

# SONGS OF FINCHES (FRINGILLIDAE) OF EASTERN NORTH AMERICA

DONALD J. BORROR

*Department of Zoology and Entomology, The Ohio State University, Columbus 10*

In the preparation of a phonograph record of finch songs (Borrer and Gunn, 1960), I had an opportunity to study over 1800 recordings of eastern finches, from 21 states of the United States and 5 provinces of Canada. Many of the songs in these recordings were analyzed by means of a Vibralyzer sound spectrograph (Borrer and Reese, 1953), and the graphs obtained reveal many details of the songs and their variation. The purpose of this paper is to present accounts of the songs of 43 species of eastern fringillids, based on a study of these recordings. Brief descriptions of these songs are given in many bird guides (e.g., Peterson, 1947; Saunders, 1951a); references to papers on the songs of individual species are cited in the following accounts.

The majority of the recordings studied (table 1) were made by myself, and are in the collection of recorded animal sounds of the Department of Zoology and Entomology, The Ohio State University; additional recordings were loaned by Dr. William W. H. Gunn and Dr. J. Bruce Falls of Toronto, and Dr. P. P. Kellogg of Cornell University.

The term "song," as used here, refers to the vocalizations, usually uttered only by the male and usually more complex in character than the bird's various call notes, which appear to function in advertising the presence of the male, in attracting a female, or in repelling other males of the same species or all of these. The descriptions in this paper refer principally to what is commonly called the "advertising song," which in many species serves the other functions as well.

There is a great deal of variation in finch songs; the songs of different species are often quite different, and there is frequently considerable variation in the songs of a given species. In some species the songs of a given bird are essentially alike, while those of different birds often differ; in other species each bird may sing songs of two or more different patterns. The intraspecific variation in each species is outlined briefly in the following accounts. The pitch range in the songs of each species is summarized in table 1.

The song patterns of many finches are not perfected until the birds reach the nesting grounds, and the songs of birds in migration are often a little different (more variable, with the patterns less well defined) from those of birds on the nesting grounds. The following accounts apply in most cases to the songs of birds on the nesting grounds.

References in the list below to side and band number refer to the location of the songs on the phonograph record (Borrer and Gunn, 1960). References such as "(S-8)" in the figure legends indicate the song on the record that is graphed; S-8 would indicate that the song graphed was the eighth song of that species on the record.

The songs of eastern fringillids may be arranged, on the basis of their pattern and quality, in nine groups, as follows:

Group 1. Songs composed of one or more series of clear whistled notes or phrases (side 1, bands 1 and 2).

1. Cardinal (*Richmondia cardinalis*)
2. Harris' Sparrow (*Zonotrichia querula*)
3. White-throated Sparrow (*Zonotrichia albicollis*)
4. Field Sparrow (*Spizella pusilla*)

TABLE 1  
*Summary of recordings studied and pitch range in Fringillid songs*

Group	Species	No.	Recordings Studied		Pitch Range (in cycles/sec)
				Source Localities	
1	Cardinal	156	Ala., Fla., Ga., Ky., Ohio, Ont., Pa., Tex., W. Va.		1500-4500
	Harris' Sparrow	3	Man.		2500-4400
	White-throated Sparrow	172	Man., Mass., Me., N. B., N. C., N. Y., Ohio, Ont., Que., Vt.		1500-6600
	Field Sparrow	89	Ky., Ohio, Ont., Pa.		2100-5000
2	White-crowned Sparrow	19	Man., Ohio, Ont.		2600-7200
	Tree Sparrow	13	Man., Ohio		3000-8000
	Smith's Longspur	1	Man.		3300-6200
	Fox Sparrow	30	Man., Ohio, Ont.		3000-5000
3	Rose-breasted Grosbeak	31	Me., Mich., Ohio, Ont.		3000-9000
	Pine Grosbeak	2	Man., N. B.		2300-4600
	Purple Finch	43	Man., Me., Ohio, Ont.		2000-8000
	Painted Bunting	1	S. C.		3000-6000
4	Blue Grosbeak	4	Ohio		2300-6700
	Indigo Bunting	44	Ky., Me., Mich., Ohio, Ont., Tenn.		2200-9000
	Dickeissel	18	Ind., Ky., Ohio, Wisc.		2500-9000
5	Slate-colored Junco	46	Man., Me., Mich., Ohio, Ont., Que.		2500-7000
	Chipping Sparrow	111	Man., Me., Mich., N. C., Ohio, Ont., Pa., W. Va.		2000-9000
	Swamp Sparrow	36	Me., Ohio, Ont.		2600-8000
6	Rufous-sided Towhee	183	Fla., Me., Mich., N. C., Ohio, Ont., W. Va.		2000-6000
	Bachman's Sparrow	17	Fla., Ohio		1500-10800
7	Vesper Sparrow	36	Mich., Ohio, Ont.		2200-9000
	Lincoln's Sparrow	12	Ont., Wyo.		1700-8500
	Lark Bunting	3	Sask., Wyo.		1500-8000
	Lark Sparrow	9	Ohio, Tex.		1300-10000
	White-winged Crossbill	9	Me.		3000-6000
	Common Redpoll	4	Man., Ont.		3000-6000
	American Goldfinch	37	Me., N. C., Ohio		2000-8000
	Pine Siskin	2	Ohio		2000-8000
8	Clay-colored Sparrow	7	Mich., Ont.		2500-8500
	Le Conte's Sparrow	4	Man.		6000-10000
	Grasshopper Sparrow	18	Man., N. D., Ohio, Ont.		4200-10000
	Sharp-tailed Sparrow	12	Man., Me.		3000-7500
	Seaside Sparrow	9	Fla., N. J.		1500-7000
	Savannah Sparrow	24	Man., Me., Ohio, Ont.		2600-9500
	Baird's Sparrow	6	Man.		4000-8000
9	Song Sparrow	583	Me., Ohio, Ont., W. Va.		1800-9000
	Lapland Longspur	2	Man.		1800-7800
	Chestnut-collared Longspur	4	Man.		2300-6500
	McCown's Longspur	1	Sask.		1700-6000
	Henslow's Sparrow	9	Ohio		3100-10200
	Evening Grosbeak	7	N. B., Ont., Pa.		2500-4000
	Red Crossbill	7	Me.		3000-6000
	Snow Bunting	2	Man.		2500-6000
Total	1826	21 states, 5 provinces		1300-10800	

