

## A GLOSSARY FOR AVIAN CONSERVATION BIOLOGY

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**ABSTRACT.**—This glossary provides standard definitions for many of the terms used in avian conservation biology. We compiled these definitions to assist communication among researchers, managers, and others involved in the Neotropical Migratory Bird Conservation Program, also known as Partners in Flight. We used existing glossaries and recent literature to prepare this glossary. The cited sources were not necessarily the first ones to use the terms. Many definitions were taken verbatim from the cited source material. Others were modified slightly to clarify the meaning. Definitions that were modified to a greater extent are indicated as being adapted from the originals. Terms that have been used in more than one way by different authors are listed with numbered alternative definitions if the definitions differ substantially. *Received 30 March 1993, accepted 23 July 1993.*

### GLOSSARY

- Accuracy:** the closeness of computations or estimates to the exact or true value (Marriott 1990:2).
- After-hatching-year (AHY) bird:** a bird in at least its second calendar year of life (Pyle et al. 1987:27; Canadian Wildlife Service and U.S. Fish and Wildlife Service 1991:5–47).
- After-second-year (ASY) bird:** a bird in at least its third calendar year of life (Pyle et al. 1987:27; Canadian Wildlife Service and U.S. Fish and Wildlife Service 1991:5–47).
- After-third-year (ATY) bird:** a bird in at least its fourth calendar year of life (Canadian Wildlife Service and U.S. Fish and Wildlife Service 1991:5–47).
- Allopatric:** occurring in different places; usually refers to geographical separation of populations (Ricklefs 1979:865). The populations may exhibit divergence in behavior, morphology, or genetic composition.
- Annual:** referring to an organism that completes its life cycle from birth or germination to death within a year (Ricklefs 1979:865).
- Area-sensitive species:** species that respond negatively to decreasing habitat patch size (Finch 1991:20).
- Assemblage:** a set of organisms whose pattern of organization (with respect to competition, predation, mutualism, etc.) is unknown (Giller and Gee 1987:537) (cf Community).
- Assessment endpoint:** see Endpoint.
- Association:** a group of species living in the same place at the same time (Ricklefs 1979:865).
- Atlas:** the result of a comprehensive survey of a large geographical area that maps the occurrence (or occurrence and relative abundance) of species in subdivisions of that area. An atlas is usually based on a grid of fixed intervals of distance or degrees latitude and longitude. It is restricted to a particular season of the year, usually the breeding season (Ralph 1981:577).

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- Biodiversity:** (1) the variety of life forms, the ecological roles they perform, and the genetic diversity they contain (Wilcox 1984:640); (2) the variety from molecular, population, and interspecific levels up to the heterogeneity of ecosystems and landscapes (Hansen and diCatri 1992:5) (syn. biological diversity).
- Biogeography:** the study of the geographic distributions of organisms, both past and present (Brown and Gibson 1983:557).
- Biological species concept:** the idea that species are groups of natural populations that are reproductively isolated from other such groups (McKittrick and Zink 1988:2) (cf Phylogenetic species concept).
- Biomarker:** the variation, induced by a substance foreign to the body, in cellular or biochemical components or processes, structures, or functions that is measurable in a biological system or sample (McCarthy et al. 1991:2).
- Boundary:** the edge between different habitat types. If distinctive, a boundary can be considered a separate edge habitat or ecotone. Boundaries that are readily crossed by an organism are called permeable, those that are crossed reluctantly are called semipermeable, and those that are not crossed are called impermeable (Dunning et al. 1992:173).
- Breeding Bird Atlas:** see Atlas.
- Breeding Bird Census (BBC):** a census program of the National Audubon Society in North America that uses the spot-mapping method during the breeding season (Ralph 1981:577).
- Breeding Bird Survey (BBS):** a cooperative program of the U.S. Fish and Wildlife Service and the Canadian Wildlife Service for monitoring population changes in North American breeding birds by using point counts along roads (Ralph 1981:577).
- Breeding dispersal:** movement of individuals that have reproduced between successive breeding sites (Greenwood 1980:1141).
- Brood parasitism (interspecific):** the laying of eggs by an individual of one species in nests of other species with subsequent care for the parasite young provided by the hosts (Lanyon 1992:77) (syn. breeding parasitism, nest parasitism [Thomson 1964:594]).
- Capture-recapture method:** a procedure involving the distinctive marking of individuals and their subsequent recapture (or sighting) to estimate population size and other population parameters (Ralph 1981:577) (syn. mark-recapture).
- Carrying capacity:** the maximum number of individuals that can use a given area of habitat without degrading the habitat and without causing social stresses that result in population reduction (McNeely et al. 1990:153).
- Catastrophe:** an event that causes sudden decreases of population size or the entire elimination of subpopulations (Ewens et al. 1987:62).
- Census (noun):** a count of all individuals in a specified area over a specified time interval (Ralph 1981:577).
- Census (verb):** the act or process of counting all individuals within a specified area and estimating density or a total population for that area (Ralph 1981:577).
- Census efficiency:** proportion of actual population density that is assessed by a census (Ralph 1981:577) (cf Detectability).
- Christmas Bird Count (formerly "Census") (CBC):** an annual project, in the Americas, of the National Audubon Society involving a one-day count in December of the individuals of all species observed within a circle that is 15 miles (24 km) in diameter (Ralph 1981:577).
- CITES species:** species (675 as of this writing) listed under the 1975 Convention on International Trade in Endangered Species (CITES), which is administered by the United Nations Environment Programme. Such species cannot be commercially traded as live specimens or wildlife products because they are endangered or threatened with extinction (Miller 1992:422).



