

TRANSCRIPT

INTERVIEWEE: Tom Devitt

INTERVIEWER: David Todd

DATE: October 16, 2023

LOCATION: Houston, Texas

SOURCE MEDIA: MP3 audio file, Zoom MP4A recording

TRANSCRIPTION: Trint, David Todd

REEL: 4177

FILE: BartonSpringsSalamander_Devitt_Tom_AustinTX_16October2023_Reel4177.mp3

David Todd [00:00:02] Well, good morning. I'm David Todd. And I have the privilege of being here with Dr. Tom Devitt. With his permission, we plan on recording this interview for research and educational work on behalf of a nonprofit group, the Conservation History Association of Texas, and for booking a Web site for Texas A&M University Press. And finally, for an archive at the Briscoe Center for American History, which is a University of Texas here in Austin.

David Todd [00:00:30] And I want to stress that he would have all rights to use the recording as he sees fit. It is his.

David Todd [00:00:37] I want to make sure that's okay with Dr. Devitt.

Tom Devitt [00:00:39] Absolutely. Thanks, David.

David Todd [00:00:41] Good, Good. All right.

David Todd [00:00:42] Well, let's get started.

David Todd [00:00:44] It is Monday, October 16th, 2023. It's about 10:10 in the morning Central Time. And my name, as I said, is David Todd. I am representing the Conservation History Association of Texas, and I'm in Austin, and we are conducting a remote interview with Dr. Tom Devitt, who is also based in the Austin, Texas area.

David Todd [00:01:06] Dr. Devitt is an Assistant Professor of Practice at the University of Texas, as well as a research scientist in the Hillis Lab at UT. Dr. David has spent many years studying the evolution and conservation of groundwater salamanders, both in the academic field and in government, as a biologist in the Watershed Protection Department at the City of Austin.

David Todd [00:01:29] Today, we'll talk about Dr. Devitt's life and career to date, and especially focus on what he's learned about the history of Barton Springs salamanders and other groundwater salamanders and their study and conservation and restoration.

David Todd [00:01:45] So, with that little preamble, I wanted to take this chance to thank Dr. Devitt for doing this, and I look forward to a few questions.

Tom Devitt [00:01:53] Happy to be here, David.

David Todd [00:01:54] Thank you. You bet.

David Todd [00:01:55] All right. Well, let's talk a little bit about your early years. Could you please tell us about your childhood and if you might be able to point to any people or events in your small years that might have influenced your later interests in animals and science and conservation?

Tom Devitt [00:02:15] For sure. So, just from the time that I can remember being able to walk, I spent all of my free time outside looking for snakes and salamanders, frogs, turtles.

Tom Devitt [00:02:31] I grew up in West Saint Paul, Minnesota, from the time, up until I was about seven years old, and we lived across the street from a pond. And every spring, when the snow melted, salamanders would emerge from the pond and make their way across the street into our yard. And so, I always had a love for salamanders.

Tom Devitt [00:02:58] These were big black and yellow tiger salamanders. And I can remember just catching them all day long. They would fall into the basement. We had a basement and there were these little areas that surrounded the windows of the basement. And they would kind of act as sort of little traps. The salamanders would fall in and they couldn't climb out.

Tom Devitt [00:03:22] So, every day I would go around and rescue the salamanders from these little pitfall traps, and frogs would fall in there and snakes, too. And so, that was just kind of my daily routine. We also had a swimming pool, and so I was constantly rescuing frogs from the skimmer drain in the swimming pool.

Tom Devitt [00:03:40] And my parents were very, very supportive of my interest. And they let me, you know, bring snakes and frogs into the house. And they would even, you know, help me take the frogs out of the drain if I couldn't do it some day for some reason.

Tom Devitt [00:04:00] And, you know, I always was asking to go to the zoo or, you know, whatever. And they would just buy me books about reptiles and amphibians.

Tom Devitt [00:04:10] And I just learned all that I could. And I just knew that I wanted to be a herpetologist someday. Although I didn't know exactly in what sort of capacity. I mean, when I was a kid, I just, you know, I didn't know what that meant, but I just knew that I wanted to work with or study reptiles and amphibians.

Tom Devitt [00:04:27] And so, then when I was seven, we moved to Texas. And I maintained that interest. I, you know, spent all my time looking for snakes and frogs, and I just kind of never grew out of it.

Tom Devitt [00:04:40] And by the time I got to high school, I had a teacher who was very influential and interested in sort of my hobby and encouraged me through those years. Her name was Jill Graham. And I went to a little private high school called St. Michael's Academy.

Tom Devitt [00:05:03] And then, when I got to college, I immediately sought out professors who studied reptiles and amphibians (that was here at UT). And I, I think I was a sophomore, begged my way into the upper division herpetology class by talking to the late Eric Pianka, who was a professor here for many years until he passed away last year. And Doctor Pianka had written a book called, "The Lizard Man Speaks". Actually, he's written several books, but he wrote one called, "The Lizard Man Speaks". And I went into his office with a copy of it and

said, "Dr. Pianka, I read your book and I loved it and I want to be a herpetologist. And I just I have to get into the class. Can you help me?"

Tom Devitt [00:05:54] And we sat and talked for a while, and sure enough, he got me into the class. And from there, I met several other professors here at U.T. that study reptiles and amphibians, including Mike Ryan, who's a famous scientist who studies animal behavior and frog communication, and also David Cannatella, who's a fantastic herpetologist, specializes in frogs primarily, and he and I are collaborators to this day. And then finally, David Hillis, who has also been kind of a mentor to me.

Tom Devitt [00:06:36] Both David Cannatella and David Hillis have kind of been mentors to me, first as an undergraduate and then later as a post-doc, and now as an assistant professor of practice and research scientist. So they are some of my closest colleagues and I've sort of just come full circle.

Tom Devitt [00:06:55] And I skipped some years in there because after college I went to graduate school at a couple of different places. I first went to Louisiana State University, where I studied with Dr. Jim McGuire, who primarily studies lizards and reptiles and amphibians in Southeast Asia, especially Indonesia. And I was at LSU for a couple of years before Jim, Dr. McGuire, got a job at U.C. Berkeley. And so I went with Jim when he moved his lab out to U.C. Berkeley and I started my Ph.D. there. I finished with a master's degree from LSU, and then I started at Berkeley and ended up working with, continuing to work with Jim, as well as a man named Craig Moritz, who's a famous Australian evolutionary biologist.

Tom Devitt [00:07:51] And then, kind of informally, I worked with David Wake, the late David Wake, who was a very famous evolutionary biologist and salamander expert. And I ended up working on a project on salamanders in California, largely as a result of being at Berkeley and being around David Wake and Craig Moritz, who had worked on this system previously.

Tom Devitt [00:08:17] And so, I've worked on salamanders for a long time.

Tom Devitt [00:08:22] And then, when I moved to Texas for a post-doc, I started working on the groundwater salamanders that you mentioned on a project that was funded by the federal government, the Fish and Wildlife Service, through Texas Parks and Wildlife. And that grant was to David Cannatella and David Hillis. And that's when we started working together on the groundwater salamanders.

Tom Devitt [00:08:52] And of course, David Hillis has worked on this group of salamanders since the early 1980s. So he's worked on them for a long, long time and described a number of species in this group.

Tom Devitt [00:09:07] And yeah, that's kind of how I got to where I am today, I guess.

David Todd [00:09:13] Well, it's ...

Tom Devitt [00:09:13] I think I answered your question and then some, so I'm not sure if that's...

David Todd [00:09:17] That was very complete. What a wonderful trip from early childhood through, you know, career days. That's tremendous to have that sort of intact interest that remained.

David Todd [00:09:34] You know, one thing that intrigued me, among other things, was that not only were you curious about salamanders and other creatures, but you had this kind of rescue instinct that ...