- Group 2. Songs of clear whistled notes, with a few short buzzes or trills or both (side 1, band 3).
5. White-crowned Sparrow (*Zonotrichia leucophrys*)
  6. Tree Sparrow (*Spizella arborea*)
  7. Smith's Longspur ((*Calcarius pictus*)
  8. Fox Sparrow (*Passerella iliaca*)
- Group 3. Songs a series of warbled or wavering phrases, successive phrases usually different (side 1, band 4).
9. Rose-breasted Grosbeak (*Pheucticus ludovicianus*)
  10. Pine Grosbeak (*Pinicola enucleator*)
  11. Purple Finch (*Carpodacus purpureus*)
  12. Painted Bunting (*Passerina ciris*)
- Group 4. Songs a series of loud phrases, successive phrases often similar (side 1, band 5).
13. Blue Grosbeak (*Guiraca caerulea*)
  14. Indigo Bunting (*Passerina cyanea*)
  15. Dickcissel (*Spiza americana*)
- Group 5. Songs a simple trill (side 1, band 6).
16. Slate-colored Junco (*Junco hyemalis*)
  17. Chipping Sparrow (*Spizella passerina*)
  18. Swamp Sparrow (*Melospiza georgiana*)
- Group 6. Songs of 1 to 4 introductory notes followed by a trill (side 1, band 7).
19. Rufous-sided Towhee (*Pipilo erythrophthalmus*)
  20. Bachman's Sparrow (*Aimophila aestivalis*)
- Group 7. Songs consisting principally of two or more trills (side 2, bands 1 and 2).
21. Vesper Sparrow (*Poocetes gramineus*)
  22. Lincoln's Sparrow (*Melospiza lincolni*)
  23. Lark Bunting (*Calamospiza melanocorys*)
  24. Lark Sparrow (*Chondestes grammacus*)
  25. White-winged Crossbill (*Loxia leucoptera*)
  26. Common Redpoll (*Acanthis flammea*)
  27. American Goldfinch (*Spinus tristis*)
  28. Pine Siskin (*Spinus pinus*)
- Group 8. Buzzy songs (side 2, bands 3 and 4).
29. Clay-colored Sparrow (*Spizella pallida*)
  30. Le Conte's Sparrow (*Passerherbulus caudaculus*)
  31. Grasshopper Sparrow (*Ammodramus savannarum*)
  32. Sharp-tailed Sparrow (*Ammospiza caudacula*)
  33. Seaside Sparrow (*Ammospiza maritima*)
  34. Savannah Sparrow (*Passerculus sandwichensis*)
  35. Baird's Sparrow (*Ammodramus bairdii*)
- Group 9. Miscellaneous songs, not readily classifiable into any of the above groups (side 2, bands 5-7).
36. Song Sparrow (*Melospiza melodia*)
  37. Lapland Longspur (*Calcarius lapponicus*)
  38. Chestnut-collared Longspur (*Calcarius ornatus*)
  39. McCown's Longspur (*Rhynchophanes mccownii*)
  40. Henslow's Sparrow (*Passerherbulus henslowii*)
  41. Evening Grosbeak (*Hesperiphona vespertina*)
  42. Red Crossbill (*Loxia curvirostra*)
  43. Snow Bunting (*Plectrophenax nivalis*)

1. *Cardinal*.—The song consists of a series of 1 to 43 loud, clear, whistled phrases uttered 1 to 9 per sec; the first phrase or two are often uttered a little more slowly than the following phrases. Most songs are 2 to 4 sec in length. The phrases contain 1 to 3 (rarely 4 to 5) notes, which are nearly all slurred, some

very abruptly. The song may be 1-parted (all the phrases alike and, except for the first phrase or two, uttered at a uniform rate) (fig. 1), or it may contain up to 5 parts; most songs with 2 or 3 parts have different phrases in the different parts. Some songs with 2 or more parts have the phrases in the second or third part very similar to those in the preceding part but uttered at a different rate (usually more slowly) or at a different (usually lower) pitch. The songs are sometimes followed by a weak buzzy trill (short notes uttered 25 to 30 per sec) that sounds a little like the trill of a red squirrel. Each bird has a vocabulary of several different phrases, which are combined to produce a number of different song patterns (with 1 to 3 phrase types per pattern). Different birds, particularly those in different areas, usually have different phrases in their vocabulary, though some phrases may be sung by birds in widely separated areas (Borrór, 1961).

2. *Harris' Sparrow*.—The song is 1 to 3 clear whistled notes that are steady in pitch. The first note (*the* note in 1-note songs) is about 1 sec in length; the other notes are about half as long. All the notes of the song are on the same pitch, but a given bird may sing songs at 2 or 3 different pitches. The songs of different birds are very similar.

