

# Glossary

Adaptive radiation	The evolution of ecological and phenotypic diversity within a rapidly multiplying lineage
ALAN	Artificial light at night
Alignment	Base (or peptide) sequences of DNA/RNA (or protein) with corresponding bases (or peptides) from different individuals arranged in the same orientation
Allochrony	Diverge in timing without temporal overlap
Allopatry	Spatially non-overlapping distributions
Anthropogenic	Relating to or resulting from the influence of humans on nature such as pollution, artificial constructions, and noise
Assembly	Smaller sequence reads are combined to a larger sequence
Call	Simple and rather short and predominantly innate vocalization given in many different behavioral contexts
Candidate gene	Gene that is expected a priori to be involved in a certain trait; very often a gene with focal functions identified in model organisms that may have a similar function on the focal trait, here migration, in other animals
Carotenoids	A set of organic pigments, often producing yellow to red colors in bird feathers and skin that cannot be produced by birds themselves, but that are mainly produced by plants and algae
Chronotype	Characterization of consistent timing of an individual's behavior, relative to other individuals; an example is wake-time relative to sunrise

Circadian	Internal rhythm with a period length of approximately 24 hours
Circannual	Internal rhythm with a period length of approximately 365 days
Codominant	Both alleles (not only a dominant one) affect the phenotype
Coverage	Average number of reads per locus in DNA sequencing
Cytosine-phosphate-Guanine (CpG) islands	Regions with a high frequency of cytosine and guanine
Density-dependent effect on diversification	The concept that speciation rate slows down over time as the number of species increases in particular clades, as a consequence of a saturation of opportunities for new speciation events
Diagnostic	In taxonomy, a marker or trait is said to be diagnostic, if it presents different character states in different taxa
Dialect	A regional variant of song differing in structural, frequency, or time parameters from other variants from adjacent regions
Dispersal	In ecological terms, describes the movement of an individual from one breeding site to another. At evolutionary scales, it refers to a species' colonization of a previously unoccupied area
Diversification rates	Refers to the net rate of speciation (the formation of new species) minus extinction (living species going extinct) rate and can be estimated from fossils and phylogenetic trees
Ecological opportunity	The availability of a wealth of resources through a relaxation of interspecific competition or the relaxation of selection on some ecologically important traits as a consequence of a key innovation, the invasion of a novel or unoccupied habitat. Ecological opportunity is considered one of the major regulators of the rate and extent of phenotypic differentiation and also speciation
Ecological speciation	Typically described as the process by which barriers to gene flow evolve between populations as a result of ecologically based divergent selection between environments. Here used in a broader sense, whenever variation among environments induces divergent selective pressures on populations and individuals which somehow results into reproductive barriers (i.e., not necessarily via divergent natural selection alone)
Ecological trap	Refers to scenarios in which rapid environmental change makes individuals prefer to settle in poor-quality

	habitats, i.e., they misjudge the environmental cues that help them to evaluate and identify high-quality habitats
Ecomorphology	The study of morphological adaptations of an organism in relation to their ecological context
Element	A single sound event, represented by a continuous black line in a sonagram. Fixed combination of notes (motifs or syllables) can be repeated in songs in a stereotyped sequence
Genetic accommodation	The evolution of a genetic coding to enable the constant expression of a trait whose expression was previously affected by the environment (i.e., from phenotypically plastic to phenotypically fixed)
Genetic drift	The change in the genetic composition of a population across generations that is due to stochastic sampling of the parental genetic variation availability; most pronounced in smaller populations
Gondwana	Also known as Gondwanaland, an ancient super continent, which existed from c. 600–530 to 160–30 million years ago. This supercontinent covered most of the landmasses in today’s southern hemisphere, including Antarctica, South America, Africa, Madagascar, the Arabian Peninsula, the Indian subcontinent, and the Australian continent
Granivorous	Grain feeding birds
Heritability	Quantitative genetics analyses characterize the relative contributions of genetic and environmental variation to phenotypic variation. Heritability ( $h^2$ ) is the response to selection of the trait in focus
High-throughput sequencing techniques	High-throughput parallel sequencing (revealing the nucleotide sequence of DNA) and parallel analysis has revolutionized our ability to analyze genomes. Current state-of-the-art technology allows sequencing and characterization of whole genomes as de novo reference for basically any study species at much lower costs
Imprinting	The development of a preference for a trait or an environment based on exposure during an earlier, sensitive period in life
Integrative taxonomy	The theory and practice of documenting and evaluating hypotheses about the taxonomic status of putative species by integrating multiple lines of evidence

