# Making wildlife sound recordings

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## 1. HINTS AND TIPS

A wide range of cheap recording equipment is readily obtainable at most audio shops. However, although these may be adequate for dictation or recording music, they will give poor results when recording wild animals in the field.

The best wildlife sound recordings are made on good quality, specialised, equipment.

The basic requirements are: microphone with parabola, or gun microphone; portable recorder (cassette, open-spool, MiniDisc, solid-state or DAT); batteries, recording tape and connecting leads. Optional extras include: headphones; tripod; stereo microphone.

Individual animals are often recorded in mono. Stereo recordings are desirable only for aesthetic reasons or when recording groups of animals (including duetting pairs of birds) or habitat (atmosphere) tracks. Specialist equipment is needed to record the ultrasounds of bats, rodents, insects and dolphins, or to record underwater sounds.

Sound recordists who record wild animals in remote locations need to weigh up several practical considerations when choosing equipment: weight including power supplies, local availability and durability of batteries or other powering, ruggedness of equipment and, of course, cost.

Most audio recording equipment is designed to record music or human speech. Many animals use frequencies and rapid changes in sounds that are near to or exceed the limits of cheaper 'consumer' recording equipment. When selecting your recording kit, consider the following characteristics for each component: frequency range, signal-to-noise ratio and dynamic range. Most manufacturers provide these technical specifications.

Each year in March or April the Sound Archive runs a one-day wildlife sound recording training day in London in conjunction with the Royal Geographical Society and BirdLife International. Thanks to the support of the BP Conservation Programme the Archive is able to loan field recording kits to selected expedition teams.

The Sound Archive enjoys close links with the Wildlife Sound Recording Society, which was formed in 1968 with the aims to encourage the recording of wildlife sounds, to offer opportunities for technical improvement and scientific study, and to further the appreciation and understanding of animal language. It holds regular meetings in the UK and members receive the journal 'Wildlife Sound' twice a year, a newsletter and CD magazine compiled from members' work. For further information, write to or email the Secretary: Alan Burbidge, 30 Wilsthorpe Road, Breaston, Derby DE72 3EB.

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## 2. MICROPHONES

Special techniques have to be employed to record wild animals. Apart from unwanted noises such as vehicles, aircraft or wind which can spoil any outdoor recording, the main difficulty is that most wildlife cannot be approached closely. An ordinary microphone will not pick up a strong enough signal unless it is close to the subject. Halving the distance between microphone and the subject boosts the signal level by a factor of four. Therefore, placing a microphone close-up is the best technique to record animals; for example, a microphone can be left at the end of a long lead on a bird's regular songpost. But this can only be done if the habits of an individual animal are known, so the majority of field recordists record animals vocalising at a distance using ultra-directional

microphones or parabolic reflectors.

A parabolic reflector (parabola) concentrates distant sounds onto a conventional microphone placed at its focus. The larger the diameter of the dish, the more amplification, but a practical size is around 50cm.

Suitable microphones to use in conjunction with parabolas are dynamic microphones with a cardioid (directional) response. These are rugged, do not require a power supply and can be used without a parabola for other recording applications. Condenser microphones are generally better quality but are costlier and require a power supply. Some parabolas have built-in microphones.

Note that if recording low frequency sounds (like those from large mammals such as deer, lions and elephants, or birds such as owls and pigeons), small parabolas are unsuitable because wavelengths longer than the parabola diameter are not reflected to the microphone. In practice, a 50cm reflector is adequate for frequencies above 600 Hertz; animals' voices containing frequencies below this figure will sound unnaturally 'thin'.

Ultra-directional (super-cardioid) microphones or gun microphones are expensive and generally less directional and powerful than parabolas but are less cumbersome and have a flatter frequency response. They are popular with expedition recordists because of their compact size compared to parabolas. Most gun microphones are condenser type, requiring a power supply. The longest microphones are most directional and are used by bird and mammal recordists. Short gun microphones are ideal for recording animals such as amphibians and insects which can be approached closely. All types should be used with a pistol grip and shock mount unit as they are very susceptible to handling noise.

Windshields. microphones are designed for indoor use, so windshields are essential for field recording in many locations, such as open grasslands, coasts, moorlands and hills, but they are not necessary in windless habitats e.g. forests. Bonnet-type wind covers are available for parabolic dishes; foam 'sleeves' can be used on gun microphones, but a cage windshield is far more effective, although costly.

