

THE NATURE AND CHARACTERISTICS OF SUB-SONG

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(Plates 69-74)

INTRODUCTION

AVICULTURALISTS and bird fanciers have long used the term "recording" to denote the quiet "practice-like" singing so often heard from their pet birds before they come into the phase of true song. It has often been asserted that the instrument known as the Recorder originally took its name from the bird flageolet which was used by bird fanciers for teaching tunes to Canaries (*Serinus canarius*), Bullfinches (*Pyrrhula pyrrhula*) and other song birds, but we are indebted to R. Thurston Dart for a recent reference (Trowell, 1957) which shows that this is in fact improbable; it seems more likely that the bird song was named from the instrument—as indeed Daines Barrington (1773) supposed.

Early aviculturalists must have noted from time to time the utterance by birds in the wild of sounds similar to their "recording" and there is no doubt that many of the early naturalists (for example, Daines Barrington) refer in their writings to sub-song, either as "recording" or without giving it a definite name. E. M. Nicholson has reminded us of Gilbert White's mention of the contrast between "the Blackcap's loud and wild pipe" and its "sweet but inward melody" and Miss E. M. Barraud has given us the reference in Charles Darwin's *Descent of Man*: "The first attempts to sing 'may be compared to the imperfect endeavour in a child to babble'. The young males continue practising, or as the bird-catchers say, 'recording', for ten or eleven months. Their first essays show hardly a rudiment of the future song; but as they grow older we can perceive what they are aiming at; and at last they are said 'to sing their song round'" (mainly quoted by Darwin from Daines Barrington).

As far as we are aware, Nicholson (1927) was the first to employ the term "sub-song", and in 1931 (p. 61) he gave a number of suggestions aimed at helping field naturalists to observe and keep notes of important variations in pattern and intensity of song. The use of the term was later developed by Nicholson and Koch (1936) simply to mean "quiet song"—that is, song of low volume. It was taken to include "all performances which are so inwardly or faintly uttered that they do not carry to anywhere near the distance over which the bird is physically capable of making itself heard". Nicholson alone adds that it has no territorial influence and provokes no visible hostility in other males. Obviously this use of the term does not imply that there is

necessarily any real difference between the sub-song and the true song except in the matter of volume and territorial significance. The term "sub-song" has been used merely to indicate volume difference by Lister (1953) and by Armstrong (1955) with reference to the Wren (*Troglodytes troglodytes*). It is clear that Armstrong uses the term to include three or four important varieties of "quiet song", some with clear social significance, others with apparently none at all. In the present paper we are attempting to restrict the term "sub-song" to one form of quiet song about which a certain amount is already known. As other forms of quiet song come to be further studied, no doubt precise names will have to be found for them.

SUB-SONG OF THE CHAFFINCH

In the course of intensive study of the song learning of the Chaffinch (*Fringilla coelebs*) carried out over a number of years (Thorpe, 1955, 1958), a good deal of information about the sub-song of this species was obtained. Full details will be found in the papers referred to above. The matter can be summarized by saying that the sub-song of the Chaffinch is not merely song of low intensity but differs from the full song in many other respects. Whereas the true song consists of a well defined burst of sound lasting, on the average, between two and three seconds and repeated at intervals of about 20 seconds, the sub-song consists of an irregular and indefinite series of notes continuing for perhaps half a minute or more, although broken up into ill-defined phrases each lasting for perhaps two or three seconds.

The notes in the Chaffinch sub-song are very variable, but they fall into two groups. The first group includes a variety of chirping and cheeping notes, and the second group a series of somewhat mechanical-sounding rattles of varying pitch. The simplest type, which is usually heard from young males in their first autumn consists of a series of chirping notes fluctuating in pitch. During this autumn period the beak is often closed while singing and the rattle is heard only infrequently. Females occasionally give a similar sub-song. In the early spring the sub-song is resumed and after a week or so the bird may be spending quite a lot of its day in producing these utterances. Sound spectrograms show that most of the notes themselves are entirely different in structure from those which go to make up the full song and are particularly characterized by containing a much bigger range of frequencies—that is to say, they are very indefinite in pitch.

