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ANALYSIS OF COYOTE LONG-DISTANCE VOCALIZATIONS

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Introduction

Vocalizations of wild canids have been the source of much controversy for decades. The function, causation, evolution and development of these vocalizations have been investigated only in recent years (Estes and Goddard, 1967; Fox, 1971; Joslin, 1966; Mech, 1970; Theberge and Falls, 1967). However, none of these studies has attempted a rigorous analysis of vocalizations comparable to those conducted on passerine birds (e.g., Lemon and Chatfield, 1973).

The purpose of this study was to conduct the first phase of a long-term research project on coyote vocalizations. The first phase utilized the "typological" or "syntactical" approach. According to Marler (1965) "such an approach is concerned primarily with describing and classifying signals and attempting to extrapolate to predictions about the potential properties of the signal system when used in actual communication." The primary objectives were to: a) classify the long-range vocalizations, b) provide a physical description of the vocalizations, and c) hypothesize as to the function of the various vocalizations.

Methods

The periods June 10 to July 3 and August 2 to August 15 were spent in the field recording vocalizations.

Study Area

The primary study area included the National Elk Refuge and the southern portion of Grand Teton National Park (Fig. 1). In addition, three vocalization bouts were recorded approximately one mile southeast of Moran, Wyoming.

Equipment

Recordings were made with a Nagra L3 portable tape recorder and a Torngren 24" parabolic reflector with an Electro-voice microphone. A tripod was used to support the parabolic reflector and mike when recordings were made from fixed locations.

Procedure

Although three bouts of group howling were elicited by human howling, all other recordings were of "spontaneous" vocalizations. Four general procedures were used to obtain recordings: a) drive throughout the study area until coyotes were spotted, then stop and approach on foot; b) approach areas of suspected coyote habitation on foot; c) spend the night in area of known coyote activity; d) drive to areas of known coyote activity and attempt to elicit vocalizations by imitating howling (primarily at night).

Results

Approximately 9.5 hours of tape was used to record 54 vocalization bouts (Fig. 1). A bout is a continuous series of vocalizations produced by one or more individuals. Bouts of barking varied in length from a few seconds to four hours.

I recorded examples of the four types of long-distance vocalizations described by Camenzind (in manuscript). Table 1 lists these vocalizations by type (my terminology) and suggested function (from Camenzind).

Table 1. Coyote long-distance vocalizations and their suggested function.

TYPE	FUNCTION
Lone Howl	Locate group members; causes similar response and/or reunion of group members.
Group Yip-howl	Reinforces group bond; proclaims territorial occupancy to neighbors; occurs at group reunion.
Lone Bark	Warning; challenge to interspecific intruders during denning season and/or near pups.
Lone Bark-howl	Proclaims territorial occupancy; warns group members; challenges interspecific intruders during non-denning season.

To date 485 sound spectrographs have been made for descriptive purposes and preliminary quantitative analyses. Preliminary analyses of the sound spectrographs indicate that there are significant individual differences in the fundamental frequencies of the barks (e.g., Fig. 3) of six different coyotes. Individual differences will be tested later for barks, bark-howls, and lone howls using a computer program prepared by Levin (1972).

The most significant finding so far is that the coyote's vocalizations are produced along a continuum and not as discrete vocalizations. This is similar to the vocalization continuums found for the lion (Schaller, 1972) and spotted hyena (Kruuk, 1972). This continuum is found from the growl (Fig. 2) through the group yip-howl (Fig. 6). The physical changes to be seen in the sound spectrographs are described in Table 2.

Table 2. Physical changes in the sounds produced along the coyote's vocalization continuum.