- Climate change: changes in the global climate system in response to physical feedbacks, chemical feedbacks, and changes in terrestrial and aquatic systems caused by humans and nature (adapted from Lubchenco et al. 1991).
- Climax: the endpoint of a successional sequence; a community that has reached a steady state under a particular set of environmental conditions (Ricklefs 1979:867).
- Cline: a geographic gradient in a measurable character, or gradient in gene, genotype, or phenotype frequency (Endler 1977:180).
- Coarse-grained: referring to qualities of the environment that occur in large patches with respect to the activity patterns of an organism. This results in the organism's ability to select usefully from among qualities (Ricklefs 1979:867) (cf Fine-grained).
- Common Birds Census (U.K.) (CBC): a program of the British Trust for Ornithology for censusing breeding birds using the spot-mapping method (Ralph 1981:577).
- Community: a group of organisms, generally of wide taxonomic affinities, occurring together. Many will interact within a framework of horizontal and vertical linkages such as competition, predation, and mutualism (Giller and Gee 1987:539) (cf Assemblage).
- Competition: an interaction between members of two or more species that, as a consequence either of exploitation of a shared resource or of interference related to that resource, has a negative effect on fitness-related characteristics of at least one of the species (Wiens 1989b:7–8).
- Connectedness: the structural links between habitat patches in a landscape; can be described from mappable features (adapted from Baudry and Merriam 1988:23).
- Connectivity: a parameter of landscape function that measures the processes by which a set of populations are interconnected into a metapopulation (adapted from Baudry and Merriam 1988:23).
- Constant-effort mist netting: a capture method, standardized over space and time, used for counting numbers of birds captured in mist nets (Ralph et al., in press).
- Contact: a single field record of an individual by sight or sound (Ralph 1981:577) (syn. detection, cue, registration, observation).
- Corridor: a spatial linkage that facilitates movements of organisms among habitat patches in a landscape (adapted from Merriam 1988:16).
- Count (noun): (1) the act or process of enumerating; (2) the number or sum total obtained by counting (Ralph 1981:577).
- Count (verb): to record the number of individuals or groups present in a population or population sample (Ralph 1981:577) (cf Census, Index).
- Deforestation: removal of trees from a forested area without adequate replanting or natural regeneration (Miller 1991:A6).
- Demographic parameters: fecundity and mortality parameters used to predict population changes, such as number of eggs laid per clutch, the frequency at which clutches are laid, the survivorship of eggs and young in the nest and to the age at first reproduction, and the subsequent survival of the adults throughout their lifetime (Ricklefs 1972:367).
- Density: the number of units (e.g., individuals, pairs, groups, nests) per unit area (Ralph 1981:577) (cf Frequency).
- Density-dependent: having influence on individuals in a population in a manner that varies with the degree of crowding in the population (Ricklefs 1979:868).
- Density-independent: having influence on individuals in a population in a manner that does not vary with the degree of crowding in the population (Ricklefs 1979:868).
- Detectability: a measure of the conspicuousness of a species equal to the proportion of actual units (individuals, territorial males, etc.) observed on a given area (Ralph 1981:577).
- Detection distance: the distance from the observer at which the individual or cluster of individuals is seen or heard (the radius in point counts and the lateral or perpendicular distance in transect counts) (Ralph 1981:577–578).



- Direct competition: the exclusion of individuals from resources by aggressive behavior or use of toxins (Ricklefs 1979:868).
- Dispersal: the movement of organisms away from the place of birth or from centers of population density (Ricklefs 1979:868) (see Breeding dispersal, Natal dispersal).
- Dispersion: (1) the pattern of spacing of individuals in a population (Ricklefs 1979:868); (2) the nonaccidental movement of individuals into or out of an area or population, typically a movement over a relatively short distance and of a regular nature (Lincoln et al. 1982:70).
- Disturbance: any relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment (Turner 1989:181).
- Diversity: typically used in relation to species, a single index that incorporates the number of species and relative abundances of species (evenness). For example, a collection is said to have high diversity if it has many species and their abundances are relatively even. There are many types of diversity (Pielou 1977:292; Wiens 1989a:123):
- Point diversity—for a small or microhabitat sample within a community regarded as homogeneous
  - Pattern diversity—as change between parts of the internal pattern of a community
  - Alpha diversity—for a sample representing a community regarded as homogeneous (despite its internal pattern)
  - Beta diversity—as change along an environmental gradient or among the different communities of a landscape
  - Gamma diversity—for a landscape or set of samples including more than one kind of community
  - Delta diversity—as change along climatic gradients or among geographic areas
  - Epsilon diversity—for a broader geographic area, including differing landscapes.
- Ecocline: a geographical gradient of vegetation structure associated with one or more environmental variables (Ricklefs 1979:868).
- Ecological effects characterization: the identification and quantification of the adverse effects elicited by a stressor and, to the extent possible, the evaluation of cause-and-effect relations (Risk Assessment Forum 1992:5).
- Ecological risk assessment: a process that evaluates the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to one or more stressors. Ecological risk assessment may evaluate one or many stressors and ecological components (Risk Assessment Forum 1992:2).
- Ecological risk characterization: a process that uses the results of the exposure and ecological effects analyses to evaluate the likelihood of adverse ecological effects associated with exposure to a stressor (Risk Assessment Forum 1992:5).
- Ecosystem: the totality of components of all kinds that make up a particular environment; the complex of biotic community and its abiotic, physical environment (McNeely et al. 1990:153).
- Ecotone: a habitat created by the juxtaposition of distinctly different habitats; an edge habitat; a zone of transition between habitats types (Ricklefs 1979:869) or adjacent ecological systems having a set of characteristics uniquely defined by space and time scales and by the strength of the interactions (Hansen and diCatri 1992:6) (see Boundary).
- Edge effect: (1) changes in a community due to the rapid creation of abrupt edges in large units of previously undisturbed habitat (Reese and Ratti 1988:127); (2) tendency for increased variety and density of organisms at community or habitat junctions (Odum 1971:157).
- Edge species: species preferring the habitat created by the abutment of distinctive vegetation types (Ricklefs 1979:869).



