

YELLOW-GREEN VIREO IN ARIZONA, WITH NOTES ON VIREO SONGS

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Most ornithologists believe that the only valid and authentic evidence of a bird's occurrence in an area is one or more specimens, something that can be studied in detail by anyone interested at any subsequent date. Trautman and Trautman (1968) have stated this principle very clearly and have based their list of Ohio birds almost entirely on specimens, excluding species based on sight records only. Tape recordings of two birds formed the basis for including Bell's Vireo (*Vireo bellii*), the only species for which they had no specimens. (Since the Trautmans' paper was published, a specimen of Bell's Vireo has been taken in Ohio.)

Perhaps the Trautmans have set a precedent. In any event, it seems to me that tape recordings—which, like specimens, can be studied in detail by anyone interested at any subsequent date—can provide evidence of a bird's occurrence in an area that is just as valid and authentic as specimens. The purpose of this paper is to document, on the basis of a tape recording, the occurrence in Arizona of a Yellow-green Vireo (*Vireo flavoviridis*), a species which has not previously been reported from that state (Phillips et al. 1964).

On 18 June 1969, while making recordings at a roadside rest area on State Route 82 about 4 mi. SW of Patagonia, Arizona (about 16 mi. NE of Nogales), I obtained a recording of a bird of which I got only a few glimpses, but not a look good enough to identify it by sight. By the time I could play some of its songs back to it in order to bring it into the open, the bird had apparently left the area. The recording was made with a Nagra III B recorder using a tape speed of 15 ips, and with a D-33 American microphone mounted in a 24-inch parabola. This recording is No. 10271 in the tape collection of the Bioacoustics Laboratory, Ohio State University; it is about 4½ min in length and contains 162 songs. The singing of this bird was much like that of a Red-eyed Vireo (*Vireo olivaceus*), but the quality was a little like that of a House Sparrow (*Passer domesticus*). All I could tell of the bird's appearance was that it was about the size of a large vireo (such as the Red-eyed), and appeared to have some yellow on its underparts. Several people in

Arizona who were familiar with the songs of the birds in the Patagonia area were unable to recognize this bird from my recording, and the bird was not found on subsequent visits to this roadside rest area. A copy of this recording was sent to L. Irby Davis, who has recorded several species of vireos in México and Central America; he said (pers. comm.) that it *might* be a Yellow-green Vireo.

The roadside rest area where this recording was made is a narrow area some 150–200 yards long on the southeast side of the road. Southeast of this strip, the land rises abruptly from rocky cliffs at the northeast end to a steep brushy slope at the southwest end. There are numerous trees and shrubs in this rest area, principally sycamore (*Platanus Wrightii*), walnut (*Juglans major*), hackberry (*Celtis reticulata*), mesquite (*Prosopis juliflora*), catclaw (*Acacia Greggii*), and elderberry (*Sambucus mexicana*). Just across the road from the rest area is Sonoita Creek, which has a flow of water and is bordered by similar vegetation, plus willow (*Salix Gooddingii*), ash (*Fraxinus velutina*), and cottonwood (*Populus Fremontii*). The dominant shrub forming the undergrowth in the woods along the stream is *Baccharis* sp. The elevation here is about 3900 feet. The bird kept to the tops of the larger trees (where it was concealed by the foliage), and ranged over some 50 yards or more of the southwest end of this area.

The tape collection at Ohio State University contains 394 recordings of vireos (not counting No. 10271), representing eight species. Through the kindness of the Cornell Laboratory of Ornithology and Don Kroodsma of Oregon State University, 31 additional vireo recordings have been made available to me. All of these recordings have been studied in some detail, and a great many of the songs in them have been graphed (using a Kay Electric Company Vibralyzer). Since making recording No. 10271, I have been able to study identified recordings of all species of vireos occurring in the United States. A summary of the recordings studied of eight of these species is given in table 1.

Two general types of singing occur in our vireos: (1) relatively long songs (usually ¾

TABLE 1. Summary of the Group 2 vireo recordings studied.

