Describing Bird Sounds in Words

Visit the ABA website <aba.org/pubs/birding/archives/vol39no4p54w1.html> to listen to recordings of the bird songs described in this article.

The idea that birdsong cannot be adequately put to paper is more than conventional wisdom among birders. It is dogma. If you don't believe me, just pick up any recent field guide and leaf through the introduction. In the section introducing song descriptions, you inevitably find disclaimers like the following:

- "Word syllabifications in most books vary; ears differ." (Peterson 1990)
- "Words at best provide a very feeble sound impression." (Sibley 2000)
- "One birder's *chip* is another's *tsip* or *chik* or even *peek*." (Dunn and Alderfer 2006)

I am convinced that the prevailing pessimism, however, is largely unjustified. Words *can*, in fact, describe bird sounds with a high degree of accuracy. Ears do differ, but except in the case of a few very high-pitched songs, most of us can hear most of the same frequencies perfectly well. Our problem, for the most part, is not so much that we *hear* differently as that we *speak* and *think* differently about what we hear. And this is a problem that can be solved with a standardized vocabulary—a systematic method of describing bird songs that will help not just field guide authors, but everyday birders working on learning the songs in their area, and even those who simply heard a neat sound in the forest and want to find out what it was.

As everyone knows, bird sounds can be represented graphically, and many systems have been invented for this, including, most successfully, the spectrogram or "sonogram". The usefulness of sonograms can hardly be overstated. The art of reading them is not as difficult as many fear—it mostly requires a little practice listening to the sound and looking at the sonogram at the same time. You can listen to the recordings of all of the sonograms in this article at the ABA website <aba.org/pubs/birding/archives/vol39no4p54w1.html>. For those who want more practice, highly accessible but comprehensive introductions to reading sonograms can be found in *The Singing Life of Birds* by Donald E. Kroodsma and *The Sound Approach to Birding* by Mark Constantine and coauthors. Note: The recordings and sonograms in this article are mine, as are the analyses summarized in the accompanying tables.

It is important to understand that the two methods of word description that are arguably most common—analogy and phonetic transcription—are not the primary concern of this article. Analogy is the comparison of one sound to another (e.g., "like a squeaky wheel"), while phonetic transcription is the representation of a sound in human speech (e.g., *wheep!* or *please' please' please' to meetcha*). Although they can be useful in many situations, both of these methods have fatal flaws that render them inferior to simple word descriptions.

