

TRANSCRIPT:

INTERVIEWEE: Jim Shaw

INTERVIEWER: David Todd

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Google Voice [00:00:02] This call is now being recorded.

David Todd [00:00:05] Hey, there, this is David Todd.

Jim Shaw [00:00:11] Hi, David.

David Todd [00:00:11] Dr. Shaw?

Jim Shaw [00:00:12] Yeah.

David Todd [00:00:13] Yeah. Hey, great!

Jim Shaw [00:00:16] I didn't know if I should call you or you were going to call me, so.

David Todd [00:00:18] No, no. You know, this works fine. The way this recorded line business works, I can't call you for privacy reasons.

David Todd [00:00:30] Oh, I see.

David Todd [00:00:32] If you call me, that way you won't be caught unawares that we were trying to make a record of this.

Jim Shaw [00:00:39] Okay.

David Todd [00:00:40] Thank you for calling me, and I should have made that more clear.

Jim Shaw [00:00:41] Sure.

David Todd [00:00:46] And thanks for your help with this oral history project. I am so delighted that you might be able to help us out here.

Jim Shaw [00:00:55] Were you, were you able to contact Glynn Riley?

David Todd [00:00:59] I have not. No, no.

Jim Shaw [00:01:02] I don't have contact information for him anymore. He's got to be retired by now. He must be, he's probably about 80 years old, if he is even still living. But he really knew more about the red wolf than anybody else. In the years and years of selective trapping, and he trapped the ones that I put telemetry collars on, and was really an advocate for him for a long time. And he also helped me in my understanding of the red wolf. And he, Glynn, never

went to college, but by golly, he was well read, and he understood the literature very well. So, if you're able to find him, it's G-L-Y-N-N, an unusual spelling, Riley, and that's just the usual word, "Riley". And I've lost all contact with him over the years, and I will, I will make an effort to try to find him online or try to make some kind of connection. But gosh, so many of the people that I worked with back in those days are dead and gone.

David Todd [00:02:08] Oh boy.

Jim Shaw [00:02:09] You know, it's just been a long time. You did, you did you Russ Clapper, right?

David Todd [00:02:15] I did. Just, you know..

Jim Shaw [00:02:16] Good. That's good.

David Todd [00:02:16] By happenstance, because I was really just starting out on this (it was about 25 years ago), and, you know, we talked about whooping cranes and then he, he introduced me to the whole story about red wolves. And so he was fascinating and such a gentleman, really nice to speak with him. Yeah.

David Todd [00:02:41] But just generally, you know, I'd be terribly interested to hear what you have to say. But if you think about it, if there are other people you might suggest we, we try to reach out to.

Jim Shaw [00:02:52] Yeah.

David Todd [00:02:53] I'd love doing that. Glad to.

Jim Shaw [00:02:58] OK.

David Todd [00:02:58] But, but today I was just hoping to grab you for a little bit and see if we can prod some memories out of you and, and hear your perspective on red wolves and wildlife study and conservation, as well.

Jim Shaw [00:03:14] Okay. I have your outline up of the questions you sent me.

David Todd [00:03:20] Yes, sir.

Jim Shaw [00:03:21] Some time ago. Would you like me to just kind of go through that and answer those questions as they come along? And if you think of anything else, feel free to cut in?

David Todd [00:03:32] Yeah. Well, that sounds like a great plan. If you don't mind, I like to lay down just a little bit of an introduction to these recordings so that folks, if they come across this transcript, they, they will know what it's, what sort of collection it's a part of and maybe introduce you. And then I'll get right into those questions that you've seen. Would that be a plan that would sit well with you?

Jim Shaw [00:04:01] Yeah, that would be fine.

David Todd [00:04:02] Okay. All right. Well, this should just take about a minute and a half - sort of a general introduction, and then, then I speak a little bit about where we are today and, and when it is and so on. I think that is a good marker to sort of anchor the rest of what you might tell us. So let me let me just jump in there.

David Todd [00:04:28] My name is David Todd, and I am very fortunate to be with Dr. Jim Shaw on a remote recording, and with his permission, our plan is to tape this interview for research and educational work on behalf of a nonprofit group called 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. And Dr. Shaw would have all rights to use the recording as he sees fit as well. And I wanted to make sure that that's agreeable with him.

Jim Shaw [00:05:14] That's fine.