Tom Devitt [00:09:46] Mmm hmm.

David Todd [00:09:46] You know, you'd find these creatures in the pool drains, strainer, or in these windows in your house, and you'd have this instinct to somehow save them. And I was wondering if you could talk a little bit about that.

Tom Devitt [00:10:03] Yeah. I mean, it's just, you know, I just, I guess I've always loved animals. I mean, my mom was a big animal lover, and so I guess, and I mean I guess my dad, too, but my mom was really just nuts about animals. And so, I guess that probably kind of rubbed off on me at an early age.

Tom Devitt [00:10:19] And, you know, I just felt sorry for these things that kind of, you know, stuck in this little windowsill pit of doom that I knew that if they didn't get out, they were just going to dry up or die. So, it just seemed like the right thing to do to get them out and help along their way.

Tom Devitt [00:10:36] And, you know, we would catch them and keep them for a few hours or, you know, just kind of, you know, play with them, handle them. And actually, I can remember I have a photograph of me and my sister with two tiger salamanders on the top of our picnic table in our back yard. And I think we were having a little salamander race with these two tiger salamanders on top of a picnic table. So, I think they were better off than they were on the windowsill, but maybe not quite as good as if they had been right back at the pond. But anyways...

David Todd [00:11:11] It was probably an adventure for all of you - salamanders and kids.

David Todd [00:11:17] So I think you mentioned Lizard Man, the book by ...

Tom Devitt [00:11:26] Dr. Eric Pianka?

David Todd [00:11:28] Mr. Pianka. Yes. And I was wondering if there were other books or maybe movies or TV shows that might have been influential in your interest in this kind of topic.

Tom Devitt [00:11:42] I can remember very clearly that I had one book about reptiles that I still have today. It was, you know, it was just this mostly picture book. I wish I had it in my office. I think I have it at the house, but I can't remember the name. But it was just "Reptiles" or something, and I would just look at that book for hours and hours and hours. And I mean, I can't believe I still have it to this day.

Tom Devitt [00:12:06] But, but let's see. TV shows. Yeah. Like, I can remember every weekend as a kid watching Mutual of Omaha's "Wild Kingdom" and with old Marlin Perkins

and his assistant Jim and I would watch also "Wild America" with, oh, what was that guy's name? I want to say it was Marty Stouffer. But I may be getting that wrong.

Tom Devitt [00:12:38] And then, of course, you know, later as, you know, when the Discovery Channel came out, Discovery Channel on National Geographic, I would watch, you know, Steve Irwin and, you know, Jeff Corwin, all these guys. And now everybody has a TV show. So I don't watch TV much anymore. But those were certainly things that I would tune in to when I was a kid and get real excited about.

David Todd [00:13:04] Good. Good. All right, That's. That's nice to know.

David Todd [00:13:10] So I was wondering, of course, you had early encounters with the tiger salamanders, but what was your first meeting with a Barton Springs salamander? Do you recall that?

Tom Devitt [00:13:22] I do. I remember it pretty clearly. It was in November of about, I think it must have been 2012 maybe. And I had just started my position as a post-doc at the University of Texas. And there was a group of graduate students and other post-docs who wanted to go look for reptiles and amphibians on the Greenbelt. And there was one spot where we knew that, you know, Barton Springs salamanders occurred. But, we knew that we weren't supposed to kind of, really actively look for them because they were protected.

Tom Devitt [00:14:09] So, we just went down to the Greenbelt and we saw like some water snakes. And it was after a big rain. And we started kind of looking around this spring. And in the spring, the first thing we saw actually was a very lavender-colored salamander. And it was just very out in the open and it didn't seem even really to want to hide. It was just kind of wandering around on the bottom of this spring pool. And I knew that, I mean, I knew immediately that it wasn't a Barton Spring salamander because it didn't really have eyes. It just had spots, you know, it had very reduced eyes and just this purplish lavender color. It was, I knew it was an Austin blind salamander. And that was exciting because that was the first time that it had ever been seen at that spring.

Tom Devitt [00:15:02] And then nearby, kind of peeking its head out from under a rock, was a Barton Springs salamander. So, that was the first time I saw both of those species, actually, and it was on the same night. So that was that was a big, that was a fun night, for sure. Definitely never forget that.

David Todd [00:15:21] That's nice. So, tell us about the Barton Springs Salamander. I guess it was discovered back in the, or first found in the 1940s, and later described in the 1990s. Can you talk about its sort of first encounters with science?

Tom Devitt [00:15:44] Yeah. So, you know, I think that salamanders have been known to occur in Barton Springs for at least since the forties, I think, maybe even before then. And they weren't sort of known as the Barton Springs salamanders because the, sort of the techniques and tools that we use nowadays for kind of molecular genetic identification of species hadn't been yet developed. So, it was basically a situation where the taxonomy kind of didn't match up with what people understood as what people understand now as kind of the boundaries of these different species. So, it was considered to be another population of more widespread salamander species.

Tom Devitt [00:16:41] And so it wasn't until, really in the late eighties, early nineties, that David Hillis and his graduate student Paul Chippendale started investigating the genetics of salamander populations in Texas, that they discovered that the Barton Springs salamander was quite distinct genetically. And then when they looked a little bit closer, they saw some differences in the external appearance as well, what we call the morphology of the species. And so they described it as a distinct species in 1993.

David Todd [00:17:29] So, the Barton Springs salamander is pretty famous politically and in the news. But I think that most of us lay people don't know much about its life history and the ecological niche that the Barton Springs salamander fills. And I was hoping that you might be able to talk about that.

Tom Devitt [00:17:53] Yeah, I'd be happy to.

Tom Devitt [00:17:56] So, the Barton Springs salamander is one of about maybe 14 or 15 species that occur in the Trinity/Edwards Aquifer system of West Central Texas. And the Barton Springs salamander is completely aquatic like all the other species that it's closely related to. They have gills. They never transform or metamorphose into terrestrial adults like some other salamanders do.

Tom Devitt [00:18:30] And so, permanently aquatic but they don't sort of, you know, just kind of swim throughout the water column. They're not, you know, like fish. They'd be very easy prey for predators if they did that. So, they basically hide on the bottom, you know, kind of among rocks and vegetation and things and, you know, kind of make their living by, you know, looking for small invertebrates to eat, probably a lot of crustaceans.

Tom Devitt [00:19:02] And, you know, there hasn't been a lot of work done on Barton Springs' diet. But the little, you know, what little data I think there is, shows that they will eat pretty much anything they can fit in their mouth. But mostly, you know, just mostly the small invertebrates that occur in springs.

Tom Devitt [00:19:22] And so, you know, their niche is very, I would say, it's very narrow in that they're highly adapted to this groundwater environment. The temperature remains constant year-round at about, you know, maybe 70 degrees. People always say Barton Springs is 68, but it's really closer to 70.

Tom Devitt [00:19:47] And, you know, so they really have a very narrow range of conditions that they can tolerate. You know, if they get too hot, they're not going to survive. If the water quality isn't good, you know, again, that's going to impact their ability to survive. So they have a very narrow ecological niche, and some very specific requirements in order to be able to survive.

Tom Devitt [00:20:12] So, you know, they've evolved over millions of years in these conditions and, yeah, they're a very specialized species. All of these groundwater salamanders are very specialized to this groundwater ecosystem.

David Todd [00:20:29] Are there any predators that prey on them? Are they part of some food chain?

Tom Devitt [00:20:35] For sure. I mean, we know that, you know, probably they, I'm not sure cannibalism has ever been observed in the wild, but I'm sure that larger salamanders would eat a smaller salamander if they were able to. Certainly, in captivity they will.