Intergradation	The transfer of genetic material between individuals from two (groups of) populations with or without unique evolutionary histories; also used to describe a pattern (clinal variation), rather than a process
Isolation by time	Limitation in gene flow caused by two populations reproducing at different times
Key innovations	The acquisition of evolutionary novelty, e.g., a novel trait that creates an ecological opportunity, positively influences ability to utilize previously unexploited resources, and promotes species proliferation
K-Pg boundary	The abbreviation for Cretaceous–Paleogene boundary representing the end of the Cretaceous at approximately 65 million years ago and the beginning of the Cenozoic era we still live in today. This transitional period was associated with a mass extinction event that led to the disappearance of 75% of plants and animals (including all non-avian dinosaurs) on Earth during a short period and that was triggered by the impact of a massive asteroid at Chicxulub, Mexico
Ligation	Linkage of two ends of DNA or RNA molecules
Light-level geolocator	Miniature light-level archival logger that allows tracking of animal movement over large distances for a certain time period. The device uses a light sensor to store light-level data at certain time points. Latitude/longitude location data of the animal can be inferred based on day length (latitude) and the time of solar noon (longitude). The geolocator must be retrieved for data download
Lineage	A metapopulation extended in time
Migratory divide	Natural hybrid zones where birds from two neighboring populations (or (sub)species) with different migratory orientation meet and mate
Modification of the environment	Manipulating and improving aspects of the current environment
Monophyletic lineage	A group of evolutionary lineages that includes the most recent common ancestor of those lineages and all of its past and current descendants
Monophyly	The grouping together of an ancestor and all of its descendants in a clade; the situation where all organisms and populations are descended from the same common ancestor and so more closely related to each other than any of them are to any other such group

Natural selection	The systematic differences in reproduction between phenotypes (including mortality before reproduction), whether caused by interactions with members of the same species (i.e. including sexual selection) or with other biotic or abiotic aspects of the environment
Neutral evolution	The change in heritable traits across generations that is not due to selection
Niche	The set of interactions with the biotic and abiotic environment which can be used to describe and understand the presence of an organism.
Non-urban habitat	This is different in different studies and ranges from natural habitats such as forests, deserts, and wetlands to farmland habitats with little urban construction, yet human modification of the land
Note	A single sound event, represented by a continuous black line in a sonagram. Fixed combination of notes (motifs or syllables) can be repeated in songs in a stereotyped sequence
NO <sub>x</sub>	Nitrogen oxides
Omnivorous	Birds that have a mixed/varied diet
Orientation cage experiment	Behavioral experiments to characterize the migratory direction of birds in captivity make use of the characteristic migratory restlessness behavior caged migrants exhibit once the migratory season approaches. Orientation cages allow recording and quantifying migratory behavior activity and the directedness of the bird's orientation during periods of migratory restlessness. Cage design can vary; the basic form is usually referred to as "Emlen funnel" (named after its inventors, Stephen T. and John T. Emlen), where the walls of a funnel-shaped cage are covered with scratch sensitive paper. Scratches that are left by the tested bird on the inclined walls of the cage are quantified to identify the bird's mean bearing
Period length	Time taken for a full cycle of a rhythmic behavior; an example is the time passing between waking up on consecutive days
Phenotypic plasticity	The ability of a single genotype to produce more than one phenotype, depending on the environment to which it is exposed
Photoperiod	Light fraction of the 24-hour day

