

## TRANSCRIPT

**INTERVIEWEE:** Chris Schalk

**INTERVIEWER:** David Todd

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**David Todd** [00:00:03] Well, good afternoon. I am David Todd, and I have the privilege of being here with Dr. Chris Schalk. And with his permission, we plan on recording this interview for research and educational work on behalf of the Conservation History Association of Texas, and for a book and a website for Texas A&M University Press, and finally, for an archive at the Briscoe Center for American History, which is at the University of Texas at Austin.

**David Todd** [00:00:33] And I wanted to take this moment to just stress that he has all rights to use the recording as he sees fit as well.

**David Todd** [00:00:41] And before we went any further, I just want to make sure that that's okay with you and that you feel free to go ahead.

**Chris Schalk** [00:00:48] Yep, sounds great.

**David Todd** [00:00:49] Okay, well, let's get started.

**David Todd** [00:00:52] It is Monday, September 25th, 2023. It's about 2:45 p.m., Central Time.

**David Todd** [00:01:01] My name, as I said, is David Todd. I'm representing this non-profit group, the Conservation History Association of Texas, and I am in Austin, and we are conducting a remote interview with Dr. Chris Schalk, who is based in the Nacogdoches, Texas area.

**David Todd** [00:01:18] Dr. Schalk is a research ecologist in the Southern Research Center of the U.S. Forest Service and earlier taught Forest Wildlife Management at Steven F. Austin State University.

**David Todd** [00:01:30] Dr. Schalk has wide research interests, which include the study of mammals, brown widow spiders, snakes, native and invasive Texas fish, as well as birds such as Bachman's sparrow, dickcissel and painted bunting.

**Chris Schalk** [00:01:49] One of his especially interesting projects has focused on studying the alligator snapping turtle and its conservation. And I hope that we might talk about that today, along with Dr. Schalk's general background.

**David Todd** [00:02:05] So, with that little introduction, that preamble, I thought we might start with a question about your childhood and if you might be able to tell us about your early years and if there might have been any people or events then, in your young life, that might have influenced your interest in animals and in reptiles and even turtles in particular?

**Chris Schalk** [00:02:30] Yes, I grew up just outside Buffalo, New York.

**Chris Schalk** [00:02:36] And I think, you know, kind of when I was young, you know, a big influence on my passion for conserving wildlife was my mom. She was just really passionate about animals and really got me interested in them early on. You know, we would often go to the Buffalo Zoo and just being able to see the diversity of different species, you know, within, you know, a small park was really impressive.

**Chris Schalk** [00:03:07] And I always enjoyed seeing the, going to the reptile house there and just seeing all the different species there, even though they weren't really doing much: they were just kind of hanging out. But they were still fascinating to me.

**Chris Schalk** [00:03:22] And then, on other events, my dad one time, randomly, (I was in fourth grade) he brought home a lizard, like a whole set-up. I think someone at his work wanted to get rid of it. And he, you know, I don't even remember the species. It was some sort of agama or something.

**Chris Schalk** [00:03:43] But anyway, having that as a pet and being able to, you know, see it kind of run around, and feed it crickets, and watch it run around the cage was really interesting, and really captured my attention early on in terms of my exposure to working with reptiles and amphibians.

**David Todd** [00:04:04] That's great. So both parents, sort of had a hand in this. Did you have any siblings or young friends then that were also enthusiastic about animals?

**Chris Schalk** [00:04:18] I have a younger brother and he really wasn't. He was more interested in sports and football and things like that.

**Chris Schalk** [00:04:24] But really, it was, I don't know, I think back to it, a lot of my, you know, colleagues and classmates and things like they weren't as interested. You know, they called me Nature Boy and would kind of tease me about, you know, my interest with animals.

**Chris Schalk** [00:04:43] So it was, yeah, probably not until high school, you know, around that time, where I was exposed to and interacted with more students that were interested in animals as well.

**David Todd** [00:04:57] Well, maybe we should talk about that. So, perhaps tell us a little bit about grade school and, of course, on towards college and grad school, if there might have been classmates or teachers that you felt were encouraging and sort of helping you find your way through this world of biology and interest in animals.

**Chris Schalk** [00:05:20] Yeah. So, you know, in high school, my high school biology teacher, Mr. O'Day, he ran a club called "Animal Health Technology". And really it was, you know, getting students exposed to kind of wildlife rehabilitation, working with vets, working with exotic species and things like that. So, you know, I was able to get a lot of experience just seeing, you know, different species of exotic animals from...

**Chris Schalk** [00:05:51] He was really interested in parrots and he even had a wildlife rehabilitation center at his house where we were taking care of wounded vultures or hawks or, you know, he had this whole set up. And so being able to interact with him and he was

really supportive. You know, we would go on field trips together to all these different clinics and wildlife rehabilitation centers and things like that.

**Chris Schalk** [00:06:19] And really, when I went into college at SUNY College of Environmental Science and Forestry in Syracuse, I was leaning towards kind of the veterinarian route. But, you know, for being a vet, you know, you have to have really high grades. And after taking organic chemistry, that kind of dissuaded my interest after, you know, trying to ... basically I didn't get an A, so I figured, "Okay, vet school's out", and maybe I need to think of some other options.

**Chris Schalk** [00:06:57] And while I was there, one of my professors, Dr. James Gibbs, he taught herpetology and he did a lot of research on reptiles and amphibians. And around that time he did a lot of work on looking at the effects of roads on turtles, and looking at biases and things like sex ratios and population structure in response to road density.

**Chris Schalk** [00:07:23] And I found those papers really interesting and I was able to work on a project with salamanders, actually looking at trying to predict road-crossing structures, basically trying to design and install road-crossing structures to move spotted salamanders across roads during their migration period in early spring in upstate New York.

**Chris Schalk** [00:07:52] And also, during that time, I was lucky enough to actually get a undergrad internship called a Research Experience for Undergrads NSF Internship working down in South Carolina with Dr. Whit Gibbons and Tom Luhring, who was a master's student at the time working on giant salamanders in the Southeast. So, there are these two salamanders, Siren and Amphiuma, you know, they can grow close to a meter long in some instances.

**Chris Schalk** [00:08:29] And we were able to do, I was able to actually get to work there for two summers and, you know, get exposed to research and really, well, publish my first papers on that. And I got a taste for research. And I really thought this is something I want to do for my career. And so it's starting in amphibians and kind of branching outward after.

**David Todd** [00:09:00] That's great. So, it sounds like a combination of class work and then field trips. And were you on any sort of outings in New York State or was this was mostly within the bounds of the, you know, SUNY classrooms?

**Chris Schalk** [00:09:21] Yeah. So, it was you know, basically the study site in New York State was in its Labrador Hollow. It's just outside Syracuse. That was kind of a hotspot for these migrations of spotted salamanders that basically they're in the uplands where they overwinter and they move down into these vernal pools that fill with snowmelt during the springtime. And that's where they breed.

**Chris Schalk** [00:09:51] And so, it was going out and doing these kind of road cruising surveys at night where we're trying to find spotted salamanders crossing the road, taking a GPS point and measuring some habitat characteristics to see, okay, where we basically find where these things are. So, those were, you know, some of my New York experiences here.

**Chris Schalk** [00:10:16] Okay. Well, thanks for introducing us to both a little bit of the Carolinas and also upstate New York.

**David Todd** [00:10:24] So, I understand that you also spent time at Texas A&M. And tell me about that era in your education.

**Chris Schalk** [00:10:35] Yes. So, I after I graduated from undergrad, I went to pursue my Ph.D. at Texas A&M with Dr. Lee Fitzgerald. And while there, so I was able to get an NSF, basically, traineeship in this new program. It's applied biodiversity science, and really, it's trying to integrate kind of natural sciences with the social sciences to develop conservation strategies while working with different, you know, local actors and institutions.

**Chris Schalk** [00:11:08] And Lee spent a lot of time in the Chaco ecosystem in South America. It's actually not that well known. It's actually the third largest ecoregion in South America, but not a lot of people know much about it, you know, in terms of just publicity, I guess. But it's a semi-arid thorn forest.

**Chris Schalk** [00:11:30] And I was able to work in Bolivia, studying the frog community down there. And it's really interesting. So, if anyone knows Pacman frogs in the pet trade, they're basically native down there. They run wild. So, it's kind of fun to see them in their natural environment, and really trying to quantify and study some fundamental aspects of the community down there.

**Chris Schalk** [00:11:58] So, trying to understand their breeding phenology, you know, basically when they're calling in correlation with rainfall or temperature, trying to understand their distribution on the landscape and how they interact with predators and prey, and understanding kind of what they're doing in that ecosystem, while working with an indigenous Isoceno Guarani biologist down there and kind of working in this case Kaa-lya National Park is really cool.

**Chris Schalk** [00:12:34] Kaa-lya is interesting because it has probably one of the largest populations of jaguars in the Western Hemisphere, but it's, getting to see one is pretty hard. It's a dense thorn forest and it's not that easy to traverse, to move through. But it was fun. It was exciting.

**David Todd** [00:12:56] It sounds great.

**David Todd** [00:12:57] So, it sounds like you've had a lot of exposure to amphibians during your, I guess, graduate school or undergraduate years. Did you do much research or study much in class about reptiles or turtles in particular?