TYPE	PHYSICAL PROPERTIES AND CHANGES
Growl[1]	Long series of noise; no pure tones.
Huff[1]	Short burst of noise; no pure tones.
Bark	More intense burst of energy with fundamental frequencies beginning to appear.
Bark-howl	Barks with fundamental frequencies clearly delineated drawn together to produce a frequency oscillation; several overtones (harmonics).
Lone howl	A pure tone clearly delineated with a single overtone dominating.
Group Yip-howl	Several individuals providing relatively pure tones and seemingly avoiding the same frequencies.[2]

[1]Recorded from penned coyotes.

[2]This avoidance of producing the same frequency has been reported for wolves (Crisler, 1965; Theberge and Falls, 1967). It is seen in the top sound spectrograph in Fig. 5 where a second coyote begins to howl at a frequency slightly higher than the one already being produced, but as it approaches the frequency of the first coyote, that coyote stops howling.

This vocal continuum provides a relatively unlimited capacity for transmitting information. This system is in contrast to the discrete systems of songbirds which produce "syllables" that can be ordered in a limited number of combinations (Lemon and Chatfield, 1973). The following statement which refers to the spotted hyena could also be applied to the coyote:

"Distinguishing between these calls is a fairly subjective procedure, and all kinds of intermediates are frequently heard. Most calls grade into each other and may probably be considered part of a large sound continuum... In a species like the spotted hyena (nocturnal, highly social, but also, and often at the same time solitary), it must be of great advantage to have an elaborate system of calls for communication..." (Kruuk, 1972).

Discussion

Although all the data has not been analyzed, I suspect that additional recordings will need to be made inorder to test the hypotheses of individual differences between coyotes for all of these long-distance vocalizations. The function of each of these vocalizations should then be tested by playback in the field. Since these vocalizations probably provide a functional continuum, as well as a physical continuum, analysis of their function will be more difficult than similar studies conducted with songbirds (e.g., Emlen, 1971).

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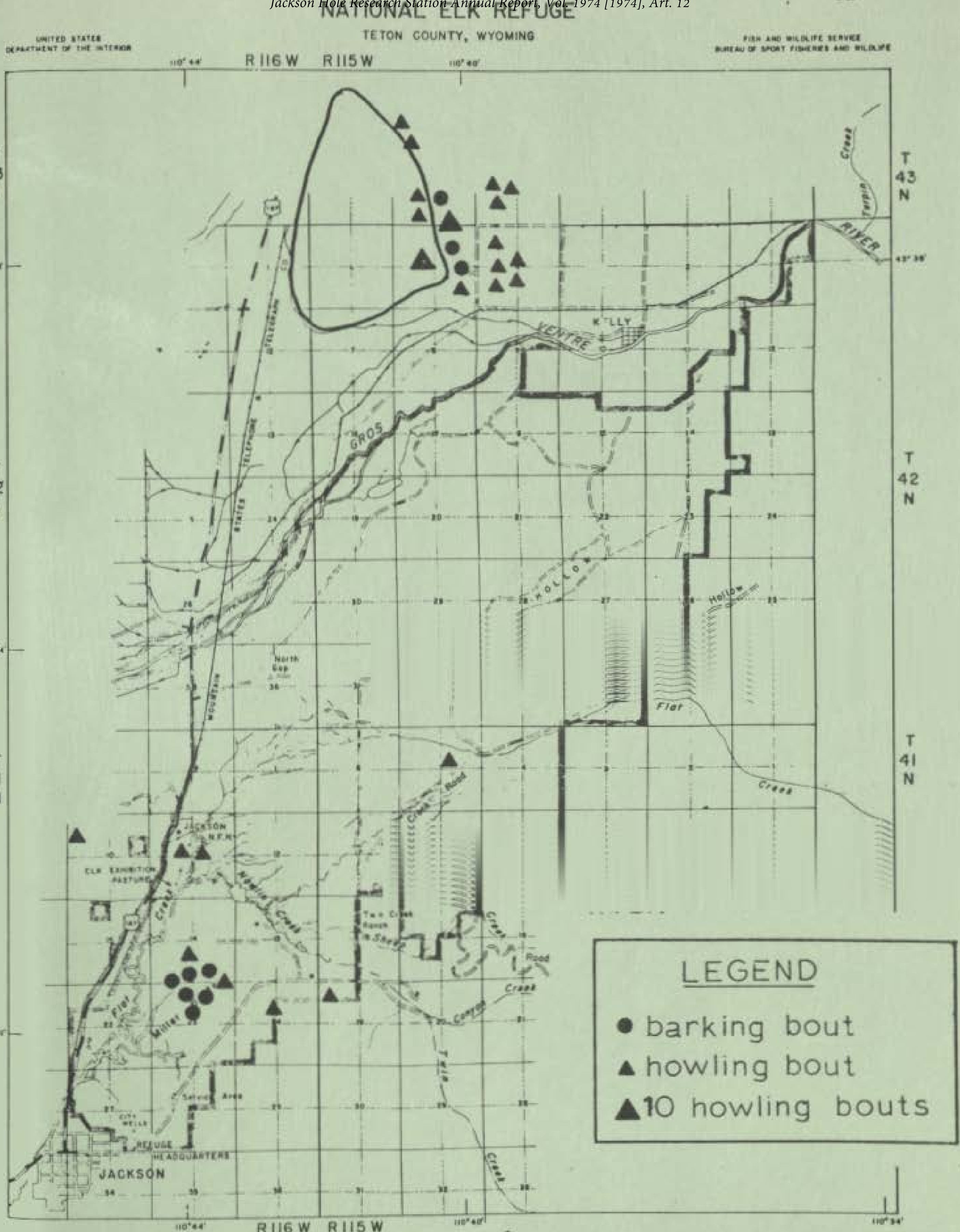

