National Park Service
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Rocky Mountain National Park
Continental Divide Research Learning Center

Bull Elk, Pavarottis of the Animal World

The Question:What is the function of elk vocalizations, or bugle calls?

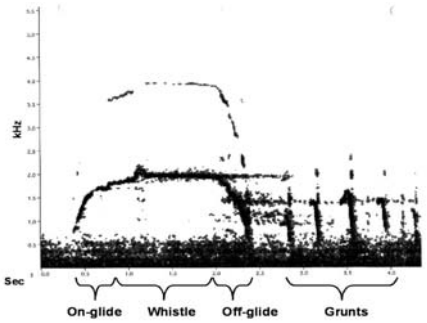
Elk rely heavily on vocalizations to communicate during the autumn mating season, or rut. Bull vocalizations and aggressive displays are common during this time. Every year thousands of visitors crowd Rocky Mountain National Park's upland meadows such as Moraine Park to witness the elk rut and hear the high-pitched whistle sounds, barks, and squeals. While the biology of this game animal has been studied by hundreds of scientists, the elk bugle call had not been explored using available sound recording and analysis equipment. In fact information on the bugle call, even in scientific journals, was mostly limited to anecdotal descriptions. Thus beginning in 1998 a team led by Dr. Jennifer Clarke, an animal behaviorist at the University of Northern Colorado, began studying elk bugle calls during the mating season.

The Project: Record elk vocalizations, compare to behavioral context of the sender, and quantitatively analyze the specific function or functions of the bugle call.

The researchers examined the characteristics of calls including the length of the bugle, frequencies used, and the loudness of individual frequencies. They observed, filmed, and recorded bugling male elk and their harems using a microphone to record calls and a video camera to record behavior associated with each call. Sound spectrograms provided a visual interpretation of the bugle calls allowing researchers to measure acoustic variables and distinguish the three parts of the vocalization: on-glide, whistle, and off-glide.

Bull elk have unique vocalizations.

The Results: The elk bugle call conveys information about the mood of the animal. Individual bulls have signature calls and harem herd size relates to the acoustic characteristics of the vocalization.



Bugle sound diagram (courtesy of Dr. Clarke).

Bugle calls made during an aggressive encounter, such as an instance where one bull was challenging another, have more frequencies in their spectrograms, and sound harsher to our human ears. These atonal calls also occur in other aggressive contexts, such as a new female entering the area or a female straying from the herd. In contrast calls produced during periods of relative calm, with no immediate threats to the master bull or his cows, lacked these harsh sounds. Despite the changing range of frequencies displayed in calls, the characteristic shape of spectrograms did appear to be unique to each bull. Individuals, for instance, varied in how quickly they climbed to the highest frequencies of the call and in how abruptly the whistle portion of the call ended. Although these subtleties can be difficult for the unpracticed human ear to detect, it is quite possible that individual elk bulls can identify each other. Smaller males with smaller harems are inconsistent in their most powerful bugle call frequencies emphasizing a different frequency in each bugle call. Big males with large harems consistently emphasize the same frequency. These "Pavarottis of the elk world" may achieve dominance, in part, because they convey their strength and superior biological condition through their bugle calls. The research suggests that animals do not necessarily need to be seeing each other in order to draw conclusions about size and fitness.

This summary is based on published, peer-reviewed and/or unpublished reports available at the time of writing. It is not intended as a statement of park policy or as a definitive account of research results.
For more information on the park's research program, see www.nps.gov/romo
Written by: Judy Visty Date: February 2006 Updated: January 2008 Photo credit: NPS-RMNP and Dr. Clarke