**Endangered Species Act:** 1973 Act of U.S. Congress, amended several times subsequently, that elevates the goal of conservation of listed species above virtually all other considerations. The act provides for identifying (listing) endangered and threatened species or distinct segments of species, monitoring candidate species, designating critical habitat, preparing recovery plans, consulting by federal agencies to ensure that their actions do not jeopardize the continued existence of listed species or adversely modify critical habitats, restricting importation and trade in endangered species or products made from them, restricting the taking of endangered fish and wildlife. The act also provides for cooperation between the federal government and the states (adapted from Rohlf 1989:25–35).

**Endemic:** confined and native to a certain region (Ricklefs 1979:869).

**Endpoint:** a characteristic of an ecological component that may be affected by exposure to a stressor (Risk Assessment Forum 1992:12); a characteristic of valued environmental entities that are believed to be at risk (Suter 1990:9). Suter (1990) distinguished two types of endpoints:

Assessment endpoint—an explicit expression of the actual environmental value that is to be protected (Suter 1990:9)

Measurement endpoint—a measurable response to a stressor that is related to the valued characteristics chosen as the assessment endpoints (Suter 1990:10).

**Environment:** physical and biological surroundings of an organism, including the plants and animals with which it interacts (Ricklefs 1979:869).

**Environmental characterization:** the prediction or measurement of the spatial and temporal distribution of a stressor and its co-occurrence or contact with the ecological components of concern (Risk Assessment Forum 1992:5).

**Environmental gradient:** a continuum of conditions, such as the gradation from hot to cold environments (Ricklefs 1979:869).

**Equitability:** (1) evenness relative to any specific standard or model of species abundance (Peet 1974:288); (2) uniformity of abundance in an assemblage of species. Equitability is greatest when all species are equally numerous (Ricklefs 1979:869) (syn. evenness).

**Estimator:** a function of sample data that describes or approximates a parameter (Ralph 1981:578).

**Evenness:** the uniformity of abundance between species in a community (Peet 1974:288).

**Exploitation:** the removal of individuals or biomass from a population by predators or parasites (Ricklefs 1979:870).

**Exploitation competition:** competition in which two or more organisms consume the same limited resource (Ehrlich and Roughgarden 1987:620) (cf Interference competition).

**Extinction:** (1) the complete disappearance of a species from the earth (Miller 1991:A5); (2) the total disappearance of a species from an island (this does not preclude later recolonization) (MacArthur and Wilson 1967:187) (cf Extirpation, Local extinction).

**Extirpation:** the elimination of a species from an island, local area, or region.

**Extractive reserves:** conservation areas that permit certain kinds of resource harvesting on a (theoretically) sustainable basis (Soulé 1991:747).

**Fecundity:** rate at which an individual produces offspring, usually expressed only for females (Ricklefs 1979:870).

**Feral:** escaped from domestication (Long 1981:7). Feral individuals may be descendants of the original escapees.

**Fine-grained:** referring to qualities of the environment that occur in small patches with respect to the activity patterns of an organism. This results in the organism's inability to distinguish qualities usefully (Ricklefs 1979:870) (cf Coarse-grained).

**First-year bird:** a bird in its first 12–16 months (or until its second prebasic molt) (Pyle et al. 1987:27) (see Hatching-year bird, After-hatching-year bird).