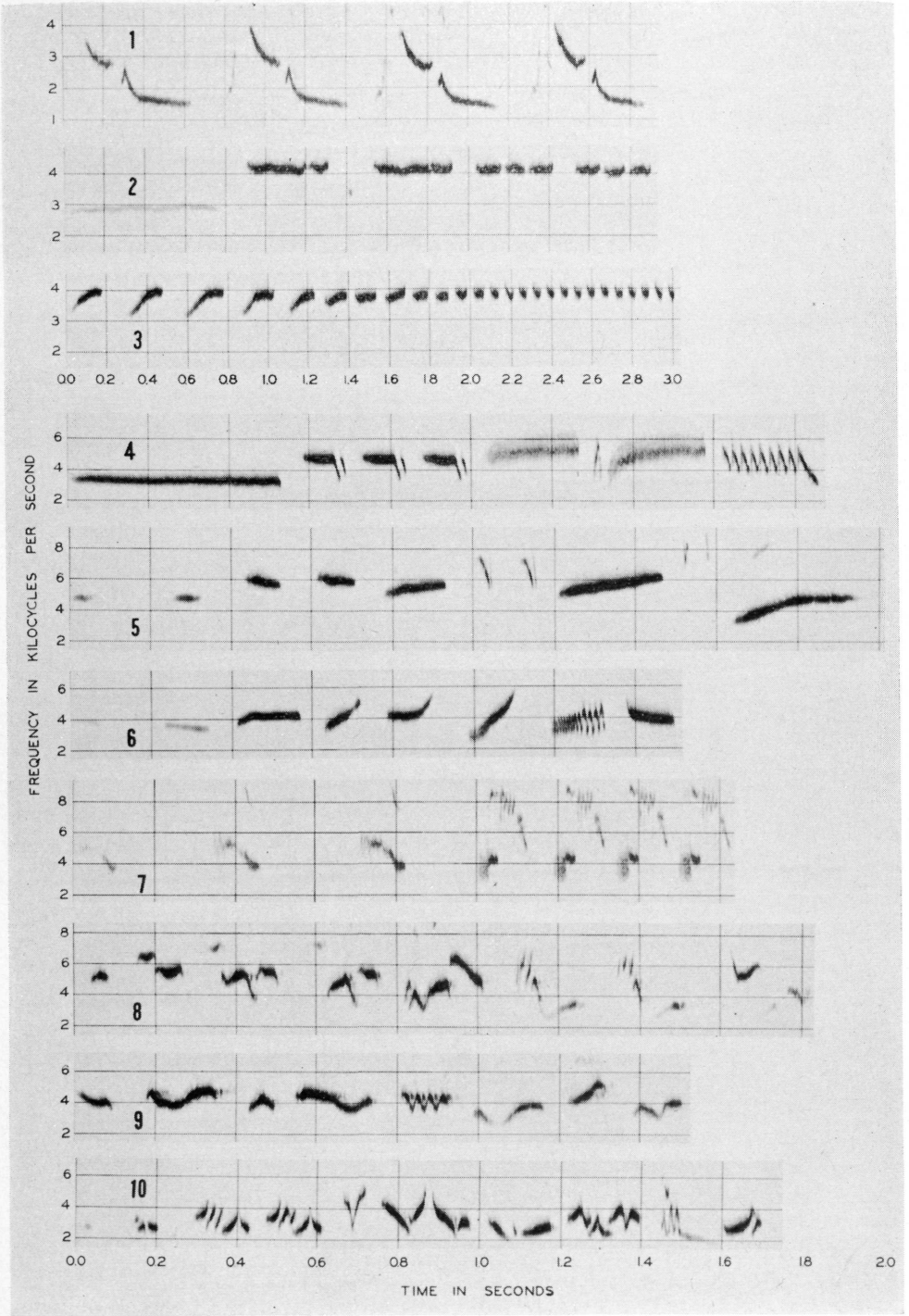
3. *White-throated Sparrow*.—The song is a series of clear whistled notes, most of them steady in pitch; it usually begins with 1 or more relatively long notes, and ends in triplets (groups of 3 notes uttered in rapid succession). There is nearly always at least one pitch change in the song, usually after the first or second note, and there are 2 or 3 pitch changes in some songs. Many songs have 1 note (usually the third) beginning with an abrupt up-slur. The songs of a given bird are generally alike in the way the pitch changes through the song, but may vary in length; the songs of different birds often have different pitch changes. The most common song pattern in this species, occurring throughout its range, begins with a low note, with the rest of the song on a higher pitch: *too titili twee titili titili*. Many eastern songs have a very short note (0.02 to 0.04 sec in length) following the second note of the song (fig. 2): *tooo tili p-tee titititi titititi*. Many songs in the midwest begin with 2 long high notes, with the remaining notes at a lower pitch: *tee tee tooo tototo tototo*. Some songs in the western part of the bird's range begin with a rapid series of short notes followed by a longer note, all on the same pitch, with the remaining notes at a higher pitch: *totototototototolo tooo tee titititi titititi*. Most song patterns in this species begin with a long low note, with the second note higher in pitch; the remaining notes may be the same pitch as the second, or some may be at a different pitch.

4. *Field Sparrow*.—The song is a series of 5 to 39 clear whistled notes, with the introductory notes longer and uttered more slowly; the song usually ends in a trill. The transition from slow introductory to fast final notes may be abrupt or gradual. The notes are uttered 2 to 6 per sec at the beginning of the song, and 6 to 48 per sec at the end. The introductory notes may be steady in pitch, slightly up-slurred (fig. 3), down-slurred, or down-slurred and then up-slurred; the final notes are usually abruptly down-slurred. The pitch trend through the

#### EXPLANATION OF FIGURES

##### FIGURES 1-10. Sound spectrographs of finch songs.

1. Cardinal. Franklin Co., Ohio, May 16, 1956 (OSU, 1880-4) (S-8).
2. White-throated Sparrow. Lincoln Co., Maine, June 15, 1957 (OSU, 2846-4) (S-7).
3. Field Sparrow. Franklin Co., Ohio, April 19, 1958 (OSU, 3230-3) (S-4).
4. White-crowned Sparrow. Moosonee, Ontario, May 29, 1958 (Gunn, C5-1) (S-2).
5. Tree Sparrow. Churchill, Manitoba, June 14, 1958 (Gunn, C2-4) (S-10).
6. Smith's Longspur. Churchill, Manitoba, June 22, 1958 (Gunn, C1-3) (S-3).
7. Dickcissel. Shelby Co., Kentucky, June 16, 1954 (OSU, 1239-6) (S-4).
8. Indigo Bunting. Franklin Co., Ohio, May 16, 1957 (OSU, 2660-5) (S-1).
9. Painted Bunting. Charleston, South Carolina, May 6, 1957 (Gunn, C1-8) (S-8).
10. Purple Finch. Lincoln Co., Maine, June 21, 1957 (OSU, 2875-2) (S-2).



song is usually steady (fig. 3), but in some songs the pitch may rise or fall slightly toward the end of the song; the pitch range in a song is always less than an octave. The songs of a given bird are generally alike except in length, but some birds may sing songs of 2 or 3 slightly different patterns; the songs of different birds are usually a little different. Occasional birds have songs that are somewhat atypical for the species (Saunders, 1922).

5. *White-crowned Sparrow*.—The song usually begins with 1 to 3 clear whistled notes that are steady in pitch, and ends with three buzzy notes, the last lower in pitch than the two preceding (fig. 4). The first note is about 0.5 sec in length; if there are 2 or 3 similar introductory notes the second and third are a little shorter. The final buzzy notes are uttered 3 to 4 per sec. Sometimes there are short clear notes or 2-note phrases in the middle of the song (fig. 4), and sometimes the second or third note of the song is slurred. One or two of the final buzzes (except the last) may begin with a short sharp note or be slightly up-slurred or both (fig. 4). Some songs end in a low trill rather than a low buzzy note. The songs of a given bird are usually very similar, but those of different birds often differ slightly.

6. *Tree Sparrow*.—The song is a series of clear high-pitched whistled notes; most notes are uttered 5 to 6 per sec, and the song is 2 to 2.5 sec in length. Some songs (fig. 5) begin with steady notes and end in slurred notes, with the pitch falling a little toward the end of the song; other songs (e.g., some from Ohio) have most of the notes slurred, some very abruptly. The song does not contain a trill, and contains buzzy notes only rarely. The songs of a given bird on the nesting grounds are generally of the same pattern but may vary in length, and the songs of different birds are usually a little different. Many songs, particularly of migrating birds, are a little like those of a fox sparrow, but the notes are usually shorter and higher-pitched, and the song seldom contains buzzy notes (which occur in most fox sparrow songs).