Figure 1. Location of vocalization bouts recorded, June and August, 1974.

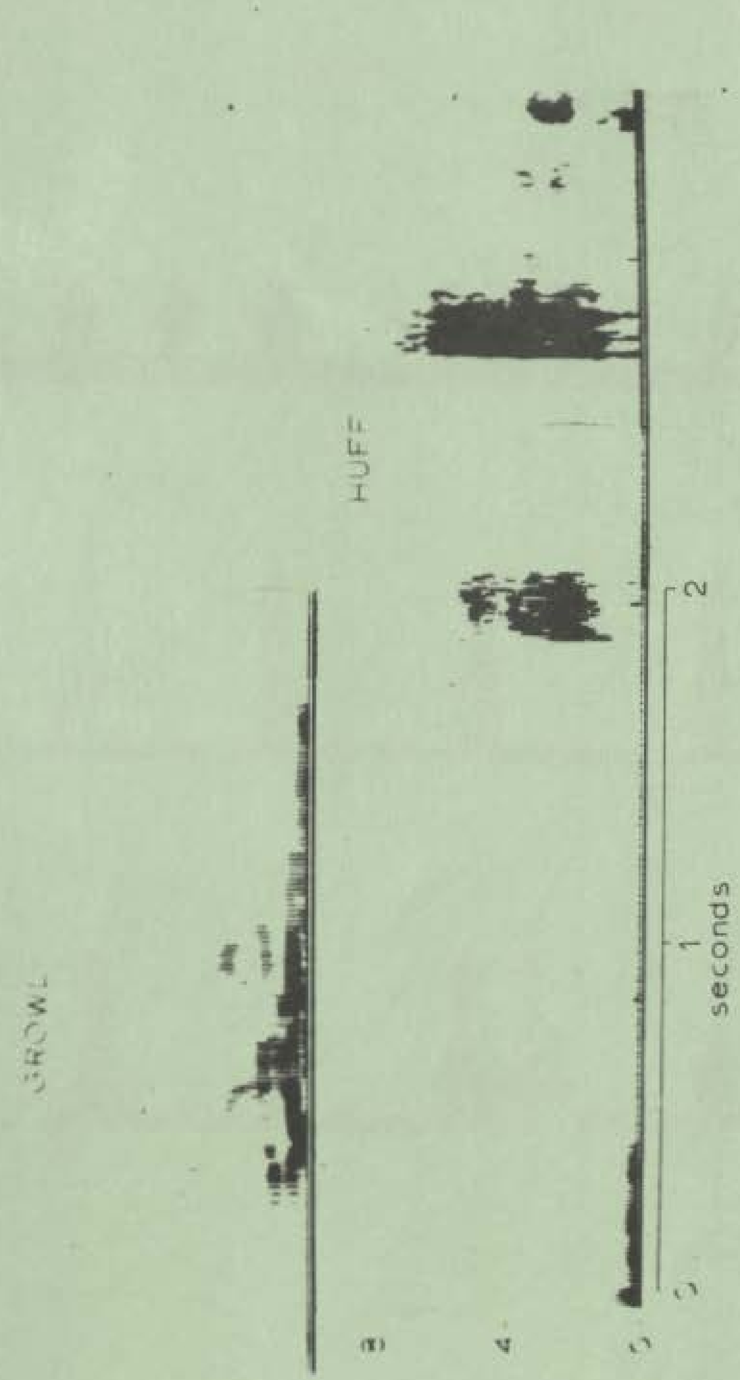

Figure 2. Sound spectrographs of the growl and huff coyote vocalizations.

