FIELD RECORDING OF NATURAL SOUNDS, WITH A NEW ZEALAND BIRD DISCOGRAPHY

By L. B. McPHERSON

ABSTRACT

This account discusses how to record natural sounds in the field, outlines a history of bird sound recordings and compares recording equipment used over the years since 1889 with what is used to-day. Uses of bird recordings are discussed, and a discography of recordings commercially available of the songs of New Zealand birds is added.

HOW TO RECORD NATURAL SOUNDS IN THE FIELD

There are three ways of tackling the problems of recording of the sounds made by animals in the wild. One way is to make a detailed study of the habits of the animal, whether it be a bird, insect or a bat or a frog, to find the place where the subject vocalises most often. A microphone is then placed in a convenient location as close as possible to the source of sound. It is essential for most birds and other larger animals to camouflage both microphone and the cable when using this method of recording which requires a great deal of patience but can result in recordings of exceptional quality. After placing the microphone and cable satisfactorily the next stage takes place at the tape recorder which should be at least 50 metres away in a sheltered spot. Once the subject to be recorded appears near its vocalising station the recorder can be switched on and made ready to record. Some tape recorders have a manually operated pause that can be used at this point; most machines suitable for field work will also allow the use of headphones which are a must for this type of work. Once the subject reaches its actual singing post the operator should start recording. I usually use the first few seconds of sounds to make any adjustments to the recording level that may be needed. At the end of recording one should make a note of the name of the species, time, place and any other relevant data that may need to be referred to at a later date for writing up field notes, etc. It can take many years to get a good recording of a bird by this method; on the other hand, many good recordings that are available have been produced in this way.

A more common method of recording natural sound particularly birds is by the use of an apparatus called a ' parabolic reflector.' This method was first used by Peter Keane and Arthur A. Allen of Cornell University, New York, in 1932. Parabolic reflectors are made in various sizes from a 12 inch (30cm) model to about a 48 inch (120cm)

diameter. The most common sizes in New Zealand seem to be the 18 (45cm), 24 (60cm), 36 (91cm) and 40 inch (102cm) sizes. The greater the diameter of a reflector, the greater is the increase of working range and frequency response. On one occasion I was able to record Tuis *(Prosthemadera novaeseelandiae)* at a distance of 800 metres with an 18 inch (45cm) reflector, the usual range of which is about 35 metres. I now use a commercially made 24 inch (60cm) reflector which is about as big as I can handle on my own for any length of time. When recording with this rig, I set the microphone at the focal point in the reflector (i.e. the point where all the reflected sounds converge), in this instance 7 inches (18cm), and train it on the bird that I am recording. I have two ways of telling if I am on to the subject being recorded: one is by a lift in volume in the headphones, and the other way is by lining up with the peep sight on the reflector. I use both of these methods in the field and I always use the reflector hand held in the field, usually with a short microphone cable. This arrangement would allow the use of tape recorders not otherwise suitable for this work. If tape recording in the field is done by a group of two, one person can take over the reflector and the other the tape recorder. This of course allows the use of bigger reflectors and long lengths of cable. The biggest advantage in using a parabolic reflector instead of an open microphone is in the fact that a reflector is a very directional piece of equipment and this becomes more noticeable as reflectors get bigger. The usual working range for the 24 inch (60cm) reflector is about 50 metres.

The third method of recording uses what is technically known as a shotgun microphone. These are very expensive but can give very good results. The microphone diaphram is built into the end of a long tube that looks rather like a shotgun, hence the name. To make a recording using this method all one has to do is to point the microphone at the subject. Headphones would be essential when recording by this method. Another method uses an instrument called a "snoopascope" which is essentially a series of tubes of an internal diameter of one inch (2.5cm). There are 36 tubes the longest of which is 36 inches (91cm) long, the shortest one inch (2.5cm). These are arranged so that any one of these can be fitted over the head of the microphone at will. This arrangement is extremely directional but has drawbacks in that it is a two man job to carry a metal snoopascope anywhere. In spite of this they are used in South Africa and elsewhere. I have heard some good bird recordings made with the method.