7. *Smith's Longspur*.—Only one recording of this species was studied; the songs were all of the same pattern and contained 6 to 8 notes (fig. 6). The next to the last note was buzzy, and the rest were clear whistles; the first note or two of the song were rather weak. The song might be paraphrased *ta ta tee twe twe twee werr-tee*.

8. *Fox Sparrow*.—The song is a series of loud whistled notes, most of them slurred, and it commonly ends in a buzzy note, a sharp *chuck*, or both. Most notes are uttered 3 to 5 per sec, sometimes grouped in 2- or 3-note phrases; successive notes are usually a little different. Most songs are 2 to 2.5 sec in length. The song occasionally contains buzzy notes, but only rarely contains a trill. The songs of a given bird are usually of the same pattern, but may vary in length; the songs of different birds are often a little different.

9. *Rose-breasted Grosbeak*.—The song is robinlike, but of a slightly different quality and with the phrases more run together. It contains up to 20 or more phrases uttered 1 to 2 per sec; each phrase contains 1 to 4 wavering notes. Each bird has a vocabulary of 15 or more different phrases, but these phrases are not uttered in any definite sequence; a given phrase is rarely uttered twice in succession, but may be uttered 2 or 3 times in different parts of the same song. Some songs contain relatively long slurred whistles, and the bird often utters a characteristic *quit* in or between songs. The phrases of different birds are usually a little different.

10. *Pine Grosbeak*.—The song is similar in quality to that of a purple finch, and consists of a series of 8 to 19 phrases uttered 6 to 7 per sec. Each phrase contains 1 to 3 slurred notes, and the phrases in a song are usually all different. The songs of a given bird may differ in pattern (i.e., contain different series of phrases), and the songs of a given pattern may vary in length. The songs of different birds are similar but usually contain slightly different phrases.

11. *Purple Finch*.—The song is a series of warbled phrases uttered 5 to 8

per sec (fig. 10). Most phrases contain both up- and down-slurred elements, and the slurring may be abrupt or gradual; a few phrases contain buzzy elements. The song is similar to that of a warbling vireo, but the phrases are very similar in pitch and the song lacks the rising pitch at the end characteristic of the vireo. Most phrases are sung only once in a song. The songs are generally about 2 sec in length but occasionally, especially early in the season, a song may be several seconds in length or the bird may sing almost continuously. The songs of a given bird are generally alike but may vary in length; each bird appears to utter a definite sequence of phrases, and different songs may end at different points in this sequence; where phrases are repeated, the number sung in sequence may differ in different songs. The songs of different birds are usually quite similar, particularly if the birds occur in the same area, but usually contain slightly different phrases.

12. *Painted Bunting*.—The song is somewhat similar to that of a warbling vireo, and consists of 8 to 11 phrases uttered 5 to 6 per sec (fig. 9); the song rarely ends in a high note, as do most songs of the vireo. The notes are all slurred, but the slurring is not abrupt. A bird may sing songs of 2 or more patterns, and the songs of a given pattern may differ in length. Only one recording of this species was studied, but it is probable that the phrases of different birds are a little different.

13. *Blue Grosbeak*.—The song is loud and clear and generally contains 10 to 17 phrases uttered about 5 per sec. Most phrases contain 1 or 2 notes, and both up- and down-slurred elements; some phrases are trilly or buzzy. Some phrases are sung 2 or 3 times in succession, or may appear in different parts of the same song. The songs of a given bird may vary in the number or sequence of the different phrases, and the songs of different birds usually contain slightly different phrases.

14. *Indigo Bunting*.—The song is loud, not particularly musical, and consists of a series of phrases about half of which are in twos; the phrases are uttered 3 to 9 per sec (fig. 8). The song may contain up to about two dozen phrases, but most songs contain 10 to 12 phrases. Each phrase may contain from one to several notes, and nearly all the notes are slurred, some very abruptly. A typical song might be paraphrased *tee tyu tyu swee swee chew chew chew chi chi whit*. The songs of a given bird usually vary in the number and types of phrases they contain; there is a great deal of variation in the phrases of different birds.

15. *Dickcissel*.—The song usually consists of 2 series of notes or phrases: *chup chup chup ciss-ciss-ciss-ciss* (fig. 7). The first series contains 1 to 4 phrases uttered 2.5 to 5 per sec, and the second 3 to 6 phrases uttered 6 to 7 per sec. The rate sometimes increases a little through the first series, or there may be a longer interval after the first or second phrase of the second series. Some songs are preceded by 1 to 5 short chips. The phrases are usually buzzy or contain buzzy elements; the phrases of the first series may appear 1- to 3-noted, and usually appear slurred; the phrases of the second series usually appear 2-noted, with the pitch rising or falling through the phrase and the last part of the phrase buzzy. The songs of a given bird are of one pattern (i.e., they contain the same types of phrases), but the phrases may vary in number. The songs of different birds often contain slightly different phrases; the 18 recordings studied contained 9 different song patterns.

16. *Slate-colored Junco*.—The song is a series of 12 to 39 similar phrases uttered 8 to 20 per sec (fig. 11), and is very similar to that of a chipping sparrow; most songs are 1 to 2 sec in length. The phrases contain 2 to 5 notes; most notes are slurred, sometimes abruptly but usually over less than an octave. In most songs at least one note in the phrase is either steady in pitch or is slurred only slightly, and the song is more musical than that of a chipping sparrow. A part of each phrase is buzzy in most songs. The songs of a given bird are of the same

pattern (phrase type) but may vary in length; the songs of different birds are often a little different (the 46 recordings studied contained 19 different patterns).

17. *Chipping Sparrow*.—The song is a series of 9 to 72 similar phrases uttered 7 to 22 per sec; most songs are 2 to 3 sec in length. The phrases contain 1 to 3 notes which are abruptly slurred, sometimes over an octave or more in 0.01 to 0.05 sec. This rapid slurring over a considerable pitch range gives the song a rather dull and unmusical quality. One note in each phrase is buzzy in some songs. The songs of a given bird are of the same pattern (phrase type) but vary in length; the songs of different birds are often a little different (the 111 recordings studied contained 39 different patterns) (Brand and Axtell, 1938; Borror, 1959b).

18. *Swamp Sparrow*.—The song is a series of 8 to 21 similar phrases uttered 5.6 to 8.8 per sec (fig. 12). The phrases generally appear 2-noted (the 2 notes of different pitch), but nearly always contain 3 to 4 notes. Most of the notes are slurred, some very abruptly over about an octave, giving the song a staccato quality. The song resembles a slow chipping sparrow song, but the phrases are more obviously composed of more than 1 note. The songs of a given bird are usually all of the same pattern (phrase type) but vary in length; the songs of different birds are often a little different (the 36 recordings studied contained 19 different patterns).