Species	No. recordings studied	Recordings audiospectrographically analyzed	
		No. recordings	No. songs
Hutton's Vireo	8 ^a	8	98
Gray Vireo	2 ^b	2	265
Yellow-throated Vireo	45	7	327
Solitary Vireo	34	9	424
Black-whiskered Vireo	7 ^b	3	356
Red-eyed Vireo	78	6	405
Philadelphia Vireo	11	4	50
Yellow-green Vireo	13 ^b	6	289
Recording No. 10271	1	1	162

^a Includes five borrowed from Cornell University, and two borrowed from D. Kroodsmä.

^b All borrowed from Cornell University.

sec or longer) uttered at rates up to about 15 per min (rarely faster), and (2) shorter songs (usually $\frac{1}{2}$ sec or shorter) uttered at rates of 50–60 (rarely more) per min. The vireos in Group 2 are sometimes (e.g., Saunders 1935; Bent 1950) described as having “long-continued song” consisting of short “phrases.” Since the short vocalizations of these birds appear comparable to the longer vocalizations of the vireos in Group 1, where the term “song” is generally used (e.g., by Saunders 1935 and by Bent 1950), it seems preferable to call the short vocalizations of the vireos in Group 2, *songs*. Some authorities would call these short vocalizations “syllables,” but this term is better used for the individual units of these vocalizations (e.g., two syllables in each of the songs in graphs 49–54, fig. 2).

Species in the first group, i.e., vireos with longer songs, uttered relatively slowly, include Black-capped Vireo (*Vireo atricapillus*), White-eyed Vireo (*Vireo griseus*), Bell's Vireo (*Vireo bellii*), and Warbling Vireo (*Vireo gilvus*), while species with shorter songs, uttered more rapidly (Group 2), include Gray Vireo (*Vireo vicinior*), Solitary Vireo (*Vireo solitarius*), Hutton's Vireo (*Vireo huttoni*), Yellow-throated Vireo (*Vireo flavifrons*), Black-whiskered Vireo (*Vireo altiloquus*), Yellow-green Vireo (*Vireo flavoviridis*), Red-eyed Vireo (*Vireo olivaceus*), and Philadelphia Vireo (*Vireo philadelphicus*).

Many of the songs in my recording No. 10271 resemble those of a House Sparrow (cf. graphs 93–101 with 102–108, fig. 3), but this recording was certainly not made from a House Sparrow. The songs in 10271 are of many different types or patterns, and these patterns are sung in an irregular sequence;

only once in the 162 songs did the bird sing the same song twice in succession. House Sparrow vocalizations are generally of only one or a few types, and a bird often utters the same type many times in succession. The pitch trend through most House Sparrow vocalizations (see graphs 102–108, fig. 3) is downward; such a pitch trend is not characteristic of the songs in 10271.

The songs in recording No. 10271 are certainly those of a vireo in Group 2. Six of these vireos (all except the Black-whiskered and Yellow-green) have been reported from Arizona (Phillips et al. 1964), but the Yellow-throated, Red-eyed, and Philadelphia Vireos are of accidental occurrence there (at least in southern Arizona).

The songs of the vireos in Group 2 differ in length, quality, and the number of syllables they contain. The song quality is affected by the abruptness of the slurring, by whether or not there is frequency modulation rapid enough to give the songs a hoarse or burry quality, and by the pitch. The various species also differ in the rate at which the songs are sung, in the number of different songs (or song patterns) an individual bird may have, and in the sequence in which the different songs are sung. Data on some of these song features for the vireos in Group 2 are given in table 2.

The vireos in Group 2 may be arranged in three groups on the basis of the size of an individual's repertoire and how this repertoire is used. In sub-group *a*, which is characteristic only of Hutton's Vireo, each bird sings songs of a single pattern, at least in most bouts. In sub-group *b* (Gray, Yellow-throated, and Black-whiskered Vireos), each bird usually has a small repertoire, generally of 12 or fewer different songs, and the sequence of the songs is variable, i.e., sometimes the sequence is irregular, sometimes regular, and sometimes a given song is sung two or more times in succession. Birds in sub-group *c* (Solitary, Red-eyed, Philadelphia, and Yellow-green Vireos) have repertoires of 13 or more different songs which are sung in an irregular sequence, and a given song is only rarely sung twice in succession. The bird in recording No. 10271 is in the third of these sub-groups.