Tom Devitt [00:20:52] And, you know, we know things like crayfish will eat salamanders. Probably, you know, I'm sure some wading birds would eat them if given the opportunity, you know, herons or things. Or, you know, fish, I'm sure, you know, eat some salamanders, although, you know, they're pretty good at staying kind of underneath the rocks. And, you know, like I said, they've evolved, you know, over millions of years in the presence of predators. So they're pretty good at avoiding predation. But I'm sure that it happens, you know, to some extent in the wild.

David Todd [00:21:37] What do you think about their lifespan or reproduction?

Tom Devitt [00:21:42] We know very little about their actual reproduction in the wild. Well, I should say there have been only a handful of times that eggs have been found in the wild. And the eggs are usually laid singly, and they hatch into these little tiny larval salamanders that that seem like they can barely swim. They kind of seem to just drift with the current. And in fact, I think that is probably how they disperse through the aquifer, is that they kind of just, when the salamanders hatch, they kind of just go with the flow.

Tom Devitt [00:22:28] And so, you know, they're probably very vulnerable at that stage to predation. And I'm sure that probably most of them don't survive that initial step, that initial life stage. But maybe they do. We just we don't really know. But, they certainly seem like they'd be easy pickings for fish and other things when they're kind of at that stage.

David Todd [00:22:53] And they typically live a matter of months, years, what?

Tom Devitt [00:23:00] You know, in the wild, we think that they probably live a number of years. You know, most of, a lot of the information we have about the Barnes Springs salamander is based on a captive population that the City of Austin maintains as a refugium for the species. And, you know, in captivity, they can live upwards of a decade. You know, I think, I'm trying to remember what the oldest salamander in captivity at that center is. I can't think, but it's probably somewhere around between ten and 15 years, I would guess.

Tom Devitt [00:23:39] And, you know, we know a lot about their reproduction in captivity. But, again, you know, to what extent that mirrors wild individuals we don't really know. There's, the City of Austin has a pretty big data set from a study that that uses a technique known as capture / recapture methods where biologists will go into a given area and capture as many salamanders as they can and photograph each individual salamander and then release it back into the wild. And then using specialized software, you can take an image of a salamander and sort of compare it against a database of images of other salamanders and try and find a match based on the unique pattern, kind of like, you know, leopard spots or cheetah spots or, you know, markings on a whale's tail, for example.

Tom Devitt [00:24:47] You've probably seen people doing that kind of work. So, it's kind of a, it's a very interesting tool to be able to estimate salamander density and try and get some information on their life history, how far they move, how long they live. So the City maintains a database of thousands and thousands of salamander images from years of study. It's a pretty amazing dataset.

David Todd [00:25:22] So, I understood that when you were a post-doc at U.T., you looked at the evolution of various salamanders, and I was wondering if you could talk about how, I gather this course of evolution spanned millions of years and has ended up with a really highly adapted creature to the Edwards / Trinity system. Can you tell us a little bit about that, what you've learned?

Tom Devitt [00:25:49] Yeah. So, we don't have a great estimate of when this sort of group of salamanders first kind of split off from its closest relatives. But the closest relative of this group of salamanders that occurs in groundwater throughout West central Texas is a terrestrial, well, it's a species that begins life as an aquatic larval salamander and then transforms into an adult that lives in East Texas.

Tom Devitt [00:26:24] So, we don't exactly know when those species diverged, but it's, you know, at least I would say probably between ten and 20 million years ago, if I had to guess. But again, that's a pretty big, that's a ballpark estimate. And so, you know, over the last however many millions of years, let's just say, you know, maybe 15 million years or so, these salamanders have kind of evolved in groundwater as the climate has become warmer and drier in Texas.

Tom Devitt [00:27:04] And we know that within this group of salamanders there have been different geographic barriers to dispersal that have contributed to sort of the isolation of different species and populations that, over time, because they're no longer exchanging genes, have diverged enough to become essentially what we call distinct species. So, they're effectively reproductively isolated with one another. They don't breed with one another either because they don't meet each other in the wild. They don't come into contact. They occur in different places. Or, because they've evolved so many differences that their offspring aren't viable.

Tom Devitt [00:28:02] So, yeah, we have, you know, in different parts of the Edwards / Trinity, we have these different species that are largely separated by surface water and groundwater divides, which kind of serve to prevent gene flow between these different populations and different species.

Tom Devitt [00:28:23] And so, we call that allopatric speciation: "allo" meaning different, and "patric" meaning place.

Tom Devitt [00:28:31] So, species or populations evolving in different places and through evolutionary processes like mutation and genetic drift, they evolve genetic differences and eventually become distinct species.

David Todd [00:28:50] That's great. It sounds like your own little Galapagos Islands in watching these salamanders disperse and diverge.

Tom Devitt [00:29:00] It's really cool. Yeah.

David Todd [00:29:01] Is there anything that is particularly distinctive about the Barton Springs salamander among its suite of, you know, 14 or 15 kin? Or is it just that it's politically been such a hot item that we seem to know or hear more about them?

Tom Devitt [00:29:21] I mean, it's certainly probably the species that's gotten the most attention, you know, because it was listed as endangered in 1997. And of course, that was, you

know, right in the middle of kind of, you know, this S.O.S. movement. And so, it definitely got a lot of attention.

Tom Devitt [00:29:44] And, you know, I think it's unique in some respects because, you know, it's a real survivor, right? I mean, the place where it was, you know, discovered and described has been, you know, a place where humans have recreated for a long time, and, you know, before Barton Springs was a pool, I'm sure that it was a site where indigenous peoples, you know, came to, you know, get fresh water and, you know, make a living.

Tom Devitt [00:30:23] So, I think in that respect, it's interesting.

Tom Devitt [00:30:27] But, you know if you look at sort of the Edwards Aquifer, all of the major springs are sort of areas where there have been, you know, a history of kind of human habitation and human settlement, which makes sense because it's a nice source of fresh water, right, in an otherwise kind of semi-arid landscape.

Tom Devitt [00:30:52] So, the Barton Springs salamander is certainly unique, but, you know, there are 13 or 14 other species out there that have similar habitat requirements and needs and just aren't as well-known because they haven't received so much attention.

David Todd [00:31:17] Well, I think you mentioned when you're talking about, you know, the distinctiveness or the similarities, that the Barton Springs salamander maybe got extra attention because it was listed as endangered in 1997. Can you give us an idea of the process of how it was first identified and then listed as endangered? How did that come about?

Tom Devitt [00:31:46] So, usually the way it works is that somebody will petition the U.S. Fish and Wildlife Service that a species should be listed as endangered due to some threat. And so, it was actually a couple of professors from the University of Texas that I believe were the first ones to petition the U.S. Fish and Wildlife Service - Dr. Mark Kirkpatrick, who's still a professor here at U.T. today, and the late Dr. Barbara Mahler, who worked for the United States Geological Survey. And I believe they were the first ones to petition the species to be listed.

Tom Devitt [00:32:38] And then the details from there, I'm not exactly sure. There's a whole history of the species going through the listing process. And there was a lot of political turmoil surrounding its eventual listing. But it eventually was listed.

Tom Devitt [00:33:04] And, you know, when it was first listed, it was thought that. Barton Springs was the only place that it occurred. And so, it was, you know, pretty easy to make the case for endangerment, because here you have this species that's only found in this, you know, one spring or series of springs that are, you know, effectively there's kind of four separate springs at Barton Springs. But they're all, you know, very much part of the same system. And so it's effectively one kind of site.

Tom Devitt [00:33:41] And so, at the time, people thought, you know, this is, I think somebody even said, "You know, this is the most endangered vertebrate, or the most range-restricted vertebrate, you know, in the entire country".

Tom Devitt [00:33:52] And, you know, as people began to continue studying these groundwater salamanders, they eventually found Barton Springs salamanders at other locations.

Tom Devitt [00:34:10] But the reasons that the Barton Springs salamander was initially listed were due to sort of, you know, destruction of habitat and threats to the species, as well as kind of inadequate regulatory mechanisms for protecting water quality and quantity that salamanders relied upon.