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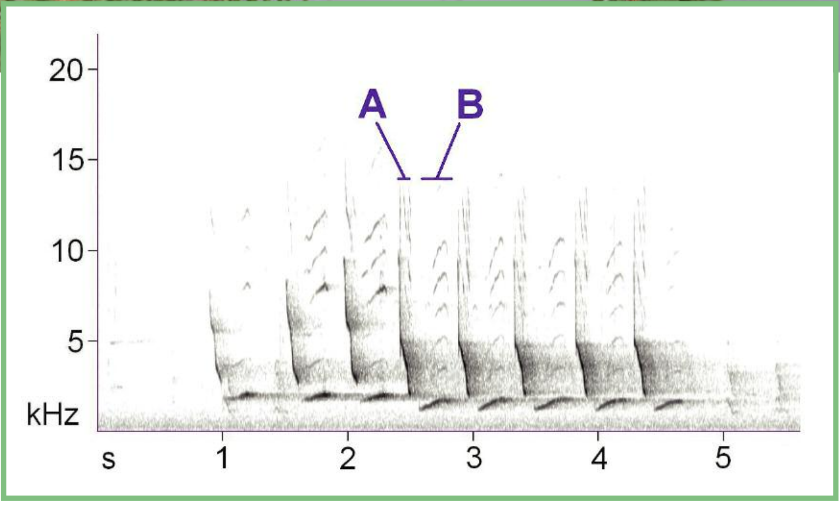
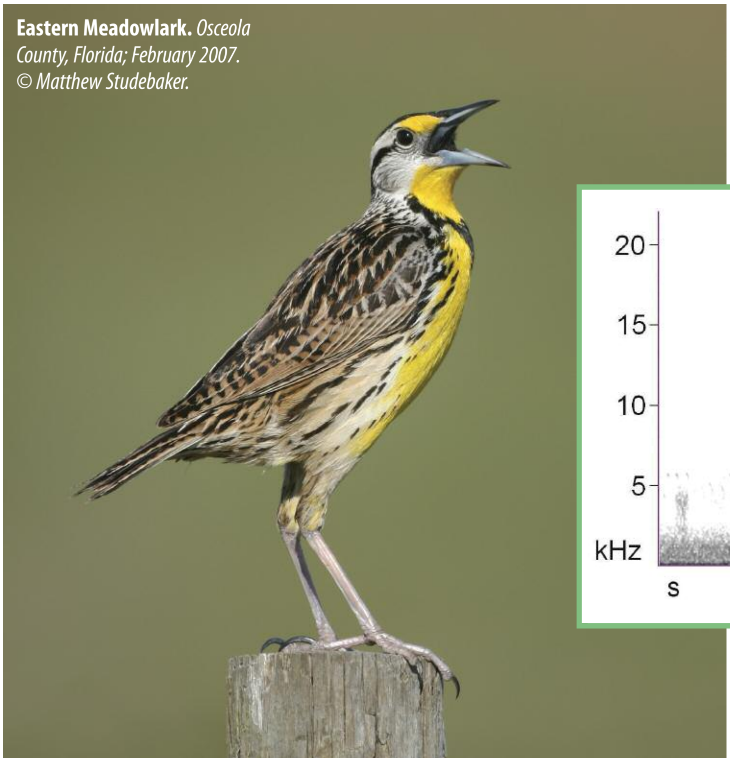
Northern Cardinal. *Summit County, Ohio; January 2006. © Mathew Studebaker.*



Primary song. Phillips County, Arkansas; 27 March 2006. This song type consists of alternating sharply downslurred whistles **(A),** which are rather unmusical, and lower, slowly upslurred whistles **(B),** which are very musical. This song is mostly whistled, but several harmonics are faintly visible; these may be responsible for the "rich" quality of the whistles. *Figure by © Nathan Pieplow. Listen to the vocalizations at the ABA website.*

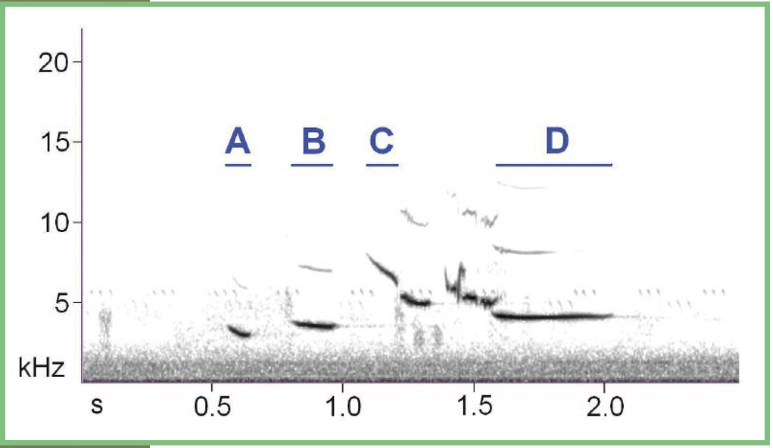
The problem with analogy is its limited audience: Analogies are marvelously effective at creating sound pictures in the heads of those familiar with the referenced sound, but practically useless for everyone else. It does you little good to know that Gray Vireo's song is faster and less burry than that of Plumbeous Vireo if you don't have an excellent mental tape of Plumbeous Vireo to play in your head.

The problem with phonetic transcription, meanwhile, is its limited capacity to carry information: Human language is not good at imitating bird sounds, for bird sounds rarely share significant characteristics with human speech, and thus phonetic transcriptions usually end up conveying mostly rhythmic information, with little or no regard to pitch, tone quality, variation, or any other crucial components of birdsong. I should emphasize that both analogy and phonetic transcription can, in fact, be tremendously useful if carefully employed, and they may not be entirely beyond the bounds of standardization themselves; but due to their flaws, they should be used only to supplement standardized descriptions, never to substitute for them.