The syllables in the songs of all these vireos consist of one or more slurs, and the slurring varies in abruptness. When the slurring is not very abrupt, there are generally only one or two slurs in a syllable, and the syllables sometimes (Yellow-throated, and some songs of Hutton's and Solitary Vireos) have a hoarse or burry quality. Each syllable in the songs of

TABLE 2. Summary of some characteristics of vireo songs.

Species	Song length (sec)		Songs/min		Pitch range of most songs (kHz)	No. syllables per song		Max. no. song patterns per bird	Sequence of song patterns
	Range	\bar{x}	Range	\bar{x}		All songs	Most songs		
Hutton's Vireo	0.18-0.35	0.285	24-41	32.8	2.4-5.4	1-2	1	1	—
Gray Vireo	0.15-0.25	0.208	32-43	37.5	1.7-4.0	1-2	1	12	Usually in a regular sequence
Yellow-throated Vireo	0.26-0.50	0.351	8-31	21.4	2.0-3.8	1	1	6	Sometimes in a regular sequence
Solitary Vireo									
western	0.16-0.72	0.351	11-29	21.0	2.0-4.3	1-3	1	17	Irregular
eastern	0.19-0.58	0.332	14-34	24.8	2.0-4.5	1-3	1-2	13	Irregular
Black-whiskered Vireo	0.16-0.70	0.506	26-31	28.8	2.0-5.0	1-3	2	9	Usually irregular; sometimes in a regular sequence for a while
Red-eyed Vireo	0.14-0.82	0.345	13-60	34.0	2.0-6.0	1-5	2-3	43	Irregular
Philadelphia Vireo	0.19-0.84	0.395	16-38	22.7	2.5-6.0	1-5	2	25	Irregular
Yellow-green Vireo	0.08-0.23	0.168	22-81	41.0	2.1-5.0	1-2	1	21	Irregular
Recording No. 10271 Patagonia, Ariz.	0.05-0.22	0.149	26-54	40.2	2.0-5.5	1-2	1	44	Irregular

the Yellow-green Vireo (and those in recording No. 10271) usually contains several abrupt slurs, and many songs have a quality similar to that of a House Sparrow.

Each individual of the short-sunged vireos (Group 2 above), and particularly those with many different songs (sub-group *c* of Group 2), seems to have some songs that are very similar to those of other individuals, and other songs that are quite different from any songs of other individuals. It may be that the songs of the first sort provide *species* recognition (by the birds themselves, and by the human bird-watcher), and those of the second sort, *individual* recognition. Graphs 38-39 and 40-41 of figure 2 are examples of the same song being sung by different individuals.

Some brief comments about the singing of the eight species of vireos in Group 2 may be of interest.

HUTTON'S VIREO

The singing of this species differs from that of the other short-sunged vireos in that the songs in most bouts of singing are all of the same type. The songs have been described (Bent 1950; Peterson 1961; Robbins et al. 1966) as being two-noted: *tcher-ree*, *ser-ree*, or *zu-weep*, and ending with a rising inflection; the songs in most of the recordings studied (graphs 1-4, fig. 1) fit this description, but the songs in others (e.g., graph 5, fig. 1) consist of a slurred note with one or two slurred elements.

This vireo breeds from southwestern British Columbia south along the Pacific Coast to central México, and eastward in southern United States to the Chisos Mountains of

southwestern Texas. It occurs principally in scrub oaks and evergreens, and in the southwestern mountains up to elevations of about 7000 ft. I have not seen this vireo in the Patagonia area of Arizona, but it might occur there.