**Chris Schalk** [00:13:18] No, actually. So, you know, I've always had, actually, an affinity for snakes. I've always enjoyed, you know, just for whatever reason, I was drawn to snakes. I always found them interesting. But, you know, they're also, you know, can be challenging at times. So, you know, I was told, well, if you want to, you know, pursue a PhD, make sure you set your project up for success. Right.

**Chris Schalk** [00:13:44] And so, if we think about what's going to be successful, it could be sample size and making sure you have enough data to run your stats. And so, amphibians are kind of an ideal organism to address a lot of those questions because you can get lots of them pretty easily.

**Chris Schalk** [00:14:05] And actually it's, you know, I didn't have a lot of exposure working with turtles until I came to Stephen F. Austin State University as a assistant professor. And you

know, Whit Gibbons, my undergrad research mentor, you know, he is, you know, one of the foremost experts on turtles, but, you know, I was just able to really work with the opportunities that were presented to me. And I really enjoyed working, and still enjoy working, with amphibians. But yeah, it wasn't until more recently that I started working with turtles.

**David Todd** [00:14:48] Okay. Well, that gives us some background about your education, and then, before that, just a little bit about your childhood.

**David Todd** [00:14:58] And I was curious if there's anything sort of in the public media, the general ecosystem of news and movies and TV and books that might have been inspiring for you about this interest in, you know, natural history and wildlife, and maybe turtles in particular.

**Chris Schalk** [00:15:26] So, yeah, we didn't have cable growing up, so we were kind of limited in what we were exposed to. But I remember watching, you know, Nature and NOVA on PBS and really enjoying those kinds of documentary shows that, you know, documented the natural history of all these different species.

**Chris Schalk** [00:15:49] But then, you know, when I was lucky enough to catch a cable show, you know, The Crocodile Hunter, Steve Irwin, you know, was ... you know, his enthusiasm towards those animals was really inspiring.

**Chris Schalk** [00:16:05] And yeah, I mean, those two media, you know, TV shows really pop out to me in terms of kind of influences.

**David Todd** [00:16:17] And any particular books that struck your fancy and might have been inspiring?

**Chris Schalk** [00:16:23] I mean, I just remember, you know, getting a field guide on reptiles and amphibians and just being able to kind of, you know, flip through the plates and seeing all the different species and just kind of imagining kind of what they're doing out in the wild and wanting to get to see all of them, you know, just basically looking at really cool pictures and pretty pictures of reptiles and amphibians made them really interesting to just kind of thumb through those pages and read on their descriptions and some basic aspects of their natural history.

**David Todd** [00:17:01] Yeah, I can see that. You know, the plates are beautiful, but it's even better to see them in the wild.

**Chris Schalk** [00:17:08] Yeah.

**David Todd** [00:17:10] Well, so, I noticed that you first were teaching at Stephen F. Austin, and then came on board at the U.S. Forest Service. And oftentimes those first jobs are the hardest. And that's a real hurdle to clear. And I'm curious if you recall anything about what might have gotten you started in your working life.

**Chris Schalk** [00:17:38] So, in terms of my, I guess you're talking about the research programs that got started up or...

**David Todd** [00:17:47] Well, was there a particular break or somebody that might have encouraged you or, you know, held a spot open for you to get started in your working life?

**Chris Schalk** [00:17:58] Oh, well, people who apply for academic jobs know it's maybe not the easiest thing to land a job at an academic institution. I think I applied for 80 or 90 jobs and got a handful, maybe a handful of phone interviews from them. And so I was able to, you know, interview and secure a job at SFA in the College of Forestry. And, you know, just by, I guess, it finally worked out, you know, and yeah, I guess in my case, 90th time's a charm in that instance.

**Chris Schalk** [00:18:41] So, yeah, I was just applying for every academic job and, really, you know, making sure you get good feedback like my advisor Lee would, you know, work with me to develop my CV and statements, things like that. But it was that motivation to, you know, just keep applying and really wanting to pursue a research career.

**David Todd** [00:19:09] Yeah. It sounds like a real marathon to, you know, apply and interview and hopefully secure one of these jobs.

**David Todd** [00:19:20] So, one of the things that we wanted to talk to you about today is this alligator snapping turtle. And it sounds like you've had a lifelong interest in wildlife, but do you remember when you first might have had an encounter with an alligator snapping turtle? Or maybe you can mention any sort of highlights of encounters with them?

**Chris Schalk** [00:19:46] Yeah. So, I mean, I'd seen them before in captivity and they were just kind of hanging out on the bottom of a tank or in an aquarium. But, I think one of the kinds of highlights that stands out to me is actually after I already was able to secure funding on a project funded by Texas Parks and Wildlife. And it was basically just trying to figure out the kinks or the logistics of trying to trap these and capture these turtles. And it was with my former Master's student, David Rosenbaum, and we went to a stream just outside of town and just set five nets just to work out, okay, how are you going to collect the habitat data? How are you going to bait these? How are you going to tie them off and secure them and things like that?

**Chris Schalk** [00:20:43] And I just remember it was May. The water was still kind of cold in this tiny stream. I mean, it wasn't very big. And we set traps and I figured out, okay, based on kind of previous reading of, you know, this species, we'll be lucky if we get one, especially because it was kind of chilly.

**Chris Schalk** [00:21:05] And then, the next day we're out checking traps and we pull up a trap and it has four alligator, no, five alligator snapping turtles in it. And it's over 400 pounds worth of turtles in this single trap. And they're ranging from 40 pounds up to, I think, 125 pounds.

**Chris Schalk** [00:21:27] And, you know, we're trying to, we're basically clawing at the mud, trying to pull this net ashore and just trying to lift it out. And, you know, these turtles are on top of each other and, you know, kind of nipping at each other and just trying to work them out of the net without losing a finger.

**Chris Schalk** [00:21:45] And, you know, it was impressive. It was a good start to the project because we were worried that David may not have enough turtles to even run stats on. So, it was definitely encouraging and impressive.

**David Todd** [00:22:04] You're going to have robust datasets. That's great.

**Chris Schalk** [00:22:08] Yeah.

**David Todd** [00:22:10] So long as you keep all your fingers.

**Chris Schalk** [00:22:12] Right.

**David Todd** [00:22:14] So, let's talk a little bit about these turtles that you caught then and I guess have caught many since. Can you introduce us to just the basic outline of the life history and the ecological niche that the alligator snapping turtle fills?

**Chris Schalk** [00:22:33] Sure.

**Chris Schalk** [00:22:34] So, you know, in terms of their life history, kind of, and this is with most turtles as well, they're really characterized by low juvenile survivorship, but high adult survivorship.

**Chris Schalk** [00:22:49] So, basically, you know, as an egg or as a juvenile they're basically meals for a lot of things, right? So, the probability of survivorship is really low. But once they attain adulthood, you know, their survival rate really increases, as with most turtles.

**Chris Schalk** [00:23:11] So, their life history really is dependent on adults, once adults reach that adult life stage surviving ... and they're also long-lived. So, once they reach that adult stage, they basically survive a long time and they're reproducing over those years. So, they have many years of sexual maturity. And really, they're just kind of trying to crank out lots of offspring with the hope that some individuals are going to survive and make it to adulthood.

**Chris Schalk** [00:23:47] So, their populations are really vulnerable to decline when you remove adults from a population, as with most turtles.

**Chris Schalk** [00:23:57] And so, the other thing is, you know, they're predators. But there is some evidence or some reports of them actually feeding on plant material as well. So, where, you know, we've brought turtles in the lab and they've excreted lots of acorns.

**Chris Schalk** [00:24:17] And so, but they're also, you know, predacious. So, in terms of, you know, we know predators are important in regulating prey populations for lots of species.

**Chris Schalk** [00:24:31] So, these animals have a lingual lure that they can use to attract fish and basically serve as ambush predators.

**Chris Schalk** [00:24:44] And also, you know, if we think about kind of their role, you know, they're important for not only moving, you know, potential dispersal of seeds, for example, in aquatic systems, but also movement of energy across ecosystem boundaries. So, you know, I mentioned that the probability of survivorship is really low for eggs. But, you know, when these animals move from the aquatic environment to the terrestrial environment to the nest, they're bringing lots of energy that they obtained in the aquatic environment, to that terrestrial environment that's food and basically almost like a resource subsidy to animals in the terrestrial environment. And so, you know, they're important for basically moving lots of biomass between kind of these two ecosystem boundaries.

**David Todd** [00:25:41] That's really intriguing. So, I guess, spent much of their life in the water. And I guess that's a really resource-rich place to be. But then they crawl out on the shore and have their nests and their young. And that's a way of removing those resources from the aquatic world to the terrestrial world?

**Chris Schalk** [00:26:03] Yeah. So, it's yeah, it's basically, yeah, what they're obtaining as adults feeding, they're translating that energy into development of eggs. And their eggs are really resource-rich in terms of the yolk from the investment from the mother and moving that into the terrestrial environment where, you know, most of the time those nests probably won't make it and they're going to be food for raccoons or opossums or, you know, some other sort of small mammal or something like that.

