

Singing Behavior of Dark-eyed Junco

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Most birders and ornithologists probably do not include Dark-eyed Juncos on their list of most interesting singers. The junco's conspicuous songs are repetitive trills that are sometimes hard to distinguish from those of Pine Warblers and Chipping Sparrows. Within flocks, juncos utter numerous, seemingly nondescript calls. But even a few minutes of quietly following a junco around will reveal that these birds have a more extensive repertoire. In fact, to me, having listened carefully for several years, juncos are remarkable vocalists. Throughout the year they produce a varied and complex assortment of songs and calls. Ralph (1977), who studied winter flocks in Utah, described a minimum of seven call types. In my graduate work I looked at some of these, but I focused primarily on songs. Juncos produce two distinct types of song, one a trill and the other a lengthy complex series. For such a familiar and unimposing bird, this vocal repertoire presents an interesting challenge to one wishing to observe and understand animal communication.

In this article I discuss junco songs and mention calls only briefly. The distinction between calls and songs is not always clear. Calls are considered nonlearned, simple vocalizations that communicate messages such as alarm, distress, and the need to maintain contact. Songs, on the other hand, are often complex, longer, and in many species at least partially learned (Kroodsma and Miller 1996). Songs generally are considered advertisements for mates and of territorial ownership, and some function to stimulate a reproductive state in the singer or listeners.

It is helpful to define two terms: syllables and songs. Syllables (see Figures 1 and 2) are the units that make up songs. Blue-winged Warbler songs, for example, often are made up of the two syllables *bee* and *buzz*. Many bird songs are series of syllables repeated in a more or less unchanging order, with easily defined beginnings and endings. Examples include songs of Yellow Warbler and Red-winged Blackbird and the long-range songs of juncos (described below; see Figure 1). An individual bird may produce several song types, distinguished by differences in timing, pitch, and vocal quality (i.e., buzzy, rough, musical).

Other songs are more continuous, with the beginning and ending of each song less easily defined. Examples include many songs of Gray Catbird, European Starling, and short-range songs of juncos (Figure 2). Like the songs of warblers and blackbirds, these songs are composed of syllables, but the pattern in which the syllables are presented cannot be easily described.

A less often described but equally interesting way to look at songs is to consider the distances over which they function. Are they the equivalent of human whispers, normal conversations, or announcements made over loudspeakers? Is a particular type of bird song loud and easily carried over several territories? Or is it so quiet that only another bird a few feet away can hear it? The first type is conspicuous to human observers and has thus been well studied. The second type is more difficult to observe

but should be equally worthy of study. Junco songs of both types, which I term long-range songs and short-range songs, are described below.

I recorded juncos in the field during 1991-1993 (Blue Ridge Mountains, Virginia) and in captivity during 1994-1995. I attempted to record the entire repertoires of about sixty juncos (all birds were color-banded for individual recognition). Recordings were analyzed using one of several different sound analysis programs, and the resulting sonograms compared to determine repertoire size and amount of song sharing among individuals. I also looked at the function of songs through focal observations, song point counts, mate choice, and song playback experiments. This article includes information from several published papers (Titus 1997,1998; Titus et al. 1997; Nolan et al. in press), and unpublished results.

Two Song Categories of Junco Songs

Long-Range Songs (LRS, Figure 1). During the breeding season adult male juncos produce a loud trill that is normally considered the species' song. These songs most often consist of 7-23 repetitions of the same syllable over a period of 1.3 to 2.0 seconds (Titus 1998). About ten percent of LRS switch syllable types during the trill (similar to Nashville Warbler song). Most LRS sound fairly pleasant, although some are mechanical and buzzy. The song is followed after a period of 4-11 seconds by another nearly identical song (that is, of the same song type). This is the only vocalization given exclusively by males. Most males have 2-5 distinct LRS types. Because a song type is repeated many times before switching to a new type, an observer may need to listen for quite some time before hearing a new type.