Tom Devitt [00:34:39] And so, even though additional localities, or additional surface populations, were found for Barton Springs salamanders, those threats, you know, basically have intensified to this day, have continued to this day.

Tom Devitt [00:34:55] And so, even though the range of the species is somewhat larger than when the species was first listed, all of the threats that were present in 1997 are still there today, and probably even more so, as the contributing zone in the Barton Springs segment of the Edwards Aquifer has been developed and sort of become more urbanized.

David Todd [00:35:32] You know, while we're talking about the salamander's listing, I thought this might be a good chance to talk about the overall trends that I guess have brought some concern to the creature. And I think that while you were a biologist at the City of Austin, you did some interesting research on salamander demographics and genetics, and I was curious if there are any overall trends that you've been following or, you know, found interesting.

Tom Devitt [00:36:07] So, in terms of the demographics of the species, I mean, I think the, excuse me, I think the main thing we can say is that the salamanders density or their abundance is very much a function of conditions in the aquifer. And so, what I mean by that is when there has been abundant rainfall and spring flow is high, salamanders are very abundant.

Tom Devitt [00:36:44] And that probably is a function of the nutrients that are being input into the aquifer, into the groundwater ecosystem, which of course allows for, you know, reproduction and feeding among salamanders when conditions are good, when conditions are ripe for feeding and reproduction, when there's a lot of nutrient input into the aquifer.

Tom Devitt [00:37:11] And then, conversely, during drought conditions, when discharge or spring flow is very low, obviously, there are fewer nutrients, organic matter being recharged into the aquifer. And so, there's just naturally less sort of reproduction and feeding going on.

Tom Devitt [00:37:35] At least, we think that's what's going on.

Tom Devitt [00:37:37] And in the data set that I mentioned previously, the capture / recapture data set kind of bears that out. It shows that, you know, during periods of high discharge, there's a little bit of a lag and then there's usually kind of a population boom when there's been a lot of rainfall and high discharge.

Tom Devitt [00:37:57] And in terms of the genetics, we don't really see any trends with the genetic data. The genetic data gives us more a picture of kind of the historical demography of the species, that is, kind of, you know, on the order of many thousands of years ago. And it essentially shows that there are genetic differences between kind of the Western and Eastern populations.

Tom Devitt [00:38:29] But all of those populations, you know, effectively are part of the same watershed, that is, the Barton Springs segment of the Edwards Aquifer that extends from about Dripping Springs, of course, all the way to Austin - so the Onion Creek and Barton Creek watersheds, essentially, as well as Bear Creek and Slaughter Creek and some of these other smaller creeks.

Tom Devitt [00:39:02] But I think, you know, in terms of trends, I think probably, you know, and so, in terms of salamander trends, certainly I think that the salamanders have increased in abundance since the species was listed and the City of Austin started to use less aggressive cleaning practices. So, you know, previously, in the history of Barton Springs, they used to spray chemicals on the rocks to prevent algae from growing. Some of which you can still see there today. They used to use chlorine.

Tom Devitt [00:39:49] And obviously those things were terrible for salamanders and other aquatic life. You know, it made the water, essentially made the environment sterile, you know, which at the time I think was just, it was the thinking that this is what we want, right, in our environment. But then, you know, now I think there's been a kind of a shift in the mindset, that this is a, you know, a big, beautiful natural ecosystem, a thriving ecosystem that, although it's been modified, you know, through dams, you know, people can enjoy it in its natural, more natural, state without all these, you know, using harsh chemicals to clean it.

Tom Devitt [00:40:31] And so, I think that there's certainly evidence that the salamanders increased in abundance when those harsh cleaning practices stopped.

Tom Devitt [00:40:43] And, you know, I think the most alarming trend probably is that over time, the overall discharges - this is looking over a long period of time - the discharge seems to be slightly decreasing.

Tom Devitt [00:41:01] And the question is, you know, "is that human-induced? Is that because of groundwater pumping in the contributing and the recharge zones of the Barton Springs segment?"

Tom Devitt [00:41:21] And I think the answer is probably yes.

Tom Devitt [00:41:23] But I'm not a hydrogeologist, and I haven't analyzed those data. But, my understanding is that the discharge has decreased over time, and that is concerning, of course.

Tom Devitt [00:41:43] Speaking more about trends, I saw that in 2017, you participated in a report that found that there were some new occurrences that had been discovered of the Barton Springs salamander, including the first discovery in the Trinity Aquifer. And I was wondering first, how did you find them? And then, you know, what did those new findings mean to you?

Tom Devitt [00:42:12] Yeah, that was pretty exciting.

Tom Devitt [00:42:15] We, you know, most of the new records that we found were following a really wet year. So, in 2016, the winter of 2016, we just had a lot of rain that year. 2016 was a great year. And so, we had springs that were, you know, flowing that, you know, maybe in previous drought years didn't flow at all.

Tom Devitt [00:42:44] And I think, as a result of that high precipitation and high discharge, you know, salamanders were present on the surface more frequently than they may have otherwise been in sort of more kind of average years or drier years.

Tom Devitt [00:43:02] And so, it was exciting to find those new occurrences because, it sort of, you know, it kind of gives hope to the idea that if something were to, something catastrophic were to happen at Barton Springs, at least there are some other, you know, populations out there.

Tom Devitt [00:43:25] And so, you know, I just think it makes the species kind of more resilient, you know, thinking about the long term future of the species, to have different populations. And, you know, some of these populations are connected to each other by gene flow, and some aren't.

Tom Devitt [00:43:47] So effectively, some are isolated from the others, at least as far as we can tell, based on genetic data.

Tom Devitt [00:43:53] But, you know, I think the more places a species occurs, the better for that species long-term chances of survival through, you know, kind of the global change that we're seeing.

David Todd [00:44:09] Okay. So one last question about trends and, and that, I guess would have to do with baseline and it seems like, you know, people and salamanders have co-existed probably for many, many years, but it sounds like these creatures really weren't known until the forties and then maybe identified in the nineties and, and you know these genetic tools are even, you know more recent.

David Todd [00:44:40] And I'm curious if comparing then and now is a challenge for you to sort of see what these longer term trends might be.

Tom Devitt [00:44:53] I mean, it's certainly challenging. You know, I think the biggest concern is just, well, I think the biggest concern is climate change and groundwater depletion. You know, there's no denying that that the climate has changed and is changing in central Texas. The evidence is overwhelming. There's no debating that.

Tom Devitt [00:45:22] And groundwater depletion is a real threat to water security in Texas, and I think more so than people realize. You know, there are parts of the Trinity Aquifer where the water table has dropped, you know, 300 feet. And that water is not coming back. It's not, it's not going to be recharged from precipitation. It's just not. That water is gone. It's effectively been used up.

Tom Devitt [00:45:58] And so, if you think about, you know, 300 feet of water table decline, that's a lot of habitat for salamanders and the other organisms that rely on the groundwater ecosystem to survive.

Tom Devitt [00:46:17] And so, you know, I think people don't think about water security in Texas, because every time we turn the tap on, the water flows.

Tom Devitt [00:46:29] But, groundwater is a limited resource, and I think we need to think seriously about our use of that water and how to conserve it for the long term.

Tom Devitt [00:46:50] I'm not sure if I answered your question.

David Todd [00:46:54] Well, I think that you pointed out that the, I guess the concerns going forward and those are ... I totally understand what you're saying.

David Todd [00:47:07] I guess I was also asking about looking in the past and sort of how you deal with an organism that you're monitoring, you're trying to see, is it going up? Is it going down? But, you know, your baseline, your point of origin, you know, ground zero, is hazy...

Tom Devitt [00:47:28] Sure.