**David Todd** [00:26:35] Okay. So, how would you describe the ecological niche that the turtle fills?

**Chris Schalk** [00:26:44] So, you know, they're, you know, they're important in that they're a predator in terms of control of other prey populations. We know that, you know, they're capable of consuming a wide variety of different taxa. So, fish, turtles, snakes, you know, basically, you know, if they can catch it, they can consume it. Right. And so they have a broad kind of dietary niche. And they can help regulate those populations.

**Chris Schalk** [00:27:25] You know, in terms of, you know, their kind of habitat needs, you know, you typically find them in slower-moving waters. They really like submerged, coarse woody debris or undercuts of banks that they'll kind of hole up in.

**Chris Schalk** [00:27:49] And, also, you know, what's kind of interesting is, is that the males and females are actually sexually dimorphic. So, males are larger than females, and males will actually fight for access to females. So, females are a limiting resource in a population. Right. And so, basically, you know, sperm is cheap, eggs are expensive, if you think about it energy-wise. And so, males will fight for access to females and try and secure matings with these females, typically during kind of the early spring here in Texas.

**Chris Schalk** [00:28:31] So, with our radio-tracking study that we have going on, we typically see movements tick up in March and in April. And we think that's males and females basically trying to find each other for mating.

**David Todd** [00:28:48] Fascinating. And you said earlier that they're a pretty long-lived species. Is that right?

**Chris Schalk** [00:28:54] Yep. And so, yeah, you know, in captivity, I think the longest one documented was about 70 years. But in terms of, you know, wild estimates or estimates of wild individuals, it's challenging, right, because oftentimes these animals out-live the researcher studying them.

**Chris Schalk** [00:29:20] So, you know, if you're not starting to study them until you're in your twenties or thirties, you know, and you study them for 30 years, you know, that's equivalent to one generation time for the species.



**Chris Schalk** [00:29:34] And so, you know, being able to kind of track and understand the dynamics of these populations is challenging for researchers, kind of given their whole life history and how long-lived they are.

**Chris Schalk** [00:29:50] We conducted a study where we did a re-survey of a prior survey, a survey that was conducted 20 years prior. And we actually captured three individuals that were captured in the original survey. And, you know, some of them only grew like a centimeter. Right?

**Chris Schalk** [00:30:11] And so, being able to try and correlate size with age or, you know, body mass with age, it's really hard to do. Right.

**Chris Schalk** [00:30:22] And so, it's through these mark/recapture studies where you're tracking individuals across time, you're able to get these kinds of estimates like age, accurate estimates of age. So, yeah, they're interesting but challenging to study.

**David Todd** [00:30:41] Yeah. And I guess that makes a good study subject in that way.

**David Todd** [00:30:46] Well, you mentioned this revisit to a survey that was done some 20 years earlier, I think it was called "Distribution Demography of the Alligator Snapping Turtle in Texas, a 20-year Perspective". And I thought this might be a good chance to understand a little bit more about the status of the turtle over that long time span in Texas. What did you learn?

**Chris Schalk** [00:31:11] Yeah. So. Well, this original study was actually conducted by my predecessor at the Forest Service, Craig Rudolph, and colleagues. And so, really, that kind of first survey was just trying to document, okay, where are they in Texas in terms of their basic distribution. Right? What counties do we find them in?

**Chris Schalk** [00:31:37] And so, 20 years later, we had a project funded by Texas Parks and Wildlife that really sought to follow up and resurvey those original 23 sites that were surveyed, but then also kind of expand it further to get into trying to predict their occurrence through some habitat variables.

**Chris Schalk** [00:32:02] But in comparing the original survey versus the contemporary one that we conducted in in 2020 and 2021, you know, we found that basically there was considerable stability in their occurrence across the original 23 sites. We were only able to survey, I think 22 of them, but by far the majority were, had the same kind of status, in that if we captured a turtle back in in 1999, 2000, we captured a turtle in those same sites 20 years later.

**Chris Schalk** [00:32:41] So, there was a lot of stability in terms of the distribution across time. And, you know, we had also, you know, we were capturing a fairly even sex ratio, a fairly even size distribution of adults to juveniles from that survey. So, you know, it kind of indicated that, you know, the population, or at least of the individuals we captured, you know, we saw some evidence of wide distribution and wide occurrence and lots of adults, which was a good thing.

**David Todd** [00:33:21] Well, that's encouraging. Nice to see that, especially when it's bracketing so many years. That kind of stability is probably a good thing.

**David Todd** [00:33:30] So, I guess, nevertheless, there's been concern about the species. I notice that Texas Parks and Wildlife put the alligator snapping turtle on its protected list back in 1987. And then I think the U.S. Fish and Wildlife Service proposed the turtle for threatened status in late 2021. And I was curious why you think those decisions were made, both at the state and then later at the federal level about the alligator snapping turtle.

**Chris Schalk** [00:34:05] Yeah. So, you know, the snapping turtle, you know, has a really wide distribution across the southeastern United States. I mean, you know, it historically went pretty far up the Mississippi River drainage. And so, but, you know, kind of the cause for concern is that at the range edges, there's evidence of basically range contraction.

**Chris Schalk** [00:34:33] So, in Kansas and Oklahoma, for example, well, in Kansas, it hasn't been detected since, I think the early nineties. And in Oklahoma, you know, basically in the Red River drainage, there's evidence of contraction of its range in that state.

**Chris Schalk** [00:34:53] And so, in Texas, there was concern because this area represents the southwestern portion of its range. And so, you know, if the species is vulnerable to declines, you know, the range edges are probably where you're going to see evidence of that.

**Chris Schalk** [00:35:11] But also, you know, historically, there was a big industry of harvesting the species for consumption and pet trade and things like that. And so, you know, those demographic traits which I mentioned previously, the fact that the population stability relies on individuals to make it to adulthood and then live a long time and reproduce over that long period of sexual maturity, you know, if you remove adults from a population, you can make those populations really vulnerable to decline very quickly.

**Chris Schalk** [00:35:53] And so, yeah, so basically Texas was proactive in that sense in listing it as protected in the 1980s.

**Chris Schalk** [00:36:10] And you know, basically the Fish and Wildlife Service is kind of starting to assess kind of the population demographics across the region as well.

**David Todd** [00:36:23] So, I guess sort of precautionary things: there are these worrisome signs along the edge of their range, this contraction - and so maybe a little caution there.

**David Todd** [00:36:37] You mentioned that that there were some reasons that aside from, you know, the issues on the edge of their range that might have brought concern. One of the issues I think you mentioned was just overharvesting for food. Can you talk a little bit about what some of that might have involved?

**Chris Schalk** [00:37:03] Yeah, so, historically, especially in the sixties and seventies, I believe there was a larger kind of industry for harvesting alligator snapping turtles for meat, basically. So turtle soup was, you know, maybe in some regions is a popular food item.

**Chris Schalk** [00:37:24] And so, there was a, there's a picture of, I think it's in Peter Pritchard's alligator snapping turtle book. David, my graduate student showed it to me, but of a trapper with, you know, hundreds of alligator snapping turtle skulls that you know, from individuals he's collected over time.

**Chris Schalk** [00:37:49] And if you think about the kind of the harvest industry, you know, those individuals that are trying to capture turtles want the biggest turtles, right? To basically

maximize you know, the meat they are obtaining. Well, those individuals also happen to be the adults in the population.

**Chris Schalk** [00:38:11] So, you can see that if you have individuals targeting large, adult, sexually mature individuals, that those populations can decline fairly quickly.

**Chris Schalk** [00:38:25] And, you know, we're still seeing some evidence of that, you know, especially from eastern populations where the harvest was really widespread.

**Chris Schalk** [00:38:37] But Texas, you know, because they were listed so early in terms of being protected within the state back in the eighties, we don't really see evidence of that here in the western part of its range.

**David Todd** [00:38:54] That's interesting. So, there's the chance to sort of see a comparison between different states that had different regulatory regimes. I mean, Texas, that was pretty cautious, protecting the turtles early on, and then I guess Louisiana and some states to the east that didn't have that same precaution.

**Chris Schalk** [00:39:16] Yes, so, and Louisiana and I believe Mississippi, you can still legally harvest alligator snapping turtles. So, in Louisiana, you can harvest one turtle per boat per day. And so, you can imagine, given the life history of the species, how quickly that's going to impact populations. Right?

**Chris Schalk** [00:39:37] And so, removing adult individuals from an area, you're not going to be able to get that kind of replenishment of offspring because you're removing sexually mature individuals from a population.

**Chris Schalk** [00:39:51] So, this, basically, you know, it's kind of interesting in that, you know, being right next door to Louisiana, here in East Texas, we have fairly widespread populations of the species in eastern Texas that are, from our surveys, are comprised of a lot of large, adult, sexually mature individuals compared to Louisiana, where it's harder to find those desired turtles.

**Chris Schalk** [00:40:24] So, there's just this kind of disparity. Because of the disparity in protection status, you start to see that it's causing individuals to move over to Texas to target those individuals and basically poach them from the state and collect them and bring them back to Louisiana as a result.

**David Todd** [00:40:46] I see. And then when they bring him back to Louisiana, they pretend that these Texas turtles were actually caught in Louisiana?