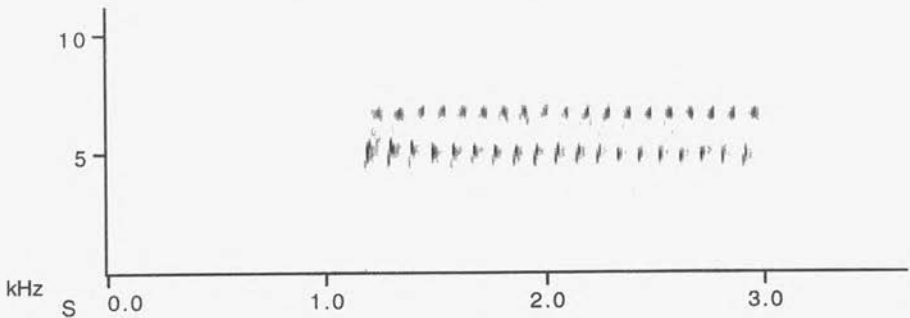


Figure 1. Junco Long Range Song: Frequency in kilohertz (kHz) versus time in seconds (S)

Junco LRS are similar to songs of Chipping Sparrow and Pine Warbler, but are usually distinguishable. Chipping Sparrow songs are usually longer than those of juncos, containing more syllables, up to sixty-two, compared with the junco maximum of twenty-five or so (Middleton 1998). The quality of Chipping Sparrow song is usually drier and more mechanical in a machine-gun-like way. Those junco LRS that sound mechanical tend to have a more ringing quality.

Pine Warbler songs are slightly shorter or the same length as junco songs, but tend to be softer and contain more notes sung at a faster pace. Some of the warbler's

songs vary in volume within the song, and some change in frequency and pace (Rodewald 1999). Where these three species occur together, however, I have occasionally heard songs that I could not positively assign to species by ear. Knowing local habitat preferences can help. In my study area, juncos occupied mixed high-altitude forests and openings, Chipping Sparrows were found in areas with short ground cover (such as lawns), and Pine Warblers were restricted to areas of mostly pines.

Within each male junco's repertoire of 2-5 versions of LRS, some may be slow and others rushed, some buzzy and others sweet, et cetera. Some song types cannot really be called trills — for example, they may resemble the mellow whistled songs of Tufted Titmouse. Occasional song types appear to be copied from other species but are still produced in the loud, lengthy bouts of long-range songs. One male in Virginia produced songs that sounded like those of an American Redstart. Williams and MacRoberts (1977) reported mimicry of a Brown Creeper by a male junco in California. All of these song variants were used at normal volume and seemed to function as normal LRS. Juncos in captivity (but able to hear wild birds outside their lab environment) have incorporated Spotted Towhee and House Finch songs into their long-range song repertoires (Marler et al. 1962).

Long-Range songs appear to function primarily as announcements of territorial ownership. They do not seem to be used in mate attraction early in the year since they are infrequent until after pairs have formed. Later in the breeding season, however, males whose mates have died greatly increase their rates of long-range song production. It seems likely that the function of this increase is to attract a new mate (Nolan et al. in press). LRS are given from the midupper levels of the forest canopy, from the tops of smaller trees, and from phone wires and similar locations (Nolan et al. in press). Males singing LRS very rarely forage or engage in other nonvocal behaviors, except for occasional preening. Normally, no other juncos are present within at least twenty meters (Titus 1998).

A variation of LRS appears to function over shorter distances. Quiet Long-Range Songs (an oxymoron; I've tried for several years to come up with a better term) are identical in structure to louder LRS but are produced at lower than normal volume, most often early in the breeding season. Males are unusually close to females during this type of LRS (average 3-10 meters), and they are usually perched in shrubs or low branches of trees (Titus 1998). Since no juncos other than the pair are likely to be within hearing range of these quiet songs, I believe that Quiet LRS may function to stimulate female reproductive condition. Songs have been documented to function this way in several species (Brockway 1969, Cheng 1992).

