

16. Field recordings of sound in air.

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Recording sounds in the field from freely moving (flying) animals is a challenge, and the sound stored in the data base is often quite different from the sound emitted by the animal. The lecture focuses on practical questions and issues involved in recording and interpreting sounds in air illustrated by examples from field recordings of echolocating bats and sound producing insects.

- Animals: The distance and direction to the animals are often unknown. Signals recorded at long distance and off axis will low pass filtered.

- Microphones are directional and only instrumentation microphones have flat frequency response. High frequency microphones are less sensitive than low frequency microphones, making high frequency recordings difficult at long distance. High frequencies are reflected from all surfaces, creating interference.

- Data acquisition: Many insects and bats communicate in the ultrasonic range. Storing high frequency signals digitally require high sampling rates. Multi-channel recording increases the demand for sampling rate. Computer sound boards or flash memory recorders are not sufficiently fast to record such sounds. Thus, either special fast A/D equipment (NI, Avisoft, Wavebook) must be used, or signals must be transformed to lower frequencies before recording, for example by a bat detector.

- Environmental effects: The severe attenuation of high frequencies in air adds to the microphone sensitivity problems when recording high frequency sounds at a distance. Sound propagation adds reflections and reverberation. A special case is recording sounds close to smooth water surfaces (bats hunting close over water) where the reflected sound is as intense as the direct sound.

However, even though the ideal recordings require multichannel, high frequency sampling with several high quality microphones, the equipment and set-up must be appropriate for the purpose. Some experiments may be better solved with simple, low budget, portable sound recorders (for example bat detectors). As long as one is aware of the restrictions from instruments and recording situation conclusions may still be drawn about the original emitted signals.

17. Field identification of European bats by sound recordings - used in studies of biology and distribution

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The lecture focuses on studying biology and distribution of European bats using sound recordings and other methods to identify the bats.

See: Ahlén, I., Baagøe, H. 1999 Use of ultrasonic detectors for bat studies in Europe: experiences from field identification, surveys, and monitoring. *Acta Chiropterologica* 1: 137 - 150