**Chris Schalk** [00:40:55] Right. Yeah. Yeah, they are. Yeah, exactly.

**David Todd** [00:41:02] So, it sounds like most of what we're talking about here is harvest for food, for turtle soup, perhaps. I understand there's also a pretty robust market for alligator snapping turtles for the pet and zoo market. Is that true?

**Chris Schalk** [00:41:23] Yeah, I think, and I don't know if it's kind of the specific kind of demographics of who's interested in bringing or wanting these species as pets. But, yeah, so, basically, they're, you know, they're, they're desired by that kind of herpetoculture industry as pets as well.

**Chris Schalk** [00:41:49] And, you know, again, it's basically equivalent to, you know, bringing these animals out for harvest. Right? So, you're effectively removing the adults from the population and still having the same impact on the populations, even though they may be breeding them in captivity for, you know, for the pet industry.

**Chris Schalk** [00:42:16] But at that point, you know, there's also issues with, you know, starting to mix genetic lineages. And we don't know kind of the impact of that. And so, yeah, it's also another big issue.

**David Todd** [00:42:31] That's interesting. So as far as the wild populations are concerned, it's sort of six and half a dozen whether these animals are killed and eaten or put in somebody's cage or terrarium, it's the same bottom line.

**Chris Schalk** [00:42:47] Yes. You're showing the same effect where they're removing these adults and, you know, you're not, you're basically removing their potential for them to contribute to future generations.

**David Todd** [00:42:57] Gotcha. Okay.

**David Todd** [00:43:00] So, I understand that some of the folks that were harvesting alligator snapping turtles would talk to private landowners and they'd say, you know, "We can take care of your vermin problem, your varmint problem, and remove some of those alligator snapping turtles as well as other turtles, and take that problem off your hands." Is that something that you've seen much sign of or heard of?

**Chris Schalk** [00:43:31] Yeah, I mean in kind of my experience of conducting these surveys, you know, oftentimes, you know, we'll, you know, pull up to a ... we trap off of bridges a lot, you know, underneath bridges where we have access. And there'll be people fishing underneath there.

**Chris Schalk** [00:43:49] And, you know, they'll see these big traps that we have and, "Hey, what are you doing?" And so we tell them that we're studying alligator snapping turtles. And a lot of times they'll tell us, "Oh, you know, those eat my fish. You know, every time I pull one up on a trot line, I shoot it in the head."

**Chris Schalk** [00:44:05] Or, there was another person ... I heard a story where someone was radio tracking alligator snapping turtles just outside of Nacogdoches here, and an individual pulled off and was looking out over a bridge at this creek and he saw an alligator snapping turtle. And he was able to basically, he got his rifle from his truck and took a shot at it and actually killed it.

**Chris Schalk** [00:44:34] So, yeah, I mean, there's been, well, I just, you know, quite a few instances of, you know, interacting with people and saying, "Okay, well, anytime I come across one, I shoot it", because they're worried that it's going to impact their fishing or things like that, or impact catfishing or things like that.

**Chris Schalk** [00:44:55] But, you know, in the grand scheme of things, it's, you know, a drop in the bucket in terms of what impact they're going to have on fish versus the impacts are having on the turtle populations of removing these adults. It's disproportionate.

**David Todd** [00:45:11] Gotcha.

**David Todd** [00:45:13] So, you mentioned that some of these fishermen were finding alligator snapping turtles on the hooks that they had laid with their trot lines. Do you find that that bycatch and hook ingestion is a big issue or not so significant for the alligator snapping turtles?

**Chris Schalk** [00:45:34] Yeah. So, you know, in the previous study that you mentioned, that 20-year comparison of populations, you know, in our extensive surveys of these sites, you know, we compare just a simple metric of looking at catch per unit effort. So, number of turtles captured, given the number of traps and the number of days we trapped, and we correlated that with presence or absence of observing a trot line.

**Chris Schalk** [00:46:07] So, these trot lines are kind of these weighted lines that are used to target things like catfish where they're baited and, and basically, you know, deployed to capture these catfish.

**Chris Schalk** [00:46:23] Well, a lot of times, you know, they'll be deployed, but you're supposed to check them within a certain period and they're supposed to be properly tagged and all that. A lot of times they're just abandoned.

**Chris Schalk** [00:46:34] And so, if you think of, you know, a benthic kind of turtle, like the alligator snapping turtle, that may be kind of cruising along on a river bottom, you know, if they get snagged on these hooks that are on these lines that are weighted, you know, it makes it a struggle to come up for air, and basically turtles end up drowning.

**Chris Schalk** [00:46:57] So we found, you know, sites that simply had trot lines present versus not, we found basically fewer captures of turtles and sites that had trot lines present.

**Chris Schalk** [00:47:09] And we're actually working on a new project right now, you know, basically trying to see if there's actually demographic impacts to the occurrence of trot lines at a site versus an unfished site. So, we're actually going to start to develop kind of some more robust approaches to seeing the impacts of trot lining on the species.

**David Todd** [00:47:37] That's really intriguing. I mean, it's grisly but interesting. So, it sounds like there may be two ways these hooks can affect a turtle. And one is that they just get snagged and then they're held at the bottom, and they can't breathe and they drown. And then the second is that they might actually ingest the hook and it gets embedded in their esophagus or stomach. Is that right? Maybe you can talk a little bit about those two different problems.

**Chris Schalk** [00:48:06] Yep. And yeah. And so, yeah, so, basically, you know, if they swallow the hook, you know, it basically tears their digestive tract and they die that way as well.

**Chris Schalk** [00:48:21] And you know, there's been studies that have looked at hook ingestion in turtles and you can actually X-ray them to count the number of hooks in individuals. And there was a paper done where basically it looked at the impacts of hook ingestion on population viability of alligator snapping turtles. It was conducted by someone in Florida, I believe. But basically, with increase in hook ingestion of these individuals, the population viability decreases based on their modeling.

**Chris Schalk** [00:49:00] And then again, also the fact that, you know, just getting snagged on these trot lines, you know, what we're noticing is, you know, we're doing some trot line surveys and it appears that, you know, a lot of these trot lines are deployed and deployed illegally where they don't have proper documentation of who the owner is, and, you know, basically their contact information.

**Chris Schalk** [00:49:28] And the problem is, is technically, you know, we're not allowed to remove those trot lines because they're private property. So, all, you know, we could just document their occurrence, but we can't actually remove them if they are illegally deployed. And so, they're kind of left out there to, you know, catch more individuals and snag more individuals.

**David Todd** [00:49:51] It reminds me of the problem with those blue crab traps on the coast where you have these abandoned traps that did ghost fishing, but you couldn't remove them because they were private property.

**Chris Schalk** [00:50:05] Right. Yeah. Yeah. With diamondback terrapins, it's a big issue for that species. Yes.

**David Todd** [00:50:10] I see. Okay.

**David Todd** [00:50:12] So, I think you mentioned early on that these turtles like underwater woody debris and they also like undercut banks. And so, I imagine the profile of a stream matters and that maybe channelization or maybe dam construction can have an impact on these alligator snapping turtles. Is that fair to say?

**Chris Schalk** [00:50:41] Yeah, It's, intuitively it makes sense. But we're also, you know, there's been work you know, Eric Munscher, in Houston, has found in Buffalo Bayou, you know, in the heart of Houston, I think he's captured over 200 alligator snapping turtles in that study site there. So, you know, I think they're pretty resilient.

**Chris Schalk** [00:51:08] But I think in-stream habitat structure is really important.

**Chris Schalk** [00:51:13] The other challenge, though, as you mentioned, dams, trying to assess the impact of dams, on things like genetic flow or population structure. It can also be challenging because, you know, a lot of times these dams are actually fairly recent on the landscape. Right? And so, they've been, you know, built in the fifties, sixties or seventies, and if you think about, you know, when the generation time of the species is 30 years, you know, we may not be able to see a demonstrable impact, you know, thus far on kind of the impact of dams on these species in terms of gene flow. Right?

**Chris Schalk** [00:51:58] And so, there's, they haven't been on the landscape long enough to see, okay, are we actually impacting generations in terms of population structure?

**David Todd** [00:52:09] It's still early days then, to see that impact. Is that what you're saying?

**Chris Schalk** [00:52:15] Yep, exactly.

**David Todd** [00:52:17] Okay.

**David Todd** [00:52:19] So, you mentioned Eric Munscher and I guess his work in some of these urban streams in Houston. And I imagine that a lot of the streams in southeast Texas have some industrial loads with heavy metals and PCBs and so on. Do you find that those kinds of water quality issues are important for these turtles or do they seem to coexist?

**Chris Schalk** [00:52:47] So, we actually did a study looking at mercury concentration in alligator snapping turtles in East Texas. And so, the concern is, as you know, with this species being so long-lived and obtaining such large body sizes that basically they could potentially accumulate or bioaccumulate lots of mercury. And there's evidence of kind of maternal transfer of this mercury from the mother to the eggs. Right? And so, then all of a sudden you could be affecting future generations through this maternal transfer of methylmercury.

**Chris Schalk** [00:53:27] And so, it was actually kind of interesting. And it's really, it's challenging. So, turtles, they don't necessarily give you clear answers all the time.