19. *Rufous-sided Towhee*.—The song consists of 1 to 2 (rarely 3 to 4) introductory notes followed by a trill; the trill frequently (fig. 13) begins with a note or phrase that is different from the remaining trill phrases. The introductory notes may be clear or buzzy, steady in pitch or slurred, and are uttered about 4 per sec; if the introduction contains 2 or more notes, these notes are usually different in pitch. The trill may contain up to 18 phrases uttered 5 to 35 (average, about 13) per sec. Each bird may sing songs of 3 or 4 different patterns; it usually sings one pattern for a while and then changes to another, but occasionally may sing songs of two patterns alternately. The songs of different birds are usually different; a given type of introduction of trill is frequently sung by different birds, but it is relatively uncommon for the entire song of different birds to be identical (Borror, 1959a).

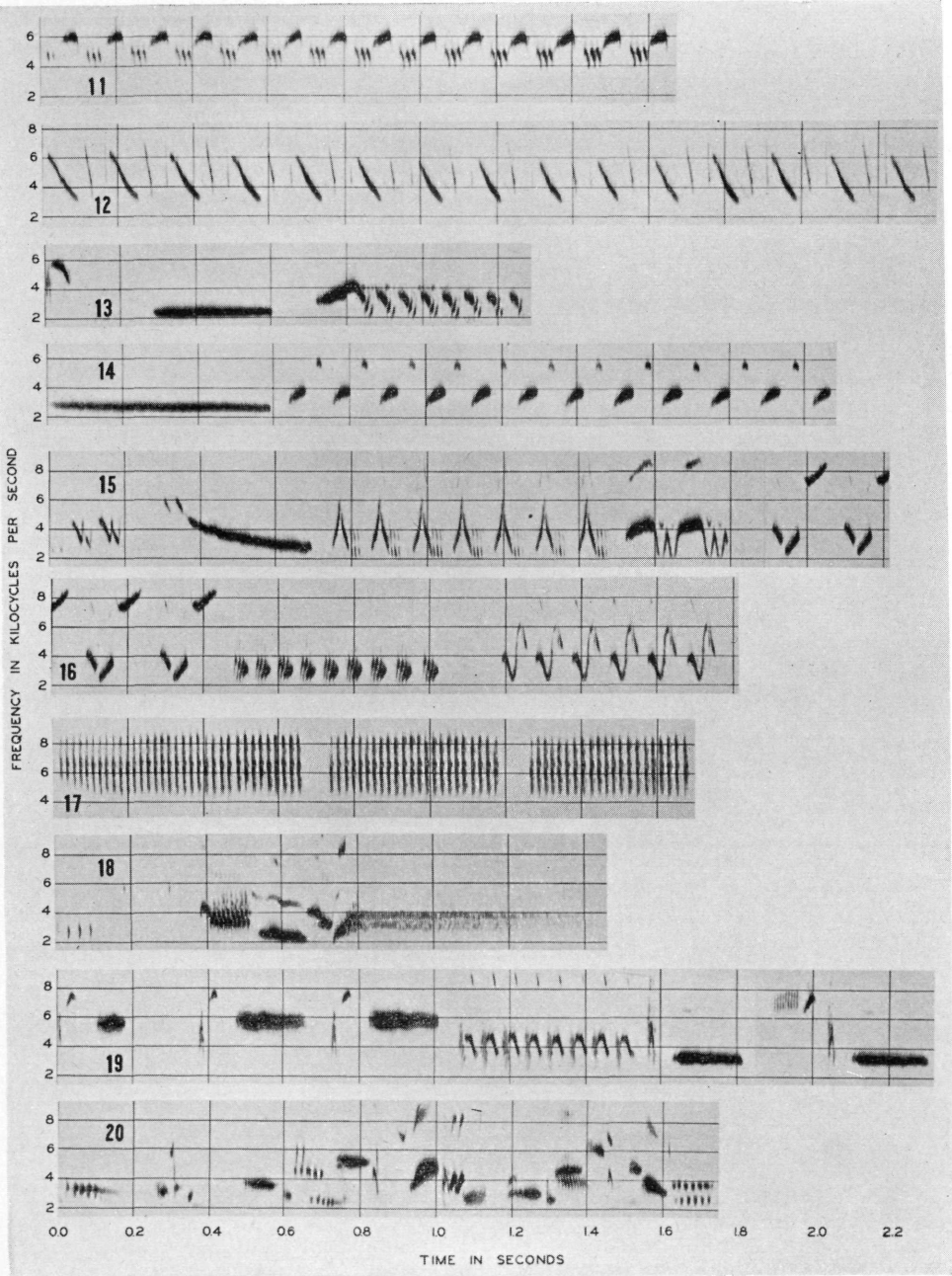
20. *Bachman's Sparrow*.—The song consists of 1 or 2 introductory notes and a trill; the introductory notes are relatively long and usually steady in pitch, and the trill is a rapid series of similar phrases (fig. 14). Most songs begin with a single introductory note, either a clear whistle or a buzz; some songs begin with 2 notes, nearly always different in pitch, either 2 whistles or a buzz and a whistle. Each bird has a repertoire of two dozen or more different songs (one Ohio bird studied had 37), which differ in the character of the introduction and trill. The pitch of the introductory note(s) varies considerably in different songs. The trill contains 3 to 20 (usually 7 to 11) phrases uttered 5 to 25 (mostly 6 to 8) per sec; the phrases contain 1 to 4 notes. Some songs contain a 2-parted trill, i.e., a few phrases of one type, then a few of another type. A bird seldom sings more than 1 or 2 songs of a given pattern before changing to another. The songs

#### EXPLANATION OF FIGURES

##### FIGURES 11-20. Sound spectrographs of finch songs.

11. Slate-colored Junco. Lincoln Co., Maine, July 3, 1958 (OSU, 3567-3) (S-8).
12. Swamp Sparrow. Lincoln Co., Maine, June 25, 1959 (OSU, 4205-9) (S-1).
13. Rufous-sided Towhee. Reynoldsburg, Ohio, May 6, 1956 (OSU, 1808-2) (S-7).
14. Bachman's Sparrow. Reynoldsburg, Ohio, May 15, 1955 (OSU, 1419-9) (S-8).
15. Lark Sparrow. Adams Co., Ohio, May 12, 1958 (OSU, 3384-5) (S-1).
16. Lark Sparrow. Last part of same song shown in fig. 15 (from 2.0 sec to end).
17. Clay-colored Sparrow. York Co., Ontario, June 28, 1957 (Gunn, C3-39) (S-3).
18. Seaside Sparrow. Panacea, Florida, March 20, 1959 (OSU, 3750-25) (S-9).
19. Song Sparrow. Lincoln Co., Maine, June 21, 1956 (OSU, 2065-5) (S-11).
20. Lapland Longspur. Churchill, Manitoba, June 21, 1958 (Gunn, C5-6) (S-last).





of different birds usually differ in the character of the trill phrases (Borrór, 1961).

