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Physical Distortion of a Call of the Jungle Crow (*Corvus macrorhynchos*) in the Process of Propagation

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Relative amplitude of the frequencies that compose a signal cannot be maintained at a long-distance. When auditory signals are used over long distances, some of their features will degrade more than others (Morton 1975; Richards and Wiley 1980). Main components in the frequencies of a call of birds for communication may not be attenuated in comparison to the other range of frequency in a given environment (Bremond and Aubin 1990). In this paper, we present a propagation test of the frequency elements of the call of a jungle crow (*Corvus macrorhynchos*) in an open field they inhabit. Jungle crows (*C. macrorhynchos*) inhabit open area and often make a flock when they forage in the field. Vocalization is an important factor to make a flock and communicate among the members of the flock. Habitat sound propagation of a call of the jungle crow (*C. macrorhychos*) was measured by using a pre-recorded playback tape as the sound source.

Materials and Methods

A juvenile jungle crow was handled by hands in an aviary. The bird being handled gave out a call. The call was recorded at a 50 cm distance from the bird by using an omnidirectional dynamic microphone (SONY F-115), a hi-fi cassette recorder (SONY TC-DSM) and a hi-fi cassette tape.

The sound propagation test was designed to sample the sound levels in a straight-line direction from the sound source horizontally to the ground. We conducted the test along a pave road in a field in the Agriculture Research Center in Tsukuba, Ibaraki Prefecture, Japan on May 5 1989. The test was conducted from 1000 to 1200 on a fine windless day. On one side of the road was meadow, and the other side was young pine trees. The test tape was played back through the speaker of a hi-fi cassette recorder. We recorded the play back call on an 8 mm video recorder (SONY CCD-V90) with the omnidirectional microphone at several sites ranging from 5 m to 200 m from the sound source. At each site, recordings were made at about 150 cm above the ground. Spectrum analysis was conducted on the recorded data using an FFT analyzer (A & D co. AD-3525). We compared the attenuation effect as a function of distance for each frequency of the sound source.

Results and Discussion

The spectra (Fig. 1) express the sound frequency on the horizontal axis and the energy in mV on the vertical axis at each distance from the sound source. There were 3 main components of frequencies at around 1.3 kHz, 1.6 kHz, and 3.0 kHz in the call at 5 m from sound source. However the 3 peak frequencies were

not proportionally attenuated with distance from the sound source. At distances of 50 m or more from the sound source, the peak frequencies around 1.3 kHz and 3.0 kHz vanished, and only the frequency around 1.6 kHz remained.

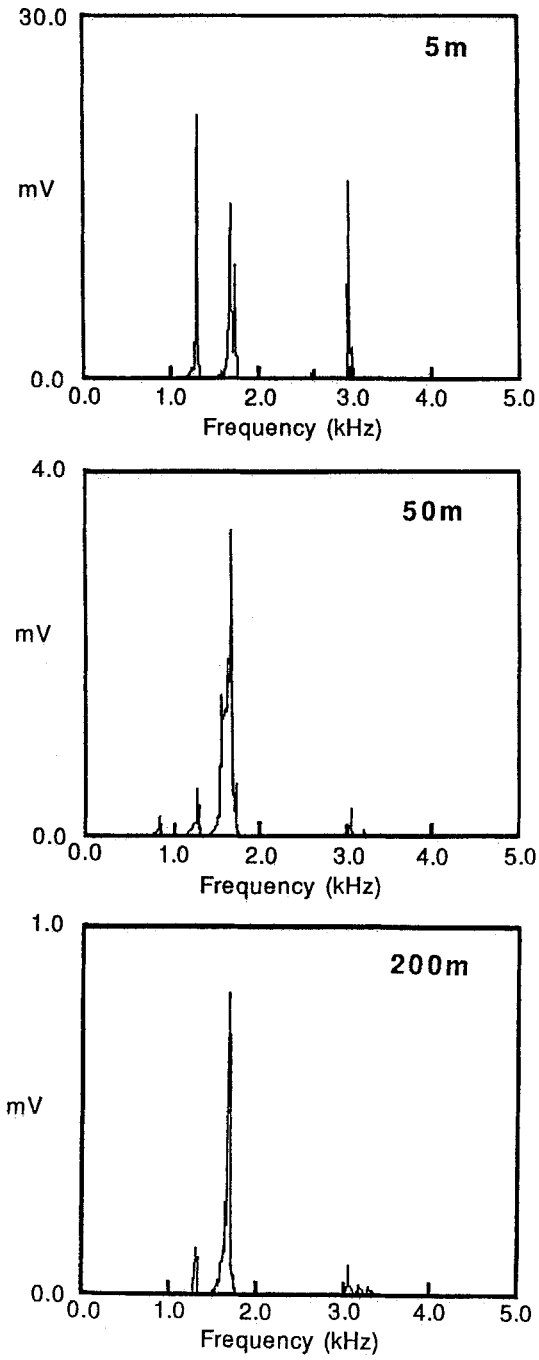

Fig. 1. The power spectra of the call of the jungle crow (*C. macrorhynchos*) at various distances from the sound source.

In general, higher frequency sound is attenuated more readily than lower frequency sound by various factors, such as absorption or diffraction. However, the habitat structure modifies the attenuation pattern of sound frequency. The distance a bird is able to communicate by sound depends on the attenuation rate of the sound used, the amplitude of the sound at the source, the level of ambient noise, and the auditory sensitivity of the individual receiving the sound. According to an audiogram (Trainer 1946), *Corvus* sp. has excellent hearing for the frequency region between 1 kHz and 3 kHz, particularly, around 1 kHz. The frequency rango of main componets of the call of the jungle crow (*C. macrorhynchos*) in this experiment was also between 1 kHz and 3 kHz. Although the energy of all the 3 main frequencies in the call of crow (1.3 kHz, 1.6kHz, and 3.0 kHz) was nearly equal at the distance of 5 m, the rate of decay was not the same for these frequencies. Only the frequency 1.6 kHz propagated through the long distance from the sound source.

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