RESEARCH PROGRAM TO MEASURE ELEPHANT CALLS AIDED BY BAG END INFRASUB LOUDSPEAKER SYSTEM

When engineers at BAG END Loudspeaker systems were developing the INFRAsub-18 subwoofer system, they envisioned a wide variety of uses for it - but listening to calls of the African elephants and lions was not one of them.

Beautiful music, intricate movie sound tracks, yes. But elephants? Lions? Well, why not?

Dr. Michael Garstang and a group of his students in the Department of Environmental Sciences at the University of Virginia - most notably David Larom and Robert Swap - are conducting research on the temperature and wind structure of the lower atmosphere and how it influences the use of sound by animals for communication and territory marking.

Their work is focused on the African savanna elephant (Loxodonta Africanus) and the African lion (Panthera Leo). The African savanna elephant was chosen because it uses the widest range for frequencies of all large terrestrial animals and is known to depend upon vocal communication as a fundamental component of its social behavior. The lion was selected because is generates the loudest calls known among savanna animals - reputed to travel up to 10 miles under certain circumstances - and because it is one of only two species that is a threat to elephants. Thus the two species play a critical role in the savanna ecological system.

“We think a lion calls at the optimum time of calling, when the atmosphere is best structured to transmit that call the greatest distance, to dictate its territory,” Dr. Garstang said. “So any other lion within hearing range of that call will know it’s there. One of the main objectives of our study is to establish a maximum range a lion calls, which we think is about 10 Km. or about 300 square Km.”

To design the acoustic system they would need to accurately record the animal sounds, Dr. Garstang and his team at the University of Virginia allied themselves with the Laboratory of Ornithology at Cornell University and Dr. Kurt Fristrup, known for his acoustic work with whales.

“After learning what Dr. Garstang required, we consulted with audio engineer Bob Grotke of the Library of Natural Sounds, and it was our consensus that the BAG END INFRAsub-18 would have the best chance of reproducing a relatively faithful rendition of the wave forms.”

Dr. Garstang and his team, along with by Dr. Fristrup’s group, supported by the National Geographic Society, traveled to Namibia, the vast desert nation formerly known as South West Africa near the southern tip of the African continent, to conduct their field experiments.

"We did this right at the end of the dry season, in October," Dr. Garstang said. "The dry season is extreme: no rain at all from March to about the end of October. By the end of September, the place is pretty desiccated; you would think there is no way an animal could survive. There is no visible grass and the bush is leafless. Yet the animals do survive, in fact they look pretty healthy. It also means water becomes a premium."

The team selected a remote site near two watering holes in Etosha National Park in northern Namibia as an optimum location for two reasons: the remoteness of the location assured their recordings would not be contaminated by any extraneous, non-native sounds, and because the watering holes they selected were the only sources of water for many miles around, they would certainly draw visitors.

At the larger of the two watering holes, the group erected a 7-foot by 7-foot tower about 25 feet off the ground, and installed their main recording system. A second, unmanned system was installed at another waterhole about 10 kilometers away.

"We put out a fixed array of eight microphones running about 100 meters out from the tower," he said.

The microphones and their cabling had to be buried because of the problem that animals are curious and if the mikes and cables were left exposed they could be destroyed. In addition, they designed special designed housings that allowed the microphones to extended just above the surface of the ground, hidden in brush. The housing protected the microphones from being crushed.

"An elephant standing on a microphone wouldn't do it much good," Dr. Garstang commented.

"On the tower, we had a computer processing unit and large digital hard disk data storage system driving by the computer. The microphones recorded in a range of frequencies from 500 Hz. to 10 Hz., so we were looking primarily at the lower frequency end of the spectrum. Because they were wired we had pretty well instantaneous reception of sound."

All eight mikes were recorded continuously whether they got any sound or not. Every 36 hours they had to down-loan the recordings onto a hard disk, and start up again. The system at the second watering hole was unmanned.