Eastern Meadowlark. *Osceola County, Florida; February 2007. © Matthew Studebaker.*

Primary song. Larimer County, Colorado; 24 June 2005. For the most part, this is a clear whistled song, although faint traces of the first harmonics can be seen above most of the notes. Notes **B** and **D** are monotone; **A** and **C** are downslurred. Note **C,** as it is higher and more sharply downslurred than the others, is the least musical of the bunch. *Figure by © Nathan Pieplow. Listen to the vocalizations at the ABA website.*



In order for song descriptions to be standardized, they must describe all perceptible *properties* of a vocalization. These perceptible properties can be divided into four broad categories, corresponding to the four basic types of auditory information the human ear is capable of discerning: pitch, tone quality, rhythmic pattern, and volume. In addition, because bird vocalizations are variable, a complete word description should also discuss variation.

Pitch

Pitch refers to how high or low on the scale the vocalization is: that is, which musical note the bird is singing, if indeed it is singing one. Many people consider pitch to be completely synonymous with **frequency**, but acousticians distinguish between the two. They define pitch as *the subjective impression of frequency*.

The difference is important because although a sonogram may be able to represent frequency in a measurable, quantitative fashion, the human ear does not work quite as efficiently. For a variety of reasons, it is impossible for any human ear to ascribe a musical pitch (e.g., a note on the piano) to most sounds made by birds. For one thing, many bird vocalizations are pitched well above the range of human music, at frequencies where pitch discrimination is problematic at best. For another, a great many bird sounds are harmonically complex, comprising not a single tone but an admixture of several. Finally, even harmonically simple sounds, if they change pitch extremely quickly, may fool the human ear into interpreting them as complex.

Thus the absolute pitch of birdsongs is usually impossible to judge, even for those lucky few with "perfect pitch"—although it can have a significant impact on tone quality (see p. 51). *Relative* pitch—the difference in pitch between different sounds, or between different parts of a sound—is far easier to discern. For instance, you don't have to know which notes a Black-capped Chickadee is singing to recognize that the second part of its song is lower than the first. Relative pitch can be useful in identification and description, but its most useful incarnation is called inflection.

Inflection is the change in pitch within a single sound. Inflection can often be readily distinguished even when absolute pitch cannot: The diagnostic buzzy *zhreee?* call of the Pine Siskin, for instance, is unmistakably upslurred, even though the harmonic complexity of the call itself defies pitch classification. In near-instantaneous terms, intonation can be of three types: *upslurred* (rising), *downslurred* (falling), or *monotone* (unchanging). The Black-capped Chickadee's *hey-sweetie* song contains three notes (the second two of which are often perceived as a single note, in which case the song is usually transcribed *fee-bee*) that are all essentially monotone: There is a sharp change in pitch *between* the first and second notes, but there is little or no perceptible pitch change *within* any of the notes.

In addition to these three terms, the tendency of birds to modulate frequency in complicated ways recommends the use of a few other descriptors. I have coined the term *overslurred* to describe pitches that rise and then fall, and *underslurred* to describe pitches that fall and then rise. These terms are synonymous with the terms *downward-arched* and *upward-arched*, respectively, of Evans and O'Brien (2002)—a terminology I find counterintuitive, as it would describe the Gateway Arch in St. Louis as a "downward" arch. Although many authors describe it merely as a downslur, the primary song of the Eastern Screech-Owl is usually an overslurred trill with an early peak: a brief upslurred part followed by a much longer downslurred part. The classic *pee-yoo-wee* song of the Eastern Wood-Pewee is usually perceived by human ears as a long, drawn-out underslur. Overslurs are very common among bird vocalizations, underslurs less so.

Other descriptors that some may find useful include *unsteady* for pitches that irregularly slide slightly flat or sharp (e.g., the song of the White-throated Sparrow), *indeterminate* for elements whose intonation cannot readily be discerned (usually because of their short duration and sharp inflection, e.g., the individual notes in a Chipping Sparrow's song), and *warbling* for vocalizations that change pitch rapidly in no simple pattern (e.g., the song of the aptly named Warbling Vireo).