A HISTORY OF BIRD SOUND RECORDING

In 1889, Ludwig Koch made a recording of an Indian Shama *(Copsychus malabaricus)* at Frankfurt on a wax cylinder. This recording is reproduced on a disc called "A Salute to Ludwig Koch." This is the earliest known bird recording to be made. The world had to wait a further seven years until the first commercial disc of a human imitation of a bird call came on the market, in America,

on a Berliner record (No. 403). The first reference in the scientific literature to the reproduction of bird song came in 1898 in Washington, D.C., with a gramophone recording of a Brown Thrasher *(Toxostoma rufum)* by Dr Sylvester D. Judd. In 1900, Cherry Kearton, in England, made the first recordings of wild birds there with the song of the Nightingale *(Luscinia megarhynchos)* and a few Song Thrush *(Turdus philomelos)* notes. Between about 1905 to 1909, Ludwig Koch, working in Frankfurt, started on the first attempt anywhere in the world to make a collection of wild bird recordings. He used a machine that recorded directly on to wax cylinders; this was in Frankfurt, Germany. In May 1910 the first commercial gramophone record ever published with a bird voice on it was issued by the Gramophone Company in England as a 10 inch (25cm), 78rpm, single-sided disc (number 6439) featuring a captive Nightingale from the aviary of Carl Reich in Berlin. Also about 1910, the first disc presenting the voices of wild birds appeared, published by the Beka Gramophone Company of Berlin. The first field recordings to be made in Russia appear to have been made late in 1912. On 18 May 1929, the first recordings of wild birds in the North American region were obtained. They were made by the Fox-Case Movietone Corporation under the ornithological direction of Arthur A. Allen and Peter Paul Kellogg at Ithaca, New York. The recordings made were on film synchronised with moving pictures, and included Song Sparrow *(Melospiza melodia)*, Rose Breasted Grosbeak *(Pheucticus ludovicianus)* and House Wren *(Troglodytes aedon)*. Also in 1929 the first recording of a wild bird from the Ethiopian area was obtained by Ludwig Koch, the bird being a Superb Glossy Starling *(Spreo superbus)*. This recording appears on the disc entitled " A Salute to Ludwig Koch " published by the BBC. In 1931 the first Australasian recording of a wild bird was made by R. T. Littlejohns with the aid of motion picture equipment. On this occasion the Lyrebird was the performer. The year 1932 saw the first use of the parabolic reflector in ornithology when two Americans, Peter Keane and Arthur A. Allen, did some experimental work. The first " Sound Book " devoted to birds was published in 1934 at Munich under the title " The Wood Resounds." This was a 10 inch (25cm) 78rpm record and a 40 page book by L. Koch and L. Heck. Then in 1934 the first bird sounds from the Antarctic were recorded on 3 December of that year. This recording of the Emperor Penguin *(Aptenodytes forsteri)* was made on an aluminium disc and was the first recording made anywhere in the world using a radio link. The first recordings from the Oriental area appear to be those made by the Coolidge Carpenter Expedition of 1937. About 1943 the first field recordings from the Neotropical region were made on Barro Colorado Island, Panama. The first recordings of birds on magnetic tape appear to be those made by Sture Palmer of Sveriges Radio on the island of Gotland in Sweden in 1946. Guillemots *(Uria aalge)* and Razorbills *(Alca torda)* were recorded on this occasion. The first commercially available records of oriental bird songs became available from Japan in 1954. Carl and Lise Weismann of Denmark commenced recording New

Zealand birds in September of 1956. Kenneth and Jean Bigwood were also active at this time. The year 1959 saw the first commercial discs of bird songs released in the USSR and in New Zealand. The first occasion when a scientific paper, as such, was illustrated by sound recording was in 1960 (see Boswall, 1969: 470). The Puerto Rican Whip Poor Will *(Caprimulgus noctitherus)* was rediscovered by the use of a sound recording of its voice in 1961. The song of the Musician Wren *(Leucolepis modulator)* recorded in Brazil by Johan Daglish Frisch was transmitted to the world via a satellite in space orbit in 1963 as part of an international television hook-up. In 1963, also, was the publication of the first bird record in stereophonic sound. The record called "Birds In Stereo" was issued by Biophon in Sweden and was a 7 inch (18cm) 45rpm, EP, by Sten Wahlstrom and Sven Aberg. References to all these historical events can be found in the paper by Boswall (1969) in a special issue of *Recorded Sound* (see Br. Inst. Rec. Sd 1969). Other relevant literature can be found in the papers by Boswall in 1963, 1964 and 1970 and by Boswall & North (1967) and also in Boswall & Prytherch (1969) which lists an especially interesting Antarctic discography.