**Chris Schalk** [00:53:37] So, you know, on average, we found that, you know, these turtles are, in terms of their mercury loads, are above the EPA standards for consumption on average.

**Chris Schalk** [00:53:48] So, you know, but there wasn't any correlation with kind of intrinsic traits of individuals. So, we didn't necessarily see larger individuals having higher mercury loads compared to smaller individuals.

**Chris Schalk** [00:54:06] But, what we did see was there was an effect of local habitat and some other things. So, you know, the greater proportion of wetland cover, we saw an increase in mercury load of those turtles. And so, that's because, you know, these wetland habitats often have the bacterial communities that can methylate mercury and convert it into that harmful form that's uptaken by organisms.

**Chris Schalk** [00:54:35] We also saw a pattern of distance to coal-fired power plant where, you know, there's an emission from coal fired plants. You know, basically there's mercury in those emissions that can settle and deposit in the surrounding landscapes. And we saw evidence of that as well.

**Chris Schalk** [00:54:56] But, you know, this is just kind of, you know, kind of a first broad sweep of trying to understand patterns of mercury bioaccumulation kind of across these different habitats.

**Chris Schalk** [00:55:09] But, I think that the main thing to kind of take away from it is the fact that, you know, based on the individual you have, you don't know what you're getting in terms of mercury load if you're just looking at size.

**Chris Schalk** [00:55:24] So, this was my graduate student, David Rosenbaum's one of his thesis chapters, and I told him, you should call this the Forest Gump problem, you know. AST are like a box of chocolates. You don't know what you're going to get in terms of mercury loads. But he didn't want to do that.

**Chris Schalk** [00:55:41] But yeah, so it's challenging. So.

**David Todd** [00:55:48] It's more subtle.

**Chris Schalk** [00:55:49] Yeah, it's a lot more nuanced. And really, you know, unless someone's paying attention to where that individual was captured, you know, you're not going to get the picture of just looking at the size of the individual.

**David Todd** [00:56:04] Okay.

**David Todd** [00:56:08] So, are there any other factors that you think might be important for the longevity and sustainability and stability of these alligator snapping turtle populations in Texas?

**Chris Schalk** [00:56:21] I mean, I think, you know, the main thing is trying to make sure that, you know, the adult life stage is protected because that's what's going to make these populations more vulnerable to decline.

**Chris Schalk** [00:56:34] But, you know, there's other aspects of their ecology that really we don't know much about. Right?

**Chris Schalk** [00:56:43] And so, if we think about adults, you know, females are big. Right? They're reaching 70 pounds. They are these big turtles. But we still don't even know a lot about their nesting. And so, there's, you know, kind of some anecdotal evidence of, you know, females pulling themselves out, you know, just a few meters from shore to nest.

**Chris Schalk** [00:57:09] But we don't know, you know, if there's a minimum distance that they do it, or if they're just nesting on kind of stream banks or, you know, in one instance, we have a report of a turtle nesting on a windthrow, of a tree that was tipped up in a windstorm and basically the kind of root wad that was exposed in the air. Local fisherman found and observed the female nesting, and basically, you know, documented that. And we're going to put together a little natural history observation on it.

**Chris Schalk** [00:57:47] But, you know, it's just ... that's one of the big unknowns, I think, for the species in that, you know, we don't know how far or how much of the terrestrial environment needs to serve as a buffer to protect that nesting habitat.

**David Todd** [00:58:06] That's fascinating.

**David Todd** [00:58:08] Well, this might be a good intro to just talk about some of the research that has been done in the past and some that's being done currently and maybe some that's forecast for the future.

**David Todd** [00:58:21] I think that that you've, in the past, pointed out that there is a shortage of baseline information and earlier studies for alligator snapping turtles. And I was wondering if you could explain, you know, why that is and what it means for your own work now.

**Chris Schalk** [00:58:40] Yeah. I mean, I think, you know, as much as maybe we don't want to admit it, a lot of, I guess, science is reactive, in that, you know, funding may be tied to, you know, if this species is under consideration for listing, and we don't know a lot of information on its current status, you know, in this region or, you know, it's been so long since those studies have been conducted, we don't know its current status.



**Chris Schalk** [00:59:08] So, I think that's motivating a lot of it because it's under consideration for a listing as federally threatened. So, it's motivating a lot more research now.

**Chris Schalk** [00:59:23] But also, you know, in terms of, you know, the infrastructure to trap turtles, it's not easy. It's not something, you know, you can go out and do point counts on a bird and, you know, just, you know, spend 3 to 5 minutes at a site in town listening to individuals.

**Chris Schalk** [00:59:41] It requires a certain type of person to trap and being able to like, you know, in terms of the investment in nets and boats and things like that, it's a big investment to work with alligator snapping turtles. And so, I think that also is a big thing.

**Chris Schalk** [01:00:03] And also finding the right people that, really, you want to make sure that, you know, it's dangerous, right? You're dealing with alligators. You're dealing with, you know, we, you know, one of my, or David Rosenbaum caught a 211-pound turtle. Right? And trying to deal and finagle that. And, you know, you have five turtles in a net and trying not to lose a finger and things like that.

**Chris Schalk** [01:00:27] So, there's a lot of challenges I think that, you know, cause the past efforts to not be as robust.

**Chris Schalk** [01:00:38] But, you know, I think now we're starting to see it really kind of blossom.

**David Todd** [01:00:45] So, it sounds like one of the challenges that researchers like yourself and Mr. Rosenbaum face is just that these turtles are pretty cryptic and I guess spend a fair amount of time in secluded places or underwater. And they're not like, as you said, you know, the birds that you could count in the air. Is that a big issue for you?

**Chris Schalk** [01:01:12] Yeah. And so, you know, these turtles are occupying kind of these slower kind of backwater streams that are typically murky and, you know, visibility is limited. And so, it's, you know, they're not coming out to bask like, you know, like a slider turtle, for example, where you could easily observe them on a log or something like that.

**Chris Schalk** [01:01:35] And so, yeah, just seeing them, you know, it's a challenge, right? And so, what we're, you know, we've done some studies in the past where we're trying to account for the fact that we don't have perfect detectability. So, basically, when you go out and you do a survey, you can't necessarily assume that if a turtle's there, that you're going to observe it or trap it or catch it, right?

**Chris Schalk** [01:02:09] And so, we've done a study that came out earlier this year where we tried to account for the fact that we don't have perfect detectability and what factors are correlated with that.

**Chris Schalk** [01:02:23] And so, we found a couple of things where basically under conditions of high streamflow, the probability of capturing a turtle is lower. We found that under a full moon, the probability of capturing a turtle is lower.

**Chris Schalk** [01:02:49] And we found that trap spacing can affect the capture rate. So, if traps are closer together, versus spread far apart, the probability of capture increases as well.

So, basically, kind of packing your traps closer to one another, you increase the probability of capturing an individual.

**Chris Schalk** [01:03:12] So, we're able to kind of use that information. And how that's useful, you know, is if you're going out conducting a survey, you want to be able to do it maybe under certain conditions or with certain methodologies in mind to maximize your capture success, for example.

**David Todd** [01:03:34] So, I guess just going with this problem that they're hard to detect, if you were to describe the best place to try to detect them, what sort of habitat would you typically look for and expect to find alligator snapping turtles?

**Chris Schalk** [01:03:55] And so, I look for, I mean, we're actually finding them in fairly small streams where we've, you know, so like, you know, small, kind of first order streams, with lots of, you know, logjams and root banks. You know, I'd probably put a trap near a bunch of coarse, woody debris and make sure I bait it with fresh fish and in slow-moving water. You know, if there's pools available, putting it in there, deeper pools. And those are some of the sites that, you know, that are probably easiest to trap them.

**Chris Schalk** [01:04:41] But, you know, the other thing, though, is we find them in in these huge river systems. Right? So, we have turtles in in Steinhagen Lake that we're capturing. And, you know, the relative abundance is pretty high in that system. But, there's lots of, you know, slow-moving water. There's lots of submerged structure that they're utilizing. So, they kind of span the spectrum.

**Chris Schalk** [01:05:09] But, if I want to make it easy on myself, I'll go for a small stream that I can walk off a bridge and just tie off to, and make my life easy if I want to see a turtle.

**David Todd** [01:05:22] Well, so, speaking of these traps that you use, I gather you use hoop nets. Can you describe how you deploy these and maybe how trapping may have changed in that sort of 20-year period between the study that Craig Rudolph was involved with and then the ones that you're doing now?

**Chris Schalk** [01:05:47] So, the traps that we ... so, we basically use kind of the protocol set up by Craig where we have these four-foot hoop nets that the mesh itself is about an inch wide. And so, there're a series of these concentric rings. So, there's, I believe, three rings and the front end of the hoop net has basically this funnel and it's a funnel made of mesh that ties into the back end of the trap itself.

**Chris Schalk** [01:06:23] And so, we tie the back end of the trap, we secure it with, you know, to a tree. Or, if we need a T-post, we'll put that in the water or some sort of kind of root bank. And we always make sure that that's elevated above the water, so that any sort of air-breathing animals can come up and get a gulp of air as needed.

**Chris Schalk** [01:06:43] And then, we always tie it high enough in case there's changing water levels due to rainfall.