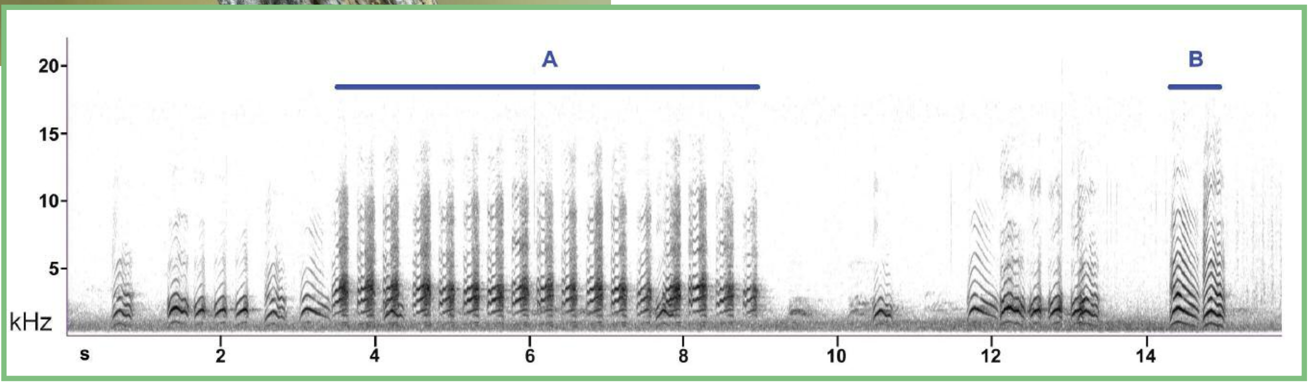

Pinyon Jay. *Lake County, Oregon; August 2006. © Alan Murphy.*

Tone Quality

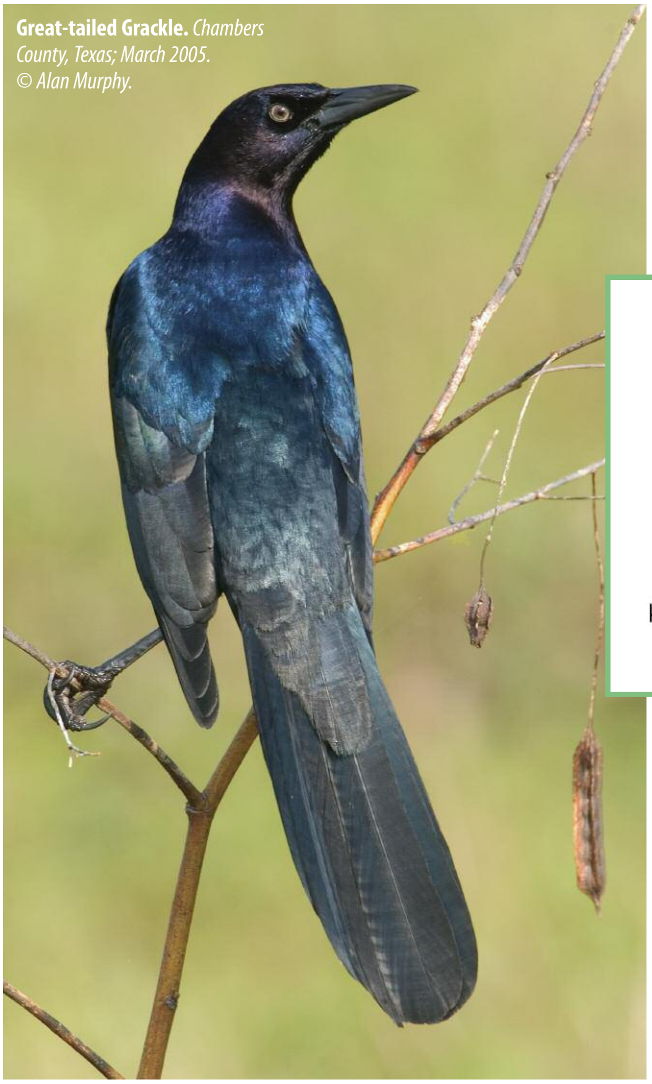
Tone quality, which acousticians call **timbre** (rhymes with "amber"), is one of the most important characteristics of bird sound, but has traditionally been considered one of the most difficult to communicate in words. I daresay that tone quality, more than any other item in this list, is ultimately responsible for the frustration many birders feel with song descriptions. Nevertheless, once we do away with phonetic transcriptions and analogies—and particularly those most insidious analogies, the anthropomorphic descriptors such as "plaintive" and "querulous" and "cheerful"—we find that tone quality can be discussed in useful subcategories that are largely objective. These include **texture**, **nasality**, and **musicality.**