This sub-song seems to have no communicatory function, for it is extremely difficult to observe that a Chaffinch hearing sub-song is in any way influenced by it except that it may be induced to start singing itself. This, however, is not a characteristic response since almost any quiet, high-pitched noise such as the hissing sound made by the running of a tap will tend to start the birds singing.

Sub-song seems to be most frequently and consistently produced by first-year males in the early spring, although it is also produced by older birds and seems in general to be characteristic of the increasing production of sex hormone. The opinion of the bird fanciers that "recording" is in the nature of practice is, to some extent, borne out by our own studies, in that the sub-song does seem to provide in some degree the raw material out of which, by practice and by the elimination of unwanted extremes of frequency, the full song is, so to speak, crystallized. This "crystallization" consists of the building up of a comparatively complex song on the basis provided by the innate or inborn song. This building up to some extent involves picking up notes and phrases from other Chaffinches with which the bird may be singing in competition in its territory, and partly entails the incorporation of sounds characteristic of the sub-song.

Although the sub-song of the Chaffinch in the wild is sometimes associated with territory and may be given both from song posts or while feeding or preening on the ground, it is perhaps more often given from fairly dense cover. This is undoubtedly one of the reasons why it is so frequently overlooked by the field observer, the quality of the notes being such that the naturalist who knows only the true song would probably not recognize the utterance as coming from the Chaffinch at all.

One very striking feature observed when one studies records of the transition of the sub-song into the full song is the fact that at least some part of the process consists in discarding those more extreme frequencies which are not required in the latter. The belief that the sub-song is of no communicatory function is supported by the fact that wild Chaffinches are not "imitative" birds in that they will not normally include in their true song sounds other than those which they have heard in the full songs of other Chaffinches. Yet when they sing the sub-song they are much less particular and it has been possible to recognize notes and phrases copied from Canaries, tits (*Parus spp.*) and other birds in the sub-songs of our experimental Chaffinches.

If, then, we base our conclusions on the Chaffinch, which has been studied far more thoroughly than any other species, we might decide that sub-song differs from true song in the following respects:

- (1) The main fundamental frequency of pitch of the notes is apt to be lower than in the full song.
- (2) The frequency (or pitch) range of the sub-song as a whole and of the individual notes of which it is composed tends to be greater.
- (3) The sub-song is much quieter.
- (4) The overall pattern of note comprising the utterance is entirely different.
- (5) The length of the phrases of the song bursts is different, tending to be longer.
- (6) The sub-song is characteristic of lower sexual motivation, being generally produced earlier in the breeding season.

- (7) There is some evidence that, especially in young birds, the sub-song is in the nature of practice for the true song.

Having established these points of difference with regard to the Chaffinch, it obviously becomes interesting to enquire whether similar differences hold good with other species. In the course of our work at Madingley we have recorded a few examples of sub-song in species other than the Chaffinch, but these would not have been sufficient to warrant an article such as this, had it not been for the generosity of the British Broadcasting Corporation in placing at our disposal some years ago a complete set of the bird song records in their collection and, further, in keeping this up to date as new records were acquired. We have, therefore, worked through all the records in this splendid collection which are labelled sub-song or which, because of their low volume or other characteristics, suggest that they might be included in this category.

In addition to the B.B.C. records, we are much indebted to Professor P. Kellogg, of Cornell University, for providing us with copies of a number of records of American bird songs where a good deal of individual variation is shown, some of which may be regarded as sub-song. It stands to reason that sub-song as at present defined is only likely to be recognized in species of which the full song is a loud and fairly stereotyped utterance in use as a territorial proclamation. In other species where the song seems to have but little territorial function and indeed seems to serve primarily, if not exclusively, as a component of sexual display and for maintaining and co-ordinating the behaviour of a mated pair through the breeding season, the usefulness of the term "sub-song" is at present very doubtful.

