Science Behind the Scenes Video Script
Soundscapes

Welcome to Behind the Scenes at Rocky Mountain National Park. I'm Judy Visty one of the park's Natural Resource Management Specialists. As part of my job, I provide logistical support for some of the more than 70 projects that happen every year in Rocky Mountain. Research results are important for decision making, but I think knowing a little bit about research studies also makes for a more interesting park visit. In this segment of Behind the Scenes, we will be taking a brief look at two projects, one focused on frogs and one on elk.

As different as these topics seem, they have something in common: they both involve studying sound. The science of sound is called acoustics. It's a relatively new and fascinating field.

Join me in meeting the two project leaders and literally hearing more about their research.

For this first study, a look at chorus and wood frogs, we're in the spectacular Kawuneeche Valley on the west side of the park. We're meeting Rick Scherer, a graduate student at Colorado State University who is funded by the U.S. Geological Survey and the National Park Service.

Hi, Rick.

Hi, Judy.

(Judy) Begin by telling us a little bit about why you are studying park frogs?

(Rick) Well, amphibians world-wide are declining, and the causes for those declines are many. There are things like UVB radiation, habitat loss, lot of the common causes that you hear for other types of declining. So we want to know how the amphibians in Rocky Mountain National Park are doing. We know some species like the boreal toad isn't doing so well. We don't know however how species like the chorus frog, the wood frog, and the tiger salamander are doing in the park. We are interested in providing at least some baseline data so the park can evaluate how these species are doing and then have baseline data with which to look at long-term trends in those populations.

(Judy) Well, I know your research has several components. How are you using sound to study frogs?

(Rick) We record frog choruses using what we call a frog logger, and the data that we can get from that are things like when does calling begin, what is the duration of the chorusing, what's the peak of the chorusing activity, what days the peak of the chorusing activity. We can also look at things like: is the peak of the activity period correlated with certain environmental characteristics like climate.

(Judy) And you'll also be able to compare data so if you record the frogs this summer, 10 years from now someone would also make a similar recording and know whether the frog populations were changing.

(Rick) Yeah, researchers in both Britain and in New York have discovered that frog breeding activity seems to be moving up earlier in the year, and they've correlated that with changes in climate patterns. So, of course, that has ramifications for questions like, or concerns like, climate change. And, so certainly, this data would again provide baseline data for the park to evaluate not only trends in populations but also trends in reproductive behavior that might suggest changes in climate.

(Judy) Well, and I guess that if the park knew that frog populations were declining we'd perhaps have an opportunity to intervene early before the population was in jeopardy.

(Judy) Can you tell us more about the frog logger?

(Rick) Sure, this is a recording device that is hooked to a clock, and it turns on once an hour and records frog calls for about 15 seconds each hour. So, there's a cord that runs from this device to a microphone that's mounted to a tree and once an hour for 15 seconds, it simply records what the frog choruses.

(Judy) So the nice thing about a frog logger is you can easily compare data from this year, and three years from now, five years from now, ten years or even twenty years.

(Rick) Yeah, and this is a very inexpensive way to capture data on frog populations that's not intrusive and then can serve as baseline information that you can use many years into the future. For example, the scientist in New York has data from almost a hundred years ago.

(Judy) Well, in the park service, of course, we hope that we'll have chorusing frogs a hundred or two hundred years from now.

(Judy)
Well, what about this pond right behind us? Is that good frog habitat?

(Rick) Yeah, this is called Gaskell Pond, and it's very typical of wood frog habitat in the Kawuneeche Valley. In this particular pond, we've been monitoring now for-this is our third field season. And, unlike our surveys in the entire valley, here we're looking for just monitoring this single population. So, we're using markering capture techniques, trying to understand population sizes and how they change over time. So, we're relatively late in the breeding season right now, and if you go out in the pond and you look what you'll find are several egg masses, and there are also tadpoles.

Tonight when we come back to observe the chorusing, chorus frogs will already be calling, and the wood frogs will start chorusing sometime around nine o'clock when it's been dark for about a half an hour. So, we'll have lots of chorus frog calling, and intermittently we'll hear the wood frog chorusing as well. Let's go find them

(Judy) Only the males sing, right?