GRAY VIREO

Each song of this species contains a few slurs that are not very abrupt, and usually has a burry quality (graphs 6-14, fig. 1); a few songs are a little like some songs of Hutton's Vireo (cf. graphs 2 and 9, fig. 1). Most birds appear to have a relatively small vocal repertoire, and the different songs are usually sung in a regular sequence. The songs are similar to those of the Yellow-throated and western Solitary Vireos, but are shorter and more rapidly uttered.

The Gray Vireo breeds in southwestern United States and northern México. In the United States it occurs north to southern Nevada and southwestern Utah, and eastward into northeastern Arizona, southeastern Colorado, western Oklahoma, and western Texas; in México it breeds in northwestern Baja California and extreme northern Coahuila. Its habitat varies from deciduous scrub to dwarf coniferous woodland, usually at 3000-6500 ft elevation.

YELLOW-THROATED VIREO

The songs of this vireo are relatively low pitched and usually have a burry quality; they generally contain only a few gradual slurs (graph 15-27, fig. 1). Each bird has a small repertoire of songs, and generally sings these songs in a regular sequence i.e., two or three

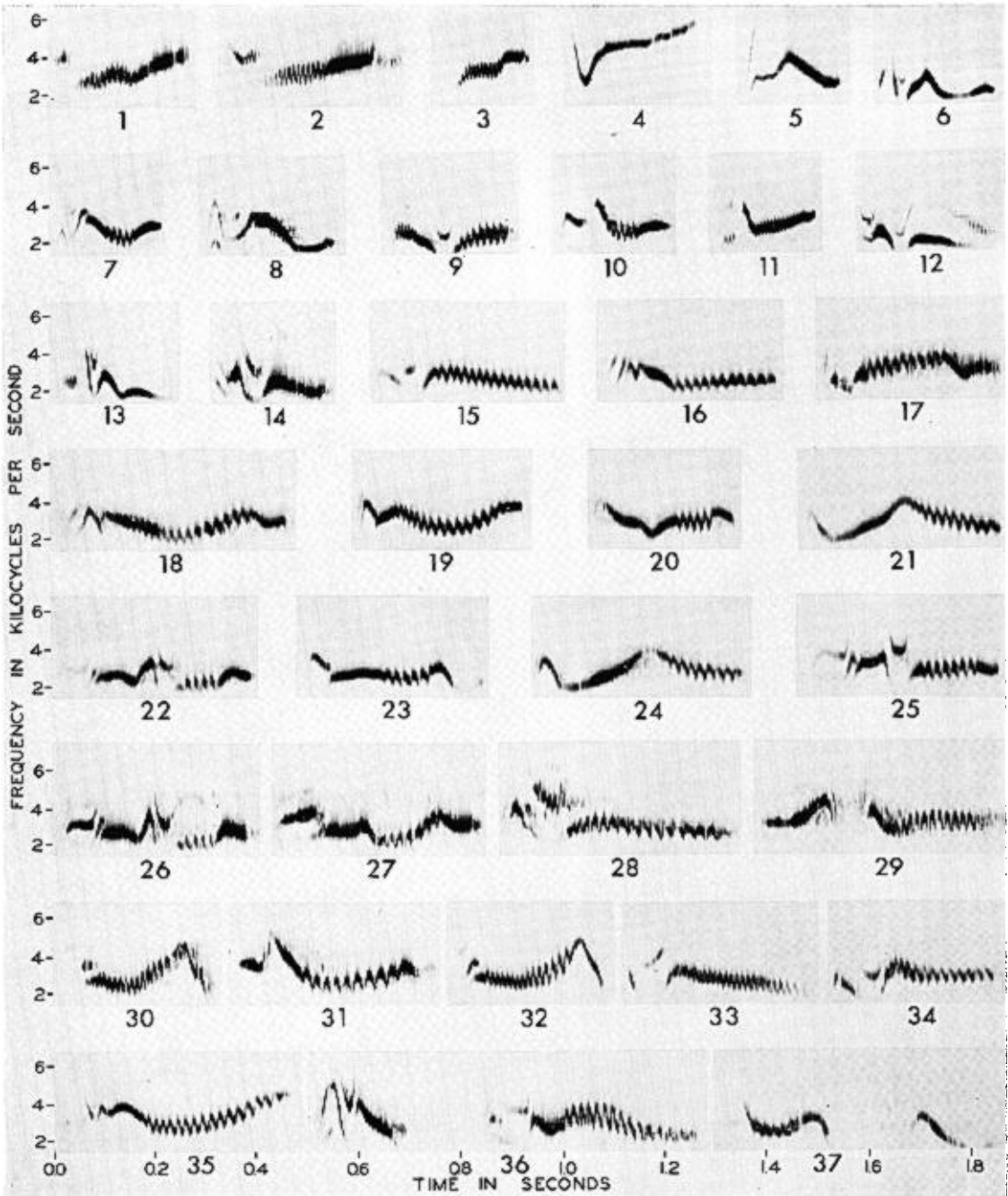


FIGURE 1. Vireo songs. Graphs 1-5, Hutton's Vireo; 6-14, Gray Vireo; 15-27, Yellow-throated Vireo; 28-37, western Solitary Vireo.

Locations: 1, 2, 5, Corvallis, Ore.; 3, San Francisco, Calif.; 4, Big Bend Natl. Park, Texas; 6-14, Kingman, Ariz.; 15, 16, 18, 20-22, 24-26, Franklin Co., Ohio; 17, Lucas Co., Ohio; 19, Charleston, S. C.; 27, Athens, Ohio; 28, 29, 31, 35, Flathead Lake, Mont.; 30, 34, 37, Portal, Ariz.; 32, 33, 36, Catalina Mts., Pima Co., Ariz.

in a particular sequence for a while, then two or three other songs in a particular sequence.

The Yellow-throated Vireo is an eastern bird whose breeding range normally extends westward only to eastern Oklahoma, Kansas, and the Dakotas. It usually occurs in deciduous woods.

SOLITARY VIREO

The songs of the eastern and western members of this species, at least in the recordings studied (22 from the east and 17 from the west), are different enough to be from two different species. The songs of eastern birds (graphs 38-48, fig. 2) are similar to those of the Red-