SUB-SONG OF THRUSHES

The European thrushes supply the best material, apart from the Chaffinch, for the study of sub-song. The Blackbird (*Turdus merula*) and the Song Thrush (*T. philomelos*) both provide examples of what appears to be sub-song, answering in every respect to the provisional definitions set forth above. Figs. 1-4 (plates 69 and 70) show examples of the sub-song of both these species as compared with the characteristic phrases from the full song, and in both species there is evidence suggesting that the sub-song is in the nature of practice. The Mistle Thrush (*T. viscivorus*) (Figs. 5 and 6, plate 70) also provides some good examples of sub-song except that we have no clear evidence that the average main frequency of the fundamental is, in this case, any lower; nor is there any very impelling reason to think that the sub-song is practice in this species. The same is true of the Redwing (*T. musicus*) (Figs. 7 and 8, plate 71) except that here there is a slight increase in the main frequency of the notes when the transition to the full song occurs.

OTHER SPECIES (FINCHES, BUNTINGS, ETC.)

In none of the other species we have investigated is there any particular reason to suppose that the sub-song serves as practice, although, of course, it must be remembered that the estimation of the evidence of this is at best a subjective matter and unless one has very prolonged experience of a number of individuals one cannot be at all definite about it. It seems probable from observations on the Brambling (*Fringilla montifringilla*) in our aviaries that the full song of this species is simply the "zee" note repeated with minor variations and that more complex utterances, which include a "churring" sequence of about 0.7 seconds duration, are eliminated as full sexual motivation develops with the season. Apart from this, however, there are a number of other cases of what seem to be genuine sub-songs. Both the Canary (*Serinus canarius*) and the American Goldfinch (*Spinus tristis*) (Figs. 9-12, plates 71 and 72) have sub-songs which are typical enough in all respects save that there is no marked difference in the duration of the song bursts as between the two types of utterance. Neither do the records we have of the American Goldfinch suggest that there is any very definite difference in volume or intensity between the two.

When we come to the buntings the position is much more obscure and one hesitates to say whether sub-song is present or not. We have a record of the Yellowhammer (*Emberiza citrinella*) which suggests that the early incomplete song contains lower frequencies than does the true song, and similarly has a greater frequency range. The Corn Bunting (*E. calandra*) also shows a tendency to have a sub-song of lower pitch and volume which in addition displays some slight differences in pattern (Figs. 13 and 14, plate 73).

In the B.B.C. collection is a recording (Fig. 16, plate 74) of the Scottish Crossbill (*Loxia pytyopsittacus scotica*), Inverness-shire, May 1957, which is labelled "sub-song", but we have no reliable recording of the full song of this sub-species with which to compare it. There is, however, a good recording of the full song of the Crossbill (*L. c. curvirostra*) from Suffolk, March 1953, (Fig. 15, plate 73) and if *The Handbook of British Birds* is correct in stating that the full songs of these two birds are indistinguishable, then we can say that the Inverness-shire record of *scoticus* (Fig. 17, plate 74) does show in several respects the characteristics which we should expect of a sub-song. Thus the main frequencies are lower, there is a distinct difference in pattern, and the song bursts are longer.

Finally, the Dunnock (*Prunella modularis*) (Figs. 18 and 19, plate 74) is the subject of a record made in Kent in March 1954, in which differences of frequency-range, volume and pattern all seem to be clear and which we may provisionally regard as genuine sub-song.

It is clear that this preliminary survey has served to do little

more than provide some suggestions as to what may prove to be a very interesting and profitable line of investigation both for the aviculturalist and the field naturalist equipped with a good tape recorder. It is with the hope that others will find this a very promising subject of research that we publish this short article.

SUMMARY

Sub-song is defined as differing from full song in being: (1) quiet, (2) of a different pattern, (3) with song bursts longer, and (4) the notes of lower fundamental frequency. Also (5) the frequency-range of the notes in the sub-song tends to be greater (i.e. the notes are less pure in tone and less definite in pitch). Finally (6) the sub-song is usually produced earlier in the breeding season when sexual motivation is lower, and in young birds at least sometimes (7) appears to be a form of "practice" for the production of the full song. Chaffinch, Blackbird and Song Thrush all have sub-songs which show evidence of having these seven characteristics. Other species having sub-songs with 4 or 5 of these characteristics are Mistle Thrush, Redwing, Canary, American Goldfinch and Dunnock. More doubtful examples of sub-song are found in Brambling, Yellowhammer, Corn Bunting and Crossbill.

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Vertical scale = frequency in kilocycles per second. Horizontal scale = time in seconds. Numbers in brackets refer to B.B.C. Record Library.

