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Developing a key to bird songs along Panama's Pipeline Road using xeno-canto recordings

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A fascinating tale of how a birder new to Panama developed a tool to help himself and other birders visiting Pipeline Road get to grips with more than 300 vocalisations from more than 200 bird species.

"Wow! We're hearing songs from a dozen species of birds, and I have no idea what they are. Isn't that great?" I directed the rhetorical question towards my 12-year-old niece as we took a walk in the hills of central Panama. My niece regarded me quizzically, as she often did. The truth was that, after 40 years of birding in the United States, I was bored with seeing and hearing the same old species of bird, week after week, year after year. Yet now, in this Panamanian forest, I was awakening with fresh excitement: I was about to learn hundreds of new, exotic songs and the birds singing them.

1 Pipeline Road, Panama (Kent Livezey). Hearing and seeing several scores of bird species here is an everyday event.

Shortly after I retired as a wildlife biologist with US Fish and Wildlife Service in 2012, my wife Nancy and I moved to Panama, her home country. She would have been happy had we stayed in beautiful western Washington state, with its cool winters and our home's amazing view of Mt. Rainier. But I was drawn to the rainforests and birds of Panama, and she readily agreed to make the move.

As many *Neotropical Birding* readers are well aware, one of the amazing things about Panama is that, within a 45-minute drive of the high-rises of downtown Panama City, national parks protect rainforests full of wildlife ranging from monkeys and big cats to toucans and trogons. This is because, for more than a century, Panama has been protecting much of its forests in the watersheds that supply the Panama Canal with its water.

Pipeline Road

About 25 km northwest of Panama City lies the small town of Gamboa. During World War II, a petroleum pipeline and its service road were built across the isthmus of Panama, from Gamboa northward to Colon. The pipeline was never used, but the 17.5-km, single-lane, dirt road persists, and grants entry through the centre of the 22,100-ha Parque Nacional Soberanía.

It's easy to bird all day in this area yet not notice the two old pipes stretching through the forest. According to *A bird-finding guide to Panama* (Angehr *et al.* 2008), "Pipeline Road is one of the best places to see tropical forest birds in the Americas, with a species list exceeding 400," a total that comprises c.40% of Panama's 1,002 species. The eBird hotspot 'Pipeline Road (Camino del Oleoducto)' reports a total of 450 species, more than any other location in Panama (eBird 2016).

Learning Pipeline Road's bird vocalisations

I started birding Pipeline Road shortly after we moved to Panama. I soon logged scores of mornings there, both alone and with my friend Domiciano Alveo, who is a guide. (Now I guide there myself!) In addition to descriptions of vocalisations in a recent field guide to Panama's birds (Angehr & Dean 2010), two tools sped up learning the songs and calls. The first was xeno-canto, the community website dedicated to sharing bird sounds from around the world (www.xeno-canto.org was introduced to *Neotropical Birding* readers by Planqué & Vellinga 2008). I spent hundreds of hours listening to vocalisations of species occurring along Pipeline Road and other parts of Latin America available from that incredible resource. Like many readers, I downloaded hundreds of songs onto my mobile phone to help me learn calls and songs while in the field.

The second tool, however, was one of my own. Over time, I developed a key to the songs and calls of the birds of Pipeline Road.

What is a key to bird vocalisations?

You may have worked with keys in a botany class where you made choices such as opposite vs alternate leaves, or in an entomology class where you decided between characteristics such as one or two pairs of wings. Using an established key helps you narrow down identifications, hopefully arriving at a single taxon.

Making a key oneself forces the originator to critically identify similarities and differences between and among characteristics. But, unlike when you have a plant or insect in hand and available for close *visual* scrutiny, keys to vocalisations demand choices based on what you *hear*. For many people, this is a tougher assignment. Fortunately, vocalisations on xeno-canto are accompanied by sonograms (actually spectrograms), so you can 'see' them, which in turn helps you hear what's going on.

Even so, this is no 'walk in the park'. Very few bird song keys exist at all (I found only two for North America: Stephenson & Whittle 2013 and Felley 2016). In terms of the Neotropics, I am not aware of any, let alone one that covers hundreds of songs. So when I started, I was heading into uncharted territory.

Developing the key necessitated many drafts over three years. As published (Livezey 2016), the key currently covers 321 songs and calls of the 216 species most commonly heard in the Pipeline Road area, including the nearby wetlands. To help users avoid having to contend with species that should not be where or when he or she is birding, I parsed the key into four broad habitat types and times of activity (diurnal vs nocturnal). Free downloads of the key are available in its published form; however, since I may be revising the key over time, you may wish to get the most up-to-date version from my website or by e-mailing me (details at end of article).