21. *Vesper Sparrow*.—The song consists of 1 to 4 relatively long, steady or slightly down-slurred notes (or 2-note phrases in which one note is much longer than the other), followed by 2 to 7 groups of more rapidly uttered phrases; most songs are 2 to 4 sec in length. The introductory notes are usually of 2 types, the first one or two being weaker and lower-pitched than the rest. Each of the remaining phrase groups contains up to 10 similar phrases, and each phrase contains 1 to 4 notes; many of the notes are buzzy. The phrases are uttered 3 to 20 (average, 5.5) per sec; most phrases are uttered slowly enough to count. A typical song might be paraphrased *tyu tyu tee tee wiliwiliwili-titotito-tyu-tyu-tyu-tyu-chee-chee-chee-chee*. The songs of a given bird usually vary in the number of phrases and phrase types they contain, and often also in the sequence of the various phrase types; occasionally they may vary in the character of the introductory notes. The phrases of different birds are usually different.

22. *Lincoln's Sparrow*.—The song is somewhat similar to that of a house wren but is more musical. It consists of 4 to 9 groups of trilly or buzzy phrases, with up to 15 similar phrases per group, and with the phrases uttered 3 to 18 per sec. Most songs begin with 1 to 4 low-pitched phrases and end in weak, low-pitched, and often buzzy phrases. Many of the phrases are buzzy, and some are (or contain) clear whistles (steady in pitch or slurred). Successive phrase groups usually differ in pitch, and the pitch range in a song may be as much as 2 octaves. The songs of a given bird vary in the number of phrases in the different groups, and in the phrase types in the song (i.e., in pattern); a bird may sing songs of 3 or more patterns, usually several songs of one pattern, then several of another. The songs of different birds are usually a little different, but those of birds in the same locality usually contain similar or identical phrases.

23. *Lark Bunting*.—The song is 3 to 8 or more groups of phrases, the phrases of each group similar and uttered 3 to 20 (mostly 4 to 8) per sec. Some songs contain a buzzy note 0.5 sec or more in length, and most phrases contain at least 1 buzzy note. The buzzy notes are usually steady in pitch; the clear notes may be steady or slurred. Each phrase group may contain up to 18 phrases, but most groups contain 4 to 8 phrases. Each bird has a vocabulary of several phrase types, which are variously combined in different songs; there is no tendency for the bird to utter its different phrases in any definite sequence. The phrases of different birds are usually a little different.

24. *Lark Sparrow*.—The song is relatively loud and musical, and consists of 3 to 11 series of trills or phrase groups, each group containing up to 19 similar phrases uttered 2 to 34 (average, about 16) per sec (fig. 15, 16). Each bird has a vocabulary of 20 or more phrases, which are variously combined to produce a large number of different song patterns (one Ohio bird studied had 58). The songs have no fixed type of beginning or end, though several songs in sequence may begin with the same groups of phrases. Each phrase contains 1 to 4 notes. Most of the notes are abruptly slurred over an octave or more; many are harsh or buzzy in quality, and most songs contain at least some buzzy notes or phrases. The phrases of different birds are usually different.

25. *White-winged Crossbill*.—The song is a series of buzzy, canarylike trills, each trill consisting of a rapid series of similar phrases. The songs are 2 to 15 (most are 4 to 6) seconds in length and contain 3 to 13 trills; each trill may contain up to 35 phrases uttered 6 to 37 (mostly 10 to 16) per sec. Each phrase may contain from one to several notes, and most phrases contain buzzy elements. Each bird has a vocabulary of 15 to 20 or more different trill phrases, and these are variously combined to produce a variety of songs. Some songs contain a given type of trill in 2 different parts of the song, or 2 consecutive trills may contain essentially the same trill phrases but uttered at a slightly different rate or pitch. There is some tendency for a bird to utter its different trills in a par-

ticular sequence, but different songs are usually different, both in the types of trills they contain and in the number of phrases in each trill. The songs of different birds usually differ in the character of the trill phrases. A bird often begins a song on one perch and flies to another without interrupting the song.

26. *Common Redpoll*.—The song is a series of short trills, each trill containing 2 to 8 or more similar phrases uttered 6 to 30 (mostly 8 to 10) per sec. The phrases are rather buzzy or lisping, and the song occasionally contains slurred whines or nasal notes similar to those of the goldfinch and siskin. The trills are uttered at the rate of 1 every sec or two, and the song is long-continued. The phrases of a given bird are mostly of just 1 type but may occasionally be of 2 or 3 types, and some trills are 2-parted. The phrases of different birds are usually different.

27. *American Goldfinch*.—The song is twittery and canarylike, a series of short phrases or trills; sometimes the songs are short (1.5 to 2.5 sec in length) and separated by silent intervals of several seconds, and sometimes the song is long-continued. The phrases contain 1 to 3 notes, which may be abruptly slurred, buzzy, or may contain both buzzy and slurred elements; the song rarely contains notes that are steady in pitch. The phrases are uttered 3 to 16 per sec, and in some series often change gradually through the series from one type to another. A characteristic call, usually uttered in flight, consists of 4 (occasionally more) notes: *per-chick-titi*; all these notes are abruptly down-slurred, and the first two are a little higher in pitch than the rest; the second note is the loudest. Another characteristic call is an up-slurred or 2-parted whine; if 2-parted the first part is relatively steady in pitch and the second part is up-slurred and often wavering. The songs of a given bird often vary considerably in the number or types of phrases, or both, that they contain; the songs of different birds usually contain slightly different phrases.

28. *Pine Siskin*.—The song is somewhat similar to that of a goldfinch, but is a little softer and more nasal in quality. It consists of a series of buzzy, whiny, or warbly phrases, mostly uttered 3 to 8 per sec: a few of one type, then a few of another type, and so on. The song is long-continued, and interspersed among the short phrases are up-slurred whines and buzzes. A characteristic buzz by which this bird may often be recognized is about 1 sec in length and increases in loudness and pitch toward the end, and it usually ends in a short abrupt note.