David Todd [00:05:15] Is that OK? Yeah, great. Okay, well, let's get started.

David Todd [00:05:21] Today is Tuesday, April 19th, 2022, and it is almost 3:20 p.m., Central Time. And as I said, my name is David Todd and I am representing the Conservation History Association of Texas and I am in Austin. We are conducting a remote interview with Dr. Shaw, who for many years was based in Stillwater, Oklahoma. But I understand is now in Arizona.

Jim Shaw [00:05:52] Well, actually, we will be moving there fairly soon, but I'm still in the Stillwater area at the moment.

David Todd [00:05:58] I see. Okay. Pardon me.

David Todd [00:06:02] And Dr. Shaw has served as professor of wildlife ecology at Oklahoma State University in Stillwater for many years. And in addition to teaching there, he carried out research on, as I understand it, prairies, bison, prairie dogs, a number of topics and as well, and this might be the focus of our visit today, he spent several years studying red wolves at a really critical time when they were being collected from the wild for captive breeding and re-release elsewhere.

David Todd [00:06:34] So today we were hoping to talk about his life and career and especially focus on that chapter of his work with the red wolf. So, with that little introduction, we've been exchanging some, some questions, a text of some questions, previously and I thought maybe we could go through those.

David Todd [00:06:58] And the first question we had was to ask him to please tell about his childhood and if there might have been any people who were, or events for that matter, that were a big, which were a big influence in his interest in working with animals and particularly, of course, these, these wolf or coyote hybrids that we've encountered in particular. So, with that long preface, if you have some thoughts there, it would be great to hear you.

Jim Shaw [00:07:32] Yeah. Ever since childhood, I always had a really strong interest in science, but especially in nature, in nature.

Jim Shaw [00:07:40] [Are you there?].

David Todd [00:07:40] [Yes, I am.]

Jim Shaw [00:07:43] And I would bring home snakes and turtles and lizards and whatever else I could catch, and sometimes to the horror of my parents, who didn't really understand that kind of thing. And then for my eighth birthday, a great aunt of mine gave me a copy of a book for young people called, "A Golden Treasury of Natural History". I still have that copy all these decades later, and I sort of dived into that book and began to understand that there are careers that involve study in nature and all these possibilities. So, I got on that trajectory pretty early in life. And I credit my great aunt with being one of the people who pushed me in that direction. I don't know if she particularly intended to, but it happened that way.

David Todd [00:08:46] Interesting. Do you think that she had an interest in wildlife, natural history, the outdoors?

Jim Shaw [00:08:55] She, she actually, she was actually a licensed nurse, and she, so she had the science background. And I think she probably sensed in me that I was I was likely to pursue a career in that, in some area related to the study of nature.

David Todd [00:09:16] I see. And did you by chance live in the country, or were you a city kid?

Jim Shaw [00:09:23] Actually, I grew up in what was then a small town in Texas. It's now much larger - Tyler, Texas in East Texas. And I have never lived on a farm or ranch, but I always had access to people's land, people I knew or the relatives that had land. And I was at all, as much as I could, I liked to spend time on those rural properties and I learned a fair amount about agriculture. I spent some summers driving tractors and, and working with cattle, but also picking up a lot about wild nature along the way.

David Todd [00:10:09] That's interesting. I think you mentioned when we were first getting started that, to your parents' horror, you often came home with creatures from the outdoors. Do you recall any of those escapades of collecting those frogs, turtles, et cetera?

Jim Shaw [00:10:32] Nothing particularly colorful. But in those days, let's say, back in the 1950s, the horned lizards were, were very common in Texas and Oklahoma and parts of Louisiana. And I used to catch those. They're very interesting armored, chunky lizards. And for reasons that are not very clear to any of us, I think, their numbers have greatly diminished in the decades since, and they're extremely rare now. I haven't seen one for decades. And I used to encounter them during the warmer parts of the year, at least once a week when I was growing up. And that was in towns, as well as the countryside.

David Todd [00:11:19] Just one of those trajectories that you can't really put a finger as to exactly why.

Jim Shaw [00:11:28] No, not really. Just was inclined that way, and I followed it.

David Todd [00:11:33] Yeah, right, right. Did, were you ever able to take any trips with your parents? Sometimes folks recall, you know, trips to parks and so on. Or was your exposure mostly just in the area around Tyler?