**Fitness:** the average contribution of one allele (i.e., one form of a gene) or genotype to the



- next generation or to succeeding generations, compared with that of other alleles or genotypes (Futuyma 1979:503). It may be either an absolute value, measured by the number of progeny per parent, or it may be relative to some reference genotype (Crow and Kimura 1970:224).
- Fixed-distance method: see Strip transect method, Point count method.
- Fledging success: (1) the average number of offspring fledged (i.e., raised until they leave the nest) per female (May and Robinson 1985); (2) percentage of hatchlings that fledge (Robinson and Rotenberry 1991:280).
- Floating birds: reserves of nonbreeding or nonterritorial birds, usually of undetermined age, present in breeding or territorial populations (von Haartman 1951:433–435).
- Floristic: referring to studies of the species composition of plant associations (Ricklefs 1979:870).
- Flyway: a broad-front band or pathway used in migration (Welty 1975:471).
- Food chain: a feeding sequence, such as seed-to-songbird-to-raptor, used to describe the flow of energy and materials in an ecosystem (adapted from Ehrlich and Roughgarden 1987:620).
- Food web: an abstract representation of the various paths of energy and material flow through populations in the community (Ricklefs 1979:870).
- Forest fragmentation: patchwork conversion and development of forest sites (usually the most accessible or most productive ones) that leave the remaining forest in stands of varying sizes and degrees of isolation (Harris 1984:4).
- Forest-interior species: species that tend to avoid edge habitats and that require large tracts of forest habitat for nesting and foraging (Whitcomb et al. 1981:139).
- Fractal dimension: an index of the complexity of spatial patterns (Turner 1989:175).
- Fractal geometry: a method to study shapes that are self-similar over many scales (Turner 1989:175).
- Frequency: the number of plots, stations, counts (visits), or intervals in which a species is detected; when expressed as a fraction of the total sampled, it becomes relative frequency (Ralph 1981:578) (cf Density).
- Functional response: the change in an individual predator's rate of exploitation of prey as a result of a change in prey density (Ricklefs 1979:870) (cf Numerical response).
- Gap analysis: the process of identifying and classifying components of biodiversity to determine which components already occur on protected areas and, conversely, which are un- or underrepresented on protected areas (Scott et al. 1993).
- Gap formation: the creation of a habitat patch of different characteristics within a larger patch (Wiens 1989b:201).
- Gene flow: the exchange of genetic traits between populations by movement of individuals, gametes, or spores (Ricklefs 1979:870).
- Generalist: a species with broad food preferences, habitat preferences, or both (Ricklefs 1979:871) (see Specialist).
- Generation time: the average age at which a female produces her offspring, or the average time for a population to increase by a factor equal to the net reproductive rate (Ricklefs 1979:871).
- Genetic drift: the change in allele frequency due to random variations in fecundity and mortality in a population (Ricklefs 1979:871).
- Genome: a full set of chromosomes (Brown and Gibson 1983:563).
- Genotype: the total genetic message found in a cell or an individual (Brown and Gibson 1983:563).
- Geographic information system (GIS): a set of computer hardware and software for analyzing and displaying spatially referenced features (i.e., points, lines, and polygons) with non-geographic attributes such as species and age (Johnson 1990:31).



- Global change: the large-scale alterations in climate, patterns of land and water use, environmental chemistry, etc., especially alterations related to human activities (Lubchenco et al. 1991).
- Guild: two or more co-occurring species' populations that exploit the same type of resources in similar ways. Competition is expected to be especially important within guilds (Wiens 1989a:156–159; Simberloff and Dayan 1991:115).
- Habitat: the place where an animal or plant usually lives, often characterized by a dominant plant form or physical characteristic (Ricklefs 1979:871).
- Habitat fragmentation: the alteration of a large habitat patch to create isolated or tenuously connected patches of the original habitat that are interspersed with an extensive mosaic of other habitat types (Wiens 1989b:201).
- Habitat patches: areas distinguished from their surroundings by environmental discontinuities. Patches are organism-defined (i.e., the edges or discontinuities have biological significance to an organism) (adapted from Wiens 1976:83).
- Habitat selection: preference for certain habitats (Ricklefs 1979:871).
- Hatching success: percentage of eggs that hatch (Robinson and Rotenberry 1991:280) (syn. hatching rate [Mayfield 1975:459]).
- Hatching-year (HY) bird: (1) a bird capable of sustained flight and known to have hatched during the calendar year in which it was banded (or seen) (Canadian Wildlife Service and U.S. Fish and Wildlife Service 1991:5–47); (2) a bird in first basic plumage in its first calendar year (Pyle et al. 1987:26–27).
- Heterogeneity: the variety of qualities found in an environment (habitat patches) or a population (genotypic variation) (Ricklefs 1979:872).
- Home range: an area, from which intruders may or may not be excluded, to which an individual restricts most of its usual activities (Ricklefs 1979:872) (cf Territory).
- Index: (1) the proportional relation of counts of objects or signs associated with a given species to counts of that species on a given area; (2) counts of individuals (e.g., at a feeding station) reflecting changes in relative abundance on a specified or local area (Ralph 1981:578).
- Index method: a counting method involving sampling that yields measures of relative abundance rather than density values (Ralph 1981:578).
- Indirect competition: the exploitation of a resource by one individual that reduces the availability of that resource to others (Ricklefs 1979:872).
- Indirect effect: (1) the impact on a species caused by affecting the species' competitors, predators, or mutualists (Dunning et al. 1992:173); (2) the impact of toxic chemicals on a species by directly affecting interactions between species. Examples are disruptions in food resources or habitat changes that affect competitive interactions, biomagnification up the food chain, and impacts on populations parasites, symbionts, pollinators, etc. (Harwell and Harwell 1989:521).
- Interference competition: competition in which one species prevents the other from having access to a limiting resource (Ehrlich and Roughgarden 1987:624) (cf Exploitation competition).
- Interspecific competition: competition between individuals of different species (Ricklefs 1979:873).
- Intraspecific competition: competition between individuals of the same species (Ricklefs 1979:873).
- Introduced species: species present in an area due to deliberate release by humans (including reintroductions, transplants, and restocked species) or due to accidental release through escape or indirect assistance (adapted from Long 1981:7) (syn. exotic species).
- Key factor analysis: a statistical treatment of population data designed to identify factors most responsible for change in population size (Ricklefs 1979:873).