29. *Clay-colored Sparrow*.—The song is usually a series of 1 to 6 similar high-pitched buzzes that vary in length up to about 1 sec (fig. 17); most songs are 1.5 to 2 sec in length. The buzzes consist of a series of similar phrases uttered 42 to 146 per sec; each phrase consists of 2 to 3 very abruptly slurred notes. The song sometimes consists of 11 to 13 buzzes, the first 6 or 7 of which are shorter and more rapidly uttered and contain more rapidly uttered phrases. The songs of a given bird may vary in the number of buzzes they contain, and the songs of different birds may differ in the number or character of the buzzes, or both of these.

30. *Le Conte's Sparrow*.—The song consists principally of two high-pitched buzzes that have a hissing quality; the first buzz is a little higher in pitch and about 0.5 sec in length, and the second is about 1 sec in length. The song is usually preceded by 2 to 3 very short (less than 0.005 sec in length), sharp, weak notes uttered over a space of about 0.1 sec, and there is a similar note at the end of the song. The songs of a given bird are essentially alike, and those of different birds are very similar.

31. *Grasshopper Sparrow*.—Most songs consist of 2 to 4 short, high-pitched notes followed by a long buzz that usually ends in a short high-pitched note.

<sup>1</sup>The songs in the recordings studied were principally of this species, but some may have been of the Hoary Redpoll (*Acanthis hornemanni*); the songs of these two species are very similar.

The introductory notes are usually of decreasing pitch; if there are 4 introductory notes the third is very weak and high-pitched. The buzz is 1.0 to 1.5 sec in length, and the first 0.10 to 0.15 sec of it is louder and a little lower in pitch than the rest. The final high note, when present, is 0.10 to 0.15 sec in length. The long buzz is a series of abruptly down-slurred notes uttered 86 to 156 per sec; rather regularly through this buzz 1 or 2 notes are slurred downward further in pitch, producing a pulsating effect (17 to 43 pulsations per sec). The songs of a given bird may differ in the number of introductory notes; the buzzes of different birds usually differ in the note or pulsation rate, but these differences are seldom apparent to the ear. Occasionally, particularly when the bird is in flight, the song is followed by a buzzy trill a couple of seconds in length: a series of notes of one type, then a series of another type, and so on up to about 15 types, with the notes uttered 14 to 90 per sec; the songs of a given bird contain the same trills, but the trills of different birds are usually a little different (Smith, 1959).

32. *Sharp-tailed Sparrow*.—The song is about 1 sec in length and consists principally of a steady hissing buzz. The birds breeding in the interior of the country (*A. c. nelsoni*) usually begin their songs with a short buzzy note about 0.05 sec in length that is either a little lower or a little higher in pitch than the principal buzz of the song, and the songs end with a short buzzy note 0.05 to 0.20 sec in length and a little lower-pitched than the principal buzz: *p-cheeeeeez-cul*. The birds breeding along the Atlantic coast from Maine (Popham Beach) north to the Gulf of St. Lawrence (*A. c. subvirgatus*) have similar songs, but the short introductory note is either lacking or low-pitched, and the song generally ends in a very short (0.01 sec in length) high note: *cheeeeeez-cul-up*. The songs of birds breeding along the Atlantic coast from southern Maine to New Jersey (*A. c. caudacuta*) usually begin their songs with 1 or 2 short, high or low notes, and lack the final low note: *ch-ch-cheeeeeez*. The songs of a given bird are essentially alike, but those of different birds often differ slightly.

33. *Seaside Sparrow*.—The song (fig. 18) begins with several very short (0.01 sec or less), sharp, usually very weak notes that are generally arranged in two groups, with 1 to 4 notes in each group; these notes are uttered 20 to 40 per sec, and the groups 8 to 10 per sec. The next (and loudest) part of the song, about 0.5 sec in length, contains several buzzy notes; these notes differ in different songs, but usually some are steady in pitch and some are slurred. The last part of the song, which is usually continuous with the last note in the second part, is a long hissing buzz lasting about 1 sec and fading out toward the end. Each bird may sing songs of 4 or more different patterns, which differ principally in the character of the first 2 parts of the song; the songs of different birds are usually a little different.

34. *Savannah Sparrow*.—The song consists of 1 to 4 short high-pitched notes uttered 3 to 4 per sec, followed by 1 to 3 short buzzy phrases a little lower in pitch and uttered 3 to 8 per sec, then 1 or 2 long buzzes about 0.5 sec in length, with the song usually ending in 1 to 3 short low-pitched notes. In songs with 2 long buzzes, the buzzes are separated by 1 to 4 (usually 1) short high-pitched notes, and the second buzz is lower in pitch and of a slightly different quality. The song lasts 2 to 3 sec. The songs of a given bird differ only in the number of introductory or final notes, and to some extent in the length of the buzzes; the songs of different birds are usually a little different.

35. *Baird's Sparrow*.—The song generally consists of a high-pitched, often somewhat buzzy note, followed by 2 to 6 (usually 3 to 4) similar 2-note phrases uttered about 4 per sec, and ends in a buzzy trill; the first note of the song is usually the highest in pitch in the song, and the final trill the lowest. The final trill usually begins with 1 to 2 slightly longer notes, followed by a series of similar notes or 2-note phrases uttered 21 to 26 per sec; this trill is about 1 sec in length, but in some songs is lacking. The songs of a given bird are usually very similar,

differing only in the number of introductory phrases or in the length of the trill; occasionally a bird may sing songs of 2 or more slightly different patterns. The songs of different birds are generally a little different.

36. *Song Sparrow*.—The songs of this species are subject to an enormous amount of variation; they consist of a series of different phrases most of which contain 1 to 4 notes, and they usually contain a trill (12 or so similar phrases uttered too fast to count). Some notes are clear whistles, usually steady in pitch; some are buzzy. Most songs (fig. 19) begin with 2 to 4 (rarely 1 or 5) similar phrases uttered at a constant rate of 2 to 4 per sec; about one song pattern in five begins with 4 to 20 similar phrases that increase in rate (much as in field sparrow songs, but these notes are not always clear whistles). The longer phrases of the song (those uttered slowly enough to count) are usually single, but occasionally are repeated two or 3 times. Successive notes in a phrase, and successive phrases, are usually different in pitch, and the pitch range in a song is usually about 2 octaves. A given bird has a vocabulary of a large number of notes and phrases, which are variously combined to produce up to 12 or so song patterns; these song patterns are often quite different. A bird usually sings one pattern for a while before changing to another; in a several-minute period of singing it may go through a large part of its repertoire. The songs of a given pattern may vary in the number of phrases in particular parts of the song, in the presence or absence of certain phrases, or in the particular types of phrases with which the song begins or ends. The songs of different birds are nearly always different, though birds in the same area usually have identical phrases in their songs (Borror, 1956, 1957, 1961; Nice, 1943; Saunders, 1951b; Wheeler and Nichols, 1924).