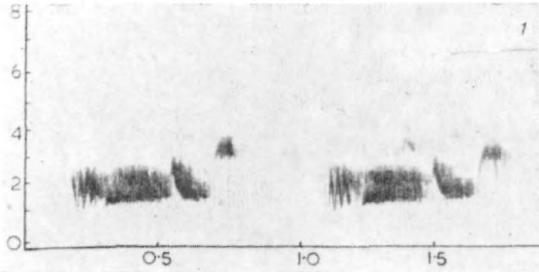


Fig. 1—Typical phrases from full song of Blackbird (*Turdus merula*): N. London, April 1957 (25025B). Phrases shown can be approximately rendered by the syllables *ill-ew*, *ill-ui*. Note fairly pure tone fundamental frequencies of the characteristic notes, restricted within a range of about 1.5 kc. with little sound above 2.5 kc. (page 512).

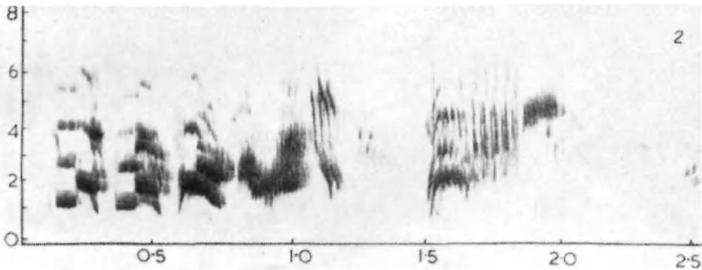


Fig. 2—Typical phrases from sub-song of Blackbird (*Turdus merula*): N. London, April 1957 (25025). Note very impure and therefore harsh-sounding notes as compared with Fig. 1, with fundamental frequencies ranging between 0.5 and 5.0 kc. (i.e. both lower and higher than those of full song).

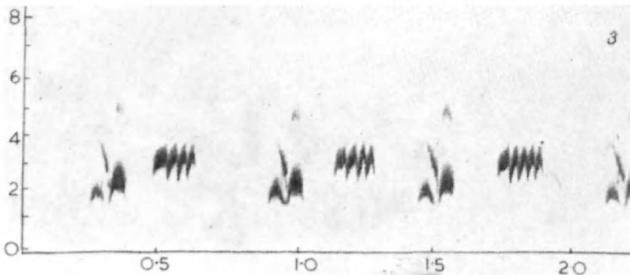


Fig. 3—Typical phrases from full song of Song Thrush (*Turdus philomelos*): Yorkshire, April 1956 (25025B). Phrases can be approximately rendered by the syllables *tu-ittee*, *tu-ittee*, *tu-ittee*. Note purity of tone. (page 512).

PLATE 70

Vertical scale = frequency in kilocycles per second. Horizontal scale = time in seconds. Numbers in brackets refer to B.B.C. Record Library.

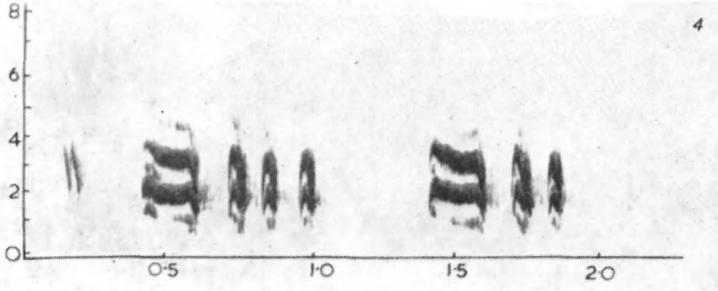


Fig. 4—Typical phrases from sub-song of Song Thrush (*Turdus philomelos*): Yorkshire, May 1954 (25025B). Note presence of lower frequencies and also greater range of frequencies as compared with the full song in Fig. 3.

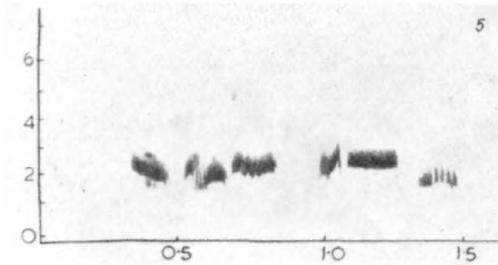


Fig. 5—Typical phrases from full song of Mistle Thrush (*Turdus viscivorus*): Kent, March 1954 (15135A). Note characteristically pure notes. (page 512).