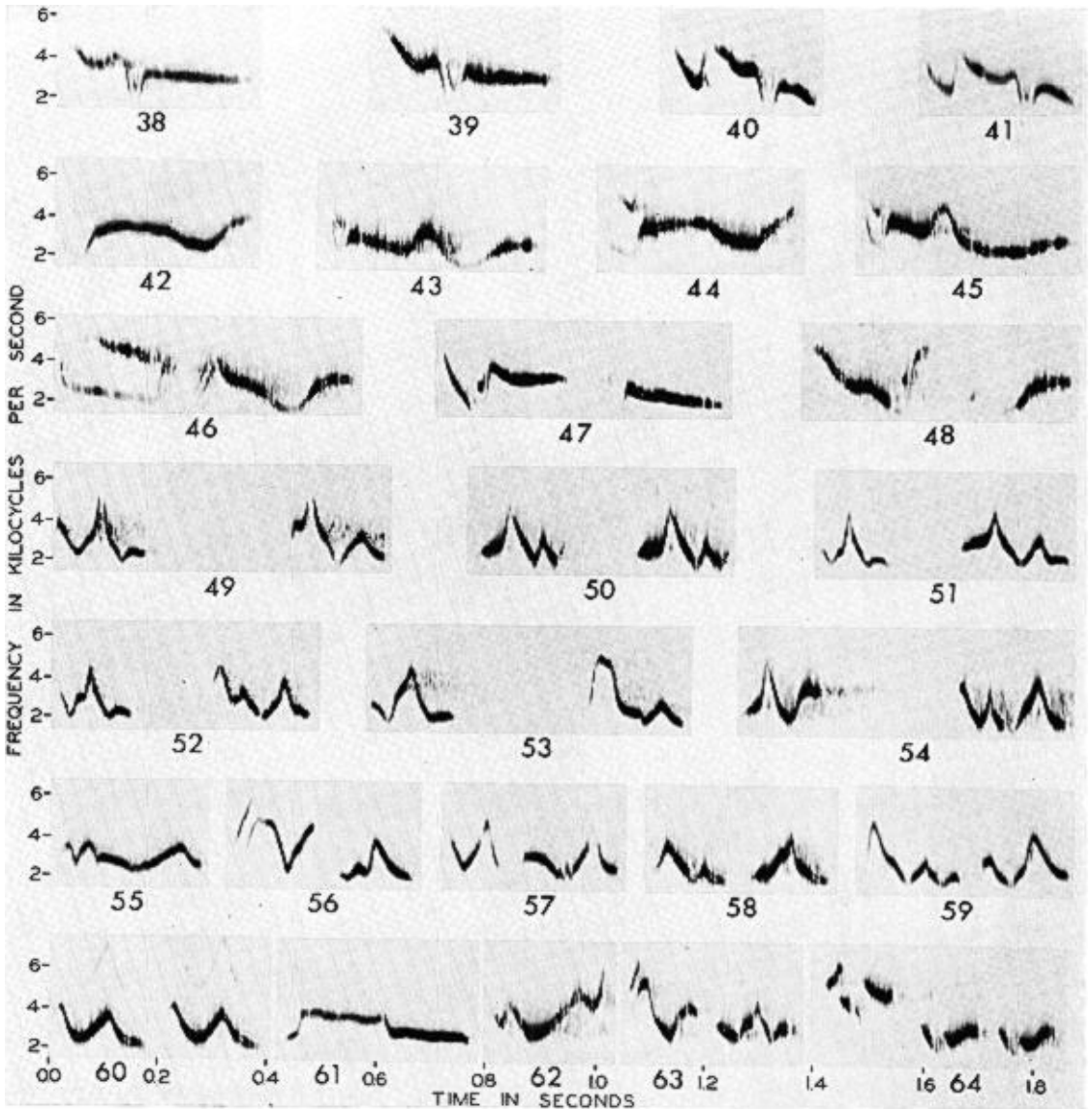


FIGURE 2. Vireo songs. Graphs 38-48, eastern Solitary Vireo; 49-54, Black-whiskered Vireo; 55-64 Red-eyed Vireo.

Locations: 38-48, Lincoln Co., Maine; 49, 53, 54, N. Key Largo, Fla.; 50-52, Miami, Fla.; 55, 58, Lucas Co., Ohio; 56, 57, 60, 61, Franklin Co., Ohio; 59, Prestonburg, Ky.; 62-64, Itasca State Park, Minn.

eyed Vireo, but they are not sung as rapidly, they do not have a hoarse or burry quality, and the slurring is less abrupt. The songs of western birds (graphs 28-37, fig. 1) resemble those of the Yellow-throated Vireo (cf. graphs 28-37 with 15-27, fig. 1); most are hoarse or burry in quality. Each of the western birds has a repertoire of as many as 13 songs, the eastern birds, repertoires of as many as 17 songs, which are not sung in a regular sequence. Members of this species rarely sing a given song twice in succession.

Two well-marked races are represented in the western material studied, *V. s. cassini*

(near Flathead Lake, Montana), and *V. s. plumbeus* (Colorado and Arizona); no significant song differences were found in the songs of these two races (cf. graphs 28, 29, 31, and 35 with 30, 32, 33, 34, and 36, fig. 1).

This vireo is widely distributed over the United States and Canada. In the East it breeds chiefly in the northern states and Canada, but in the Appalachians it breeds as far south as Georgia. It breeds throughout the western states, but in the Southwest it occurs principally in the mountains. It is a bird of hardwood and coniferous forests.