37. *Lapland Longspur*.—The song (fig. 20) is musical and often somewhat tinkling, and consists of a series of phrases uttered 3 to 4 per sec; most songs contain 8 to 10 phrases, but occasional songs are longer. Most of the notes are musical in quality and steady in pitch, but many are uttered so fast that a buzzy effect is produced. The notes are mostly 0.01 to 0.10 sec in length, but many songs end in a longer note (0.25 to 0.30 sec in length) that slurs up and then down. Successive notes are nearly always different in pitch. In some parts of the song a liquid effect is produced by the overlapping of notes, i.e., one note beginning before the preceding note ends; some of the phrases resemble those of a wood thrush. The songs of a given bird are very similar, but those of different birds may differ slightly.

38. *Chestnut-collared Longspur*.—The song is loud, rather musical, somewhat similar in quality to the song of a western meadowlark, and is generally 2 to 2.5 sec in length. It consists of 5 to 10 (usually 7 to 8) phrases uttered 3 to 4 per sec; the phrases may contain from one to several notes. The 3 or 4 introductory phrases contain clear notes, and are of decreasing pitch; the final phrases are usually buzzy. The first phrase or two of the song are usually quite weak. The phrases are not repeated in a given song, but some phrases contain repetitive elements. The songs of a given bird are essentially alike, differing only in the character of the final weak phrases; the songs of different birds usually contain slightly different phrases.

39. *McCown's Longspur*.—The song is a fast warble, a little like the chattering of a house sparrow but more musical. The notes, nearly all of which are slurred, are mostly uttered 30 to 40 per sec, and successive notes are rarely alike or of the same pitch. There is some tendency for the notes to be grouped into phrases about 0.25 sec in length, but for the most part the phrases are more or less run together. The song sometimes contains 1 or 2 thin, high-pitched, slightly down-slurred whistles about 0.25 sec in length. The songs of a given bird usually vary in length, and sometimes also in the sequence of notes. A bird may sometimes, particularly when disturbed at its nest, sing almost continuously.

40. *Henslow's Sparrow*.—The songs are short (about 0.25 sec in length), high-pitched, and usually appear 2-parted: *lee-sick* or *se-lick*; the second part

is louder and lower in pitch. The song actually consists of 4 to 6 groups of notes, but the notes are uttered too rapidly for the ear to detect them all. The songs of a given bird are practically identical, but those of different birds may differ slightly (Borrer and Reese, 1954).

41. *Evening Grosbeak*.—The principal sounds uttered by this bird are short chirping notes somewhat similar to some of the chirping of a house sparrow. The notes are of two general types, a relatively clear down-slurred note about 0.15 sec in length that begins abruptly, and a buzz 0.15 to 0.25 sec in length that usually slurs upward slightly and then downward. These two types of notes are not uttered in any definite sequence or at any definite rate, and the notes of different birds are very similar.

42. *Red Crossbill*.—This bird utters a variety of short notes, 2- and 3-note phrases, buzzes, and a few slurred whistles. The most characteristic utterance is a short, sharp, *kip-kip-kip*; these notes are abruptly up-slurred, and are generally uttered in groups of 2 to 4 or more, 3 to 4 notes per sec. Most of the notes and phrases are uttered 2.5 to 5 per sec, and they are apparently not uttered in any definite sequence. The notes and phrases of different birds often differ slightly.

43. *Snow Bunting*.—This bird utters a variety of low-pitched whistles, accented phrases, buzzes, and occasionally short trills. The whistles are usually slurred, and are 0.15 to 0.30 sec in length. The buzzes are steady in pitch or down-slurred, 0.10 to 0.25 sec in length, and are often harsh in quality. The phrases vary considerably; they may contain 2 to several notes, abruptly slurred elements, or buzzy elements. Many notes are uttered singly, 1 or more sec apart, producing a chirping effect; sometimes the notes and phrases are uttered in more rapid succession, 3 to 5 per sec, sometimes in a more or less definite sequence and sometimes in a varying sequence. These more rapid series sometimes end in a high-pitched, rather weak, clear whistled note that is usually down-slurred. Each bird utters a considerable variety of notes and phrases, and the phrases of different birds are usually different.

#### ACKNOWLEDGMENTS

I wish to express my appreciation to Dr. W. W. H. Gunn, Dr. J. Bruce Falls, and Dr. P. P. Kellogg for the loan of recordings for study, and to Dr. Gunn for suggestions in the preparation of this paper.

#### LITERATURE CITED

- Borrer, D. J.** 1956. The variation in a song sparrow's songs. *Wheaton Club Bull.* 1: 22-23.  
 ———. 1957. Additional notes on the variation in song sparrow songs. *Wheaton Club Bull.* 2: 6-10.  
 ———. 1959a. Variation in the songs of the rufous-sided towhee. *Wilson Bull.* 71: 54-72.  
 ———. 1959b. Songs of the chipping sparrow. *Ohio. J. Sci.* 59: 347-356.  
 ———. 1961. Intraspecific variation in passerine bird songs. *Wilson Bull.* 73: 57-78.  
 ——— and **W. W. H. Gunn.** 1960. Finches. Songs of Fringillidae of eastern and central North America. A 12-inch long-play phonograph record, published by Federation of Ontario Naturalists, Toronto.  
 ——— and **C. R. Reese.** 1953. Analysis of bird songs by means of a Vibralyzer. *Wilson Bull.* 65: 271-303.  
 ——— and ———. 1954. Analytical studies of Henslow's sparrow songs. *Wilson Bull.* 66: 243-252.  
**Brand, A. R.** and **H. H. Axtell.** 1938. The song of the chipping sparrow. *Auk* 55: 125-126.  
**Nice, M. M.** 1943. Studies in the life history of the song sparrow II. *Trans. Linn. Soc. N. Y.*, 6: viii+328.  
**Peterson, R. T.** 1947 (2nd rev. ed.). *A Field Guide to the Birds.* Houghton Mifflin Co., Boston. xxiv+290 pp.  
**Saunders, A. A.** 1922. The song of the field sparrow. *Auk* 39: 386-399.  
 ———. 1951a (2nd ed.). *A Guide to Bird Songs.* Doubleday and Co., Inc., New York. xiv+307 pp.  
 ———. 1951b. The song of the song sparrow. *Wilson Bull.* 63: 99-109.  
**Smith, R. L.** 1959. The songs of the grasshopper sparrow. *Wilson Bull.* 71: 141-152.  
**Wheeler, W. C.** and **J. T. Nichols.** 1924. The song of the song sparrow (a systematic study of its construction). *Auk* 41: 444-451.