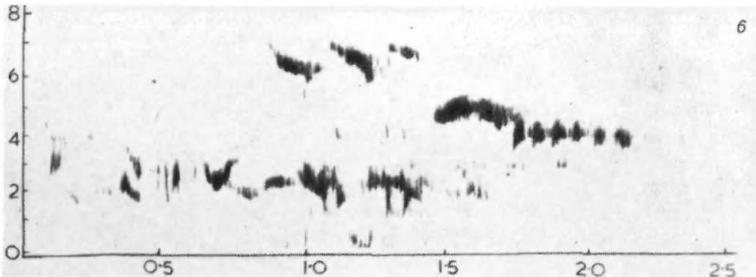


Fig. 6—Typical phrases from sub-song of Mistle Thrush (*Turdus viscivorus*): Kent, March 1954 (15134A). Note harsh impure notes with big frequency range and rambling ill-defined phrases.

Vertical scale = frequency in kilocycles per second. Horizontal scale = time in seconds. Numbers in brackets refer to B.B.C. Record Library.

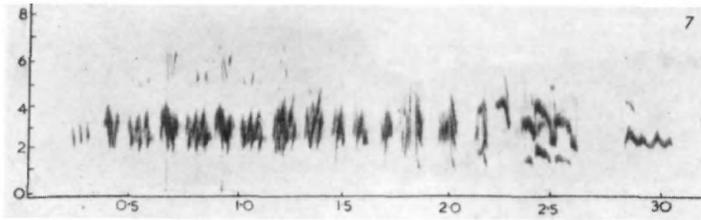


Fig. 7—Typical phrases from full song of Redwing (*Turdus musicus*): Thingvallatvñ, Iceland, June 1953 (15093). (page 512).

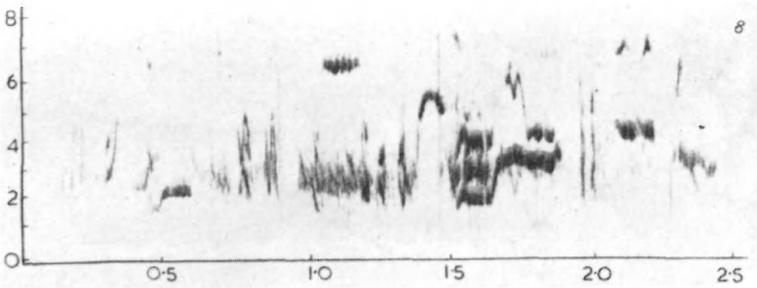


Fig. 8—Typical phrases from sub-song of Redwing (*Turdus musicus*): Kent, March 1954 (15134A). Note big frequency range and phrases less well defined than those in Fig. 7.

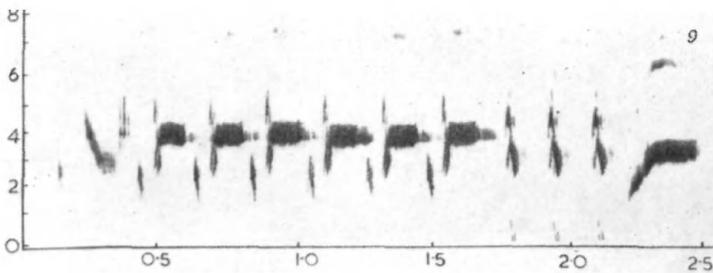


Fig. 9—Typical phrases from full song of Canary (*Serinus c. canarius*) (15030). Note purity of notes. (page 513).

Vertical scale = frequency in kilocycles per second. Horizontal scale = time in seconds. Numbers in brackets refer to B.B.C. Record Library.