Jim Shaw [00:11:51] It was mostly, mostly the area around that part of Texas. We didn't really travel that much, but I did get to spend a lot of time in the rural landscapes, which I really appreciated.

David Todd [00:12:04] Yes, right.

David Todd [00:12:06] Well, to just step forward a little bit after your childhood. Can you tell us anything about your grade school experiences, or maybe in college and graduate school, and whether there were some, you know, educational experiences, whether with teachers or with your classmates, that might have influenced your interest in wildlife and, and the outdoors?

Jim Shaw [00:12:34] Well, I don't think there was much in public schools in those days that that influenced me in that particular direction. I went to college at Stephen F. Austin, which is in Nacogdoches, Texas. And very quickly volunteered to, to work on some wildlife research projects, and I got a lot of experience, an awful lot of experience with someone just starting out in college. I was very blessed to have a good many mentors who were wildlife research biologists with the Fish and Wildlife Service, Texas Parks and Wildlife Department, and U.S. Forest Service, all there on campus. And I also had an advisor who was a recent graduate, a Ph.D. in wildlife science from Texas A&M. So, he was a big influence as well. So, once I got to, I got to Stephen F. Austin, I was able to take advantage of a lot of opportunities, and it really fired me up and inspired me to, to go on to graduate school.

David Todd [00:13:48] Well, when you were at Stephen F. Austin, was it, were these experiences, these opportunities, were they mostly in laboratory or out in the field?

Jim Shaw [00:14:00] They were out in the field.

David Todd [00:14:01] I see.

Jim Shaw [00:14:03] Almost exclusively. Yeah.

David Todd [00:14:07] And was this work with, with reptiles or birds?

Jim Shaw [00:14:13] No, this was, this was mainly work with mammals, by that time.

David Todd [00:14:20] I see.

David Todd [00:14:22] And this was mostly in the national forests or private lands?

Jim Shaw [00:14:26] You know, there was a Stephen F Austin Experimental Forest, which was part of one of the national forests in East Texas. It was Forest Service land, but there were contractual agreements for research between the University and the Forest Service. I spent a lot of time there. I was working on a long-term project on the fox squirrel, and got my first introduction to the white-tailed deer, and started learning about them because they were very common there. And we had some in captivity for studies and it was the first time I really got interested in more diverse animals and larger species of animals, and wound up with my career it was all large mammals.

David Todd [00:15:18] That's fascinating. You know, while we're on the subject of squirrels, I've heard some people mention that the populations of squirrels, and the way they sort of interacted with people, changed over the years - that the numbers of squirrels, and maybe their locations, changed as hardwoods became maybe more rare, and softwoods were planted

out. And also, that the hunting of squirrels saw a decline. Can you tell if there's any truth to either of those trends?

Jim Shaw [00:15:55] Yeah, there is. To begin with, squirrels can't be supported on pine monocultures. They just don't have the, the right foods and the right kind of cover. So, as the pine monocultures expanded, squirrel populations plummeted in those immediate areas.

Jim Shaw [00:16:15] However, squirrels are very adaptable and persisted wherever there was natural hardwood habitat, for example, along creeks and rivers. And for that matter, squirrels have urbanized very well, too. So they take advantage of being in town and adapting very well to that.

Jim Shaw [00:16:34] Right now, I live in a rural part of Oklahoma, and I have both fox and grey squirrels on the property all the time, and I put out food for them. They're very adaptable and they're very good at raiding bird feeders too.

Jim Shaw [00:16:50] And you mentioned something about hunting and the interest in hunting squirrels has waned. That's probably true. I haven't seen any statistics on that in several years, but the trend was down for squirrels. And I think the primary reason for that was that other opportunities were emerging. For example, in the 1950s, deer were still pretty scarce in lots of parts of the country. The populations really hadn't recovered that well. So, people will hunt what's available and squirrels were always available. But that was before the pines became so extensive. Squirrels being plentiful, people hunted squirrels.

Jim Shaw [00:17:36] But once the deer numbers built up, a lot of the hunters were far more interested in shooting deer than shooting squirrels - a lot more meat that way. And it's, it's more interesting a lot of other ways. So, I think the interest in squirrel hunting fell off because other opportunities emerged, particularly with respect to white-tailed deer.

David Todd [00:18:02] I see, okay. Well, that's good to know.

David Todd [00:18:07] Well, so I gather that after college at Stephen F. Austin, you went on to graduate school. Is that right?