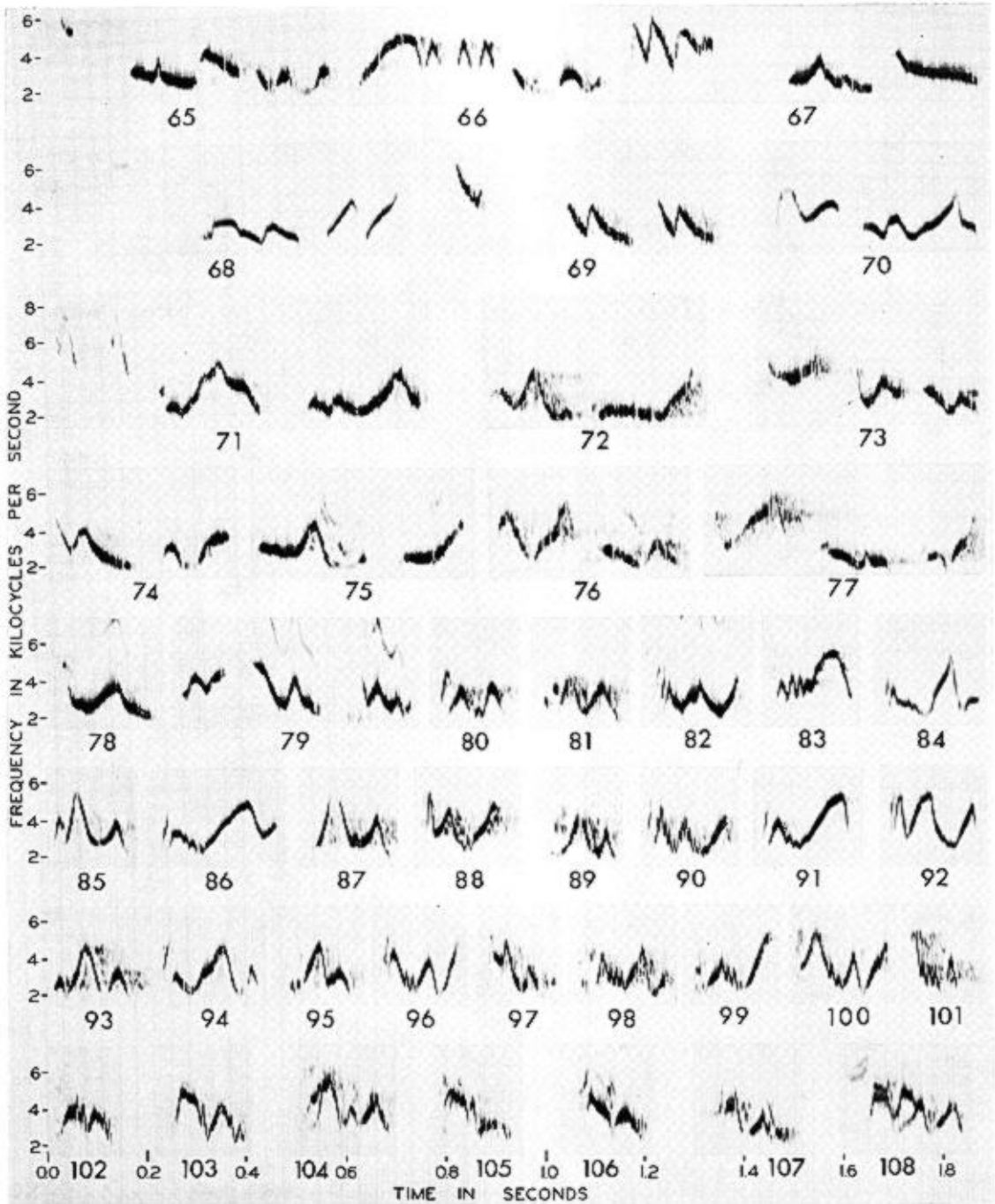


FIGURE 3. Vireo and House Sparrow songs. Graphs 65-71, Red-eyed Vireo; 72-79, Philadelphia Vireo; 80-92, Yellow-green Vireo; 93-101, recording No. 10271; 102-108, House Sparrow.