In New Zealand, J. L. Kendrick of the Wildlife Service of the Department of Internal Affairs started working on the National Collection of Wildlife Sounds in 1963 (see Kendrick 1973 and Anon. 1974) and several catalogues of the Collection's unpublished recordings have been issued. The Orange-fronted Parakeet *(Cyanoramphus malherbi)*, formerly thought to be extinct, was rediscovered in the Durville Valley during 1965 by the use of recordings from this collection.

RECORDING EQUIPMENT OVER THE YEARS

The earliest recordings were made directly on to a wax cylinder on an Edison cylinder machine. The sound that was being recorded was focused into a horn which had a stylus attached to its trailing end. Any sound picked up by the horn caused the stylus to vibrate and the louder the sound the greater was the vibration. This stylus was set on to the outer edge of a wax cylinder so that it would cut a groove as the cylinder revolved at a set speed, usually 160 rpm. At the same time the stylus moved slowly across the cylinder faithfully transcribing on to the wax the vibrations caused by the horn picking up a sound signal. In the 1930s disc cutters were used in the field. These machines were very cumbersome things but technically much advanced over the cylinders in use earlier. To use these machines successfully one had to be very patient indeed. Most of the recordings available used the open microphone technique described earlier. The microphones had to be set up in a suitable locality and long cables run to the recording plant up to a mile away. The operator had to monitor the incoming signal continuously on headphones or on a small speaker. Once a satisfactory signal was received one could lower the cutting stylus on to the disc which revolved at 78rpm and cut a recording in the normal manner. These discs could be 10 (25cm) or 12 inches

(30cm) and ran from 2½ to 4 minutes respectively per side. The recordings are usually referred to as acetate discs because they are an aluminium disc covered with a thin coating of acetate. In the USA and in Australia movie picture equipment was used on a few occasions to record bird sounds. This technique apparently recorded the sound on to an optical sound film at the same time as the moving film was being exposed. The next development was the parabolic reflector which made field recording very much easier, even of species which are usually very wary. Perhaps the greatest advantage of this method is that the operator and equipment can be some distance away from the subject being recorded thus causing less stress to it.

A more recent method is using the shotgun microphone which is very directional but suffers from a lack of range for this type of work. This type of microphone can be used successfully in windy conditions where the other techniques cannot be employed satisfactorily. This factor is a big advantage to consider when deciding what method of recording is to be used. In some difficult situations radio transmitting equipment is used as part of the set up. This entails the use of a portable radio transmitter which is set up to broadcast the signal from the microphone back to a radio receiver which is connected, in turn, to the tape recorder. This was a practical proposition in earlier days when tape recorders were big, heavy, cumbersome machines not easily carried about, but today's light weight portables may be lighter than the portable radio transmitter.

RECORDING EQUIPMENT TO-DAY

Tape recorders are by far the most popular medium for recording natural sounds, several different makes and models being used with differing characteristics, and some doing a better job than others.

The best tape recorder made for this type of work would be without doubt the Nagra, a machine with several interesting features according to the model. These machines will record and play both of the major recording curves in use today (CCIR & NAB) and are full track variable speed machines. Most laboratory workers have access to these or to the Uher machine. Second to the Nagra would perhaps be the Uher 4000 series, particularly models L and S. These machines have the disadvantage of being limited to a 5 inch (13cm) reel of tape with a consequent reduction in playing time. The Nagra will take a 7 inch (18cm) reel of tape. Another problem with the Uher for field work is that they are half track machines, but they are considerably lighter than the Nagra and very solidly built. If the recorded tape is likely to be replayed on a studio machine with a full track head, one should record a half track tape, one track only, otherwise both tracks would be heard together with one of them going backwards. These comments also apply to four track machines as well. The Uher tape recorder plays and records to the NAB standard.

