
- Breeding can be quite erratic, depending on conditions.
- The taxonomy of this group has been very controversial. Sometimes flamingos are classified as being most closely related to the Anseriformes (e.g., their bills are quite duck-like), at other times to the Ciconiiformes (e.g., they are quite heron-like in overall morphology)

CICONIIFORMES (HERONS, STORKS, ETC.)

- Approx. 120 species.
- Found worldwide.
- Mostly long-legged, long-necked, aquatic wading birds.
- Mostly colonial.
- Herons have powerdowns (specialized feathers that disintegrate and are used in feather care)

PELECANIFORMES (PELICANS, CORMORANTS, BOOBIES, FRIGATEBIRDS, ETC.)

- Approx. 67 species.
- Found in all oceans, and throughout tropical and temperate land masses.
- Aquatic.
- Group is defined by totipalmate feet, which means that there is webbing linking all four toes. (Note there is some controversy over whether the birds in this order are all related; some suggest that totipalmate feet may have arisen through convergent evolution in some groups; recent DNA evidence suggest frigatebirds are a separate order, and that ibises and herons belong here.)
- A key characteristic is some form of an extensible gular pouch below the bill. This is most well developed in the pelicans.

ACCIPITRIFORMES (HAWKS)

- Approx. 240 species
- Order includes New and Old World vultures
- Worldwide
- Mostly meat eaters (some are insectivores), hooked bills and talons
- Many species are sexually dimorphic (females usually larger than males).

FALCONIFORMES (FALCONS)

- Approx. 64 species.

- Similar characteristics to Accipitriformes, but more closely related to Psittaciiformes
- Worldwide.
- Mostly meat eaters (some are insectivores) and have hooked bill and talons.

GRUIFORMES (CRANES, RAILS, ETC.)

- Approx. 210 species.
- Group is very diverse, with a wide range of body morphologies. Consequently, there is some disagreement as to whether the order is monophyletic.
- Worldwide (including many tiny tropical islands).
- Includes terrestrial, semi-aquatic, and fully aquatic species.
- Most species (especially rails) are very secretive.

CHARADRIIFORMES (SHOREBIRDS, GULLS, AUKS, ETC.)

- Over 300 species.
- Worldwide.
- Mostly waterbirds (some are terrestrial, but derived from waterbirds).
- Taxonomically this order is united by various features of the skeleton and syrinx, but there is also a lot of variation within the group.

PTEROCLIDIFORMES (SANDGROUSE)

- 16 species
- Old World
- Terrestrial seed eaters which live mostly in dry grasslands
- Breast feathers adapted for soaking up and carrying water, which their chicks drink from the feathers

COLUMBIFORMES (PIGEONS AND DOVES)

- > 300 species.

- Worldwide.
- Plump-bodied birds, with short legs and relatively small heads.
- Mostly seed-eaters, but some are fruit eaters (e.g., fruit pigeons).
- Have a large crop and produce “crop milk” to feed their young.
- The now extinct dodo, was a member of this order.

PSITTACIFORMES (PARROTS)

- Approx. 358 species.
- Pantropical, with high diversity of species in Australia.
- Hooked bill, fleshy tongue (which is used to manipulated food), zygodactyl feet (2 toes pointing forward, 2 pointing backwards: in most birds 3 point forwards and 1 backwards).
- Mostly fruit and seed eaters (but some are carnivorous!).
- Mostly very colorful.
- Mostly very gregarious, flocking birds, usually form long-term pair bonds, long-lived (macaws can live several decades).

OPISTHOCOMIFORMES (HOATZIN)

- 1 species
- South American
- Arboreal
- Foliavore (eats leaves), with a greatly enlarged crop for fermentation
- Chicks hatch with functional claws on two digits, which later regress and disappear. Claws are used for climbing.

MUSOPHAGIFORMES (TURACOS)

- 23 species.
- African.
- Arboreal.