- Keystone species:** a species whose abundance dramatically alters the structure and dynamics of ecological systems (Brown and Heske 1990:1705).
- Landscape:** the landforms of a region in the aggregate; the land surface and its associated habitats at scales of hectares to many square kilometers (for most vertebrates); a spatially heterogeneous area (Turner 1989:173); mosaic of habitat types occupying a spatial scale intermediate between an organism's normal home-range size and its regional distribution (Dunning et al. 1992:169).
- Landscape change:** alteration in the structure and function of the ecological mosaic of a landscape through time (Turner 1989:173).
- Landscape complementation:** changes in population caused by the relative distributions of habitat patches containing nonsubstitutable resources in a landscape. Example: increased populations in a portion of a landscape where foraging patches and roosting patches are adjacent, compared with parts of the landscape where these patches are isolated (Dunning et al. 1992:170–171) (see Landscape supplementation).
- Landscape composition:** the relative amounts of habitat types contained within a landscape (Dunning et al. 1992:170).
- Landscape ecology:** field of study that considers the development and dynamics of spatial heterogeneity, interactions and exchanges across heterogeneous landscapes, the influences of spatial heterogeneity on biotic and abiotic processes, and the management of spatial heterogeneity (Turner 1989:172).
- Landscape function:** the interactions among the spatial elements, that is, the flow of energy, materials, and organisms among the component ecosystems (Turner 1989:173).
- Landscape indexes:** indexes of landscape structure (pattern), including richness, evenness, patchiness, diversity, dominance, contagion, edges, fractal dimension, nearest neighbor probability, and the size and distribution of patches (Turner 1989:177–178).
- Landscape physiognomy:** features associated with the physical layout of elements within a landscape (Dunning et al. 1992:170).
- Landscape structure:** spatial relationships between distinctive ecosystems, that is, the distribution of energy, materials, and species in relation to the sizes, shapes, numbers, kinds, and configurations of components (Turner 1989:173); composition and extent of different habitat types (landscape composition) and their spatial arrangement (landscape physiognomy) in a landscape (Dunning et al. 1992:170).
- Landscape supplementation:** changes in populations caused by the distribution of habitat patches containing substitutable resources in a landscape. Example: increased population in a small patch found in a portion of the landscape where residents can easily forage in other nearby similar patches (Dunning et al. 1992:171–172) (see Landscape complementation).
- Life form:** characteristic structure of a plant or animal (Ricklefs 1979:873).
- Life history:** a system of interrelated adaptive traits forming a set of reproductive tactics (Stearns 1976:19).
- Life table:** a summary by age of the survivorship and fecundity in a population, usually of females (Ricklefs 1979:873).
- Life zone:** a more or less distinct belt of vegetation occurring within, and characteristic of, a particular range of latitude or elevation (Ricklefs 1979:873).
- Limiting resource:** a resource that is in short supply compared with the demand for it (Ehrlich and Roughgarden 1987:625).
- Line transect:** a sampling route, through a surveyed area, that is followed by an observer counting contacts over a measured distance (Ralph 1981:578).
- Local extinction:** disappearance of a population from a habitat patch or local area. Local extinctions can accumulate into regional extinctions and finally global extinction (adapted from Merriam and Wegner 1992).