Many field recordings have been made on Ficord tape recorders. While these are not as good as the two previous makes they can

produce some excellent recording. The two models I have seen are limited to a 4 inch (10cm) reel of tape and work to the CCIR standard. One of the first portable machines to become available was the EMI L2 series, not especially designed for field recording but frequently used there. These machines were made for rcording on the spot interviews, for radio broadcast work and allied use. The EMI L2 is still in use in some places as a broadcast machine after twenty years. These machines had a 5 inch (13cm) reel of tape and recorded to the CCIR standard. Most of the birds on the record " A Treasury of New Zealand Bird Song " were recorded on an EMI L2. Volumes 4 and 5 in " Sounds of New Zealand Birds " were also recorded on these machines; volumes 1, 2 and 3 were recorded on the Uher 4000. Another machine used in North America is the Magnemite although rarely seen in New Zealand. This machine operates at the high speed of 15 inches (38cm) per second and is a half track model. The only other machine mentioned that will reach this tape speed is the Nagra, all the rest having a maximum of 7½ ips (19cm) except the EMI L2C which also operated at 15 ips (38cm).

MICROPHONES

A directional dynamic type is most suited to field work for several reasons, one of the most important being the rugged heavy duty construction of these microphones. The two I use myself have good responses from 20Hz to 20000Hz in one instance and from 40Hz to 18000Hz in the other case. Most of the better microphones in this class have a good output and drive most tape recorders well without having to use transformers or amplifiers. For field work low to medium impedance microphones (15 to 600 ohms) are essential particularly if long cables between microphone and tape recorder are being used. If an operator uses high impedance microphones, transformers and possibly line amplifiers may be needed particularly on long runs of cable.

I use AKG D200 and Grampian D4 microphones for my own recording work and have found these to be very satisfactory indeed for use in the field. Other microphones that are suitable are certain models from the Electrovoice Altec, and STC ranges. Some recording work in the field is being done with excellent results with both Moving Coil and Condensor microphones now. However, both of these types of microphones are not as robust as the other kinds of dynamic microphones and are much more prone to damage. Crystal microphones are not really suitable for field work as they cannot be used with a long lead without serious technical problems occurring. Another factor against these microphones is a reduced frequency response.

POSSIBILITIES OF OTHER TAPE RECORDERS

Although professional tape recorders give the best results if properly used, this does not mean that the domestic recorder cannot be used in the field. I have in my collection a recording of a New Zealand Black-browed Albatross *(Diomedea melanophris impavida)*

that was recorded on a cassette recorder on Campbell Island during December 1972. The quality of this recording is very good indeed and is better than some professional tapes that I have heard. I also have a recording that was made on a National portable machine of the White-winged Triller *(Lalage sueurii tricolor)* seen in Dunedin in 1969 (see MacPherson, 1973). This recording while not of the highest standard mostly due to the circumstances in which it was recorded has richly repaid the work that was devoted to it during the copying process. It will be published, I hope, on disc in 1976. The portable battery operated machine can be used in the field with a short microphone cable and careful attention to recording technique with great results. The faster the tape speed employed the better the resulting recording should be, all other things being equal. This is because a tape travelling at a high speed can handle high levels of high frequencies better than the same tape at half the speed. Mains operated tape recorders can be used in the field also but with considerable difficulty. If recording is being done in a location well away from an AC power supply one can use a car battery and a converter that will supply the correct voltage and cycles with a good chance of acceptable results. The long playing record by Myles E. W. North entitled " Voices of African Birds " contains examples of birds recorded in this way.

USES FOR YOUR FIELD RECORDING

Once your field recording has been made the problem arises of what to do with it. Tape recordings of natural sounds are used in a variety of ways for differing projects. Anyone who has listened to radio serials or some TV programmes will have heard natural sounds used to create an atmosphere. Recorded tapes are sometimes used for the sound track of both movie and TV films. In these circumstances the original tape is copied and edited on to a second tape which is, in turn, used in the appropriate place on the finished film.

Another very important use for your field tape recording is that of scientific research into the life and habits of birds, insects and other kinds of wildlife. For this work a recording should be a good clean one with little or no background sound. A great deal of analysis is carried out today using the audio spectrograph, a machine which prints out a graph of the sound that is being studied. The graph shows a frequency reading against a time base and can be fairly easily related to the original recording if the need arises. This instrument also can be used to show the intensity of the sound being analyzed. Differing races of birds have been separated in this way in recent years. Perhaps the most well known way of using a field recording is by publication of a gramophone record using a copy of the original recording. This can be done in two ways: one is to splice all the required recordings together in the correct sequence and to have a master disc (matrix) for a gramophone record produced from this. This method has the disadvantages of not allowing a uniform standard of audio level and quality control. The second method involves more

work but gives much greater control over both levels and quality. The field recordings selected are copied directly on to the master tape, the levels of sound being kept to constant volume. Any filtering that may be necessary to improve the quality of a recorded field tape is done at this stage. Any identifications are fed in at this point as well. Tape recordings of bird calls have been used to keep birds away from certain areas such as airfields and orchards and other places where they are a nuisance. Birds formerly thought to be extinct have been rediscovered by playing a recording of their voices in the area where they were last seen. A more recent innovation is the formation of a national collection of such recordings. There are few collections in existance on a zoogeographical basis anywhere in the world at present but most notable would be Cornell University Library, Institute Echo of France, and the BBC in England.