Short-Range Songs (SRS, Figure 2). Short-range songs are completely unlike the loud trills of LRS. Each syllable is most often followed by a different one, so instead of a trill one hears a complex song sometimes compared with that of American Goldfinch (Forbush 1929, Tanner 1958). Each junco repertoire contains 6-40 different syllable types, including whistles, rattles, buzzes, warbles, junco call types, and syllables from LRS. The maximum range at which SRS can be heard may be as short

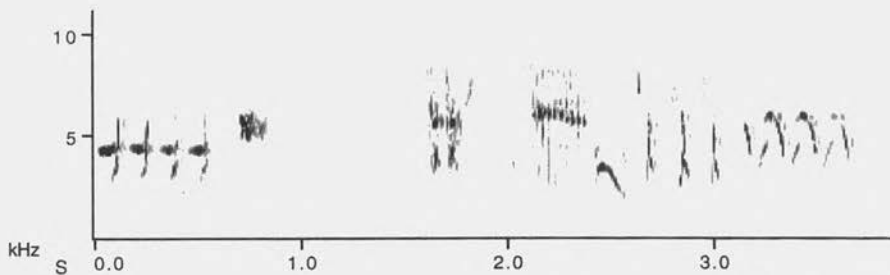


Figure 2. Junco Short Range Song: Frequency in kilohertz (kHz) versus time in seconds (s)

as 1-2 meters, but often lies between 10-20 m (Titus 1997; birds and humans are roughly equivalent in their powers of detection, and thus SRS should be audible to other juncos over only short distances).

SRS, like LRS, may contain phrases copied from other species' repertoires. In Virginia these included calls of American Goldfinch, Pine Siskin, and Red Crossbill (Titus 1998). Juncos housed in outdoor aviaries in Indiana included songs of Least Flycatcher and apparently Henslow's Sparrow (nearby breeders) in their repertoires (Nolan et al. in press).

Because short-range songs in many species are quiet and sound jumbled, they are often confused with subsong. Subsong is a transitory phase in song development given by juvenile birds or briefly by adults just prior to the breeding season. Subsongs are more varied than final adult songs and include syllables that will not ultimately remain in the adult's repertoire. Syllables do not have reliable pitch or timing, sounding different with each repetition. Junco subsong is infrequently observed. I have heard it during March and April in Massachusetts, and in captivity for only short periods in early spring and fall. In contrast, SRS is used throughout the breeding season, and syllables within SRS are stereotyped (sound the same throughout the breeding season). While subsong is thought to function only as a learning phase, observational and experimental evidence suggest that SRS is important in reproductive behavior. Use of SRS was highest when females were presumed to be fertile, and playback of SRS elicited strong responses by both males and females (Titus 1997, 1998). Most research on avian behavior has been conducted during the breeding season, when conditions are more favorable for field work. During this period true subsong should be rare, and many reports of subsong in the literature probably refer to SRS (Titus 1997).

As with LRS, Short-range songs can be divided into categories that differ in volume (thus range), structure, and function. The most frequently described SRS are used during courtship, when they are often part of a quite spectacular display (Forbush 1929, Hostetter 1961, Titus 1998). In these SRS, syllables are given at the rate of approximately one to three per second. Wide frequency sweeps (*tzweee*) and quiet call notes are often included in these songs. These SRS are generally difficult to hear at more than 15 m. These songs are often associated with particular behaviors. In the spring, males courting females may erect several tracts of feathers, including

those on the back, rump, sides, and crown, making themselves almost ball-shaped. Wings may be held low along the sides, and the tail is spread wide, flashing the bright white outer portions. Courting males may hop rapidly around females or between branches. Females may become moderately puffy at times but do not seem to vocalize when they do so. In addition to use in courtship displays, lone birds of either sex may produce these SRS, though without much display.

Rapid Short-Range Songs are faster and sometimes louder than regular SRS (although still carrying only short distances). They are frequently used during chases with other juncos, and often include quiet versions of LRS types. These and the previous SRS may be given during flight.