**Chris Schalk** [01:06:51] And then, in the front of the trap, we'll either tie a cinder block to it, or stake it with a T-post and basically pull it tight.

**Chris Schalk** [01:07:00] And, basically, the animal kind of hits that trap opening and goes in and they pass through that funnel, and they can't really get out very easily because that funnel leads so deep into the trap.

**Chris Schalk** [01:07:18] But, you know, in terms of the slight difference between Craig's survey and our survey methods, is, you know, we still need fresh fish to bait, to lure these animals in. But Craig would just kind of tie a piece of fish in the back of the trap. And so, the first turtle got the prize basically, and was able to eat that piece of fish.

**Chris Schalk** [01:07:41] And so, David Rosenbaum, in talking to people about kind of survey methodologies, decided to use this bait canister. So, basically what it is, is it's a PVC pipe with a kind of a screw top that you stuff with fish. And there's a bunch of holes drilled into the side of the PVC pipe. So, and it's tied to the back of the trap as well.

**Chris Schalk** [01:08:09] So, the scent of the fish disperses in the water. But, when the turtle goes in, the first turtle in doesn't get a prize because they can't access the bait because it's in that PVC canister.

**Chris Schalk** [01:08:21] So, basically, it maximizes kind of that bait in terms of its scent permeating in the aquatic environment. And so, it lures or basically attracts more turtles over the period until we check traps, which is 24 hours.

**Chris Schalk** [01:08:40] So, that's something that, you know, that's why, for example, in that kind of first trapping experience with turtles where I had five individuals in a net, well, that's because that bait canister was there and, you know, still are attracted to turtles and luring them in.

**Chris Schalk** [01:08:59] So, we got lots, you know, higher capture per unit effort in our more recent survey. But, we think it's because of that simple change in how the bait was deployed that basically attracted turtles over that full 24-hour period between checks.

**David Todd** [01:09:17] I see. So, having this PVC pipe and just relying on the scent to appeal to the turtles may have brought in more turtles, rather than the old style where I guess the first turtle in got the get the fish and no scent was remaining?

**Chris Schalk** [01:09:38] Right.

**David Todd** [01:09:40] So, say you capture these guys and then somehow extricate them from the net. What sort of sampling do you do on these turtles? What are you interested in once you have them?

**Chris Schalk** [01:09:53] Yes. So, I mean, any sort of basic kind of demographic parameter, we try and collect off these individuals because they're so important, you know, in terms of having them in hand. So, we'll collect, you know, basic things on body size. So, actually measuring turtles is not as easy as one might think. There's basically a bunch of different ways to skin a cat. Well, there's a bunch of ways to measure a turtle.

**Chris Schalk** [01:10:27] So, we'll use, you know, we actually use tree calipers to measure them because they're so big. But we'll do kind of a carapace length, which is the top shell. We'll do plastron on the length, which is the bottom portion of the shell, tail length, head width (carefully we do that), you know, body mass.

**Chris Schalk** [01:10:56] And then, we'll sex individuals, so male or female or juvenile.

**Chris Schalk** [01:11:03] And then, typically we'll take a tissue sample and blood. So, blood, you know, we collected blood off a bunch of turtles in past surveys that are being used for a population genetics study.

**Chris Schalk** [01:11:18] And then, for the mercury bioaccumulation study that I mentioned, we take muscle tissue. And so, with that, we'll take a biopsy punch from the tail region and collect that muscle tissue for analysis in the lab.

**Chris Schalk** [01:11:34] And then, after that, you know, after they're all processed, depending on, you know, kind of the purpose of, you know, why we're capturing these turtles, we'll first mark them. So, and turtles are actually really easy to ... well, I should say easy ... but there's a useful way to mark them permanently where we put notches in their scutes. So, a scute is just an enlarged scale on the shell of a turtle.

**Chris Schalk** [01:12:06] And so, the scute's on the outside edge of the shell, there's basically a marking system where each skew corresponds to a letter. And so, you can take a file or a Dremel and put a notch in the scute and you can give a turtle a mark of A, X, Z. Right? And so, you're able to basically give it a permanent, we give it a three-letter mark.

**Chris Schalk** [01:12:38] And then also, depending on the study, we may or may not attach a radio transmitter to the individual as well, to track it. And so, that's also really easy to do with turtles of this size. And we literally bolt the radio transmitters onto the shell where we drill into the edges of the scutes and attach a radio transmitter to the shell and bolt it on and lock the bolts in. And it's good to go.

**Chris Schalk** [01:13:11] Oh, and so once you've got one of these turtles marked either with a notch or if you're maybe trailing with the transmitter, what sort of information do you get about their movements?

**Chris Schalk** [01:13:28] Yeah. So, it's, well, it's kind of interesting because in the one survey where we did the 20-year survey, we actually recaptured three individuals from the previous survey and they'd barely moved from their site of original capture. So, 20 years later, we basically found them in the same exact spot, which was, it was shocking to think about that, that they, once they're settled in they're just couch potatoes, we think, just hanging out.

**Chris Schalk** [01:14:04] But, you know, the other thing, though, is we're also, we actually have radio transmitters on two groups of turtles that we're monitoring. And so, one group was a group of turtles that were actually illegally collected by a poacher from Louisiana. And basically, the Fish and Wildlife Service wanted to basically determine what can we do with these turtles. And through a series of, you know, genetic analyses, we were able to find their drainage of origin. And through kind of trapping, previous trapping, we were able to determine, okay, there's an AST population there that they could potentially contribute to.

**Chris Schalk** [01:14:48] We reintroduced these turtles back into these systems. So, we have those individuals radio-tagged. But, we also have wild turtles radio-tagged as well that were native to that site, that were weren't poached at all. And we're noticing pretty big differences in their movement ecology.

**Chris Schalk** [01:15:10] So, the repatriated turtles move just a lot more. They move more frequently, they move longer distances. You know, after initial release, to give you kind of a perspective, we saw one individual actually move 26 miles upstream and it was actually captured on a trot line and someone posted on Facebook because they saw the radio transmitter: "Hey, did anyone lose a turtle?" And we were able to go and get its location and get a fix on it, and it survived. You know, the fisherman released it off the trot line.

**Chris Schalk** [01:15:47] But, and then it moved 26 miles back downstream later on and came back to the site where we released it.

**Chris Schalk** [01:15:56] But, compared to the kind of native turtles, we're seeing that they move a lot less. So, they're still making movements. And typically, we see movements occur, you know, especially in the springtime, where we think they're doing these mate-searching activities in trying to find males or females.

**Chris Schalk** [01:16:19] And then, what we tend to see is, you know, throughout the course of the summer, it's getting too hot and they kind of slow down in their movements, and basically, they just kind of hang out and try and find cooler waters and move to deeper waters where they're not moving as much.

**Chris Schalk** [01:16:34] And now this time of year where it's starting to cool off again, we start to see them moving more and we think they're kind of moving more, foraging more to try and build up some reserves before the winter hits where they kind of shut down again and hang out.

**David Todd** [01:16:52] So, you told us a little bit about the likely places that you would find them and I was wondering if you could talk a little bit about these individuals that have been found, a lot of them, in Buffalo Bayou, and some of the other urban streams in the Houston area. And maybe help us understand why they might be persisting there where you think there just be a lot of, you know, pressures on them of many kinds.

**Chris Schalk** [01:17:26] Yeah. I mean, it's, I think these species, you know, the species is a lot more resilient than we think in terms of being able to withstand kind of stressors.

**Chris Schalk** [01:17:38] And, you know, I think for them, you know, if the stream conditions are right, where they have, you know, suitable in-stream structure, you know, and you're not removing adults from a population, I think, you know, they'll do fairly well. And so, but, you know, like you mentioned in terms of kind of maybe potential for dams or impoundments or things to potentially have an impact, you know, I don't know if we were able to kind of see that effect yet, given the life history of the species.

**Chris Schalk** [01:18:16] But, you know, I've seen, you know, turtles with, you know, bites taken out of their head from, you know, males fighting one another. And we are able to recapture that individual some time later. So, I think they're pretty resilient with things getting thrown at them. But, you know, I think if the kind of the fundamental conditions are there in terms of their habitat needs, that they'll be able to persist in really what we would think as stressful situations.

**David Todd** [01:18:49] Well, it sounds like one of the factors that might allow these turtles to persist in Houston is if the adults are not removed. I mean, do you feel like there's just less opportunity for either intentional catching or using trot lines in those urban streams?

**Chris Schalk** [01:19:10] Yeah. And yeah, I'm not sure of, you know, kind of the fishing regulations in Buffalo Bayou and how common is to trot line or something like that in that area. But yeah, I think if those, you know, if there's lower passive fishing pressure through deployment of trot lines, you know, that's going to have a big impact on, you know, those populations persisting in that area.

**David Todd** [01:19:39] Okay. So, I guess I wanted to go back to these survey questions of how you get a, you know, a good idea of what a population looks like. And I think that you and some of your authors had tried to, you know, weigh the differences between catch per unit effort and then the true abundance.

**Chris Schalk** [01:20:06] Mm hmm.

**David Todd** [01:20:06] Can you talk a little bit more about that? I think you touched on it earlier, but maybe some just give one more try on explaining what the difference is.