(Rick) Yeah, the idea is, the dogma is, that the males stake out a location. They call from that location, and the females seek them out. They are attracted to the males based on various cues about the acoustics of the male's call.

(Judy) I've heard that you tag and even radio-collar frogs. Can you tell us a little bit about that?

(Rick) Yeah, those two things have different purposes. The tagging is so that we can individually identify animals. That's important in estimating demographic parameters. For example, things like what's the survival rate of a wood frog in this population. What's the population size of this wood frog population or chorus frog population? You can estimate all kinds of different things, but you have to be able to individually identify a frog. To do that, we have to mark them with little plastic tags that we'll look at later on. (Looking at a tag on a frog) You can see how it really pops out of there.

(Judy)Yeah.

(Rick) She's number B04.

The telemetry work which is just simply attaching a transmitter to the back of a frog allows us to see how they move about the landscape and use the landscape.

(Judy) So you're actually able to put a radio collar on a frog?

(Rick) Yeah, the frogs themselves weigh anywhere from nine to 13 grams. The transmitter is attached to a belt, and it's put around the frog's waist. So, there's a general rule of thumb that you don't want to exceed 10% of an animal's body mass with the transmitter and the attaching device. So, these transmitters and the device weigh about .9 grams, and the frogs weigh anywhere from nine to 13 grams. So, while it seems really sort of humorous that you'd be able to attach a transmitter to a frog, it is possible. What limits us in the usefulness of this technology is the battery life. The battery has to be so small to make the weight part work out, that it has a very short battery life. So we have to continue to add new transmitters as time goes on and as the batteries run out.

(Demonstrating how to put belt and transmitter on a frog)

(Judy) An understanding of amphibians in the Kawuneeche Valley is necessary to protect them now and in the future. Rick Sherer and his team are making an important contribution towards that park goal.

Frogs mate in spring and early summer, so the best time to hear them is in May and June. But each season has its sounds. We're going to shift now to talk about a sound heard from August to November, a sound made by the park's best known wildlife species, the elk or wapiti. We'll be joining Dr. Jennifer Clarke from the University of Northern Colorado who has been studying elk communication behavior in and around Rocky Mountain National Park for the last five years.

(Jennifer) Our first step had to be to record the calls, measure what are the frequencies they're using, what's the duration of the call, where do they put their power. There are a number of things. And then, we started asking questions.

Two of the first questions we started to look at were: Do the males have what's called signature characteristics in their bugles. That is, can you tell Tom from Dick from Harry in the bugles, and we found out, indeed, you can. Each male puts his emphasis in a different portion of the call. And no one else uses that particular frequency for their emphasis.

(Judy) Can you explain some of the other things you saw, or heard I should say, in bugles?

(Jennifer) Well you're right. We do see them and hear them, because we print out sound spectrograms which are a visual interpretation of the sound. And we measure all sorts of acoustic variables on those. With some of the other differences, going along with the signature characteristics, we also looked at, to tell bulls apart, they have very unique antler branching patterns. So you can tell different bulls based on their antler branching patterns. And we noticed that those bulls with the biggest antlers, and antler points can be used as a relative indication, not a hard, fast measure, but a relative indication of size, health, and maturity. Those big guys could hit the highest highs in their calls as well as the lowest lows, in the same call, because the call has a unique frequency where it goes up, what's called an on-glide, the long whistle, and then an off-glide. Those males who have high frequency, power in the whistle, and a low frequency power in the off-glide were the big guys, and they had the largest herds. We term that the "Pavarotti Effect. "

(Judy) What I love about your work is I've been listening to elk for years and hadn't picked up the subtleties, the complexity, of what's going on in terms of communications. Recently you moved into cow-calf interactions.

(Jennifer) Yes, one of my students, Gin Johnson, has been looking at cow-calf calls. The cow calls, as females, are incredibly complex and that, I think, will take a lifetime to tease those out –what they're saying. The calf calls are fairly simple. In fact, what Gin Johnson is revealing is that if you take a calf call and essentially stretch it out, you have a bugle. But, if you smash it up and down, you know, shortened in time, lowered a little bit in frequency, that is a calf call.

(Judy) Now, I think I heard you mention one other type of call, the "Rod Stewart."