FILTERING

When field recording is being done for eventual use on disc or inclusion in a library of natural sounds the ideal is for the recording to be free from all extraneous noise. This is not always possible in New Zealand, the worst problem being wind. However, a recording of fair quality that has wind, water or even traffic noise on it can often be improved to an acceptable standard by filtering, thereby removing the unwanted sound and leaving the rest. As an example, all the recordings on volumes 4 and 5 of " Sounds of New Zealand Birds " have been improved in this way. I check all my field tapes when I am listening to them and write down on my field notes any filtering that might be needed at a later date. The filter that I use is a home made one that can remove up to 30 decibels per octave below any of six set frequencies up to 1000 hertz or 30db per octave above 1200Hz either independently or together as may be required. This filter was recently checked by the Engineering School of the University of Canterbury and was found to be accurate to 0.5 db, a figure equal to that of the best equipment available.

CONCLUSION

It is a sound practice to duplicate all your field tapes and to keep a copy in a separate place in case the original is destroyed or lost. It is for this reason that copies of all my tapes are to be deposited with the British Library of Wildlife Sounds which is a division of the British Institute of Recorded Sound in London.

A NEW ZEALAND DISCOGRAPHY OF BIRD SONG

BIGWOOD, K. & J. 1959. "A Treasury of New Zealand Bird Song." Three 7 inch (18cm) 45rpm extended play discs, EC14, EC15 and EC16. Published by A. H. & A. W. Reed, Wellington, New Zealand (Kiwi Records). These records came as a boxed set with a 40 page booklet by Gordon R. Williams of the New Zealand Wildlife Service who also introduces the 30 species presented.

EC14

Kea
North Island Kaka
Yellow-crowned Parakeet
Takahe*
Western Weka
White Heron
Blackbird
Song Thrush
House Sparrow
Dunnock

EC15

Tui
Bellbird
Grey Warbler
Yellowhead
South Island Robin
Yellow-breasted Tit
Redpoll
Greenfinch
Chaffinch
Goldfinch

EC16

South Island Kiwi
Morepork
Pied Stilt
Banded Dotterel
Blue Duck*
Paradise Duck
Yellowhammer
Skylark
Starling
White-backed Magpie
(*recorded by G. R. Williams)

BIGWOOD, K. & J. (1961). A Treasury of New Zealand Bird Song, No. 4.
One 7 inch (18cm) 45rpm extended play record, EC25. Supplement Number One. Booklet by Gordon R. Williams. A. H. & A. W. Reed, Wellington.

North Island Kiwi
New Zealand Falcon
Pukeko
Shining Cuckoo
New Zealand Kingfisher
Whitehead
Brown Creeper
New Zealand Pipit
Silvereye
Black Swan

WEISMANN, C. & L. (1963). New Zealand Bird Songs.
Two 4 inch (10cm) reels of tape recorded at 7½ips (19cm). Tape numbers 21 & 22.

No. 21

Grey Warbler
Pied Tit
Whitehead
North Island Robin
North Island Fantail
Bellbird
Tui
North Island Weka

No. 22

North Island Kaka
Kea
Morepork
Fairy Prion
Paradise Duck
Northern Blue Penguin

McPHERSON, L. B. (1970). Sounds of New Zealand Birds, Volume One.

One 7 inch (18cm) 45rpm extended play disc, No. PR575. McPherson Natural History Unit, Christchurch.

House Sparrow
Starling
Song Thrush
Stewart Island Weka
South Island Saddleback
Red-billed Gull
Shy (White-capped) Mollymawk
Black Oystercatcher
Sooty Shearwater
South Island Pied Oystercatcher

BIGWOOD, K. & J. (1971). A Treasury of New Zealand Bird Song.

One 12 inch (30cm) 33 1/3 rpm record, No. SLP 25. This is a re-issue of the first set of records in this discography; also available as a tape cassette, No. TCSLP 25.