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## 3. RECORDERS

Recorders should be lightweight yet robust. A carrying case and strap are useful and the controls on the machine should be easy to operate when carried on the shoulder. Noise reduction facilities (Dolby, Dbx, DNL etc.) and automatic gain controls should not be used because they do not work well with animal sounds. Some recorders, including dictaphones, have built-in microphones. While these are useful for dictating notes, they give poor results for wildlife recordings. Note that rechargeable batteries can be used on most recorders in place of dry cells. Some models lack built-in speakers so you should obtain a small plug-in unit if you need to play back recordings other than on headphones in the field.

### 3.1 Cassette recorders

Cassette recorders are the most popular choice for the beginner and for many expedition recordists on account of size, low weight and comparatively small cost. The tape running speed may be inaccurate so it is worth regularly checking cassette recorders; alternatively, at the end of each cassette record the sound of a tuning fork as a calibration signal. Avoid using models that have only automatic recording levels - a manual recording control gives far better results when used properly.

### 3.2 Reel-to-reel recorders

Reel-to-reel recorders are generally heavier and bulkier but give far better quality recordings and the tapes can be easily edited. They are now less popular than other recorders, but can be bought easily second-hand from professional audio suppliers to the film industry.

### 3.3 MiniDisc

MD (MiniDisc) recorders are now popular with field recordists because the portable models are reliable, compact and the quality sounds very good. However, the format uses a data reduction process to reduce digital storage space, which is designed to be transparent to human hearing. Whether this subtly damages recordings of wildlife is a controversial topic; however, you should be wary of using MD if your recordings might be used for scientific analysis later.

### 3.4 DAT

R-DAT portable recorders can be unreliable in humid conditions but the digital quality is unbeatable. Unlike MD, DAT (Digital Audio Tape) does not selectively reject parts of the audio spectrum so it is suitable for scientific recording. Editing is difficult and powering can be a problem on portables: most machines run only on rechargeable cells giving limited recording time.

### 3.5 Solid state

Solid state (flash card/disk drive) recorders have been developed in the last few years. These recorders use compact flash memory cards or computer drives to record. Some models offer a choice of recording in different file formats: the uncompressed format (e.g. PCM 'wav' file) should be used in preference to compressed (e.g. MP3) formats. At present, recording times at the uncompressed quality are limited and the memory cards or drives are relatively expensive. As the memory is used up, the sounds are best 'downloaded' to a PC or CD to free up space for more recording. These types of recorders are likely to become an attractive alternative to other types of recorders.

## 4. TAPE AND BATTERIES

**Analogue cassettes**: Use Chrome (CrO2) rather than Ferric type cassettes if your recorder has a Chrome setting: these give an extended frequency response. 60-minute cassettes are better than longer lengths because the tape material is thicker.

**Quarter-inch reel-to-reel tape**: can be bought in different thicknesses and spool sizes. Long-play is recommended for portable recorders.

**R-DAT** tapes: come in lengths between 15 to 120 minutes, and 120-minute tapes appear to be as good quality as the shorter lengths, so are better value.

Most recorders use a lot of power; dry cells should be of the alkaline type. Rechargeable batteries can be used if a reliable power supply (car, mains, solar cells or generator) is available between recording sessions. Most rechargeables take several hours to charge, so take 2 or 3 sets so you can record while the used sets are charging.

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## 5. OTHER EQUIPMENT

Connecting leads and plugs between microphones and recorders must be strong to withstand heavy use. They should be of the right length so that the microphone or parabola can be held away from the recorder (to avoid machine noise), but not so long that loose wire snags on vegetation or causes extraneous noise when in use. Most professional microphones can be supplied with the correct lead and plug to fit the microphone input of your recorder. Gas soldering irons are very compact and ideal for repairs in remote locations.

**Headphones** are not essential but help in monitoring the level of recorded signal, checking against distortion and also help to aim directional microphones/parabolas while recording.

**Tripods or monopods** that can attach to the carrying handles of parabolas or gunmicrophones are very useful if one can manage to carry this extra item of baggage. They eliminate handling noise and leave hands free for controlling the recorder, binoculars, etc.

