

## RECORDING SOUNDS OF WILD BIRDS.

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THERE is little question that if it were possible to produce satisfactory phonograph records of birds' songs and calls, the study of bird voices would be greatly stimulated. All previous methods, while useful in their way, were, at best, merely makeshifts, awaiting the time when science should have advanced sufficiently so that faithful reproductions of actual singing birds could be made. Aretas A. Saunders, in "Bird Song," N. Y. State Museum Handbook, 7, 1929, says, "Perhaps some day we can devise a phonograph that can amplify bird songs sufficiently to record those of wild birds. Then we shall be able to play the records over as much as we like and analyze the song in detail." E. H. Forbush, in 'Game Birds, Wild Fowl, and Shore Birds,' 1912, says, page iv, "Attempts to suggest bird notes on paper almost always are inadequate. My own always have been unsatisfactory."

All classes of bird students would find bird song records extremely useful. The casual bird lover would find identification much easier if he could study the songs and calls at his leisure. The nature-study teacher in the rural and suburban school would be able to make much greater progress with her bird study classes, if in addition to her adequate pictures of birds, she could also have available bird song phonograph records. The serious student of ornithology could study song in a way that has been impossible heretofore.

It was with these thoughts in mind, in 1931, in the Ornithological Laboratory of Cornell University, that these experiments were started. Under Prof. Arthur A. Allen's direction and supervision, and with the aid of the many interested bird students, there was greater chance of success at Ithaca than in almost any other locality.

It is now several years since sound has been added to the motion picture and it naturally follows that if the motion picture industry can take sound out-of-doors, the naturalist should also be able to do so. The advances made in the last ten years in per-

fecting amplifying tubes, and in electrical sound recording, have made both the talking-movie and recording sounds from nature possible. It merely remained to discover what was the most satisfactory method of adapting the various inventions to our needs.

After much trial and error, and many false starts, we finally devised a machine which can be described, in general terms, as an adaptation of the sound half of a "location" motion picture truck. The mechanism is housed in a small closed Ford truck, and takes two men to manipulate it.

The essential points of the method of recording used are as follows. The microphone transforms sound-waves into electrical energy, and amplifiers increase the comparatively feeble microphone current to values sufficient to cause a glow tube to flicker in exact correspondence with the frequency and intensity of the sound. The glow tube is placed in the camera so as to affect a narrow track of the film. The exposure is made through an air slit .001 inches wide. The emulsion side of the film passes over and close to the slit, back of which is the glow tube. The speed of the film is constant, and passes the slit at the rate of eighteen inches per second. The machine would therefore theoretically record vibrations up to 18,000 single vibrations, or 9000 double vibrations per second. Certain mechanical causes make it probable, however, that about 6000 double vibrations is as high as can be recorded by the apparatus used in these experiments. This, however, appears to be sufficiently high to give faithful reproduction of bird song.

In making a sound recording, a cable is run out from the truck to a suitable location for the microphones. Two microphones are carried, one a condenser, the second, a dynamic. They can be set anywhere within 250 feet of the truck, and thus far it has been found that at that distance from a road one can get sufficiently close to any bird whose voice one desires to photograph. The closer one is to the singer the better; as it is advantageous to amplify as little as possible; for the greater the amplification the greater will be the sounds other than those desired; and we have found that one of our greatest difficulties in recording is to get the sound wanted, without a background of extraneous sounds.

The cable from the microphone is connected to the amplifier in the truck, and the increased current is fed into the glow tube, which is inserted into the sound camera. One of the operators is inside the truck, and has on a pair of earphones. He can listen to the sound as it is picked up by the microphone 200 feet away. He also has control of the amplifier switchboard. At the proper moment he throws the switch which drives the motor, and sends the film through the camera. Thus are bird sounds recorded.

Development is practically the same as for motion picture film. The developed film is then ready to be played back; and there are numerous commercial sound and picture projectors that are available for that purpose.

Transferring the film recording to phonograph is entirely feasible, and merely another mechanical process. We have been able to produce a record which gives a truthful rendition of a number of singing birds. How good the sound is depends, very often, on how accurate the phonograph is on which the record is played. A number of the poorer grade phonographs are incapable of reproducing the higher frequencies of certain bird songs; and naturally these songs are heard in a more or less distorted form when played on an inadequate machine; but with the fine electrical reproduction of a good, modern, amplifying phonograph, almost perfect reproduction is attained.

It must not be assumed that the taking of bird sounds is a simple process. It is far from that, just as the getting of good photographs is also difficult. There are a number of factors that enter into bird sound recording that make it much more complicated than the brief description just given would suggest. The truck not only carries the sound camera, amplifier and microphones, but also an imposing array of storage and dry cell batteries; and making the various circuits of direct current give satisfactory results necessitates the assistance of skilful physicists and electrical engineers. Even assuming that the machinery is in perfect order,—and it is delicate in the extreme, and often in need of attention,—other factors come in to harrass the recorder.

It is not as simple as it would seem to get a location where there is absolute quiet. Too great proximity to a traffic road, for instance, makes recording impossible. Frogs and farmyard noises

also interfere, as do aeroplanes, farm tractors, and even insects that buzz close to the microphone. A passing railroad train several miles distant often holds up recording; and we cannot choose locations near babbling brooks and streams, as the sound of the rushing water makes a constant background, so much akin to the mechanical noises of reproduction as to be mistaken for them. Working close to electric wires of any sort is dangerous, as the hum from the wires is likely to be picked up by the microphones. But undoubtedly the worst trouble is with the wind. On windy days it is practically impossible to work, and it has often occurred that after starting out before sunrise to record, on a still morning, before the location is reached and the machinery is set up, a breeze has started up, and all one can do is to take up the equipment, and try again on some more favorable day.

But even with all these impediments, making actual records of wild birds' songs is distinctly feasible; and it would seem logical to assume that the study of bird songs through these records is a branch of ornithology that will be much used in the future. Many of the secrets of avian life are hidden in an understanding of the meaning of song, and with the possibility of actually taking with us from the field the song of the bird, we are in a far better position than heretofore to unravel these mysteries.

It would seem that a new field for the student of bird life has presented itself. The possibilities are very large, the subject one that has been difficult to approach heretofore. It is folly to predict but there are certainly many improvements and changes awaiting development in sound recording.

This, however, does seem apparent:—now that electrical amplification methods can be used in recording sounds from nature, that technique is likely to become almost as indispensable to the ornithologist of the future, as the camera has become to the present, generation, and as the gun was to earlier workers.

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