WILLIAMS, G. R. & N.Z. WILDLIFE SERVICE (1972). A Treasury of New Zealand Bird Song. Supplement No. 2. Seabirds Calling.

One 7 inch (18cm) 45rpm extended play recording, No. EC34.

Wandering Albatross
Australasian Gannet
Northern Blue Penguin
White-fronted Tern
Caspian Tern
Sooty Shearwater
Fluttering Shearwater
Wedge-tailed Shearwater
Southern Diving Petrel
Broad-billed Prion

McPHERSON, L. B. (1972). Sounds of New Zealand Birds, Volume Two.

One 7 inch (18cm) 45rpm extended play disc, No. PR629.

Goldfinch
Tui
South Island Fantail
Rock Pigeon
Erect-crested Penguin
Paradise Duck
Canada Goose
Peafowl
California Quail
Spotted Shag

McPHERSON, L. B. (1972). Sounds of New Zealand Birds, Volume Three.

One 7 inch (18cm) 45rpm extended play disc, No. PR641.

Budgerigar
Blackbird
Crimson Rosella
Black Swan
Grey Partridge
Chukor
Yellowhammer
Mallard
Black-billed Gull
Grey Warbler

McPHERSON, L. B. (1973). Sounds of New Zealand Birds, Volume Four.

One 7 inch (18cm) 45rpm extended play disc, No. PR699. Field recordings by C. & L. Weismann.

Tui	North Island Fantail
Bellbird	Silvereye
North Island Robin	Brown Creeper
Whitehead	Pied Tit
South Island Fantail	Long-tailed Cuckoo

McPHERSON, L. B. (1974). Sounds of New Zealand Birds, Volume Five.

One 7 inch (18cm) 45rpm extended play disc, No. PR739. Field recordings by C. & L. Weismann.

North Island Weka	Kea
Red-fronted Parakeet	Pukeko
North Island Kaka	Fairy Prion
Northern Blue Penguin	Indian Myna
Morepork	Australasian Gannets

McPHERSON, L. B. (1975). Sounds of New Zealand Birds, Volume Six.

One 7 inch (18cm) 45rpm extended play disc, *in preparation.* Field recordings by C. Paulin*, H. Best† and J. Hutchinson**.

Adelie Penguin*	Mottled Petrel†
Snares Crested penguin†	Southern Diving Petrel†
Yellow-nosed Mollmawk**	Southern Skua†
Bullers Mollymawk†	Southern Black-backed Gull
Antarctic Tern†	Snares Cape Pigeon†

McPHERSON, L. B. (1976). Sounds of New Zealand Birds, Volume Seven.

One 7 inch (18cm) 45rpm extended play disc, *in preparation.* Field recordings by H. Best† and B. McPherson*.

Rook	Yellowhead
Skylark	North Island Saddleback
Redpoll	South Island Fernbird†
Welcome Swallow	Yellow-breasted Tit
White-winged Triller*	South Island Robin

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BR. INST. REC. SD. 1969. Recorded Sound. The Journal of the British Institute of Recorded Sound, No. 34. Wildlife special issue (including — Commercial gramophone records of wildlife sound, by Jeffery Boswall, pp. 425-427, Wildlife recordings in the BBC Sound Archives, by John Burton, pp. 427-432, Bird sound recording in South Africa, by June Stannard, pp. 434-435, Wildlife recording by the Swedish Broadcasting Corporation, by Sture Palmer, pp. 447-448, and several other articles by Jeffery Boswall — A British discography of wildlife sound, pp. 463-465, A bibliography of wildlife sound recordings, pp. 466-469, and Some major events in the world history of bird sound recordings, pp. 469-470.

BR. INST. REC. SD, 1974. Recorded Sound. The Journal of the British Institute of Recorded Sound, No. 54 (April). Pp. 273-313 (several papers on similar topics, including — A preliminary world list of wildlife sound libraries, by Jeffery Boswall, pp. 276-277, Analysis and notation of bird vocalizations, by Joan Hall-Craggs, pp. 291-297, A bibliography of wildlife discographies, by Jeffery Boswall, p. 305 and A discography of bird sound from the Nearctic region, by Jeffery Boswall, pp. 306-312).

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L. B. McPherson,
P.O. Box 21-083,
Edgeware,
Christchurch