Jim Shaw [00:18:16] That's right. And where did you go and what did you learn? Well, I went from Stephen F. Austin to Yale University in 1968, which was kind of a crazy year for political events and whatnot. But one of the faculty at Stephen F. Austin had fairly recently completed a Ph.D. at the Yale School of Forestry and Environmental Studies, and he was aware that they were trying to develop and expand a graduate program in wildlife ecology. So he wrote a strong recommendation for me, along with a couple of other faculty members, and I wound up getting a graduate fellowship to the Yale School of Forestry and Environmental Studies and tuition was waived. So, I had an opportunity and I grabbed it.

David Todd [00:19:15] Isn't that great to be relieved of the burden of trying to work and pay tuition.

Jim Shaw [00:19:22] That's true.

David Todd [00:19:24] And was it during your time at Yale or shortly afterwards that you, you first might have gotten in touch with these studies on red wolves? Not so much red wolves, but one of my graduate advisers had worked with gray wolves at Isle Royale National

Park in Lake Superior. And talking to him about his experiences and then later going to Isle Royale with him on some of the surveys, I developed a keen interest in, in wolves in general and canids more broadly. And that's what got me interested.

Jim Shaw [00:20:06] And then one of my friends at Stephen F. Austin went to work for Texas Parks and Wildlife Department as the first non-game biologist. And he became aware of the perils of the red wolf and now critically endangered that animal really was, and I worked with him doing those howl surveys, where we used the air raid sirens to simulate wolf howls to get some idea of the distribution and relative abundance of the red wolves along the Gulf Coast of Texas. And by that time, that's where all of them were. They weren't anywhere else.

David Todd [00:20:47] Well, so I think this may lead into this paper that I enjoyed reading called, "The Distribution and Relative Density of the Red Wolf in Texas", that you and Dennis Russell put together.

Jim Shaw [00:21:02] Yes.

David Todd [00:21:02] And I think presented it the Southeastern Association of Game and Fish Commissioners meeting in 1971.

Jim Shaw [00:21:13] Yeah, we published that.

David Todd [00:21:14] And I'd love to know more about that.

Jim Shaw [00:21:17] Well, the three publications that we co-authored were all done centered around that survey, because no one had, before that, had ever tried to find out just how extensive an area they inhabited and roughly how many there were. And the reason it was so confusing was people continued to call coyotes as they moved into area, became more common, they referred to them as "wolves". And I always thought that was a very silly thing to do because a coyote is maybe a third to one fourth the size of a gray wolf. Now, red wolves are kind of in between. But still, a red wolf, it can be twice the size of a garden-variety coyote, and they don't really look that much alike if you looked at a good many of them.

David Todd [00:22:23] So, it's just the nomenclature was, was different and kind of distinct to that part of East Texas, is that right, that they assume that they should call them "wolves"?

Jim Shaw [00:22:38] Yeah. In general, where red wolves were abundant, and to this day where gray wolves are abundant, you have very few coyotes. Because these wolves will attack and kill coyotes. And what happened was people killed wolves off, both red and gray. And that opened up the opportunity for coyotes to expand eastwards.

Jim Shaw [00:23:03] At the time of Lewis and Clark, for example, which has been a little over 200 years ago, there were no coyotes east of the Mississippi. And now coyotes occur in every state in the continental United States. So, they've expanded enormously in the, in the last, oh, 100 to 200 years.

David Todd [00:23:27] And do you think that that trend, that expansion, of the coyote population and range was mostly due to predator control on the wolves?

Jim Shaw [00:23:39] Yes, I think it was.

David Todd [00:23:44] I see. OK.

David Todd [00:23:48] Well, this may be a little bit of a detour, but, but just to help introduce lay people like me to, to the red wolf, can you sort of give us a brief synopsis of the red wolf's life history and maybe the ecological niche that it would fill?

Jim Shaw [00:24:12] Well, I can only speak to the Chambers County, Texas, population in the early '70s, the one I worked with most intensively. That, that animal was on the east side of Galveston Bay. And Galveston Bay and the Houston metropolitan area separated the wild canids that were along the coast west of Galveston Bay from those east of Galveston Bay. In other words, there was minimal gene flow between those populations.

Jim Shaw [00:24:52] As they were originally described, long ago, far before I got involved, they were given subspecies, different subspecies status. The ones east of Galveston Bay, where I worked intensively, were *Canis rufus gregoryi*, the ones west of Galveston Bay, *Canis rufus rufus*. And the latter were consistently smaller and more coyote-like than the ones east of Galveston Bay.