Texture can be of two types: *beats* and *noise*. Either, both, or neither of these may be present in a sound. A sound that has no texture (no beats and no noise) can be described as *clear*. Familiar clear bird sounds include the usual whistles of the Northern Cardinal and Carolina Wren, the territorial hooting of the Great Horned Owl, the song of the Mourning Dove, the *Chicago* call of the California Quail, the namesake call of the Northern Bobwhite, and the tin trumpet noises of the Red-breasted Nuthatch.

Beats, to the acoustician, are regularly repeated modulations in amplitude or frequency. Beats, to the birder, are what distinguish a trill from a simple clear whistle. In bird songs, modulations are usually in both amplitude and frequency, and the difference between these types of modulation (AM and FM) may be imperceptible in many cases. When present, beats can be measured in modulations per second, also known as Hertz (Hz). The rate of slow beats, up to about 10–15 Hz, can usually be measured in the field with some accuracy by experienced observers with a watch.

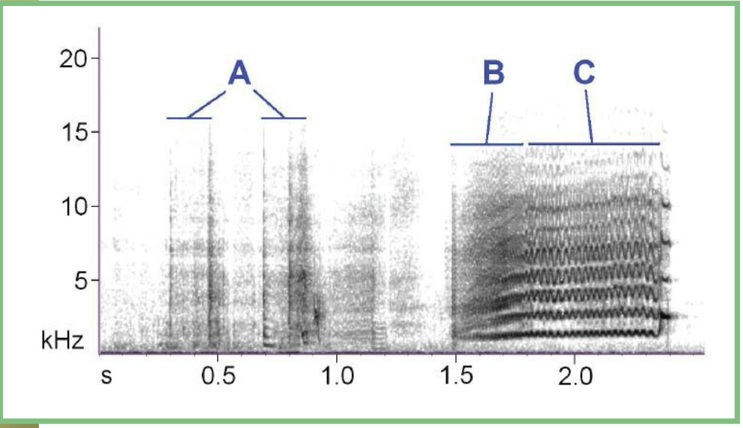


Adult calls and juvenile begging calls. Fremont County, Colorado; 18 May 2005. The juvenile begging calls are labeled **A;** they are in strict monotone series, each upslurred and nasal at the beginning, noisy at the end. Notes **B** are typical of adult calls; the "zebra stripe" pattern of many strong harmonics indicates strong nasality, and the arched shape indicates an overslurred intonation. *Figure by © Nathan Pieplow. Listen to the vocalizations at the ABA website.*



Great-tailed Grackle. *Chambers County, Texas; March 2005. © Alan Murphy.*

Primary song. Weld County, Colorado; 21 May 2006. Notes **A** are the "stick-breaking" noises typical of eastern populations; the strong vertical lines represent popping or clicking sounds, and the "mess" in between is noise similar to that of static. Part **B** of the song starts out noisy, but develops a voice with fast beats that rises in pitch. In part **C,** the highly nasal voice with beats has lost its noise content. Note that because the harmonics are multiples of the fundamental frequency, the rate of any change in the fundamental frequency is also multiplied; this is why the beats appear progressively more exaggerated with each higher harmonic. *Figure by © Nathan Pieplow. Listen to the vocalizations at the ABA website.*



Faster beats can be difficult to measure accurately without sound analysis equipment, but with experience some decent estimations are possible. Slower beats (below about 15–20 Hz) tend to be perceived as whinnies or trills. Faster beats tend to be perceived as burry or buzzy tone qualities. The presence or absence of beats is a major feature distinguishing, among others, "Eastern" from "Mexican" Whip-poor-wills, Scarlet and Western Tanagers from American Robin, the "classic" Common Raven croak from the *caw* of the American Crow, and the Rock Pigeon's *coo* from the primary song of any North American dove (see Table 1).