Simple Short-Range Songs are the lowest volume songs and are often composed of very few syllable types (note, however, that the ability to count syllable types depends on how easy it is to hear them, so I make the preceding statement cautiously). Simple SRS are used by pair members while they move about in close proximity to each other. Using standard recording techniques, it was usually impossible for me to determine with certainty which pair member(s) was singing. These songs are so quiet that they may be impossible to detect at distances of more than a few yards. Simple SRS appear more likely than the previous two songs to be composed of syllables that are repeated in recognizable patterns, for example ABC...ABC...AC...AC....

Seasonal Aspects of Junco Song


Spring: Males of most bird species return to breeding territories and, within the first day or two, begin singing their Long-Range Songs. In juncos, however, this sequence appears to be reversed. Males arrive a few days ahead of females, roaming in loose flocks. When females arrive, potential mating partners begin distancing themselves from flocks, possibly rejoining the flock later in the day, especially during inclement weather. LRS are infrequently heard. In this period, and until females begin incubating several weeks later, SRS are prevalent and easily observed by a careful, slow-moving observer who follows pairs at a few meters distance. During fights, presumably over territorial ownership, Rapid SRS may be observed. As the spring progresses, LRS become more common.

Summer: Males sing LRS throughout the day, with less evidence of a dawn chorus than in many species. By late summer LRS are infrequent. Females away from their mates may sing SRS or Simple SRS. SRS by males are uncommon at this time. In some cases, males courting potential new mates (such as males whose mates have died) have been observed singing SRS.

Fall: There are little data for this period. In the late summer/early fall I have seen hatching-year males sing SRS. Adult males occasionally produce LRS and SRS during the fall.

Winter: SRS are much more frequent than LRS during the winter, at least in eastern North America (Nolan et al. in press). Usually these are in the form of SRS or Simple SRS. They are often produced by lone males, although they also occur during

chases and fights. I have not yet observed females singing SRS in winter, but most females winter farther south than my study areas (Ketterson and Nolan 1976).

As outlined above, juncos use a variety of vocalizations throughout the year in a wide range of contexts. Many questions remain about singing behavior in this and other species. Some of the least studied areas for practically all species include nonbreeding season behavior, female song, and short-range song. Juncos, because of their abundance and approachability, provide an excellent opportunity to study the less conspicuous aspects of vocal communication. 

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DARK-EYED JUNCO, WILLIAM E. DAVIS, JR.

News from MassWildlife

Oystercatchers – MassWildlife coordinated the most comprehensive survey of breeding American Oystercatchers ever conducted in the Commonwealth by compiling data from 50 biologists censusing nearly 150 coastal beaches. . . . Preliminary results show the birds nesting at 48 sites along the coast with 41 pairs found on Nantucket, 38 pairs on the Vineyard and 25 pairs at the Monomoy National Wildlife Refuge in Chatham. One hundred fifty total breeding pairs were counted and overall reproductive success estimated at 0.6 chicks fledged per pair. As their name implies, oystercatchers feed on shellfish and sandworms. While the population is increasing in Massachusetts and expanding steadily northward along the New England coast, the species is receiving increasing conservation attention because of its overall rarity. The entire North American population is estimated at only 7500 individual birds.

Swan Survey – MassWildlife has been surveying the resident Mute Swan population in the Commonwealth since 1986, when 585 of the feral white birds were counted. The most recent survey, completed during the summer of 2002, reveals 947 swans now calling Bay State waters home. The survey is done every three years by flying over areas east of Route 495, including Cape Cod and the Islands, and counting the bright white adults and their grayish-colored cygnets. Greater Boston and inland swan reports are checked from the ground. The survey is scheduled for early August, a time when adult swans are molting and young swans are still unable to fly. Of the 947 total birds counted, 779 were adults and 168 were young. Fifty-seven pairs with broods were noted with an average of 2.9 cygnets per brood. Swans colonized Massachusetts decades ago when the birds, originally brought from Europe and introduced in New York, became established in the wild. Common in southeastern Massachusetts, swans have expanded north along the coast, up the Connecticut River valley from Long Island Sound, and have become established at scattered lakes and ponds in central Massachusetts. Subsequent to the 1986 survey when 585 swans were counted, surveys have been conducted in 1989 (565), 1993 (660), 1996 (917), 1999 (980) and 2002 (947).