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## 6. LINKS AND USEFUL READING

### 6.1 Links

- **Alosa** [http://www.sonidosdelanaturaleza.com/] has information in Spanish on nature sound recording

- **Bioacoustics** journal [http://www.bioacoustics.info/] frequently contains specialist articles on new recording and analysis equipment and methods.
- **Borror Laboratory of Bioacoustics** recording sounds [http://blb.biosci.ohio-state.edu/tips.html]
- How to record nature [http://www.naturesongs.com/Sounds.html]
- Instruments & techniques for sound recording and analysis [http://www.unipv.it/cibra/instru.html]
- Nature recordists email discussion group [http://groups.yahoo.com/group/naturerecordists/]
- Techniques for recording nature [http://birds.cornell.edu/LNS/recordingnature/recordingnature_index.html]

### 6.2 Articles

Articles listed here may be consulted in the British Library Reading Rooms:


- Burbidge, A.; Iannantuoni, M. et al. (1997). *An introduction to wildlife sound recording*, Wildlife Sound Recording Society. pp26.
- Hopp, S. L., Owren, M. J. & Evans, C. S. (eds) 1998. *Animal acoustical communication: sound analysis and research methods*. Springer. Shelfmark **HUS 591.594**
- Kettle, R. & Vielliard, J. M. E. 1991. Documentation standards for wildlife sound recordings. *Bioacoustics* 3:235-238. Shelfmark **HUS 050**
- Kroodsma, D. E., et al. (1996). Natural sound archives: guidance for recordists and a request for cooperation. In D. E. Kroodsma & E. H. Miller (Eds.), *Ecology and Evolution of Acoustic Communication in Birds* (pp. 474-486). New York: Cornell University Press. Shelfmark **HUS 598.259**
- Margoschis, R. (1977). *Recording Natural History Sounds*. Herts: Print & Press Services Ltd. Shelfmark **HUS 591.590 208**
- Parker, T. A. III. (1991) On the use of tape recorders in avifaunal surveys. *Auk* 108:443-444. Shelfmark **AC 3595**
- Tombs, D. (1980). *Sound Recording: from microphone to master tape*. David & Charles. Shelfmark **HUS 621.38932**
- Vielliard, J. (1993). Recording wildlife in tropical rainforest. *Bioacoustics* 4:305-311. Shelfmark **HUS 050**


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## 7. ULTRASOUND RECORDING

Ultrasounds are sounds at frequencies above the human hearing limit, i.e. above about 20,000 Hz. These are emitted by most bats, dolphins, shrews, rodents and certain

insects. Conventional audio recorders such as those listed above will not record ultrasounds. The solution is first to reduce the frequencies to within audible range, by using an ultrasonic detector ('bat detector'), and then connect a cable from the audio output of the detector to the line input of your recorder.

## 7.1 Types of detector

**Pulse (P) envelope detector**: wide band, ie covering all frequencies; produces clicks in response to ultrasound, but not tuneable. Useful for detection, but not for identification or analysis.

**Heterodyne (H)**: rather like a radio receiver, the most widely used type of bat detector; a dial is used to tune the circuits to a particular frequency band. The band width is narrow, typically 5-10 kHz, so species not in the frequency range being used may be missed. Frequency readings must be read from the calibrated tuning dial. With practice can be used to aid identification in the field. Much signal information is lost, but amplitude, frequency and rhythm can be assessed.

**Frequency division (FD)**: wideband; the signal is frequency divided by a factor of 4, 8 16, 32 (typically); only loudest harmonic selected, and analysis of the output is difficult.

**Time expansion (TE)**: wideband; signals are recorded digitally in solid-state memory (hence "memory detector"), then replayed when required at 1/10 or 1/20 speed. The slowed-down output is audible and easily recorded, and the complete ultrasound spectra are preserved but the instrument cannot record during replay and recording durations are limited by memory size. Best used in conjunction with another bat detector which 'logs' ultrasounds continuously.

## 7.2 Making your own

You will need basic soldering skills and electronic experience for all of the following kits:

- Alana Ecology [http://www.alanaecology.com/] - you can order the Magenta MK11 Detector as a self-assemble kit
- Convergence Tech, Inc. [http://www.econvergence.net/batdet.htm] - the Belfry Bat Detector Kit can be assembled at home
- http://www.btinternet.com/~mr.pentops/bat.htm - tells you how to built a bat detector from an old radio

## 7.3 Useful reading

The articles listed here may be consulted in the British Library Reading Rooms:

- Pye, J. D. & Langbauer Jr., W. R. (1998). Ultrasound and infrasound. In: *Animal acoustic communication: sound analysis and research methods*. (S. L. Hopp, M. J