Jim Shaw [00:25:22] My interpretation of that is that even by the early 20th century, coyotes had begun to hybridize with those west of Galveston Bay to an earlier, to a greater extent, and that pulled the average size down to where they were even originally described as a different subspecies than the larger red wolves to the East.

Jim Shaw [00:25:52] And in terms of the niche of the red wolf, it could have been in, in the colonial times, for example, they could have behaved very much like gray wolves. That is, they could have taken things like, like deer and beavers and prey about that size category.

Jim Shaw [00:26:14] On the Gulf Coast of Texas, where the red wolf made its last stand, and where I worked, too, around the Anahuac National Wildlife Refuge, by that time, nutria had been accidentally, and maybe sometimes deliberately introduced, from South America. And this a large aquatic rodent, about midway in size between muskrat and beaver. And they became extremely numerous, and there were always lots of swamp rabbits also in the salt marsh area, which meant that red, red wolves that lived there probably had it pretty easy in terms of hunting, because they could easily capture both swamp rabbits and nutria.

Jim Shaw [00:27:01] And some of the old timers told me, (it's been over 50 years ago), that after the nutria became established in good numbers there, their losses of calves to wolves greatly diminished, became pretty rare. And the thinking was, is that the nutria just offered an easier, less dangerous type of prey. And then they switched over to a large extent.

Jim Shaw [00:27:30] And my own research confirm that the nutria was number one in terms of the prey that they actually took, followed by a swamp rabbit.

David Todd [00:27:41] Well, you know...

Jim Shaw [00:27:45] So, their niche was, and under those circumstances, much close to that of coyote than gray wolf.

David Todd [00:27:51] I see. And these nutria, were they brought to Louisiana for the fur trade, is that right?

Jim Shaw [00:27:59] Yes, they were.

David Todd [00:28:01] When did that start, do you think?

Jim Shaw [00:28:03] Oh gosh, that probably goes back well into the 19th century. People had ideas about raising them kind of game farm style. But what happens, especially near the coast of places like Louisiana, they have these things from time-to-time called "hurricanes". And a hurricane can lay waste to the best of animal holding facilities, so I'm sure some escaped that way and others, somebody might have decided to get out of the business and just turned them loose.

Jim Shaw [00:28:35] Either way, they get in and they adapt very quickly. They are pretty prolific, so the numbers go up and they adapted very well to the salt marsh habitat.

David Todd [00:28:50] Well, that's interesting. So, to just flip back to what you were saying before, it sounds like there were these two populations of red wolves and were they subspecies one on the west side of Galveston Bay and one on the east side? Is that right?

Jim Shaw [00:29:06] Yes, that's correct.

David Todd [00:29:08] And then they and the larger ones were on the west side and the smaller on the east?

Jim Shaw [00:29:14] No, the larger, larger ones were on the east side.

David Todd [00:29:19] I see, okay. OK. Sorry.

Jim Shaw [00:29:22] That's, if you check a fairly detailed map of Chambers County, Texas, where the Anahuac Wildlife Refuge is, you'll see that the west side of Chambers County is Galveston Bay. So, what was, what was happening there was there was minimal opportunity, or gene flow, between populations of wolves or wolf-like animals east or west of Galveston Bay.

Jim Shaw [00:29:52] Because, if you go north of Galveston Bay, then you run into the Houston metropolitan area. There was very little opportunity for them to move through all that mess in order to disperse and mate with the others on the other side. So what the Galveston Bay and that Houston complex probably did was it actually helped sustain the animals east of Galveston Bay in a more pure form.

Jim Shaw [00:30:19] I'm quite sure that the *Canis rufus rufus* resulted from an earlier hybridization with coyotes. They didn't, and there were some behavioral differences that we discovered, as well as some genetic differences. So, they were much more coyote-like than the animals east of Galveston Bay.

David Todd [00:30:42] I see. Okay. Thank you for sorting that out for me, I appreciate it.

Jim Shaw [00:30:46] One of the differences we discovered was foxes and coyotes have a threat expression if they're cornered and frightened and they "gape", that is, they open the mouth extremely wide. Gray wolves don't do that. They snarl, but they don't gape. And I knew this was true with gray wolves compared to coyotes. Coyotes gape, gray wolves don't. So, OK, what do red wolves do?