- Logistic equation: mathematical expression for a particular sigmoid growth curve in which the percent rate of increase decreases in linear fashion as population size increases (Ricklefs 1979:874).
- Mapping method: see Spot-mapping method.
- MAPS: Monitoring Avian Productivity and Survivorship program, which utilizes constant-effort mist netting and banding and intensive point counts during the breeding season at a continent-wide network of stations. MAPS is coordinated by The Institute for Bird Populations (DeSante 1992).
- Mayfield method: a method used to calculate the rate of nesting success based on the number of days that a nest was under observation (i.e., nest days of "exposure"); developed by Mayfield (1975).
- Measurement bias: a systematic under- or overestimation of the true values due to a difference between the actual measurement and what one intends to measure (adapted from Gilbert 1987:11) (cf Statistical bias).
- Measurement endpoint: see Endpoint.
- Mesic: moderately moist (Krebs 1985:724).
- Metapopulation: a collection or set of local populations living where discrete patches of the area are habitable and the intervening regions are not (Gilpin 1987:127); basic demographic unit composed of a set of populations in different habitat patches linked by movement of individuals (Merriam and Wegner 1992:151).
- Microhabitat: the particular parts of a habitat that an individual encounters in the course of its activities (Ricklefs 1979:874).
- Migration: regular, extensive, seasonal movements of birds between their breeding regions and their "wintering" regions (Welty 1975:463).
- Altitudinal migration—a vertical pattern of migration in which populations that breed in the alpine or subalpine zones in summer move to lower levels in winter (Welty 1975:475). Inverted altitudinal migration refers to organisms that move to higher levels in winter.
- Leap-frog migration—a pattern of migration taken when subspecies of the same species occupy two or more breeding areas (and also wintering areas) in the axis of migratory flight. Subspecies that breed progressively closer to one end of the axis winter progressively closer to the other end. An example is the Fox Sparrow, of which six subspecies inhabit the Pacific coast of North America. On its migration south, each subspecies flies over winter areas already occupied by the subspecies that breeds south of it (Welty 1975:472).
- Long-distance migration—a pattern of latitudinal migration used by a species that moves from arctic or temperate regions where it breeds to tropical or subtropical regions for the winter (Welty 1975:465).
- Loop migration—a circular pattern of migration such that the migration pathway in the fall differs from the migration pathway in the spring (Welty 1975:472).
- Short-distance migration—a pattern of latitudinal migration used by species that move within, rather than between, temperate or tropical zones (Welty 1975:465).
- Minimum viable population: a threshold number of individuals that will ensure (with some probability level) that a population will persist in a viable state for a given interval of time (adapted from Gilpin and Soulé 1986:19).
- Monitoring: measuring population trends using any of various counting methods (Ralph et al., in press).
- Monitoring Avian Productivity and Survivorship program. See MAPS.
- Morph: a specific form, shape, or structure (Ricklefs 1979:874).
- Mortality: ratio of the number of deaths of individuals to the population, often described as a function of age; death rate (Ricklefs 1979:874).



- Multi-brooded: producing more than one clutch or brood per season (Ricklefs 1972:401), usually in reference to a life history trait of a species.
- Natal dispersal: movement from birth (natal) site to first breeding or potential breeding site (Greenwood 1980:1141).
- Neighborhood effect: increased impact of landscape features located in the immediate neighborhood of a focal patch compared with features farther from the local patch (Dunning et al. 1992:173).
- Neotropical migrant: a migratory bird in the Neotropical faunal region. The Neotropical Migratory Bird Conservation Program focuses primarily on species that nest in the Nearctic faunal region and winter in the Neotropical region (Stangel 1992).
- Nest parasitism: (1) expression used by some authors (e.g., Thomson 1964:594, Monroe 1991:225) for brood parasitism; (2) taking over nests of other species (Lanyon 1992:78).
- Nest success: survival of eggs or nestlings (usually excluding those of brood parasites) (Mayfield 1975:459) (see Hatching success).
- Net reproductive rate: the number of offspring that females are expected to bear on average during their lifetimes (Ricklefs 1979:875).
- Niche: multidimensional utilization distribution, giving a population's use of resources ordered along resource axes (Schoener 1989:79).
- Numerical response: change in the population size of a predatory species as a result of a change in the density of its prey (Ricklefs 1979:876) (cf Functional response).
- Parameter: (1) A statistical parameter is a numerical characteristic about the population of interest (Freedman et al. 1978:301); (2) A model parameter is a numerical quantity that mediates the relationships between variables in a model (Starfield and Bleloch 1986:4).
- Partners in Flight: a Western Hemisphere program designed to conserve neotropical migratory birds and officially endorsed by numerous federal and state agencies and nongovernment organization (National Fish and Wildlife Foundation 1992:1). Also known as Neotropical Migratory Bird Conservation Program.
- Patch dynamics: the change in the distribution of habitat patches in a landscape generated by patterns of disturbance and subsequent patterns of vegetative succession (Pickett and Thompson 1978:29).
- Pattern: a statement about relationships among several observations of nature. It connotes a particular configuration of properties of the system under investigation (Wiens 1989a:18).
- Perennial: referring to an organism that lives for more than one year (Ricklefs 1979:876).
- Phenotype: the way in which the genetic message of an individual is expressed in its morphology, physiology, and behavior (Brown and Gibson 1983:567).
- Phylogenetic species concept: the idea that a species is the smallest diagnosable cluster of individual organisms within which there is a parental pattern of ancestry and descent (McKittrick and Zink 1988:2) (cf Biological species concept).
- Physiognomy: the topography and other physical characteristics of a landform and its vegetation (Brown and Gibson 1983:568).
- Point count method: count of contacts recorded by an observer from a fixed observation point and over a specified time interval: fixed distance (radius) point count is limited to individuals within a single fixed distance; variable distance (radius) point count is limited to individuals within distances varying according to species-characteristic detection distances (syn. variable circular plot); and unlimited distance point count includes all individuals without limits, that is, all detections recorded regardless of distance (e.g. the "Indices Ponctuels d'Abondance" [IPA] developed in France) (Ralph 1981:578) (syn. station count method).
- Point transect: a transect along which the point count method is used. No recordings are