Owren & CS Evans, eds.) Berlin, Springer-Verlag: 221-249. Shelfmark HUS 591.594

- Pye, J. D. (1992) Equipment and techniques for the study of ultrasound in air. *Bioacoustics* 4:77-78. Shelfmark HUS 050
- Pye, J. D. (1983) Techniques for studying ultrasound. pp 39-65 In: *Bioacoustics, a comparative approach* (B.D. Lewis, ed.) Academic Press. Shelfmark (B) FF 53
- Roeder, K. (1965). Moths and ultrasound. *Scientific American* 232: 94-102. Shelfmark (P) BW 50-E (81)
- Russ, J. (1999). *The Bats of Britain and Ireland: Echolocation calls, sound analysis and species identification*, Alana Ecology, England. Shelfmark HUS 599.40448
- Sales, G. & Pye, D. (1974). *Ultrasonic communication by animals*. London: Chapman & Hall Ltd. Shelfmark HUS 591.1825
- Smith, W. J. (1979). The study of ultrasonic communication. American Zoologist, 19: 531-538. Shelfmark (P) EP 00-E (2)
- Waters, D. A., & Walsh, A. L. (1994). The influence of bat detector brand on the quantitative estimation of bat activity. *Bioacoustics*, 5(3): 205-221. Shelfmark HUS 050

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## 8. INFRASOUND RECORDING

Infrasounds are frequencies below the human frequency range, i.e. below about 20 Hz and are produced by elephants and baleen whales.

### 8.1 Links and useful reading

**Biosonar** [http://www.biosonar.bris.ac.uk/]: Seeing with sound, includes some excellent graphics

**Savanna Elephant Vocalisation Project** [http://www.elephantvoices.org/]

The articles listed here may be consulted in the British Library Reading Rooms:

- Charif, R. (1993). The sounds of silence. *Wildlife Conservation* 96(2): 44-47. (On infrasonic communication in elephants) Shelfmark (P) CC 36-E (16)
- Moss, R. and Lockie, I. (1979). Infrasonic components in the song of the *Capercaillie tetrao urogallus*. Ibis 121: 95-97. Shelfmark (P) GC 10-E (2)
- Pye, J. D. & Langbauer Jr., W. R. (1998). Ultrasound and infrasound. In: *Animal acoustic communication: sound analysis and research methods*. (S. L. Hopp, M. J Owren & CS Evans, eds.) Berlin, Springer-Verlag: 221-249. Shelfmark HUS 591.594

- Payne, K. B.; Langbauer Jr., W. R. et al. (1986). Infrasonic calls of the Asian elephant *(Elephas maximus). Behavioral Ecology & Sociobiology* 18: 297-301. Shelfmark (P) FF 35-E (1)

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## 9. UNDERWATER SOUND RECORDING

Special microphones called hydrophones are used to record underwater sounds. Sounds travel underwater at about five times the speed in air, so reliable identification of the source of a sound is difficult, especially in the sea where underwater visibility can be poor.

### 9.1 Information

**Marine Information & Advisory Service** [http://www.library.soton.ac.uk/nol/mias.shtml]

**Woods Hole Oceanographic Institution** [http://www.whoi.edu/]

### 9.2 Making your own recordings

Underwater Acoustics Research Group, Loughborough University, Ashby Road, Loughborough, Leicestershire LE11 3TU, UK - their data sheet can be downloaded, go to 'Products', then 'Home-made Hydrophone Kit'. [http://sonar-fs.lboro.ac.uk/]

### 9.3 Useful reading

The articles listed here may be consulted in the British Library Reading Rooms:

- Geil, F. G. (1992): Hydrophone techniques for underwater sound pickup. *J. Audio Engineering Society*, 40, pp:711-718. Shelfmark HUS 505
- Hawkins, A. D. & Myrberg, A. A. (1983): Hearing and sound communication underwater. In: *Bioacoustics: a comparative approach* (edited by B. Lewis) Academic Press. Shelfmark (B) FF 53
- Reed, B. (1987): Some notes on underwater sound recording. *Wildlife Sound* (Journal of the Wildlife Sound Recording Society). 5, pp:19-20. (Basic information for beginners) Shelfmark HUS 050
- Tyack, P. L. (1998). Acoustic communication under the sea. In: *Animal acoustic communication: sound analysis and research methods*. (S. L. Hopp, M. J Owren & CS Evans, eds.) Berlin, Springer-Verlag, pp:163-220. Shelfmark HUS 591.594
- Watkins, W. A., & Daher, M. A. (1992): Underwater sound recording of animals. *Bioacoustics*, 4, pp:195-210. Shelfmark HUS 050

## FURTHER INFORMATION

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