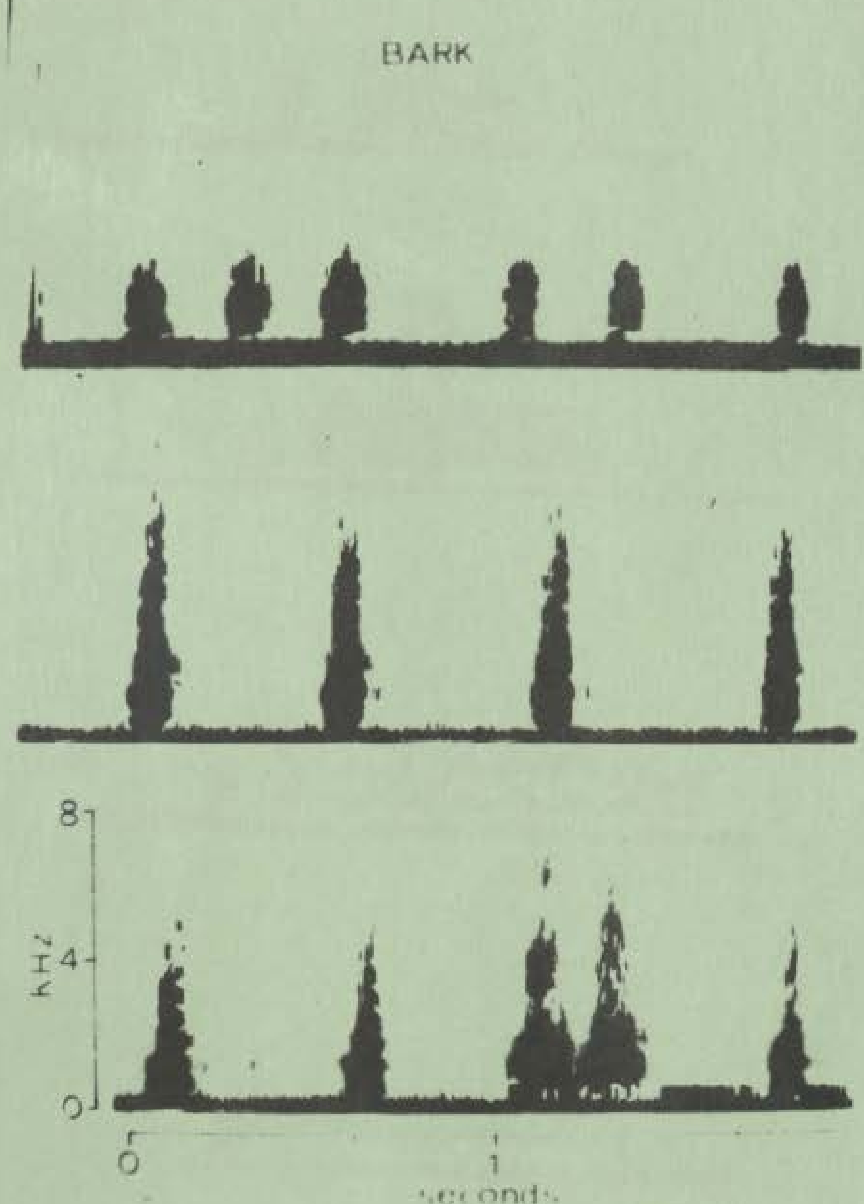

Figure 3. Sound spectrographs of coyote bark vocalizations.

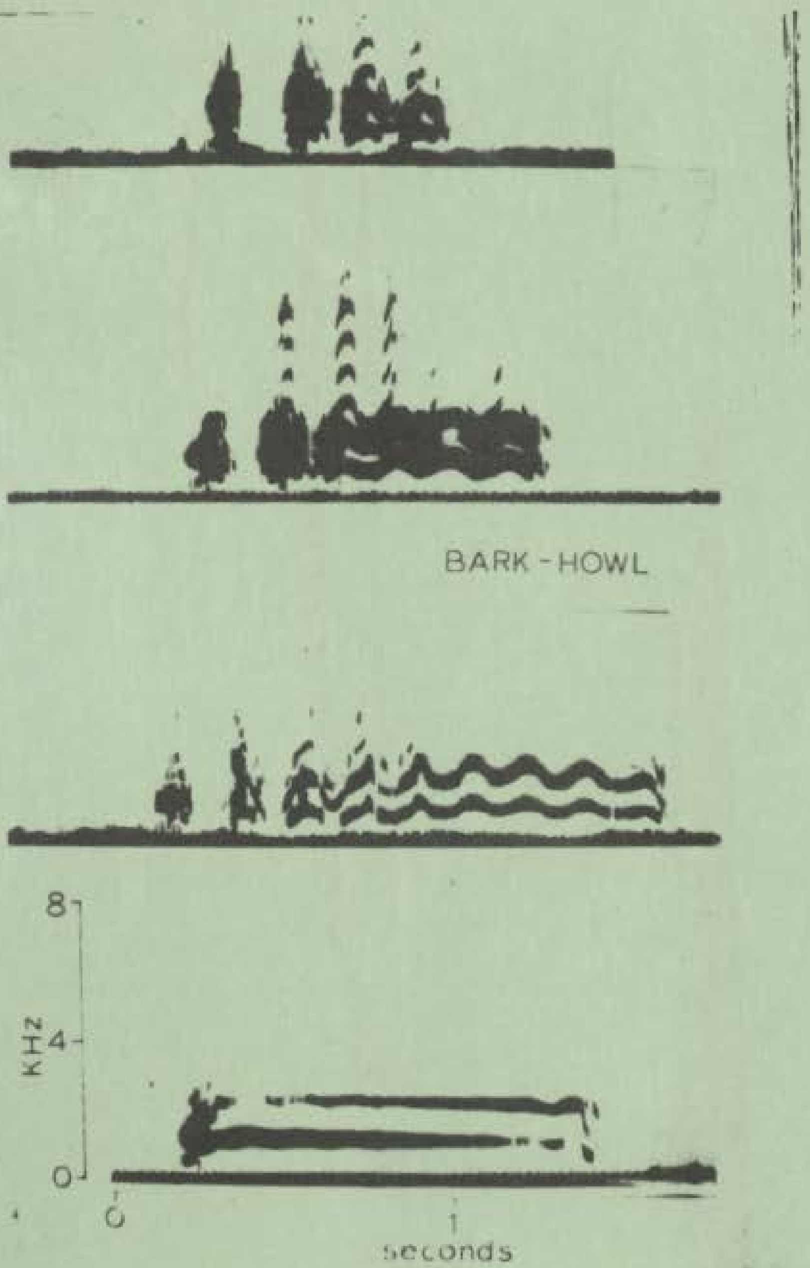

Figure 4. Sound spectrographs of the bark and bark-howl coyote vocalizations. Note the transition between the bark and bark-howl.