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2 Male Red-crowned Woodpecker *Melanerpes rubricapillus*, Pipeline Road, Panama, December 2010 (Joseph Tobias). Two songs: a loud, harsh *churr-r-r-r* and a quick *whicka-whicka-whicka*.

3 Male Black-cheeked Woodpecker *Melanerpes pucherani*, Arenal, Costa Rica, February 2014 (Phil Yates/pjayphotos.com). Two songs, both loud, churring, and rattling, but one is lower and rougher.

4 Scaly-throated Leaftosser *Sclerurus guatemalensis*, Pipeline Road, Panama, January 2011 (Joseph Tobias). The two upslurring, sharply whistled songs are described in the excerpt from the key.

5 Black-breasted Puffbird *Notharchus pectoralis*, Canopy Tower, Panama, May 2015 (Beth Hamel; http://tinyurl.com/hawkperson_flickr). The long, loud, whistled song is described in the excerpt from the key.

6 Male White-whiskered Puffbird *Malacoptila panamensis*, Pipeline Road, Panama, December 2010 (Joseph Tobias). Both songs are quiet, high, thin, hissing, and almost insect-like.

7 Male Purple-throated Fruitcrow *Querula purpurata*, Pipeline Road, Panama, December 2010 (Joseph Tobias). Three songs include a short series of loud, melodious *whoops*, usually rising at the end: *whooop, whooop, whooOOP!*

8 The easily imitated, whistled song of the male Fasciated Antshrike *Cymbilaimus lineatus* is described in the excerpt from the key. Photographed at Gamboa, Panama, August 2013 (Vivek Tiwari/www.flickr.com/spiderhunters).

9 Male Spotted Antbird *Hylophylax naevioide*s, Gamboa, Panama, January 2011 (Joseph Tobias). The three vocalisations are a rapid, sharp trill, a few sharp *chip…chip, chip* calls, and an airy series of about 8–10 elements, each of which sound like *WHEEEEEza*.

10 Bicoloured Antbird *Gymnopithys bicolor*, Canopy Tower, Panama, May 2015 (Beth Hamel; http://tinyurl.com/hawkperson_flickr). Song is a series of about 8–12 harsh, airy whistles.

11 Checker-throated Antwren *Epinecrophylla fulviventris*, Pipeline Road, Panama, January 2011 (Joseph Tobias). Competing males sometimes turn up the volume and increase the tempo when scolding each other as close as c.20 cm apart.

12 Streaked Flycatcher *Myiodynastes maculatus insolus*, Gamboa, Panama, January 2011 (Joseph Tobias). At dawn and dusk, males sing a nasal, musical *wheet!-fididi-wheet!*, but, during the day, utter only a nasal, sharp *chik!*

13 Streaked Saltator *Saltator striatipectus*, Gamboa, Panama, January 2011 (Joseph Tobias). Three songs range from a very high-pitched, sharp *tsit* to a series of sweet runs mixed with strong, clear, downslurring whistles.

14 Plain-coloured Tanager *Tangara inornata*, Gamboa, Panama, January 2011 (Joseph Tobias). Both single-element and trilling songs are very high pitched.

Using the key

Once you have downloaded the key, I recommend that you first read and understand the definitions of terms, listening to each of the examples from xeno-canto. Then, read the table of contents, which shows the order in which choices are made between characteristics. For example, does the song trill or churr? Does it upslur or downslur? Does the tempo accelerate or decelerate? Does the pitch rise or fall? (When one tries to describe a bird song, many adjectives may come to mind in no particular order. However, within a key, it is imperative that descriptors are used in a consistent order to group similar songs together, eliminate duplication, and optimise the probability the users correctly identify the birds.)

Then go through the choices in the key and listen to the songs. Look carefully at the spectrograms that are provided with each song to *see* how, for example, songs upslur, accelerate in tempo, or fall in pitch. (For excellent advice on how to read spectrograms, see Pieplow 2007 and McCallum 2010a, 2010b.) In many cases, choices end with several species when there is no objective way to describe how the species differ; when that happens, I provide relative comparisons via text or tables. Final species choices link to songs from xeno-canto. A way to streamline keying-out a song is to make the first few choices via the table of contents, jump to the appropriate part of the key (ctrl + click on the page number), and go from there. Within the key itself, you can jump down choices using hyperlinks. If, after using the key, you have any suggestions to improve it, please e-mail me.