David Todd [00:47:28] Because it's a small hidden creature. It comes out, you know, if the rain conditions are correct and so on. And so, I was wondering: how you deal with that kind of uncertainty?

Tom Devitt [00:47:38] No, that's a great question. And I mean, I think, you know, more to your point there, that's the difficulty of studying groundwater organisms in general, is that, you know, many of them are difficult to observe and study directly.

Tom Devitt [00:47:52] You know, even more than the Barton Springs salamander, there are several blind salamanders, we call them, that live their entire lives, you know, underground in the aquifer, in, you know, water-filled caves and conduits and things where we can't access them.

Tom Devitt [00:48:11] And the only way we know about them is, you know, from groundwater wells where they occasionally are, you know, spat out from the aquifer or, you know, from cameras that we can stick down into the aquifer. And so, those species in particular, I mean, we have no idea what their population numbers are like, right?

Tom Devitt [00:48:35] I mean, it's just, I think that just kind of goes speaks to the challenge of studying things that occur in a groundwater ecosystem. It's really, in my opinion, kind of one of the last frontiers of biodiversity on the planet.

Tom Devitt [00:48:54] You know, groundwater is the largest source, is the largest fresh water habitat on Earth. And compared to surface water, freshwater, we know almost nothing about it.

Tom Devitt [00:49:10] And so, you know, it's really hard to answer the question of what is the baseline, right, when this environment is so difficult to access and study.

David Todd [00:49:30] Yeah, it's a challenge, I'm sure.

Tom Devitt [00:49:33] Mmm hmmm.

David Todd [00:49:33] Glad you're working on it.

Tom Devitt [00:49:34] Well, that's what makes it exciting, though, right? Is the challenge.

David Todd [00:49:39] Exactly. Yeah.

David Todd [00:49:43] So, I thought this might be a good time to just pivot a little bit.

David Todd [00:49:47] You've talked to us a little bit about the concerns affecting the Barton Springs salamander - you know, the way that the pool has been treated and cleaned over the years, the groundwater levels. I think you touched on water quality questions and I've heard that sediment runoff may be a problem as well as pesticide exposure. And maybe you were thinking of other water quality issues, but maybe you can get into that a little bit to help us understand what those impacts might be.

Tom Devitt [00:50:26] I think. Yes, certainly, I think, you know anything that enters the aquifer, whether it's what we call, you know, point source pollution, you know, or non-point source pollution (you know, that is like, you know, runoff from roads would be an example of non-point source pollution, you know, or sedimentation from construction activities), you know, anything that sort of changes the chemistry or the quality of the groundwater potentially has, you know, potentially can affect the aquatic ecosystem in a number of ways, both, you know, in fact the aquatic as well as the terrestrial ecosystem that relies on the water.

Tom Devitt [00:51:19] So, you know, I think that all of those things are definitely a concern. And you know, to what extent pesticides and other sources of pollution directly affect the salamanders, I think that scientists are still trying to answer some of those questions.

Tom Devitt [00:51:46] But what we can say is that, in the areas where this question has been asked and studied, salamanders do appear to be affected in more urbanized watersheds. So, in urbanized watersheds, at least the few that have been, you know, really examined, salamanders occur in lower densities or appeared to have, you know, issues that that may be related to the presence of toxins in the environment. So, it's definitely a concern, for sure.

David Todd [00:52:35] Well, so is it sort of a black box where you see urbanism goes up and population densities go down? Or do you have an idea of the mechanisms, you know, what the sediment might be doing to these salamanders or, you know, is atrazine or other chemicals, are they causing deformities or other problems?

Tom Devitt [00:52:54] I wouldn't say it's a black box. I would say that, you know, kind of based on first principles, we have a pretty good understanding of what some of these, you know, pesticides and fertilizers do to aquatic life in general. And, you know, whether or not anybody has performed those specific tests on salamanders in the lab, you know, through a dosing study or something, you know, that's only been done in a couple of species of groundwater salamanders.

Tom Devitt [00:53:33] But, but certainly, you know, it's there's a very clear relationship between, you know, chemicals, as you would expect, and the health of salamanders, for sure. So, it's definitely an area of active study, you know, for aquatic biologist, I think and I know that there are people that are working on that very question, trying to trying to figure out really what are the kind of the chemicals that are the major threats.

Tom Devitt [00:54:12] But, you know, certainly, you know, pesticides have been detected in Barton Springs. I mean, they're really ubiquitous in the environment because there's just so much widespread use of them. Pesticides, fertilizers, you know, all of the things that, you know, cars, deposit on roads, all those things, you know. And the greater amount of what we call impervious cover, basically, you know, things like paved roads and rooftops and, you know, things that collect those chemicals then, you know, just are washed off when it rains

and then washed into the creeks and then, you know, into either, you know, the river or into recharge features that then go straight into the aquifer.

Tom Devitt [00:55:10] So, when we talk about, you know, development affecting water quality, you know, I think we know the mechanisms that result in water quality declines as a result of urbanization. And one of them is the increase in the amount of impervious cover and just the chemicals and things that go along with that.

David Todd [00:55:33] So, is one of the issues with understanding, you know, the mechanics of these problems that you just can't sacrifice any of these Barton Springs salamanders, or other rare creatures, to actually see what the LD-50 effects might be or ...

Tom Devitt [00:55:55] It's actually not. I mean, there's certainly some, you know, there are certainly regulations in place. And you have to, obviously, you know, have approval of, you know, institutional animal care and use committee and the Fish and Wildlife Service and, you know, whatever other governing bodies are involved.

Tom Devitt [00:56:20] But, you know, in cases, for example, like several of these species that we have captive refugia for, you know, sometimes there's so much offspring that there just isn't the need or the space to, you know, to bring eggs to hatching.

Tom Devitt [00:56:42] So, you know, these animals will many, if not most of the species, will breed pretty readily in captivity. And so, you know, that's an obvious source of animals for, you know, conducting research like you're talking about. And so that's not really a limiting factor, although, you know, certainly there are protocols and things that have to be followed for endangered and threatened species.

David Todd [00:57:17] Okay. Well, while we're talking about research on Barton Springs salamanders, and their kin, I understand that you have looked at the evolution and development of these really distinctive adaptations to life underground, which is such a foreign kind of environment to what we're used to is as big, bipedals, you know, out in the sunshine on land. Can you talk about these eye structures and lateral line systems that they have?

Tom Devitt [00:57:54] Yeah. So along with some collaborators here at U.T. and also at Texas State, we've been trying to understand kind of the genetic and developmental basis for a process, an evolutionary process, that we call convergent evolution, and that is the situation where natural selection essentially causes distinct species to converge on a similar phenotype, or appearance, that is sort of due to the similar environmental pressures of living in complete darkness in a nutrient-limited environment. These distinct species will end up looking the same. And so, we're you know, we're trying to understand kind of why is that?

Tom Devitt [00:58:54] You know, there's these different subterranean species of salamanders that occur in the Edwards aquifer that look remarkably similar, but are genetically very, very different. And so we're trying to understand kind of what are the genetic and developmental similarities that result in these changes? So, looking at the portion of the genome that is expressed that we can actually identify genes that are involved in these changes and then compare differences among species looking at DNA sequence data, actually RNA sequences, to be more precise.

David Todd [00:59:40] Okay. Maybe you can walk us through the development of one of the organs or systems that, you know, has somehow converged among these very distinct, genetically-speaking, species.

Tom Devitt [00:59:59] Yes, I think the most obvious one, you know, are the eyes. And, you know, in multiple different species, salamanders have either reduced eyes, you know, or in some cases, even completely lost them.

Tom Devitt [01:00:18] And, you know, intuitively you can understand why that would be. When you're living in a completely dark environment, there's no point in having eyes and it's, you know, energetically expensive to maintain eyes if you're not using them. And so that's kind of the most obvious feature.