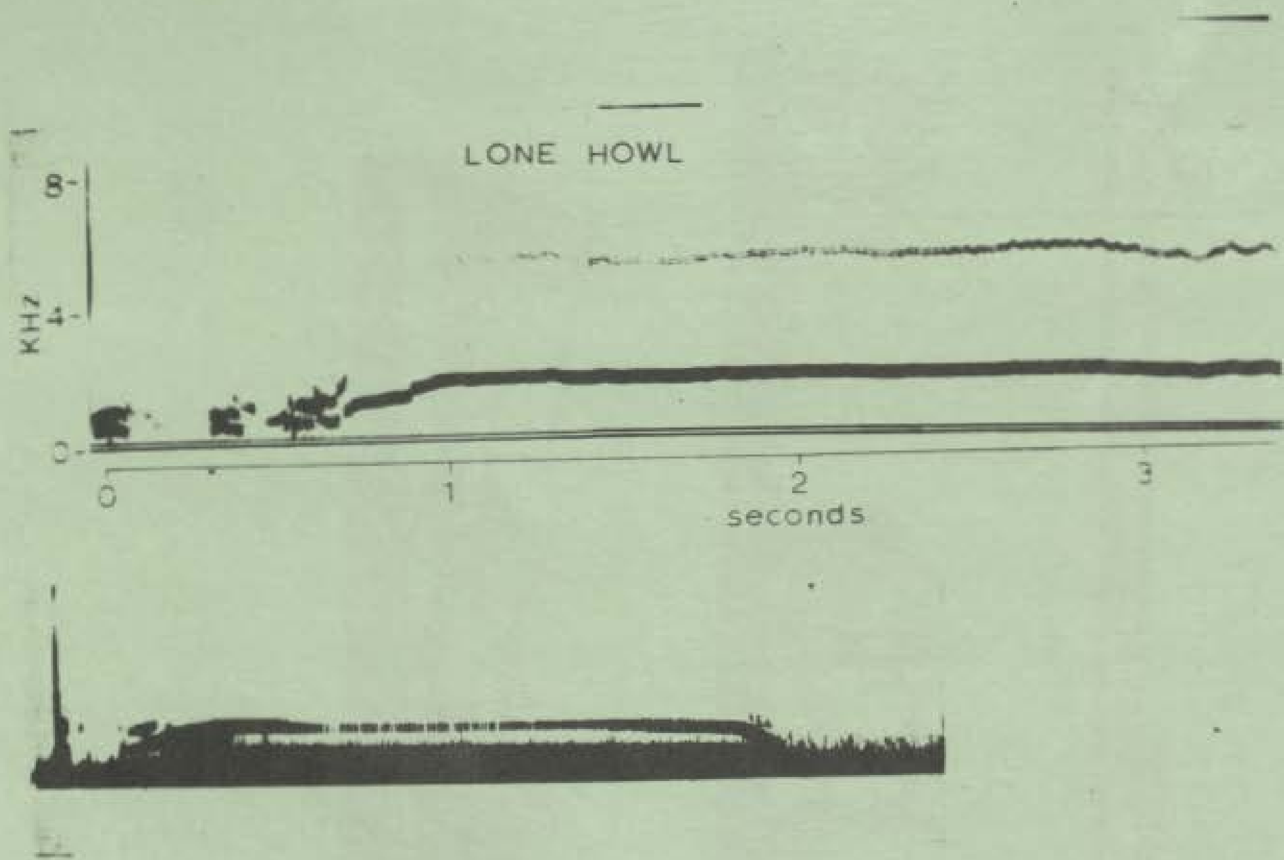

Figure 5. Sound spectrographs of two coyotes' lone howl vocalizations.