Table 1. Beat Rates of Some Sample Bird Vocalizations.

Species	Vocalization	Hz (beats per second)
Eastern Screech-Owl	overslurred whinny	12–14 Hz
Chipping Sparrow	primary song	12–15 Hz (rarely to 7 Hz)
Northern Parula	rising buzzy trill	20–30 Hz (variable)
Plumbeous Vireo	primary song	40–60 Hz
Cassin's Kingbird	*chi-queer* call	125 Hz
Common Nighthawk	*peent* vocalization	240 Hz

Noise is aperiodic, essentially random sound that contains energy at many audible frequencies without discernible pattern. Non-bird sounds that consist mostly of noise include those of waterfalls and television static. When bird sounds contain a lot of noise, they are typically described as "harsh": for example, the *shreck* of Steller's Jay, or the hissing of angry swans or geese. Examples of sounds that are intermediate between noisy and clear include the *raaak* of a Clark's Nutcracker, the hoarse scream of a Red-tailed Hawk, and the grunting whinny of a Virginia Rail: We can hear a "voice" inside these sounds, but we can also hear noise. A sound can contain noise and beats simultaneously, as do the chattering scolds of some wrens, and the drumming of woodpeckers and Ruffed Grouse. Sounds like the latter two, which consist of noise without any audible "voice", I often describe as *toneless*.

Nasality is a measure of the amount of energy distributed among harmonics of the sound. Sounds that we discern as *whistles* (e.g., all the examples of clear sounds above, save the Red-breasted Nuthatch) have essentially no harmonics: All their energy is concentrated on a single frequency at any given time, so that their sonograms can be drawn using single lines. Harmonics are components of the sound that are produced at the same time, but at frequencies that are integer multiples of the original sound, which is called the fundamental. Thus if a bird creates a complex sound with a fundamental of 2 kHz, the first harmonic will be at 4 kHz, the second at 6 kHz, the third at 8 kHz, and so on. On the sonogram, the harmonics will show up as "phantom" copies of the fundamental sound, situated directly above it at more-or-less regular intervals. Rather than hearing this set of simultaneous sounds separately, our brains perceive a single sound with a complex tone, one that we frequently (but not always) interpret as nasal.

Ideally, I would like to tell you that sounds can be classified as *whistled* if they do not contain harmonics, and as *nasal* if they do, but unfortunately the situation is a little more complicated. Although we are not likely to interpret whistled songs as nasal, our ears do tend to interpret some nasal songs as whistled, particularly if they are relatively high-pitched. Thus there remains some work to be done on deciding how to discuss this aspect of tone quality.

Finally, the tone qualities of bird sounds can also vary in their **musicality.** This might be defined as the extent to which a sound's pitch can be determined by human ears (see discussion under "Pitch", p. 50). In the case of clear whistles, musicality is dependent entirely upon two variables: (a) frequency and (b) the speed or "sharpness" of inflection.

As the pitch of a clear monotone whistle changes from low to high, it will change from a cooing or hooting sound, like that of the Mourning Dove or Great Horned Owl (ca. 0.25–0.4 kHz), to a "mellow" high whistle, like that of the Northern Saw-whet Owl or Northern Pygmy-Owl (both ca. 1 kHz), to a "thin" high whistle, like that of the Eastern Wood-Pewee or the *hey-sweetie* song of the Black-capped Chickadee (ca. 3–5 kHz), to an unmusical sibilant sound, like the song of the Black-and-white Warbler or the calls of the Cedar Waxwing (ca. 6–9 kHz). These last "high-sibilant" sounds are unmusical only because of their pitch, not because of their noise content, but they are frequently confused with high-pitched noisy sounds like the sound of the letter *–s* in English; the difference can be subtle and difficult to distinguish.