**Chris Schalk** [01:20:15] Yeah. So, you know, your catch per unit effort, or CPUE, is just basically you're counting or adding up the number of individuals that you capture and dividing it by your survey effort. So, and you know, for alligator snapping turtles, the most common metric of survey effort is trap-days or trap-nights. Right? So, it's dependent on the number of traps you have deployed. So, for example, if I deploy ten hoop nets and I deploy them for ten days straight, I have 100 trap-nights. Right? And so, then I can and if I capture ten individuals, my CPUE, is, what is it, 0.1, basically. So, for every 100 trap nights I capture or, you know, point one individuals. Right.

**Chris Schalk** [01:21:12] And so, but the issue with that is that you're not accounting for the fact that there is potential for imperfect detectability. And so, you want, you know, you assume across those ten nights that the conditions are exactly the same and you have equal probability of capturing an individual, which may not be the case. Right? You could have a rainstorm, you could have had a temperature drop, you could have a full moon or something.

**Chris Schalk** [01:21:42] And all those things basically you need to account for that may affect your ability to capture an individual on a given sampling period.

**Chris Schalk** [01:21:52] And so, basically, you know, what we did in this previous study is we tried to think about, based on the turtle's biology and ecology and natural history, what factors could be affecting our ability to detect them or capture them in a hoop net. Right?

**Chris Schalk** [01:22:11] And so, that's where we, you know, measured every time we set out traps, we measured stream velocity, right?

**Chris Schalk** [01:22:17] Or, it's actually funny that the moon phase thing was David would be out running traps and he would have trouble falling asleep in his tent during full moons and it would keep him up at night. And then he'd wake up the next morning and go and check his traps, and not have any turtles. And he got really annoyed.

**Chris Schalk** [01:22:39] So, he was thinking about this and he read an anecdote in a book where an AST trapper made a note of he tended to catch fewer turtles on nights of the full moon. And so, he actually included this moon phase as a covariate and found it to be actually significant.

**Chris Schalk** [01:23:04] Trying to understand the exact mechanism as to why that is: you know, we have some ideas, but it's still not really well known or well-defined.

**Chris Schalk** [01:23:13] But anyway, so, taking all this into consideration, you're able to look at the conditions when you surveyed and basically build in better estimates or more robust estimates of, you know, your abundance or your occurrence or detectability at a site.

**David Todd** [01:23:35] Okay. So, I guess, in really simple terms, there's maybe a fudge factor for some of these, you know, issues that might influence how many turtles, how lucky you might be to catch a turtle.

**Chris Schalk** [01:23:52] Yeah, it's accounting for the differences across either sites or time of surveys and are able to account for that.

**David Todd** [01:24:02] Okay. So, one kind of related question. Please help us with vocabulary, again - the difference between occupancy and abundance for alligator snapping turtles.

**Chris Schalk** [01:24:15] Yes. So, occupancy, really at its core, is it's a one or a zero. Right. Is it there or is it not? So, you're just interested in documenting presence or absence. And when you model occupancy, you still need to account for detectability.

**Chris Schalk** [01:24:35] Abundance, though, you still look at and utilize the detectability of the species, but you're actually able to get an estimate of number of individuals, you know, per unit area, for example. Right. And so, you're moving beyond just, "Is the site occupied or not?", to really getting, "Okay, how many turtles per river kilometer in a given area?" Right. And so, you're able to get an actual count of, maybe some inferences on, the population size at a site.

**Chris Schalk** [01:25:15] And so, with occupancy, you can get an idea, depending on the conditions or the site or things like the probability that that site is occupied. Right. Going from 0 to 1. But, you know, you're still just trying to determine presence or absence.

**Chris Schalk** [01:25:32] Whereas, abundance you're trying to get an actual count of individuals.

**David Todd** [01:25:37] Okay. That helps a lot. Thanks for explaining that.

**David Todd** [01:25:42] Well, let's shift to, I guess, the question of just how you make sure that these turtles, however many there are, are, you know, as sustainably protected as possible and maybe recovered to even higher numbers. Can you, you know, describe some of the most promising recovery strategies that you might suggest for keeping these alligator snapping turtles in Texas streams.

**Chris Schalk** [01:26:17] Yeah. So, I mean, just in terms of, you know, I think a kind of a more landscape, regional scale, you know, in our study on the occupancy of this species, the biggest predictor of whether or not a site was occupied was proportion of forest cover, within this, we were looking at sub watersheds.

**Chris Schalk** [01:26:41] And so, really, you know, what we found is, is basically, if there was, I think it was about 40% forest cover within these sub watersheds, occupancy was close to almost 100%. So really high up there.

**Chris Schalk** [01:26:59] So, you know, and if we think about that, you know, managing these landscape-scale efforts of making sure that there's forest cover is a really important way to think about conservation for the species.

**Chris Schalk** [01:27:20] And we think that, you know, forest cover is important because of the input of woody debris into streams. But, it can also be kind of this larger scale, kind of region-wide aspect of, you know, in East Texas, you just tend to have more trees, which is also correlated with the range of the species itself.

**Chris Schalk** [01:27:41] But, you know, I think, at kind of a fundamental scale, making sure that there is adequate forest cover within these aquatic sites is kind of a good first step.

**David Todd** [01:27:57] So, part of the issue that I guess you're drilling down to is this more woody debris input, which I guess is like mast and acorns that support populations that either they feed on directly or else, you know...

**Chris Schalk** [01:28:18] Well, it's also. Yeah. So, it's also the actual like coarse woody debris of fallen trees and branches that they're using as refugia to hide out and serve as kind of ambush sites and basically utilizing those sites.

**Chris Schalk** [01:28:37] You know, the forest cover, it can also have an impact on things like, you know, the temperature within the water. Right. And potentially, you know, fish communities that may be important for their food sources.

**Chris Schalk** [01:28:52] So, yeah. So, it's kind of a combination of factors where, you know, I guess in terms of the simplest terms, it's we know that forest cover is important and it can have kind of these cascading effects on other aspects of resources that are important for these turtles.

**David Todd** [01:29:11] I see. So, habitat matters.

**David Todd** [01:29:15] What do you think about issues with trot lines and bycatch? Is that significant?

**Chris Schalk** [01:29:23] Oh, absolutely. I mean, you know, the main thing is to make sure that adults are protected. Right. And, you know, because these populations are so vulnerable to decline. I think there was a study where it was something like if there were 2% of females removed from alligator snapping turtle populations, you saw evidence of decline. And so really, it's making sure that you protect adults, and especially adult females, that are going to be really important to population viability in the long term.

**David Todd** [01:30:02] I see. And so, part of that, I guess, is maybe working with folks that may be a pretty innocent - they're out there, you know, running a trot line for catfish and they unintentionally catch an alligator snapping turtle. But then you're also dealing with folks that are going after them very deliberately and trying to catch them for the pet trade or the food trade. Is that true?

**Chris Schalk** [01:30:34] Yeah. Yeah. You know, I think it's, you know, I think a lot of it is unintended bycatch, I think, you know, probably poses a greater risk because, you know, it's more widespread as opposed to, you know, targeted, you know, poaching efforts of people



trying to capture these turtles in Texas. So, you know, if you think about the kind of the extent of trot lines across rivers, you know, they're much known for targeting catfish and other fishes. You know, it's much more widespread and can pose a greater risk to the species than poaching.

**Chris Schalk** [01:31:19] But still, you know, a poacher that's driven and really trying to target these species can have a huge impact in a short amount of time as well.

**Chris Schalk** [01:31:31] So, yeah, I think it's a combination of all the above.

**David Todd** [01:31:37] I've heard some folks, when they're thinking about the poaching problem, say that it's tough in two respects: one is that it's so difficult to catch poachers and to intervene in the black market. You know, they're good at hiding their tracks in a private property state like Texas. But then secondly, once they're brought in to justice, the penalties are pretty light. Is that something that you'd agree with or do you think that that's not really a true claim?

**Chris Schalk** [01:32:17] I mean, I agree it's hard to catch these individuals in the act just because of the amount of, you know, area where these turtles occur. Right. And game wardens and Fish and Wildlife Service agents can't be everywhere all at once. So it's challenging to, you know, try and look for, you know, one or two illegally deployed hoop nets or trot lines. Right. So that part, you know, is just a matter, an issue with kind of the scale itself.

**Chris Schalk** [01:32:53] But, you know, there was an instance where, you know, the repatriated turtles that I mentioned, you know, they were basically captured as part of a sting operation. And so, basically there was a suspected poacher that they thought came over to Texas and brought those turtles back to Louisiana to sell them for meat and things like that. Well, they set up a sting operation and they basically caught him in the act with these illegal turtles. And they were able to prove they were from Texas, based on genetics and things like that.

**Chris Schalk** [01:33:31] But, you know, the individual was convicted. He went to prison for six years, I believe. And so, you know, it's no slouch in terms of, you know, doing prison time, you know, when poachers are captured and convicted. So, six years is a long time, in my opinion.

**David Todd** [01:33:53] Yeah. Yeah. I follow you.

**David Todd** [01:33:57] You know, you talked a little bit about this circumstance between Texas and Louisiana and I think that you found this in one of the papers you wrote that there's this irony that the Texas protection of turtles makes it sort of a magnet for folks from adjoining states, particularly Louisiana, to come over and poach there because the populations are robust, because of the, you know, regulatory status for the turtles here in Texas. Is that, maybe you can flesh that out a little bit because it is kind of a paradox.