Jim Shaw [00:31:17] What I found at the time was the red wolves, that were east of Galveston Bay, with one exception that was obviously a hybrid, but all the others that I had captured or handled or released, they threatened with a snarl, not a gape.

Jim Shaw [00:31:34] But the ones from west of Galveston Bay, where they were smaller and more coyote-like, just in appearance, they would threaten with a gape. And it just so happened, I had a, I had a behavioral geneticist on my doctoral committee who worked with coyotes and wolves a lot. And he picked up on that very quickly and did a little bit of genetic experiments with, with his captive populations. And he found out that the ability to gape was inherited. Very simple, it's a very simple Mendelian genetics - at least, that was his idea at the time.

Jim Shaw [00:32:12] So it was under genetic control. So, we demonstrated a genetic difference, as well as the behavioral difference, between east and west of Galveston Bay.

David Todd [00:32:22] Boy. Well, that must have been nice to have some sort of bright-line test. I understood that it got harder and harder to distinguish some of those hybrids from those that were more pure-bred on either side of the dividing line, coyotes and wolves.

David Todd [00:32:40] Well, tell me more about how you, how you surveyed these animals, because I understood that you were also trying to distinguish them and find them by doing these howl-response counts. That sounds really interesting.

Jim Shaw [00:32:54] Yeah. I continued doing a modified, modified version of what Dennis Russell and I'd done. I learned to use my own voice instead of a hand-crank air raid siren, and I could get them to howl back at me. And the howl of the animals in Chambers County was very distinct from coyotes. And I'd heard coyotes a lot of times and places, and many, many, many times since. And coyotes have a higher pitched howl, a lot more, it's more complex, and they're usually not as many coyotes together.

Jim Shaw [00:33:32] The red wolf in Chambers County, at that time, had a much deeper pitch howl, sounded much more like a gray wolf.

David Todd [00:33:45] Can you still do your, your call?

Jim Shaw [00:33:48] Oh, probably not anymore. But there really aren't any populations of red wolves left in Texas. So, it would be kind of a futile effort, really. What I, what I regret not doing, is making recordings of the howls at that particular time and then have them subject to sonogram analysis. I was focused on just trying to get an idea of relative abundance and distribution. But I do regret never having made good-quality recordings that other people could analyze later on and compare them with any changes that occurred in populations.

David Todd [00:34:31] I see now, is this correct that you also did some radio tracking with the red wolves?

Jim Shaw [00:34:40] Yes, I did. Yeah.

David Todd [00:34:43] How would you go about doing that?

Jim Shaw [00:34:46] I got the help of Glynn Riley, who worked for the U.S. Fish and Wildlife Service at that time, it was called the Bureau of Biological Survey. And he was a predator control trapper. And he was the best friend that red wolves ever had in that area. He was very sensitive to the fact of how endangered they were. And he tried his best to educate the ranchers and local residents and try to get them to refrain from killing them at every opportunity.

Jim Shaw [00:35:20] At that time, there was no legal protection for red wolves at all, when I was in the field. That came later with the Endangered Species Act of 1973.

David Todd [00:35:33] So at that time, they really were just considered non-game or even below that, as sort of a predator that should be shot on sight or trapped out.

Jim Shaw [00:35:43] Oh yeah. And it was assumed that there were just widespread, because people in East Texas called any wild canid, they called it a "wolf", they just referred to it as a "wolf". And they didn't make that distinction. So, one could easily get the idea that wolves were extremely common throughout East Texas. They weren't. Those animals were coyotes, except for the ones along the Gulf Coast.

David Todd [00:36:09] And so in these last years that the red wolf was, was still in the wild, what do you think the biggest pressures were on them? You know, I've heard people mention the predator control. You just cited that. But I've also understood that maybe waterfowl hunters might have shot some, or that disease and parasites might have been a problem. Well, what do you think was important?

Jim Shaw [00:36:41] Well, I don't think waterfowl hunters shot red wolves to any extent because the kind of shot shell loads you use on waterfowl hunting don't have the range for wolves. And wolves are, they're smart enough to avoid lots of gunfire. So, I don't think that was a factor.

Jim Shaw [00:37:00] They did have parasite problems, which we described in various publications. The heartworm and hookworm were the two main ones. Heartworm is something that your dog can get if it's not under treatment, and you certainly have that in the Austin area. If you, if you have a dog that stays outside very much and gets chewed on by mosquitoes, if they're not treated, they can develop heartworms, which becomes fatal in dogs or can be - the same in wolves.