The other variable affecting tonality/musicality is the "sharpness" of inflection. When whistles change pitch slowly, we tend to interpret them as highly musical (e.g., the slower songs of Northern Cardinal), but the faster they sweep across a pitch range (i.e., the more vertical the line on the sonogram), the closer they come to producing all the intermediate pitches at once, a situation our brains tend to interpret as noise. The "classic" song of the Chipping Sparrow, then, is less musical than the "classic" song of the Dark-eyed Junco primarily because its elements are more sharply downslurred than those of the junco.

Note that there is one other significant factor that can affect tone quality: polyphony, in which both sides of a bird's syrinx produce sound simultaneously, so that it is "speaking with two voices". Relatively rare among North American birds, this fascinating phenomenon complicates matters enough that I have chosen not to discuss it in this article.

Black-throated Sparrow. *Riverside County, California; January 2007. © Brian E. Small.*

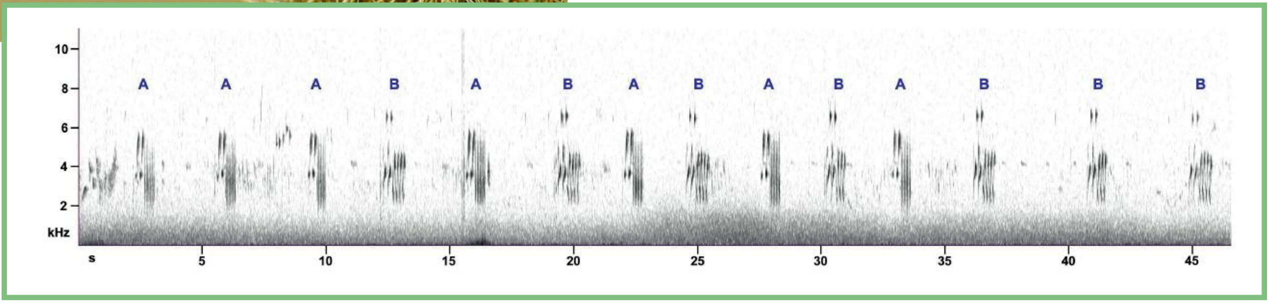
Rhythmic Pattern

Rhythmic pattern is the behavior of the sound in time. It is essentially identical to what acousticians measure with an oscilloscope and call the "envelope" of the sound.

The rhythmic patterns of bird songs can be extraordinarily complex. However, of all the sound characteristics discussed here, they are also some of the most quantifiable and easily measured in the field. In particular, the **duration** of particular songs or song elements and the **rate** at which those songs or song elements are delivered can usually be fairly accurately measured in the field by anyone with a decent timepiece.

Duration of phrases or song bouts can be important in

Primary song. Mesa County, Colorado; 7 April 2007. Although this song pattern fits the definition of variable variety, note the strong tendency toward alternating variety. This tendency usually distinguishes Black-throated Sparrow's song from that of Bewick's Wren, which can sound very similar in western Colorado, but which typically repeats song types dozens of times before switching. *Figure by © Nathan Pieplow. Listen to the vocalizations at the ABA website.*



identification. Also useful is measuring how long the singer pauses between songs. Both of these measurements often vary within and among individuals, but phrase length is frequently less variable than repeat rate, and thus more important to note. In either case, a range of durations can be given when variation is great.

Rate is easiest to describe and measure when simple elements or phrases are repeated, as in a trill or a series of monosyllables, in which case the most important question is whether the pattern is *accelerating*, *decelerating*, *irregular*, or *strict* (unchanging). In all four instances, quantitative rate information can be recorded in elements per second; approximate maximum and/or minimum rates can be given if the rhythm is not strict. Note that elements repeated extremely quickly (faster than 10–20 Hz or so) become perceptible as beats.