Locations: 65, 66, Itasca State Park, Minn.; 67-71, Flathead Lake, Mont.; 72-79, 102-108, Franklin Co., Ohio; 80, 85, 87, 90, Choluteca, Honduras; 82, 83, Piste, Yucatan, México; 84, 86, 91, Gamboa, C. Z.; 88, Estel, Nicaragua; 89, Hopelchen, Campeche, México; 92, Champoton, Campeche, México; 93-101, Patagonia, Ariz.

BLACK-WHISKERED VIREO

The songs of this vireo are similar to those of the Red-eyed, but average a little longer, and the singing is a little more deliberate. The songs contain one to three (usually two) syllables that are separated by a silent interval

as long or longer than the syllables (graphs 49-54, fig. 2) (generally shorter than the syllables in the Red-eyed Vireo). Each bird has a repertoire of several syllables, which are used in different combinations in different songs; some songs (e.g., graph 50, fig. 2) con-

tain two syllables of the same type. The different syllables are very similar. The different songs are sung in a varied sequence; sometimes the sequence is irregular, sometimes two or three patterns are sung in a regular sequence, and a bird may sometimes sing a given song two or more times in succession.

The breeding range of this vireo extends from southern Florida (from about Tampa Bay southward) south into the West Indies. In southern Florida this vireo is usually found in mangroves and hammocks.

RED-EYED VIREO

Songs of this vireo (graphs 55–64, fig. 2, and graphs 65–71, fig. 3) are robin-like in quality (rarely hoarse or burry), and are uttered rather rapidly. Each song contains one to five syllables, and each syllable consists of two or more slurred elements. Most eastern songs contain two syllables; songs of western birds (e.g., graphs 65–71, fig. 3) generally contain more syllables and are a little longer. Occasional two-syllabled songs of eastern birds have the two syllables alike (graph 60, fig. 2); western songs often contain a given syllable uttered twice in succession (graph 66, 68, 69, 71, fig. 3). Each bird has a large repertoire of syllables; in eastern songs a given syllable is generally used in only one combination, but in western songs may be used in different combinations. Each bird has a large number of different songs, which are not sung in any fixed sequence; only rarely will a bird sing the same song twice in succession.

This species is probably the most common and widely distributed of our vireos, occurring throughout the United States and southern Canada, but it is rare or absent in the Southwest. It occurs principally in deciduous woods.

PHILADELPHIA VIREO

The songs of this vireo (graphs 72–79, fig. 3) are very similar to those of the Red-eyed Vireo; they contain one to five (usually two or three) syllables, and each syllable contains one or more slurred elements. The songs average a little longer than the songs of Red-eyed Vireos in the East. A few syllables in some songs are quite short (less than 0.05 sec).

The Philadelphia Vireo breeds in the northern United States and southern Canada from

northern New England and Quebec west to eastern Montana and Alberta. It usually occurs in more open woods and shrubby areas than the Red-eyed Vireo.

YELLOW-GREEN VIREO

The songs of this vireo (graphs 80–92, fig. 3) are similar to those of the Red-eyed Vireo, but they are shorter, less musical, and usually uttered at a faster rate. Most songs consist of a single syllable; each syllable in a two-syllabled song may be sung alone as a complete song. Each song contains up to several slurs, which are generally rather abrupt; some slurs show a frequency modulation (zigzag lines on the graph; see especially graphs 83, 86, 90, fig. 3). Each bird has a repertoire of many different songs, which are not sung in a fixed sequence.

This vireo breeds from northern México south to the Canal Zone in second growth woodlands, orchards, roadside and shade trees, and similar habitats. It is quite rare as far north as the United States, but has been recorded in the Brownsville-Harlingen region of Texas and in southern California (Riverside and Dana Point).

Since the songs in my recording No. 10271 resemble those of a Yellow-green Vireo in quality, song length and syllable content, singing rate, frequency modulation in some slurs (see especially graphs 96, 98, 99, fig. 3), and in the nature and use of the bird's repertoire, I conclude that the bird singing these songs *was* a Yellow-green Vireo.

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