- made between stations (as opposed to strip transects with continuous recordings) (Ralph 1981:578).
- Polymorphism:** occurrence of more than one distinct form of individuals in a population (Ricklefs 1979:877).
- Population:** a group of coexisting (conspecific) individuals that interbreed if they are sexually reproductive (Sinclair 1989).
- Population viability analysis (PVA):** analysis that estimates minimum viable populations (Gilpin and Soulé 1986:19) (syn. population vulnerability analysis).
- Postfledging mortality:** the death rate of young after fledging, calculated from the following: the fates of young birds after fledging (or hatching in the case of precocial young), when these fates can be observed directly; changes in the ratio between juvenile and adult birds in populations; and the number of surviving young needed to replace adult losses, when adult mortality rates and the production of fledglings are known (Ricklefs 1972:373).
- Precision:** a quality, associated with a class of measurements, that refers to the way in which repeated observations conform to themselves (Marriott 1990:159).
- Primary succession:** the sequence of communities developing in a newly exposed site devoid of life (Ricklefs 1979:877).
- Process:** the operation of some factor or factors that produce a particular relationship among observations (Wiens 1989a:19).
- Productivity:** the number of young produced per pair of birds, or the reproductive performance of the population, estimated as the proportion of young in the total population just after the breeding season (Ricklefs 1972:417).
- Proximate factors:** aspects of the environment that organisms use as cues for behavior; for example, daylength (Ricklefs 1979:877) (cf Ultimate factors).
- Quadrat:** a small sample plot, usually square or rectangular (Ralph 1981:578).
- Rate of increase:** a measurement of the change in numbers of a population. The finite, or geometric, rate of increase ( $\lambda$ ) is the factor by which the size of a population changes over a specified period (Caughley 1977:51; Ricklefs 1979:871). The exponential rate ( $r$ ) is the power to which  $e$  (the base of natural logarithms) is raised such that  $e^r = \lambda$  (Caughley 1977:52). Caughley (1977:109) distinguished the following exponential rates:
- $\rho$ —the intrinsic rate of increase in the best of all possible environments.
  - Intrinsic rate of increase**—the rate at which a population with a stable age distribution grows in a given environment when no resource is in short supply (syn. Malthusian parameter [Ricklefs 1979:874]).
  - Observed rate of increase**—the rate of increase at which a population increases over time.
  - Potential rate of increase**—the rate that would result if the effect of a given agent of mortality were eliminated.
  - Survival-fecundity rate of increase**—the exponential rate at which a population would increase if it had a stable age distribution appropriate to its current schedules of age-specific survival and fecundity.
- Ricklefs (1979:873) defined the innate capacity for increase as the intrinsic growth rate of a population under ideal conditions without the restraining effects of competition.
- Recovery plan:** a plan that details actions or conditions necessary to promote species recovery, that is, improvement in the status of species listed under the Endangered Species Act to the point at which listing is no longer appropriate. Plans are required for virtually all listed species (adapted from Rohlf 1989:87–89).
- Recovery team:** a group, established by the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS) (the agencies that share authority for listing species as endangered or threatened under the Endangered Species Act), that prepares a recovery plan for a species listed under the Endangered Species Act. The team usually



- consists of representatives from agencies that are charged with implementing the plan, scientists with expertise about the species involved, representatives from industries that may be affected by the plan, and USFWS/NMFS personnel (adapted from Rohlf 1989: 88–89).
- Recruitment: the addition of new individuals to a population by reproduction (Ricklefs 1979:878), commonly measured as the proportion of young in the population just before the breeding season (Ricklefs 1972:418).
- Refugium: an area that remains unchanged while areas surrounding it change markedly; hence the area serves as a refuge for species requiring specific habitats (Brown and Gibson 1983:569).
- Relative abundance: a percent measure or index of abundances of individuals of all species in a community (Ralph 1981:578) (syn. dominance [in Europe]; cf Index, Frequency, Density).
- Relative frequency: see Frequency.
- Remote sensing: the imaging of earth features from suborbital and orbital altitudes, using various wavelengths of the visible and invisible spectrum (Richason 1978:xi).
- Resident: inhabiting a given locality throughout the year; sedentary (Welty 1975:463).
- Resource: a substance or object required by an organism for normal maintenance, growth, and reproduction (Ricklefs 1979:878).
- Restoration ecology: the re-creation of a natural or self-sustaining community or ecosystem (Jordan et al. 1987:331).
- Riparian: along the bank of a river or lake (Ricklefs 1979:878).
- Secondary succession: progression of communities in habitats where the climax community has been disturbed or removed entirely (Ricklefs 1979:878).
- Second-year (SY) bird: a bird in its second calendar year of life (Pyle et al. 1987:27; Canadian Wildlife Service and U.S. Fish and Wildlife Service 1991:5–47).
- Sedentary: not migratory; see also Resident (Welty 1975:46).
- Sere: a series of stages of community change in a particular area leading toward a stable state (Ricklefs 1979:879).
- Sink habitat: a habitat in which reproduction is insufficient to balance local mortality. The population can persist in the habitat only by being a net importer of individuals (adapted from Pulliam 1988:653–654).
- Sink population: a population that occupies habitat types in which reproductive output is inadequate to maintain local population levels. The population may be replenished by emigrants from source populations (Wiens and Rotenberry 1981:531).
- Source habitat: a habitat that is a net exporter of individuals (Pulliam 1988:654).
- Source population: a population that occupies habitat suitable for reproduction, in which the output of offspring results in a population that exceeds the carrying capacity of the local habitat, promoting dispersal (adapted from Wiens and Rotenberry 1981:531).
- Specialist: a species with narrow food preferences, habitat preferences, or both (after Ricklefs 1979:871) (see Generalist).
- Species: a group of actually or potentially interbreeding populations that are reproductively isolated from all other kinds of organisms (Ricklefs 1979:880).
- Species-area relationship: a plot (often log-log) of the numbers of species of a particular taxon against area, such as islands or other biogeographic regions (Brown and Gibson 1983:570).
- Species diversity: see Diversity.
- Species richness: the number of species in a given area (Ralph 1981:578).
- Spot-mapping method: a census procedure that plots on a map individuals seen or heard in a surveyed area. The survey is usually conducted over a period of days or weeks in a