Table 2. Types of Variety.

Type of Variety	Pattern	Primary Song Examples
no variety	A A A A A A A...	Least Flycatcher, Indigo and Lazuli Buntings, "Red" Fox Sparrow
alternating variety	A B A B A B A...	Eastern Phoebe, Western Wood-Pewee (dawn song), Bell's Vireo
eventual variety	A A A B B B B C...	Hutton's Vireo, Carolina and Bewick's Wrens, Northern Cardinal, meadowlarks
immediate variety	A B C D B A E C...	Red-eyed Vireo, Hermit and Varied Thrushes, "Slate-colored" and "Thick-billed" Fox Sparrows
variable variety	A B C C D B B E...	Hammond's and Dusky Flycatchers, American Robin, Scarlet and Western Tanagers

Volume

Volume is incontestably the least important item in this list. For better or for worse, contrasts in volume rarely provide us with valuable identification information. Song descriptions should probably mention the volumes of songs that sound particularly loud and carry far, or that sound extraordinarily soft and attenuate quickly, or that contain certain parts of a bird's song that are more likely than others to be heard at a distance. More importantly, some vocalizations do have a noticeable *crescendo* or *decrescendo*, and these always bear mentioning. The strong crescendo of the Ovenbird, for instance, is perhaps the single most distinctive feature of its song.

Variation

Variation is the final essential ingredient in the complete voice description. Most bird vocalizations are variable; what the birder needs to know is *how* and *when* they are variable. What does the bird repeat? What does it *not* repeat? What do consecutive songs have in common? Is a single bird likely to alternate between two phrases, repeat one phrase for a while before switching, or change songs continually?

This last question is familiar to eastern birders accustomed to separating the songs of the Northern Mockingbird, Brown Thrasher, and Gray Catbird by their patterns of variation. However, differences in variation, particularly variation in patterns of song delivery (which some authors call **variety**), can be hugely important in other identifications also. Birds can sing with *no variety*, when consecutive phrases are always the same; *alternating variety*, in which two song types alternate back and forth; *eventual variety*, in which the bird sings one song type repeatedly, then switches to another which it repeats for a while; *immediate variety*, in which consecutive song types are always different; and *variable variety*, which is like immediate variety, except that consecutive song phrases are repeated now and then (see Table 2). Fitting birds into these five boxes, of course, simplifies their actual behavior, and birds can sometimes sing patterns atypical of their species; some species regularly switch patterns. Nonetheless, variety is an important and easily observed characteristic.

Obviously, the terms and concepts discussed in this article are not sufficient in themselves to build a completely standard vocabulary for describing bird song in words. However, I do hope they will stimulate a lively discussion of the ways in which we can and should improve our methods for writing such descriptions. In particular, regardless of what terminology we end up using, we should strive to listen more carefully to bird sounds and to study them on sonograms and note how their acoustic structure contributes to what we hear.

And most important of all, when we set about describing a bird sound in words, we should avoid the temptation to describe how the sound makes us feel or what it reminds us of, because those things exist in us, not in the sound. Instead we should strive to describe what is there: what can be measured with a stopwatch, pointed out on a sonogram, and defined in an empirical fashion. I cannot claim yet to have accomplished this with pinpoint accuracy. But I firmly believe that it can be done, and I firmly believe we should start to do it.

Literature Cited

Constantine, M., A.B. van den Berg, and M. Robb. 2006. *The Sound Approach to Birding*. The Sound Approach, Dorset.

Dunn, J.L, and J. Alderfer. 2006. *National Geographic Field Guide to the Birds of North America*, fifth edition. National Geographic Society, Washington.

Evans, W.R., and M. O'Brien. 2002. *Flight Calls of Migratory Birds*. Old Bird, Ithaca.

Kroodsma, D. 2005. *The Singing Life of Birds*. Houghton Mifflin, Boston.

Peterson, R.T. 1990. *A Field Guide to Western Birds*, third edition. Houghton Mifflin, Boston.

Sibley, D.A. 2000. *The Sibley Guide to Birds*. Knopf, New York.