"We manned the tower 24 hours a day continuously for about 36 days," he said. "There were times we estimated there were 500 animals around us of different species. There might be 10 or so different species, and some of the herd animals, such as the big antelope, the Elong, which is a big antelope the size of a moose, those herds were as big as 100-200 there at one time."

To check their daily collection of recordings, the team employed a portable system: a DAT HHD-PRO 1000, with an omni-directional Steinhouser microphone, specifically selected for extended low frequency performance.

"By watching the recorder we could actually see the sound pulses coming in, and then we used the directional mikes to pick out those sounds. Those were manually operated, and that's where we used the BAG END INFRASUB-18 speaker," Dr. Garstang said. "When he got off the tower, we took those tapes to our main camp, about 30 kilometers away.

"There, we would play back the tapes and we could pick out sounds and compare them with manually-kept logbooks to identify what animals were making the sounds. In many cases, you knew precisely what caller was, such as a lion roaring. But sometimes at night you couldn't always tell. Ostriches, for example, make a call very similar to a lion's roar and sometimes it was very hard to distinguish between he two. In many cases we had visual identification of the call, and then by playing in back we could verify we got that animal's call on the tape. Back in the lab further detailed work is being done.

"But the field check was very important because that was the only method we had to make sure we were getting what we wanted," he said. "The ability of the speaker to accurately reproduce the sound we were getting - in particular infrasonic wave forms - was critical and we selected the BAG END INFRAsub on the recommendation of Dr. Fristrup's team at Cornell, because of its low frequency capabilities - and that proved the case. The fidelity of the INFRAsub was excellent; it performed remarkably well under some very rugged conditions."

Oddly enough, when Dr. Garstang contacted BAG END, a sales person at the company, upon hearing that he planed to ship the INFRAsub-18 to Africa and use it in, essentially, an outdoor situation, tried to talk him out of it. Knowing the INFRAsub-18 was designed for recording studio and home theater use, the sales person feared it might not hold up in the face of some of the harsh conditions in which it might have to operate.

"Actually, he told me he thought it went down too low to be of use to us," Dr. Garstang said. "But we told him that was exactly why we wanted it, and he finally agreed to sell us one."

And, at times, the conditions were as billed on occasion, but the gear held up and performed in spite of wind, dust and temperature extremes.

"Because it was the dry season, dust was a major problem. Basically, we were in the open. We had some lean-to sheds, but that was far from laboratory conditions. At one point, we encountered a dust storm and had completely "white-out" conditions."

While working at the base camp one evening, Dr. Fristrup had an unexpected endorsement of the BAG END's fidelity. "I performed one series of tests at full power, which included the musth rumbles of a male elephant (the musth condition is similar to a deer in rut)," he recalled. "Later that evening, we were surprised to hear a very loud elephant call right outside our compound, which suggests our experiment proved more productive than we anticipated."

After the field experiments were completed, all of the recorded data was shipped back to Cornell, where the research team is using two software packages developed there to analyze the recordings. One package will sort out the signals from the acoustic record so they the calling animals can be identified. From previous work the team programmed in patterns of calling frequencies of elephant and lion species, so computer can do the basic sorting out from the huge mass of data from the field.

"The second software package does the locating of the source of the sound by triangulation. Using the speed of sound and at the same time measuring atmospheric conditions at the time of the recording, we can calculate the velocity of sound very accurately and then by triangulation we can locate the caller," Dr. Garstang said.

The research team has just started its laboratory analysis now. But the data-gathering phase is concluded. "You would think spending 24 hours a day on a 7x7 platform for a month in heat and wind would just be pretty hard," Dr, Garstang said. "But experiments aside, the visages were so intriguing we didn't have a chance to be bored."

What will the analysis determine? What conclusions will be drawn? What will it all mean? We may learn in the not-to-distant future. A team of National Geographic photographers and cinematographers accompanied the research team to Namibia, and is planning to report on the findings later this year.