Phylogeographic analysis	Analysis of the geographic distribution of (intraspecific) phylogenetic lineages, study of how genetic diversity within a species is distributed across its geographic range and apportioned phylogenetically within the species
Polymorphic	Occurrence of more than one form in the same individual or population of a species
Repertoire	The entirety of song types of an individual
Reproductive isolation	Mechanisms preventing interbreeding among individuals from different species due to mating incompatibilities caused by morphological, physiological, or genetic barriers
Selection of the environment	Comparing and choosing among a set of (potentially) available environments
Sexual ornament	A trait that (mainly) functions to improve sexual attractiveness to the other sex
Sexual selection	The systematic differences in reproduction between phenotypes due to competition over fertilizations
Sink-source dynamic	This can be used to explain the flow of individuals between an urban and a rural habitat. A sink population has a negative population growth and a source population has a positive population growth. The surplus individuals from a source population often disperse to a sink population
Sonagram	Spectrographic visualization of sound events with frequency plotted against time
Song	Complex and rather long vocalization often composed of many different combinations of notes and displayed in two major behavioral contexts: territorial defense and mate attraction. Variable song types of an individual can be distinguished by different structural parameters or different note combinations
Speciation	Evolutionary divergence of subsets of one ancestral species into two (or more) different species
Species criterion	A rule designed to delimit species
Species delimitation	The designation of the taxonomic (and often also geographic) boundaries of one or more taxa
Species property	A property of a species taxon that may be used to infer the evolutionary history of that taxon (e.g. diagnosability, reciprocal monophyly) or its interactions with other taxa (adaptive zone, reproductive isolation)
Stable-isotope signature	The chemical composition of stable isotopes in a certain tissue at a specific time is unique to the area where the bird resides during the time of food take

	up. Depending on the molt schedule of the bird species you study, feathers may be perfectly suited for stable-isotope analyses as for each species they grow during a clearly defined molt period. Once the feather is grown, its stable isotope becomes metabolically inert. If the bird undergoes complete molt in its wintering grounds, the feather coat it wears upon arrival on the breeding ground mirrors the isotope signature of its wintering grounds and thus can be used as proxy for wintering grounds and consequently migratory orientation
Sticky ends	DNA ends with an overhang of nucleotides
Subspecies	There are two major definitions: (1) a population that differs taxonomically from other populations, (2) a population possessing some properties of species (e.g. diagnosability or reciprocal monophyly), but lacking a defining property (usually reproductive isolation)
Sympatry	Co-occurrence of two distinct species (or subspecies) due to spatially overlapping distributions
Syntax	Sequential order of notes or motifs
Taxon (plural: taxa)	A named subspecies, species, genus, and so on for any taxonomic rank
Taxonomy	The science of biodiversity; the theory and practice of delimiting biological taxa
Urban adapter species	Birds that rely on natural resources, but are able to utilize human subsidies. These species are very common in sub-urban areas or in city parks, but survive better in natural environments
Urban avoider species	Birds that avoid urban areas. These are species that have special requirements such as large territories, certain foods or breeding grounds
Urban exploiter species	Birds that depend on human resources to maintain their population size, species that flourish in urban environments. These species are often considered as pest species or invasive species
Urban heat island	Metropolitan area that is significantly warmer than its surrounding rural areas due to human activities
Urban stressor (driver)	Anthropogenic introduced factors that are more present in urban areas and that affect birds, such as pollution, human disturbance, and increased temperature

Urbanization	This is a broad term and its definition varies with the study focus. Here I use urbanization for anthropogenic disturbance that is associated with densification of humans and human activities, i.e. cities
Vocalization	Any kind of tonal utterance used for communication among individuals of the same or even of different species