Could this key be the first of many?

If you visit Pipeline Road, I believe that using my key will help you get to grips with the bird vocalisations that you hear. Of course, I realise you may never bird in central Panama. Nevertheless, reading through the key should help fine-tune your mind and ears to many of the nuances of bird vocalisations and, therefore, make you a better listener to songs in other areas.

Moreover, if I can develop a key to bird sounds, so can you. If you're planning on birding an area for a long time (i.e. rather than making a single, short visit) and are trying to master the region's bird vocalisations, I encourage you to make a key that covers all of the songs and calls of birds inhabiting that area or, at least, the ones you find to be troublesome. I suggest you follow a consistent pattern of choices—one that works for you and the songs in your area.

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EXCERPT FROM THE KEY TO BIRD VOCALISATIONS OF PIPELINE ROAD

Here's an excerpt from the key, presented for illustrative purposes. Definitions of the terms used (e.g. of 'upslur', 'element', 'phrase' and 'section') are contained in the key itself.

ELEMENTS UPSLUR

Tempo accelerates and decelerates

Scaly-throated Leaftosser *Sclerurus guatemalensis*. A "long series (sometimes continuing for several minutes) of sharp whistles" (Angehr & Dean 2010, p194), starting with several upslurring whistles followed by about 3–12 non-upslurring, accelerating whistles that fall then rise: *Weeep! Weeep! Weeep! Weeep! We-we-we-we-we-we*. Each section lasts about 4 seconds and can blend almost seamlessly into the next as if riding a roller coaster up and down, up and down, etc. (www.xeno-canto.org/16068 by Ken Allaire)

Tempo is steady

Pitch rises

Wedge-billed Woodcreeper *Glyphorynchus spirurus*. About 6–8, upslurring, sharp elements that rise in pitch and then end abruptly: *Clee clee clee clee clee clee clee.* Sharper than song of Olivaceous Flatbill *Rhynchocyclus olivaceus*. (www.xeno-canto.org/92916 by Tom Stevens)

Olivaceous Flatbill *Rhynchocyclus olivaceus*. About 4–6 upslurring, rising, wheezy elements: *weee weee weee weee weee*. Airier than song of Wedge-billed Woodcreeper. (www.xeno-canto.org/158862 by Rodrigo Dela Rosa)

Pitch falls

Song ends in falling couplets

Black-breasted Puffbird *Notharchus pectoralis*. About 15–50 strong, nasal, fast, upslurring whistles *Wheep! Wheep! Wheep!* at about 2–2.5 per second, followed by a series of about 8–12 "descending couplets: *whik-kooo, whik-koo, whik-ku*" (Angehr & Dean 2010, p170) at about one per second. (www.xeno-canto.org/108270 by Jerome Fischer)

Song does not end in falling couplets

Song is composed of one phrase of repeated elements; does not have a pause after the first element

Scaly-throated Leaftosser *Sclerurus guatemalensis*. A strong, sharp, fast series of about 8–12 upslurring whistles, the last two or three of which fall. About five elements per second. Faster and stronger than song of Fasciated Antshrike. (www.xeno-canto.org/112873 by Sander Bot)

Fasciated Antshrike *Cymbilaimus lineatus*. A series of about 4–8 clear, upslurring whistles, with the first two or three elements slightly higher than the rest. About two elements per second. Easily imitated by whistling, unlike songs of the other species in this section. (www.xeno-canto.org/24194 by Ken Allaire)

Tropical Gnatcatcher *Polioptila plumbea*. A series of about 8–14 high, airy, thin, upslurring falling elements. Airy, unlike songs of the other species in this section. (www.xeno-canto.org/59517 by Mike Nelson)

Song is composed of three sections; has a pause after the first element

Brown-capped Tyrannulet *Ornithion brunneicapillus*. A "series of 4–7 high-pitched whistled notes; the first one or two [upslurred] notes…[are]…followed by a distinct pause, …[then a fast phrase composed of a] series of notes…descending rapidly: *fwee, fee-fee-fii-fi*" (Angehr & Dean 2010, p222), terminating in an upslurred *weet!* Variations include skipping the first note, the pause, the last note, and all but the first note. (www.xeno-canto.org/92095 by Mike Nelson, www.xeno-canto.org/18618 by Ken Allaire)