(Jennifer) Well, with that, when bulls, the males, are in the vicinity of other males, there's frequently a volley back and forth of bugling. Now, if a male starts to approach another male's herd, what's called the harem master, the one in the herd, he'll get very annoyed essentially, and he emits a bugle that changes a lot. It gets hoarse. It gets very deep-very rough sounding. And, that is a very clear signal of his aggression. It's increasingly complex the more angry they get. And that also goes along with a theory called the Motivation Structural Rules, that you can tell an animal's mood by the structure of its vocalization. Probably the elk use the calls as one of a suite of characteristics when they are assessing a potential competitor or a potential mate. And undoubtedly, they also use the visuals of the size of the individual, the rack, and probably scent. Scent is highly used during the rut. Now here's a four-point bull, working on five points, and he's approaching. Here's a younger four-point, much smaller than he is. And they're eyeing each other. And, there's a female approaching the larger male. Now he chases off the young male. (bugle sound) Now that bugle is what a colleague suggested we refer to as the "Rod Stewart Effect" because very hoarse in the center part of the bugle during the whistle portion. Now that particular male, because he's only a four-point going on a five-point, he cannot hit those really high highs with a lot of power or those really low lows with a lot of power. And we can see that from the spectrograms we have. His frequency, the highest frequency he has, his fundamental, is not as high, and the off-glide was essentially non-existent which is the part where he's mainly talking to cows. And he definitely was not speaking to any of the females in this interaction. He was aiming it totally at that young bull.

(Judy) And, so, he's not going to have many cows join his harem.

(Jennifer) It is doubtful. His bugle is a little quavery and doesn't have the power of the large male.

Now here is a large six-point male. He is pursuing a female, scenting to see if she's ready to be mated. She's evading him. (bugle sound) And he bugles. And that bugle had that hoarseness in it. That is very consistent. After a female evades a male's advances, he gets this hoarse bugle. And now he is pursuing another female. She's running away. (bugle sound) And another hoarse bugle. All right, now, same male, (bugle sound) and again that hoarse bugle after pursing female who ran away.

(Judy) He's so fluid the way he moves.

(Judy) (bugle sound) There he goes again.

(Jennifer) Here's a lone calf, (bugle sound) undoubtedly calling for mom, staying in one place. Sometimes, they run about and call. (bugle sound) But frequently they will stand still and just call for mom. We don't see a lot of signature differences in calf calls yet. And we think they are fairly similar. It's like small children, when they yell "Mom," they all sound the same. If you're in a grocery store, and a child yells "Mom," all the moms look around.

Now this is a big male and he's thrashing in the cedars there. (bugle sound) Now, that's a classic bugle where he's hitting the high highs, so I'll wager that he's a six-point. And as we talked about with the "Pavarotti Effect," only the big males can hit those high highs and the low lows. He followed that with grunts, and those are very puzzling vocalizations. We are investigating what their function is. As yet, our data are entirely inconclusive.

(Judy) Well, how would a young bull elk learn to bugle?

(Jennifer) That is an excellent question and that again would be a future area for study-the whole ontogeny of bugling. Do they copy another male? Do they sound like their dad? It is unknown. It's one of those many, many questions still to be looked at.

(Judy) We are fortunate we have you so close so that, there in Greeley, so that you can come up every fall and explore this fascinating question.

(Jennifer) Well, we're fortunate as well. Thank you. (bugle sound)

(Judy) Rick Sherer uses sound as a tool to understand the ecology of frogs. Jennifer Clark studies sound as one aspect of animal behavior. The work of many scientists around the world studying sound has resulted in a new term, "soundscape." A soundscape is a total acoustic environment including the sounds both of man and of nature.

We know from visitor surveys that the sounds heard during a park visit create a profound sense of relaxation and peace. We are especially fortunate in that Rocky Mountain National Park, alone among all national parks, has an overflights ban on commercial sight-seeing planes. This ban came about because the Estes Park League of Women Voters joined with local and state officials to support congressional legislation prohibiting the types of low-flying tours that have significantly impacted the soundscapes in other national parks. You will still hear the occasional jet, private plane, and emergency helicopter BUT the sounds of nature prevail here.

The national park cares for special places saved by the American people so that all may experience our heritage.

Soundscapes, such as you experience here at Rocky Mountain National Park, are growing increasingly unique, because they are places where the sounds of nature predominate over the sounds made by man.

April, 2009