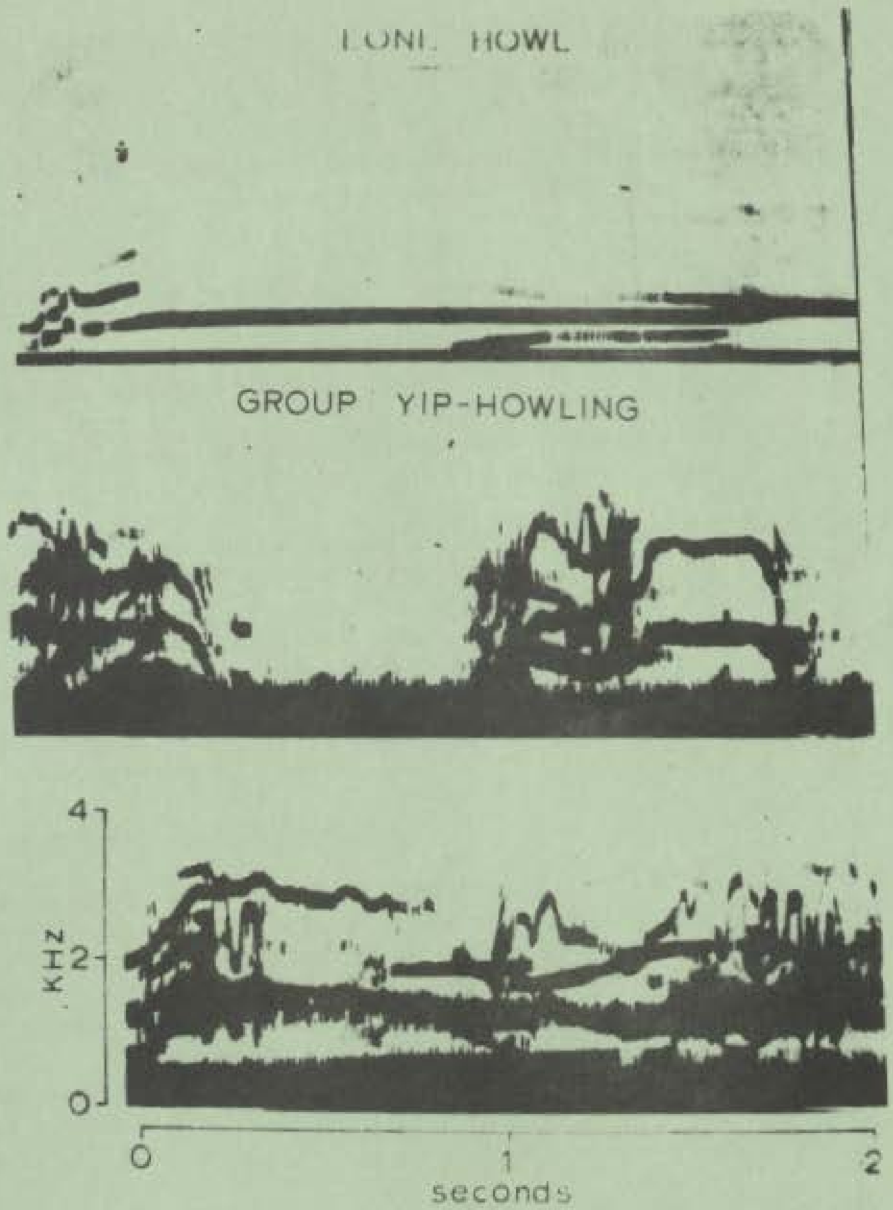

Figure 6. Sound spectrographs of group yip-howl vocalizations of coyotes.