**Chris Schalk** [01:34:38] Yeah. I mean, basically, you know, Texas was at the forefront in terms of, you know, protection status for these turtles back in the eighties and, you know, mid-eighties and that's 30 years ago. Right. That's a whole generation time for the species.

**Chris Schalk** [01:34:56] And if you compare that to Louisiana, you know, Louisiana's been harvesting this entire time, maybe not as intensively as in the past, but still having a

demonstrable impact on the population structure of individuals within that state and populations within that state.

**Chris Schalk** [01:35:16] So, the fact that you have these AST protected in Texas for such a long period of time, basically, you know, and over such a large area. Right. They occur across, you know, pretty considerable portion of the eastern part of the state makes it kind of ripe for opportunities for poachers to come over and illegally deploy their traps and trot lines and things to target those really large turtles that are desired by poachers.

**Chris Schalk** [01:35:52] And I think I mentioned this earlier. You know, we captured a turtle that was 211 pounds, and I believe that's the record for the largest turtle ever captured. And it was David and his field techs John Mike [Arnett] and Jake Swanson pulled up this trap. And it's three full-grown men in a little jon boat and a 200-pound turtle and it was about to exceed the weight capacity of the jon boat so they made the undergrad jump off and swim to shore so they wouldn't capsize the boat.

**Chris Schalk** [01:36:27] So, but it's pretty impressive and just trying to think, you know, how long this individual lived there and the conditions to make it grow so big. It's really impressive.

**David Todd** [01:36:41] I loved the undergrad student had to jump off. That's wonderful. That's hilarious.

**David Todd** [01:36:50] So, I've heard some people tell me that there is some captive breeding going on to try to restore these populations, or just give a sort of insurance policy for the populations. What can you tell me about that?

**Chris Schalk** [01:37:08] I don't know too much about it. I believe there's a captive breeding facility in Oklahoma, if I'm not mistaken. And I think they're, that facility is trying to basically reintroduce or bolster populations in that region of Oklahoma and potentially Kansas. But I'm not too sure about that. But yeah, that's kind of the extent of what I know about that.

**David Todd** [01:37:40] Okay. Well, so just to go back to the first thing you mentioned as one of the most important issues for alligator snapping turtle recovery. And that is what kind of forest structure you have and, you know, if you were talking to your colleagues at the Forest Service or to a private woodlot owner, is there something that you would tell him or her about how to manage a, you know, harvest scheme to try to protect these alligator snapping turtles?

**Chris Schalk** [01:38:15] So, so, that's also you know, we know that forest cover's important, but we don't know the ... the challenging thing is we don't know the, I guess, the extent of what streams are important for the general kind of life history of the species. So, you know, we know that with any sort of timber harvest, that there should be a Stream Management Zone, or an SMZ, that leaves some sort of buffer for kind of these abiotic processes of filtration to control sediment inputs into streams and things like that.

**Chris Schalk** [01:38:54] But, in terms of what that buffer is for, you know, importance of alligator snapping turtles, you know, how far that needs to be from the stream edge, we don't know, because that study hasn't been conducted yet.

**Chris Schalk** [01:39:07] The other thing, though, is we don't know, you know, on the landscape if you think about kind of the occurrence of streams, ranging from small streams to

these larger kind of river systems, we don't know the relative importance of small streams to large rivers for the species.

**Chris Schalk** [01:39:27] We know that we capture a lot of them in these smaller streams. But, you know, are they moving in there for nesting? Or are they important for overwintering, you know, things like that where, you know does that mean, you know, certain times of years are more important for the others relative to stream types and forest cover?

**Chris Schalk** [01:39:48] It's still, there are still a lot more questions I think, that need to be addressed to, you know, properly inform someone about the importance of forest cover and maybe conducting like a timber harvest and things like that.

**Chris Schalk** [01:40:05] So, I think that comes, you know, comes with research. You get a lot more questions a lot of times than answers necessarily, or at least it generates a lot more questions to kind of address these nuances that you start thinking about more.

**David Todd** [01:40:21] Well, and it sounds like this is early times, you know, haven't been studied in this formal way that you've been doing for many years. And these turtles can live for so long. I guess it's hard to see the impacts. Is that kind of the combination of things that makes these questions maybe so hard to resolve?

**Chris Schalk** [01:40:42] Yeah. And I think it's, you know, I think it's a kind of a good start to start addressing these questions. But yeah, but given the life history of the species, the fact that, you know, it's so long-lived and, you know, there could be a potential for lag effects to see impacts on populations where just because something happens immediately, we may not see it kind of emerge as a potential issue until later on in that population.

**Chris Schalk** [01:41:12] And even just like fundamental basic aspects like, "Where is this species nesting?" Right? You know, "How far, how much of the landscape is important for this species, for, you know, nest survival or suitable nesting habitat."

**Chris Schalk** [01:41:29] Like those fundamental basic natural history questions, important for the species, you know, still need to be addressed in an, a really robust, you know, study.

**David Todd** [01:41:42] Okay. So, one other question I had about this recovery issue is that I've heard that there's been this explosion of, I think they're called mesopredators, and I guess raccoons are a good example.

**Chris Schalk** [01:42:01] Mm hmm.

**David Todd** [01:42:01] And is that a factor for these turtles' eggs and, you know, the sustainability of their populations?

**Chris Schalk** [01:42:09] Yes, I think it depends probably where you're at in terms of the impacts of mesopredators on turtles. So, you know, maybe under kind of more rural areas where maybe there's other kind of larger predators like coyotes or something that may have kind of this top-down control on mesopredators, it may just be the normal kind of background nest predation rate that you have.

**Chris Schalk** [01:42:43] But, you know, maybe in like an urban area, for example, like in Buffalo Bayou, where maybe there is a greater abundance of raccoons or opossums or things,

you know, there could be an impact on nest success there because there's no larger predators controlling these mesopredators.

**Chris Schalk** [01:43:05] So, yeah, that that can definitely be an issue, because really, you know, nest survival isn't that high under natural conditions. Right? And so, if you do have a higher abundance of mesopredators in an area, you know, I can imagine a scenario where nest survival really would drop even more.

**David Todd** [01:43:24] Okay. Well, I had two more things I wanted to ask you. And then we'll let you get back to other more important things than talking to me.

**David Todd** [01:43:39] So, you've put in a lot of time and effort into struggling with 211-pound alligator snapping turtles. And, you know, and I'm curious why you think it is important, given those challenges, to study and conserve alligator snapping turtles. What's the deal?

**Chris Schalk** [01:44:03] Yeah. You know, I think just given the life history of this species, you know, you have this large predator in these aquatic habitats that if we think about kind of the function of these ecosystems, you know, they can play a large role, right? I mean, in terms of, you know, kind of what I outlined earlier in our talk where we're basically, you know, being able to regulate or have an impact on populations of other species. Right.

**Chris Schalk** [01:44:40] And really, that goes both ways, right? So, serving as predators to, you know, to fishes and turtles and all these other animals, but also the fact that, you know, those small alligator snapping turtles and their eggs are, you know, basically a kind of tasty morsel for a lot of other species that, you know, in both the terrestrial and aquatic environment.

**Chris Schalk** [01:45:06] So, you know, they can potentially have a large impact on these ecosystems. And if we lose these really large animals from these ecosystems, it could have a pretty considerable impact potentially on the structure and function of these ecosystems.

**Chris Schalk** [01:45:28] So, I think from just kind of an ecosystem health perspective, it's important to understand that, you know, these animals serve a function and a role within their habitats.

**David Todd** [01:45:49] I hear you. All right. Well, so you have covered lots of ground. Thank you very much.

**David Todd** [01:45:58] Is there anything you'd like to add about alligator snapping turtles or about wildlife conservation in Texas just in general that we might have overlooked, that I've giving short shrift to that you want to address?

**Chris Schalk** [01:46:15] I mean, I think we've covered a lot. You know, I think it's, you know, so for me, you know, I think it makes me feel good to know that there's lots of alligator snapping turtles in the streams here in Texas and being able to, you know, think about them kind of cruising around and, you know, kind of doing their turtle thing. You know, basically, you know, it makes me motivated that, you know, seeing the research that I do has a demonstrable impact on the conservation of the species.

**Chris Schalk** [01:46:53] So, yeah, that's all I have to say about that (I think that's from a movie somewhere). Yeah.

**David Todd** [01:47:02] Well, it's neat that you're answering these questions about a creature that a lot of people don't know much about, probably never get to see, and, you know, it sounds like it has a big role in the ecosystem.

**David Todd** [01:47:16] So, thank you so much, Dr. Schalk. You've been really kind to spend some time with us. And I, I wanted to say thank you and I wish you well.

**Chris Schalk** [01:47:28] Thanks. I appreciate the opportunity and I really enjoyed it.

**David Todd** [01:47:31] Well, good. Me too.

**David Todd** [01:47:33] Well, I'm going to stop the recording now. And thank you so much.

**Chris Schalk** [01:47:39] Thank you.