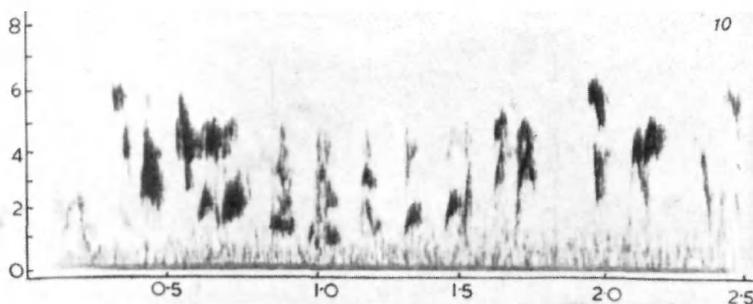


Fig. 10—Typical phrases from juvenile song of Canary (*Serinus c. canarius*), Madingley, Cambridge, July 1954. Note impurity of notes, containing much lower frequencies than those in Fig. 9.

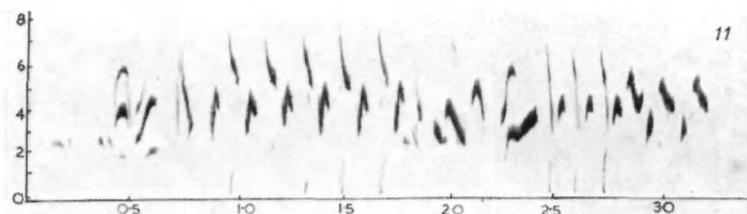


Fig. 11—Typical phrases from full song of American Goldfinch (*Spinus tristis*): Steward Peak, Ithaca, New York (Cornell recording). (page 513).

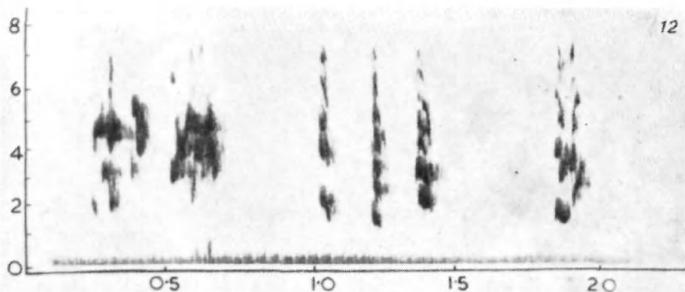


Fig. 12—Typical phrases from song of young captive American Goldfinch (*Spinus tristis*): Varna, New York, August 1952 (Cornell recording). Note that sound energy in the notes is spread fairly randomly over about 7 kc., compared with about 3 kc. in the full song in Fig. 11.

Vertical scale = frequency in kilocycles per second. Horizontal scale = time in seconds. Numbers in brackets refer to B.B.C. Record Library.

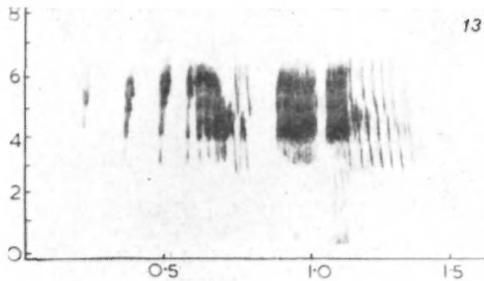


Fig. 13—Song of adult hand-reared Corn Bunting (*Emberiza calandra*): Madingley, Cambridge, May 1954 (W.H.T. Disc 120). This consists of a single short phrase of clicking and jangling notes, which is completely innate. (page 513).

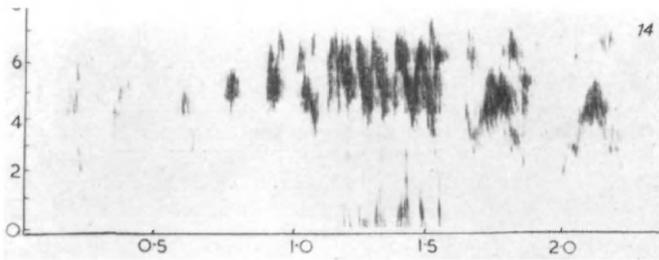


Fig. 14—Probable sub-song of hand-reared Corn Bunting (*Emberiza calandra*): Madingley, Cambridge, November 1952 (W.H.T. Disc 59). Note longer sequence with bigger frequency range than song in Fig. 13.

