The published records of Kirtland's Warblers in spring and autumn migration indicate that they may not pause enroute until at or near their destinations. If this is true of one warbler, it may also be true of other small land birds.

I thank Cameron B. Kepler, Paul W. Sykes Jr., and Elliot J. Tramer for reading a draft of this manuscript.

LITERATURE CITED


Received 2 July 1987, accepted 7 July 1987.

Bird Migration Terminology

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The patterns of migratory behavior in birds span a continuum from obligate long-distance annual migrations to irregular eruptive movements. Current studies reveal ever more variability in avian migration systems. Effective communication requires that established terminology be used precisely and that some new terms be employed to reflect our increased knowledge of migration patterns. We propose standard usage for several common migration terms. We have been as conservative as possible in retaining established terminology, and where possible we suggest simply adding modifiers that more accurately describe the phenomena.

Much of the variability within migration patterns probably is based on underlying differences in the mechanisms that control migratory behavior. We mention some of these possible differences, but for only a fraction of species do we have any information on the mechanisms. Therefore, the terms we propose are intended to be descriptive of the observed phenomena and carry no implication regarding the specific mechanisms involved.

The term annual migrant should be applied to populations (species or geographically defined breeding populations of a species) in which all individuals migrate from their breeding sites on an annual basis. This descriptive term is preferable to others, e.g. obligate, true, or regular migrant, that are often used synonymously. A well-known example is the Blackpoll Warbler (Dendroica striata). Data from some extensively studied European species indicate that annual migratory disposition expressed in caged birds is often based on endogenous processes (i.e. occurs in the absence of external stimuli; see Gwinner 1986 for a recent review). It is, however, becoming increasingly clear that the migration of at least some annual migrants may not be entirely the result of an endogenous motivation. Rather, late stages of autumn migration can occur only in response to external stimuli (e.g. failure in food supply, unusually high density of conspecifics, extreme weather conditions) and may not occur annually. For example, field evidence indicates that Yellow-rumped Warblers (Dendroica coronata; Terrill and Ohmart 1984), American Tree Sparrows (Spizella arborea; Niles et al. 1969), Harris' Sparrows (Zonotrichia querula; Rohwer 1978), and some species of Palearctic nocturnal migrants (e.g. Lack 1983, Haila et al. 1986) exhibit a delayed or facultative phase of migratory behavior after the initial portion, or obligate phase, of annual migration. In addition, there is experimental evidence for facultative migration in Dark-eyed Juncos (Junco hyemalis; Terrill 1987, 1988) and Garden Warblers (Sylvia borin; Gwinner pers. comm.). Thus, in terms of regulatory mechanisms, it is misleading to assume that the entire annual migration is under endogenous control simply because a species is an annual migrant. Indeed, an endogenous component need not be involved in annual migration, although we know of no examples where an annual migration is stimulated exclusively by exogenous factors.

We therefore propose the terms obligate phase and facultative phase as modifiers to describe the behavior of individual annual migrants. The obligate phase is the initial portion of migration from the breeding
area, performed annually regardless of environmental conditions. In many species the fundamental stimulus for the obligate phase of migration may be endogenous. In some individuals this phase may constitute the entire migration. The facultative phase is a period following the obligate phase in at least some individuals of annual migrant populations in which further migration is induced by deteriorating environmental conditions (see Terrill 1987, 1988 for a detailed discussion; see also Lack 1983).

Partial migrant populations include some individuals that do and some that do not migrate from the same breeding area (Lack 1944, Shüz and Meise 1968, Gauthreaux 1982). The term has also been applied to species that are migratory in part of their breeding range and resident elsewhere (e.g. Bruun 1970, Hayman et al. 1986). To avoid confusion, we recommend that the term be used only to reflect the behavior of individuals within a population, not as a descriptor of species consisting of migratory and resident populations.

Partial migration is sometimes used synonymously with "facultative migration" (e.g. Gauthreaux 1982). Whereas partial migration can certainly be facultative, as in the Blue Tit (Parus caeruleus; Smith and Nilsson 1987), it can also be under more rigid, endogenous control (Berthold 1985). We therefore propose the term obligate partial migration to refer to the behavior of those individuals of a partial migrant population that migrate each year regardless of annual environmental variation or fluctuations in population density. Presumably, the behavior reflects a genetic polymorphism, and the impetus to migrate is primarily endogenous (e.g. German populations of the European Robin, Erithacus rubecula; Biebach 1983). We suggest that the term facultative partial migration be used for individuals that may or may not migrate in any given year. Whether an individual migrates appears to depend largely, if not entirely, on environmental conditions (e.g. Blue Tit; Smith and Nilsson 1987).

The term differential migration refers to the situation in which migration in some distinguishable classes of individuals (ages, sexes, races) differs with respect to timing, distance, or both (see Gauthreaux 1982). Recently, Kettersson and Nolan (1983) restricted use of the term to populations in which all individuals migrate (annual migrants), and that definition has been adopted by Berthold (1985). Of course, partial migrants can also exhibit differential timing or distance, and we propose that the term be used in its original, broader sense as a modifier of any of the migration categories outlined above.

**Literature Cited**


Received 11 September 1987, accepted 7 October 1987.