- Reversible outer toe (probably helps them to cling on to branches while perching).
- Mostly vegetarian.
- Most have crests on the tops of their heads, and many have brightly colored bare skin around the eye and bill.
- Birds in this order also have unique plumage pigments that produce green (turacoverdin) and red (turacin) colors.

CUCULIFORMES (CUCKOOS)

- 143 species.
- Worldwide.
- Many cuckoo species, especially those in Old World, are brood parasites.
- Have zygodactyl feet.
- Most species are insectivorous, although some eat small vertebrates (roadrunners eat rattlesnakes).
Many cuckoos are well known for eating very hairy caterpillars that are shunned by most birds.

STRIGIFORMES (OWLS)

- Approx. 178 species.
- Worldwide.
- Mostly nocturnal birds of prey.
- Many anatomical features facilitate hunting in the dark.
- Rounded heads, eyes on front of the head (rather than sides), facial disks with specialized feathers that funnel sounds to the ear openings, some have asymmetrical ears, skulls, etc.

CAPRIMULGIFORMES (NIGHTJARS, OILBIRD, POTOOS, ETC.)

- 113 species.
- Worldwide in temperate and tropical zones.
- Crepuscular (comes out at dawn or dusk) or nocturnal.

- Mostly insectivorous, catching prey while in flight. Have very large mouths surrounded by rictal bristles.
- Plumages are very cryptic; almost impossible to find during the day.

APODIFORMES (SWIFTS, HUMMINGBIRDS, AND OWLET-NIGHTJARS)

- More than 400 species: 103 species of swift and 319 species of hummingbird.
- Worldwide (hummingbirds only in the Americas).
- Extremely aerial. Swifts feed on insects on the wing and rarely touch land except to nest. Hummingbirds feed on insects and on nectar and have specialized flight that allows them to hover and provides extraordinary maneuverability when feeding at flowers.
- Translation of Apodiformes implies “without feet”: legs are very short, feet are very small.
- Swifts have a large mouth (good for catching insects), but a tiny bill; hummingbirds have a long needle-like bill with a long tongue that is ideal for drinking up nectar.
- Both swifts and hummingbirds have long narrow wings, with specialized wing skeletal anatomy.

COLIIFORMES (MOUSEBIRDS)

- 6 species.
- African.
- Crested, with long tails.
- All toes can be directed forwards.
- Lack apteria.
- Very sociable.

TROGONIFORMES (TROGONS)

- 39 species.
- Pantropical (except Australasia).

- Heterodactyl feet (toes number 1 and 2 point backwards; similar to zygodactyl except that that involves toes 1 and 4 pointing backwards). Note that this toe arrangement is not found in any other order of birds.
- Eats mostly fruit and insects.
- Brightly colored, largely iridescent green often with yellow or red below. Note that the red pigment in these birds is unusually unstable and fades quickly once the bird dies (hence museum specimens do not show the colors very well).

LEPTOSOMATIDAE (CUCKOO-ROLLERS)

- 1 species
- Madagascar
- relationships poorly understood; formerly in Coraciiformes

CORACIIFORMES (KINGFISHERS AND ALLIES)

- Approx. 156 species.
- Worldwide.
- Syndactyl feet (two of the front toes are fused at the base); in birds this is only found in this order.
- These birds mostly have big heads (often relatively big bills) and relatively small feet.
- Many are very brightly colored.
- Many are cavity nesters.

PICIFORMES (WOODPECKERS, TOUCANS, ETC.)

- Approx. 410 species.
- Worldwide (mostly tropics).
- Zygodactyl feet.
- Diversity of feeding habits; woodpeckers and honeyguides especially well known.

BUCEROTIFORMES (HORNILLS AND HOOPOES)

- Approx. 62 species
- Africa, Asia, Madagascar
- Syndactyl feet
- Hornbills have head casques

PASSERIFORMES (PERCHING BIRDS)

- Approx. 5700 species - more than half of all species of birds.
- Worldwide.
- Characteristic features include: enlarged flexible hind toe; unique sperm, palate, oil glands and limb muscles.
- Extremely diverse group.