Tom Devitt [01:00:42] And there are some species even where there are populations that live on the surface, in surface springs or spring-fed streams and have eyes. And then there are populations of the same species that live underground, just a few feet away, that lack eyes or have reduced eyes. And so that presents a really interesting opportunity to look at, you know, how these populations diverge and how quickly they can adapt to these different environments, and, you know, whether a given species, you know, if raised in different environments, you know, exhibit some of these changes.

Tom Devitt [01:01:24] So, there's all kinds of really interesting, you know, very basic, interesting, you know, fundamental evolutionary and ecological questions that we can ask in this group of salamanders. So we're very excited about the work.

David Todd [01:01:43] So, I'm intrigued by the challenges that you and your colleagues face in studying these creatures. And, you know, I imagine a lot of biologists who maybe don't have this same level of obstacle: they go out and grab a species and look at it upside down and right side up.

Tom Devitt [01:02:03] Yes.

David Todd [01:02:03] But you've got to work with, as I understand it, sometimes these trace amounts of eDNA that's left in the environment. And you don't have access to the organism itself. Is that correct?

Tom Devitt [01:02:16] Yes.

David Todd [01:02:17] Let's talk about how that works.

Tom Devitt [01:02:19] Yeah. So, one of the techniques that we can use to actually try and better understand the distribution of these salamanders, you know, again, because for species that live in the aquifer, we don't always have access to their habitat. And so, one thing we can do is actually collect groundwater that's, you know, being discharged at the surface from a spring, collect that water and filter it, and then take that filter and see if we can detect any trace amounts of DNA that are shed by salamanders, whether it's through skin or feces or a dead salamander or what have you.

Tom Devitt [01:03:03] And we can actually use molecular methods to detect those trace amounts of DNA - very, very minute amounts of DNA.

Tom Devitt [01:03:15] And that helps us get a better understanding of where the species occur in order to be able to kind of inform conservation and management of the species. Because the implications, obviously, as we talked about with the Barton Springs salamander, you know, if a species only occurs in one place, it, you know, probably has a much higher probability of going extinct. Right?

Tom Devitt [01:03:47] Whereas if you have a species occurring in multiple places, the probability is less.

Tom Devitt [01:03:53] So, it's important to know, you know, how wide the distribution of a species is for conservation and management purposes.

David Todd [01:04:07] Well. So the eDNA is basically a one or zero. It's an absence or a presence. Or does it tell you something about density as well?

Tom Devitt [01:04:17] We haven't gotten to the point where we can make or ask questions about density. I think that will be possible in the not-too-distant future. But, at this point, it's mainly a presence / absence assay.

Tom Devitt [01:04:38] And the difficulty is when you get a negative result, that is, when you fail to detect the species. It doesn't mean the species isn't there. It just means you didn't detect it on that day in your sample. So you can go back to a spring, you know, multiple times over multiple, you know, discharge conditions and maybe you don't detect it, you know, the first five times and maybe detect it on the sixth time because you've had a lot of rainfall, for example.

Tom Devitt [01:05:13] So, the difficulty is, is interpreting, I think those negative results and trying to draw an inference about, you know, whether something is truly absent or whether you just failed to detect it, because you can imagine that your ability to detect the organism is a function of the density of the salamanders that are there.

Tom Devitt [01:05:42] And so, if a species is a very deep aquifer species that occurs in low abundance, your ability to detect it is going to be pretty limited.

Tom Devitt [01:05:53] But if a species is relatively abundant on the surface or just beneath the surface and occurs at a greater density, your ability to detect them is going to be relatively good.

Tom Devitt [01:06:07] So we could, for example, go to Barton Springs and it would be relatively easy to detect salamanders at the springs there because they occur at a relatively high abundance, whereas for other species, there are undescribed species that we only have a handful of specimens of, that we've been trying to detect using this method, but but haven't so far been able to detect even from places we know they occur. And that's just because they occur so deep in the aquifer, and/or at such low densities, that it's just nearly impossible to detect them.

David Todd [01:06:51] Okay. Well, you're one of these scientists that I think are in a kind of interesting position where, you know, you're doing this research, and particularly though when you were at the City of Austin, you were also using that research to inform some regulatory efforts and some restoration/conservation efforts - so a very applied kind of science role there.

David Todd [01:07:16] And I was wondering if you could talk about some of the conservation / protection efforts that might have stemmed from some of the discoveries and work that you were doing on the science side. I think you mentioned just when we were earlier during the interview about changes in the way the Barton Springs pool has been kept clean. You know, maybe there's some other measures that have come out of this?

Tom Devitt [01:07:46] Yeah. The cleaning changes that certainly predated me at the City. But some things that happened when I was at the City were the stream restoration projects. So, there's a concrete amphitheater adjacent to Barton Springs pool called Eliza Spring. And that was essentially impounded way back when, sometime in the 1920s maybe. And there's a set of springs that occur in that amphitheater.

Tom Devitt [01:08:30] And previously, the water from those springs went into a tunnel that then went into another tunnel that bypassed Barton Springs pool and then eventually dumped into Barton Creek. And so, one of the things that the City did when I was there was a project that daylighted that spring run, that is, they uncovered the discharge pipe that led from the amphitheater to the bypass tunnel of Barton Springs pool. And they planted native vegetation and they put in, you know, natural limestone rocks. And the salamanders colonized that stream pretty readily and, you know, effectively, you know, giving the species sort of more habitat at Eliza's Spring.

Tom Devitt [01:09:33] And unfortunately, the spring stream still goes into the tunnel that bypasses Barton Springs. It would have been ideal if it had been allowed to go into Barton Springs pool. But, for a number of logistical reasons due to the design of the pool and the bypass tunnel, it wasn't possible. But ideally, you know, it would be nice if someday all of the springs could be connected, you know, above ground, as they once were.

Tom Devitt [01:10:07] And a similar stream restoration project is happening at a different spring on the other side of the pool, at a place called Old Mill Spring or Sunken Garden Spring. And I don't think construction has begun quite yet, but there are plans to daylight that stream as well. Or rather, that stream already exists. But it's kind of a straight shot and the velocity is too high for salamanders. So, they're going to try and make more of a meandering, more salamander-friendly stream that exits from that amphitheater and goes to Barton Creek.

David Todd [01:10:53] That's neat. That sounds like some sort of positive effort. And I guess so this is all involving the area right around the pool, the Barton and the Eliza Springs and Old Mill area.

Tom Devitt [01:11:11] Yes.

David Todd [01:11:12] What about upstream? You know, there's this enormous recharge zone and then the contributing zone and can you tell us anything about, you know, efforts to try to protect the salamander from impacts that may be stemming from development up there?

Tom Devitt [01:11:28] Yeah I mean I think the biggest effort that the City of Austin has sort of put forth to protecting lands in the contributing zone and the recharge zone is through their Water Quality Protection Lands Initiative, where effectively they are trying to partner with private landowners in getting the land protected in conservation easements to sort of either limit or sort of influence the way that those lands can be developed.

Tom Devitt [01:12:09] And so, you know, by setting aside some lands as sort of natural habitat, you know, which is great not just for salamanders, but for biodiversity in general, you know, in the Austin area. It provides, you know, a means to keep sort of more water on the land as well as, you know, better quality water entering the aquifer.

Tom Devitt [01:12:40] And so really, by protecting that land upstream of Barton Springs, I think that's one of the best things that people can do to protect the water quality and quantity at Barton Springs. Because if you don't protect the area upstream, then you just got the end of the funnel, basically, at Barton Springs. So.

David Todd [01:13:10] That's a good way to put it. Yeah. The springs is the funnel.

Tom Devitt [01:13:14] Yeah.

David Todd [01:13:16] So. I thought it would be interesting to hear you talk a little bit, I think you touched on this how the protection of the lands in the recharge zone and the contributing lands not only benefit salamanders but benefit other creatures and biodiversity in general.