Jim Shaw [00:37:27] I was able to correlate a period of, when the locals said that the wolves declined, which was prior to my work, and probably in the '60s, although offhand I don't remember the exact time period. But I checked the weather records, and those years were higher than average rainfall, which probably in that, given the salt marsh country, means higher populations of mosquitoes, which is more opportunity for heartworms to, to flourish. So I think that decline is, it's circumstantial evidence, I can't prove it, but I suspected that decline during the '60s was in part due to heartworm infestation. It can be fatal.

David Todd [00:38:17] That is so interesting. So, these small, little mosquitoes might have wiped out a, what, 50-60 pound animal, you know, with time and enough bites.

Jim Shaw [00:38:32] Well, you know, it's the heartworm is what did it. These worms reach their adult size in the heart, and they can shut, and ultimately, they can shut down a critical valve and kill, kill the host. That heartworms probably were always there, so I don't think it

was anything new. It wasn't something that just showed up. But it certainly didn't help the red wolves at all.

Jim Shaw [00:38:58] And once, of course, they were, they were gone farther inland where heartworms wouldn't have been quite as much of a problem as along the Gulf Coast, then there was no backup. So, the remaining red wolves were probably hammered pretty hard by, by heartworms and to some extent, hookworms. Hookworms are not as likely to be fatal, but they do weaken an animal, and that can cause problems with their ability to get normal prey and sort of thing.

Jim Shaw [00:39:28] Do you, do you think that this genetic swamping that I think you were talking about earlier, the hybridizing might have led to inbreeding or, you know, just less immunity to, to disease or parasites?

Jim Shaw [00:39:49] No, if anything, hybridization, in theory at least, should increase the opportunity for resistance because it's the opposite of inbreeding. It's outbreeding, and in theory that, that could have helped. I don't see any evidence that it did, and there's no guarantee it would have.

Jim Shaw [00:40:09] But, we now know that hybridization between species of vertebrates is much more common than we thought 50, 60 years ago. And for example, I'll give you an example between gray wolves and coyotes, because normally gray wolves ... [Excuse me.] ... will attack and kill a coyote. But when gray wolf populations get very low, and gray wolves can't get find a mate, now, under those circumstances, they may wind up breeding with coyotes.

Jim Shaw [00:40:51] In fact, there at seems to be very good evidence of that, as the coyotes expanded into the Great Lakes region in the West, in the last 150, 200 years, they moved in there, those populations north of the Great Lakes, that is primarily in Canada, picked up detectable genes, we now know through molecular genetics, from gray wolves.

Jim Shaw [00:41:21] Those south of the Great Lakes, it's much, much less common, and those are more like coyotes in terms of appearance and size and behavior. The one north of the Great Lakes are, were treated as mystery canids for a while, but we now have inferred pretty conclusively that they were hybrids between gray wolves and coyotes.

Jim Shaw [00:41:46] And so it was happening not just between red wolves and coyotes, but under certain circumstances between gray wolves and coyote.

David Todd [00:41:55] I see. So, and I apologize for being so naive about this, but, you know, as say a wolf population declines, it's more likely that they will outbreed, hybridize with coyotes, rather than try to breed with their own kind and run into these inbreeding bottlenecks.

Jim Shaw [00:42:18] Well, I don't think the problem is so much inbreeding; it's just low numbers that leads to the greater chance of gray wolf or red wolf mating with coyote. It's, inbreeding is, it's not genetically desirable for any, for the conservation of any species because it reduces their ability to adapt genetically. But, before you get serious inbreeding, you often start losing populations just by the sheer numbers. If the individual can't find mates, then that's it, that's a dead end.

Jim Shaw [00:42:58] And so that, my suspicion has always been that more of wolf populations went out because of just low numbers, than they did through hybridization. But as the numbers went down, there's a greater chance that hybridization would occur.

Jim Shaw [00:43:18] So you have the two working kind of together: the low numbers of wolves, the presence of more coyotes, because you're not that many wolves to suppress them, leads to greater chances that they will cross.

David Todd [00:43:32] I see, okay.