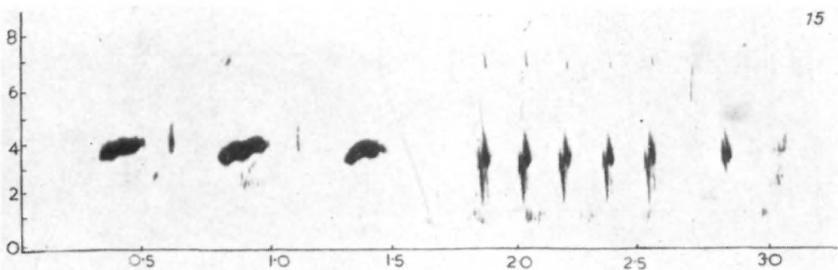


Fig. 15—Typical notes from full song of Crossbill (*Loxia c. curvirostra*): Suffolk, March 1953 (1522B). (page 513).

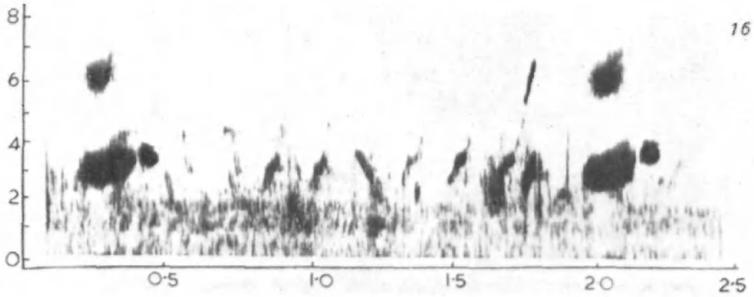


Fig. 16—Typical notes and phrases from sub-song of Scottish Crossbill (*Loxia pytyopsittacus scotica*): Inverness-shire, May 1957 (25031A).

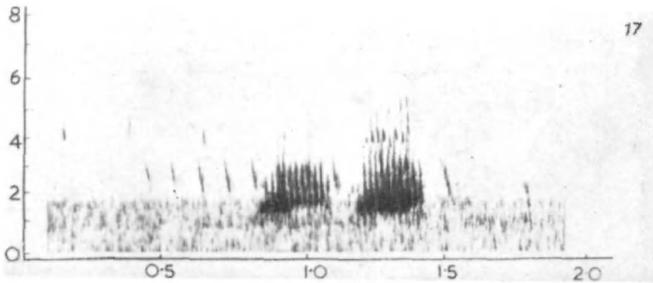


Fig. 17—Churring notes from sub-song of Scottish Crossbill (*Loxia pytyopsittacus scotica*): Inverness-shire, May 1957 (25031A).

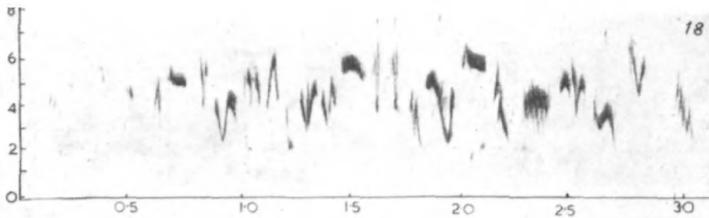


Fig. 18—Phrase from full song of Dunnock (*Prunella modularis*): Hampshire, May 1957 (15032A). (page 513).

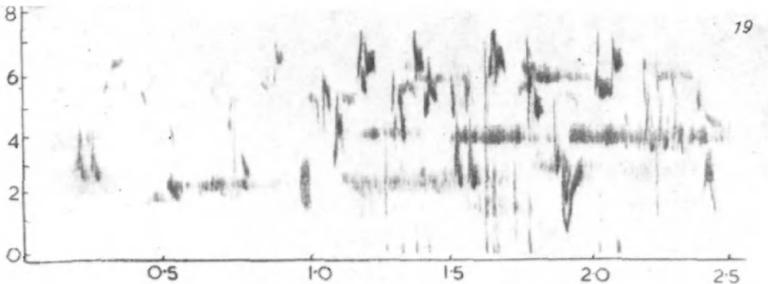


Fig. 19—Phrase from sub-song of Dunnock (*Prunella modularis*): Kent, March 1954 (15134B). Obviously similar to song in Fig. 18, but fundamental range greater and phrasing much less well defined.