Tom Devitt [01:13:37] I was curious if you can sort of talk about the Barton Springs salamander as an indicator. I think you once talked about it as kind of a bellwether for the health and integrity of the Edwards and Trinity Aquifers. What do you mean by that?

Tom Devitt [01:13:54] Yeah, I mean, I think that all of these groundwater salamanders, you know, not just the Barton Springs salamanders, are really indicative of the health and the integrity of the aquifer and the groundwater ecosystem.

Tom Devitt [01:14:12] You know, we know that because these salamanders have such a narrow, specialized niche that they can't exist when the integrity or the health of the ecosystem has been compromised to some point of no return.

Tom Devitt [01:14:35] So, I think that, you know, in areas where salamanders occur, still occur, that I think that that's a good sign that the watershed at least was in good shape.

Tom Devitt [01:14:54] And whether it's still in good shape, you know, is a question that obviously requires some monitoring and some data to determine. Because, you know, on the flip side of this, just because the salamanders are there doesn't mean that the water quality is great. But, you know, maybe they're sort of on their way to sort of local extinction. Hopefully, that's not the case, and I don't think it is in most places.

Tom Devitt [01:15:17] But I think it's, you know, they're sort of the proverbial canary in the coal mine situation where, you know, I kind of hate to use that metaphor because I think it's been overused, but, you know, salamanders, and amphibians in general, are really, you know, indicators of the integrity and the health of our environment.

Tom Devitt [01:15:43] And, unfortunately, you know, amphibians are going extinct, you know, around the globe at a really astonishing rate. And it's really concerning. And again, I think it's concerning for us as humans, because it suggests that, you know, the environment is being degraded.

Tom Devitt [01:16:03] And, you know, it's not you know, I think it's hard to make the argument that, you know, that it's going to affect humans if we lose the extinction of one species. But, you know, all of these species are part of, you know, kind of the web of life and everything is connected. And so we should be concerned when one species are going extinct.

David Todd [01:16:33] So, in a way, I guess what you're saying is that these creatures have such a narrow band, such a, you know, exquisite little niche that they need, that they're a very sort of precise gauge of the health and quality of their environment. Is that one way to put it?

Tom Devitt [01:16:55] That's the point that I'm trying to make. And you know, I'm not saying that it's an exact, you know, measure of health or integrity, but I think it's a pretty, I think it's a pretty good indicator, I guess. Yeah.

David Todd [01:17:14] Okay. So, one of the things that I think has been interesting about your trajectory, your career, is that not only do you do research, but you also are kind to share what you've learned with the public and not solely, you know, your colleagues who operate on that higher level, but also those of us that are, you know, just among the general public and don't really understand the nuances and details. And I know you've talked to a number of organizations, and I was wondering how you couch this and put it in terms that you feel are accurate but still accessible, and what sort of responses you feel you're getting from these talks with the public.

Tom Devitt [01:18:01] That's a great question. Yeah. I mean, I kind of feel, I feel pretty strongly that it's, you know, it's scientists' duty to really make our work more accessible and understandable to the general public, and, you know, to taxpayers who are effectively funding our research. And so, you know, you all are stakeholders, you know, we're all kind of stakeholders. And so it's my job, one of my responsibilities, to make this information accessible and understandable. And so, you know, I just, I view it as part of my job as something I need to do to kind of to educate people about what we're doing and kind of why it's important.

Tom Devitt [01:18:53] I think there can be a perception that, you know, the research that goes on in academia is kind of this ivory tower, sort of, you know, environment with very obscure questions that aren't, you know, maybe are not relevant to human health and the environment.

Tom Devitt [01:19:09] But, you know, everything that that we're doing is very relevant to, you know, to human health, to the environment, to climate change, all those things.

Tom Devitt [01:19:23] And so, you know, and part of it, too, is I don't just feel an obligation, I mean, I enjoy it. I love, I love talking to people about what I do and hopefully getting other people to care a little bit more, or think a little bit more carefully, about how to be better stewards of our environment.

David Todd [01:19:45] Well, you're brave to do that, I think. This may be just a personal comment, but I find that some scientists are loathe to talk to the public because it's easy to get tangled up in problems of translation. And it's, and it can be hot out there. I mean, especially if it's an area of great public interest and controversy, you know, it can be uncomfortable. And I was wondering how you, as a scientist, deal with topics like the Barton Springs salamander that are, you know, the subject of a lot of interest and concern and controversy.

Tom Devitt [01:20:29] I mean, you know, all of us, most of the scientists I would say that I know are, you know, take a, adopt a view, you know, like myself, that it's kind of an obligation that we have to educate people about why what we're doing is important and what it is that we do.

Tom Devitt [01:20:49] And, you know, certainly, when it comes to topics like endangered species and private landowners in Texas, you know, oftentimes, I think the media portrays those as opposing, you know, sort of forces - you know, sort of the, you know, developers versus the conservationists or, you know, salamanders versus, you know, housing.

Tom Devitt [01:21:18] But it's really not like that.

Tom Devitt [01:21:24] I think that makes for a good story, but it doesn't have to be that way, you know.

Tom Devitt [01:21:29] People and salamanders need the same things. So in other words, what's good for salamanders is good for people.

Tom Devitt [01:21:42] And some people certainly would argue that, you know, for example, the listing of the Barton Springs salamander has, you know, limited development or somehow hindered development in, you know, sort of southwest Austin.

Tom Devitt [01:21:59] But, you know, there certainly has been a lot of development to the west of Austin, and I don't think that anybody is hurting economically as a result of the listing of that species.

Tom Devitt [01:22:20] You know, I can understand why people want to move to Austin and the surrounding areas. And so, you know, people need a place to live. Like, I can understand why there are new housing developments all over the place. And, you know, developers are just trying to make a living. Right? So I can understand that.

Tom Devitt [01:22:41] But there's a balance, right, to, you know, finding a balance between sort of, you know, developing and, you know, having some areas that are kind of untouched, you know, for biodiversity and for people to enjoy and recreate.

Tom Devitt [01:23:02] And, you know, I think that Austin's an amazing example of finding that balance, right? I mean, here we are in this, you know, major metropolitan area and, you know, almost right in the middle of downtown, we have these endangered endemic species that are making their home and seem to be doing pretty well. Right? Despite the fact that they're surrounded by hundreds of swimmers on a daily basis. I think it's pretty remarkable.

Tom Devitt [01:23:34] So, you know, things like, you know, water rights and groundwater laws, all of those things. You know, Texas politics is not, is certainly not friendly for endangered species and conservation a lot of times. I wouldn't say all the time, but a lot of times.

Tom Devitt [01:23:59] And so, but I think that, I think that most people, and I think more and more people, are beginning to understand that it's not about, you know, endangered species versus private property owners. Right? The federal government doesn't want to come in and take somebody's land away because there's a species that's in danger. They just don't.

Tom Devitt [01:24:30] But there's this, I think there's some kind of unnecessarily, I guess, just fear about this around endangered species and how the rules and regulations actually work. I think most people, most landowners, don't understand all of it. And so, it's important for, you know, for them to be educated about it.

Tom Devitt [01:24:58] And, you know, but the bigger thing is, you know, all these species are part of our natural heritage. And as Texans, you know, we should be proud of them and we shouldn't be scared to tell people that they occur on our property or, you know, because we're afraid that somebody is going to come and take our land away. Like that's not going to happen.

Tom Devitt [01:25:18] So, we should, I mean, I think we should celebrate this diversity and, you know, do everything we can to, you know, to protect it, while still allowing for, you know, growth and, you know, economic development.

Tom Devitt [01:25:34] I mean the economy in Texas is in great shape. I mean, it's like, you know, we have endangered species here and the economy is in great shape. Like those two things are not in opposition. They don't have to be at least.

David Todd [01:25:53] Got it.