- season, and individual territories or home ranges are then demarcated by examining the clusters of observations. Used in Breeding Bird Census (Ralph 1981:578) (syn. Territory-mapping).
- Stable age distribution:** the proportions of the population in different age classes when the rate of increase has converged to a constant (which depends on the fixed schedules of survival and fecundity). The ratios between the numbers in the age classes are constants (Caughley 1977:89).
- Station:** (1) the area within which observations made from a point are recorded by the observer (or often synonymous with "point," see Point count method) (Ralph 1981:578); (2) a monitoring station is an area of usually less than about 50 ha where intensive censuses, nest searching, and/or mist netting are conducted (Ralph et al., in press).
- Statistical bias:** a difference between the expected value of an estimator and the population parameter being estimated (Gilbert 1987:12) (cf Measurement bias).
- Stenotopic:** found in only one or a relatively small number of habitats (MacArthur and Wilson 1967:191).
- Stressor:** any chemical, physical, or biological entity that can induce adverse effects on individuals, populations, communities, or ecosystems (Risk Assessment Forum 1992:1).
- Strip transect method:** a procedure using a strip of land, or water, of fixed direction that is sampled visually and/or aurally by an observer. Counts may be one of the following: fixed distance (width) counts limited to a strip of set width for all or specially chosen species; variable distance (width) counts, with different, species-specific widths that are determined to reflect detection attenuation; or unlimited distance counts, in which all detections are recorded regardless of distance (Ralph 1981:578) (syn. belt-transect).
- Stochastic:** implies the presence of a random variable (Marriott 1990:197).
- Subclimax:** a stage of succession along a sere prevented from progressing to the climatic climax (i.e., the steady-state community characteristic of a particular climate) by fire, grazing, and similar factors (Ricklefs 1979:880).
- Subspecies:** subpopulations within a species that are distinguishable by morphological characteristics and, sometimes, by physiological or behavioral characteristics (Ricklefs 1979:880) (syn. race).
- Succession:** replacement of populations in a habitat through a regular progression to a stable state (climax) (Ricklefs 1979:880).
- Survey:** an enumeration or index of the number of individuals in an area from which inferences about the population can be made (Ralph 1981:578) (cf Census, Count).
- Survival:** the proportion of newborn individuals alive at a given age (Ricklefs 1979:880).
- Sympatric:** occurring in the same place, usually referring to areas of overlap in species distributions (Ricklefs 1979:880).
- Syntopic:** pertaining to populations or species that occupy the same macrohabitat (Lincoln et al. 1982:242).
- Territory:** any area defended by one or more individuals against intrusion by others of the same or different species (Ricklefs 1979:881) (cf Home range).
- Territory-mapping:** see Spot-mapping method.
- Third-year (TY) bird:** a bird in its third calendar year of life (Pyle et al. 1987:27).
- Transect:** a cross section of an area along which the observer moves in a given direction (Ralph 1981:578) (see Line transect, Point transect, Strip transect method).
- Trophic:** pertaining to food or nutrition (Ricklefs 1979:881).
- Trophic level:** the position in the food chain determined by the number of energy-transfer steps to that level (Ricklefs 1979:881).
- Trophic structure:** organization of the community based on feeding relationships of populations (Ricklefs 1979:881).



- Turnover: the process of local extinction (e.g., on islands) of some species and their replacement by other species. The turnover rate is the number of species eliminated and replaced per unit time (MacArthur and Wilson 1967:191).
- Ultimate factors: aspects of the environment that are directly important to the well-being of an organism (for example, food) (Ricklefs 1979:881). Ultimate factors are concerned with fitness (Lack 1954:5) (cf Proximate factors).
- Variable circular plot: see Point count method.
- Variable-distance method: see Strip transect method, Point count method.
- Variance: a statistical measure of the dispersion of a set of values about its mean (Ricklefs 1979:881).
- Winter Bird Population Study (U.S.): a program of the National Audubon Society involving census of wintering birds by counting and mapping, but not depending on persisting occupation of territories or home ranges (Ralph 1981:578) (cf Breeding Bird Census).
- Xeric: referring to habitats in which plant production is limited by lack of water (Ricklefs 1979:882).

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