David Todd [01:25:56] You know, most of our conversation has been about the Barton Springs salamander and maybe Central Texas salamanders more broadly. But I was wondering if the situation with the Barton Springs salamander and then these 14 or 15 affiliated salamanders in central Texas brings to mind any other issues, just more generally about amphibians, either in Texas, the United States or globally. I think you've touched on the, you know, some of the challenges facing them, but maybe can go into a little more detail.

Tom Devitt [01:26:34] Yeah, I mean, amphibians are really in bad shape globally. Over the last couple of decades, they have just been getting hammered. You know, it's really the death by a thousand cuts scenario where, you know, climate change, habitat degradation, invasive species, overuse, harvesting for some species. All of these things are contributing to the demise of amphibians globally.

Tom Devitt [01:27:12] And so, you know, I think the species at this point in time in west central Texas have been spared some of those effects.

Tom Devitt [01:27:28] But we're starting to see more and more springs dry up. Right? So springs that used to flow prior to development, starting in about the 1950s, prior to groundwater development, really starting in about the 1950s, these springs are no longer flowing.

Tom Devitt [01:27:50] And so when you get springs that stop flowing, obviously there's no habitat for organisms that require that groundwater to survive.

Tom Devitt [01:28:02] And maybe there are other springs where that species still lives. But when too many springs dry up, those populations go extinct locally, and then eventually the species goes extinct, right, if all the subpopulations go extinct.

Tom Devitt [01:28:21] And it's not just the salamander, of course, that occurs there, there are, you know, many other species and there are interactions among those species. And so if

one species goes extinct, maybe another species relied on that, you know, for prey or whatever. There's myriad sort of, you know, direct and indirect species interactions that take place in an ecosystem. And so, when one species is affected, the other species are affected.

Tom Devitt [01:28:47] So, you know, really this groundwater depletion, I really think is the biggest threat to the salamanders in central Texas.

Tom Devitt [01:28:57] And, you know, as climate change intensifies... I mean, this last summer was unprecedented. Right? We had 108 degree temperatures, like for I don't know how many days in a row. But as the ground you know, as climate change intensifies, people are going to be using more and more groundwater.

Tom Devitt [01:29:22] And so, it's just going to exacerbate that groundwater depletion, which of course, is going to result in habitat loss and a decline in ecosystem functioning.

Tom Devitt [01:29:39] And we rely on that ecosystem functioning for things like water purification, for example. So, these organisms that occur in the water, the groundwater, serve a role. They're not, you know, just there not doing anything. They do things like biodegradation of contaminants. You know, they maintain spaces, open spaces for water flow. You know, there's a variety of things that these groundwater organisms do that are of benefit to humans.

Tom Devitt [01:30:19] And if those things go extinct, the water quality is going to be compromised. It's that simple.

Tom Devitt [01:30:25] But we're using it fast. The bottom line is we're using the water faster than it's being replenished, by a lot, and climate change is intensifying and making that problem worse.

Tom Devitt [01:30:39] And so we really need a sea change in how we think about and use water in central Texas. Because the conditions are only going to get worse.

Tom Devitt [01:30:58] And so we should, I think people really need to understand why water security is at risk. Because it is at risk and it's more at risk than people realize.

David Todd [01:31:14] Yeah. I guess, what's the old line about, you don't worry about water until the well goes dry?

Tom Devitt [01:31:21] Yeah.

David Todd [01:31:21] And it's. It's hard to focus your mind until it does.

David Todd [01:31:26] Yeah. Yep. Well, I guess this may bring us to nearly a close. Is there anything that you might like to add about Barton Springs salamanders - what you've learned, what you think about them, why they're important to you? Do they have a soul? Anything profound?

Tom Devitt [01:31:47] You know, you asked me that question, and I've been pondering it so much and trying to come up with some answer that I felt would sound profound. And I didn't come up with anything.

Tom Devitt [01:32:05] So the answer is, you know, final thoughts: I hate to just focus on the Barton Springs salamander because although it is kind of the most famous one, there are all these other species that face the same threats as the Barton Springs salamander, and, you know, in my mind, are sort of just as important. Right? Like, I don't want to, I kind of hate to make it just about that species.

Tom Devitt [01:32:29] But, you know, these groundwater organisms, in general, I think, as I mentioned previously, they're part of the natural heritage of Texas. And it would be a real shame if we lost them to extinction because we didn't do a better job of being stewards of our environment. Right? That's kind of the bottom line.

Tom Devitt [01:32:51] And I think that, you know, people will make the argument that, you know, humans aren't going to be hurt if these species go extinct. And I think that that is generally true. I think that that's a difficult argument to make, that we should conserve species because if we don't, humans are going to go extinct. Like humans will be fine if these species go extinct. I don't like to say that, but it's the truth, essentially.

Tom Devitt [01:33:24] But we should want to conserve biodiversity, because for a number of reasons, right, for esthetic reasons, for future generations, because they exist on Earth and existed on Earth long before we did, because they have a right to be here.

Tom Devitt [01:33:44] So, do they have a soul? I don't know. But they have a right to live. They have a right to live here and a right to be here.

Tom Devitt [01:33:51] And I don't think that humans have, you know, I don't think it's our, I don't think it's our right to use the environment for our own greed and, you know, at the expense of all these other organisms and beings that live on our Earth, that we share the Earth with.

Tom Devitt [01:34:13] I mean, it's our job to be stewards of the environment.

Tom Devitt [01:34:18] And I mean, that's what the Endangered Species Act is about, right? This was, this was a bipartisan effort that was passed back in the seventies where people basically said, we need to conserve biodiversity because it's at risk, and people care about nature. Like people, most people, inherently care about nature and we want it. We want to do the right thing by conserving biodiversity. That's what the Endangered Species Act is about.

Tom Devitt [01:34:52] It's not about developers versus, you know, private landowners. It's not.

Tom Devitt [01:34:58] So, you know, that's kind of, I guess, I don't want to get political in the last few minutes, but I think we should all think about conserving biodiversity for biodiversity's sake, not because of what it can do for humans, but because it's the right thing to do.

David Todd [01:35:28] Yeah, it's just integral. And I guess that's what you're saying, that it has its own value and you don't have to explain it. Is that close?

Tom Devitt [01:35:40] 100%. Yeah. I don't think we need to. We don't need to sell it or disguise it as something else. It's, you know, biodiversity is part of life. It's, it is life. Right? And we're part of that.

Tom Devitt [01:35:56] And we have to do the right thing. It's up to us.

David Todd [01:36:02] Well, it sounds like you do the right thing every day just by thinking and working on these issues.

Tom Devitt [01:36:09] I don't want to sound high and mighty. I do what I can, but I still live here and I still have an impact. And I drive a car and, you know, all those things. So it's about finding that balance. And the balance is different for different people, you know, but, I think the first step is just educating people and thinking about it. And, right, like small, small decisions that you make can have an impact and can have a ripple effect.

Tom Devitt [01:36:32] So I'm certainly not, I'm certainly not under any delusion that I'm, you know, somehow higher and mightier. But I think about this stuff a lot, so.

David Todd [01:36:43] Yes. Well, thanks for helping us think about it as well. I appreciate your time today and thanks for being patient while we went through this laundry list of questions. You've been very tolerant.

Tom Devitt [01:36:55] I appreciate you and I appreciate the opportunity. This was a lot of fun. And yeah, I'm very happy to be a part of this project. I was flattered that you asked me and, yeah, excited to see the final result.

David Todd [01:37:10] Great. Well, thanks so much for participating.

David Todd [01:37:14] Looks like it's almost lunch time. Go, go take a break and enjoy the rest of your day.

Tom Devitt [01:37:20] Thanks so much, David.

David Todd [01:37:21] All right. Thank you. Bye now.

Tom Devitt [01:37:23] Take care. Bye.