David Todd [00:43:35] So I think you mentioned earlier that there are these numbers of red wolves in Chambers, I guess other parts of Southeast Texas, became, became rare, a lot of the local folks were not aware of how rare they had become. And I think you said part of it was just the linguistic thing, that people were referring to coyotes as "wolves", when they were distinct. But, but I'm wondering if, if it was, you know, there might have been other things going on: that there was, you know, that the wolves were secretive and nocturnal, or that, I don't know, there just wasn't enough baseline data to compare the current numbers to, to know that, hey, you know, this is lower than it used to be. Or is there any other factor involved there in missing this big decline?

Jim Shaw [00:44:33] Well, one thing, for one thing, it's hard to find something when very few people are even looking. And nobody was really looking until really we got involved in the early '70s. Glynn Riley was aware of it, but he was, he was way ahead of his time. But most people just heard of these animals all described as wolves. And they, they didn't, nobody went in and said, "OK, the ones here, weigh an average of 56 pounds, and the ones farther inland average weight is 30 pounds." Now, that's a pretty big difference. And so, nobody was doing that kind of comparison. And coyotes were being controlled, just as wolves were, to protect livestock, and, you know, there's been a federal program for that that's been in place since the very early 20th century.

David Todd [00:45:38] Right. And just, I'd be curious to know from your study of canids, did you find that there was, there were, you know, strong indications that red wolves or even coyotes were taking substantial numbers of calves?

Jim Shaw [00:46:00] Well, to tell you the truth, the, there was never much research done on cost effectiveness of predator control, and the reason for that was the politics of it. Livestock owners were able to take advantage of this free or very low-cost federal service to get rid of what they were calling wolves. And the assumption was if you get rid of enough of these things, you won't have any problems with livestock losses. Nobody really went in and tried to measure the livestock losses and see how much that was in terms of economic costs, versus how much it cost to control whatever predators were there. So that was another opportunity that was missed because I think the people involved in predator control for the most part, they couldn't have wanted a cost/benefit analysis because it might have shown them the wrong thing, something they didn't really want to have to face. It may have been pretty much a waste of money.

David Todd [00:47:13] Interesting. So do you think that the cost of having these, these trappers out there might have been much greater, or somewhat greater, than, than the value of the calves that were actually lost to coyotes or wolves.

Jim Shaw [00:47:35] I'm very suspicious that was often the case. Now, if you look at animal damage control problems, whether it's black bears or coyotes or whatever, you see that the damage patterns vary enormously. One area to another and what seems to happen is you get animals as intelligent and adaptable as coyotes or black bears, they learn, and a few individuals will learn to exploit a new resource, be it calves or pigs or whatever that might be out there that belong to people. And they'll, and they'll hit them really hard.

Jim Shaw [00:48:14] So locally, you may have a population of coyotes or again, black bears or any other predators, that inflicts a great deal of damage. But then you move out 10 miles in any direction, and the damage may not be occurring at all because those individual predators haven't learned to exploit that particular resource and taught their young how to hunt them.

David Todd [00:48:44] Oh, that's fascinating. So.

Jim Shaw [00:48:47] Yes.

David Todd [00:48:47] So this was not hard-wired, inherited behavior and interest in taking a calf or a lamb, but it was something that might have been learned within a few individuals in a particular area, but not widely practiced by other animals.

Jim Shaw [00:49:08] Yes. And during that, during the '50s and '60s and into the '70s, the wool industry in the West was much greater than it is today, for various economic reasons. We import so much wool now that we really can't compete very well, and those big operations are not what they used to be. But coyotes find it very easy to kill, to kill sheep, much easier than cattle. And so most of the predator control to protect livestock during that period was done to protect sheep within those areas where the coyotes were expanding.

David Todd [00:49:50] Huh. But I guess this is a system that they set up, maybe for more vulnerable animals, and it also got applied to animals like calves that may be less vulnerable. Does that make sense?

Jim Shaw [00:50:05] You know, calves, calves are a lot bigger than, than baby lambs. I mean, they are a lot bigger and they've got more fight in them. They can kick. Their mothers are much bigger and can resist. So, it's not really that easy for coyote to take, to take calves or, more broadly speaking, cattle, than it is for them to take sheep. Sheep are just that much smaller and a lot easier to take. So there, the damage against sheep, which was really more extensive than it was against cattle.

David Todd [00:50:41] Yeah, I guess what I'm curious is if, say, you've got a federal system that crosses many states and crosses industry from, you know, sheep and goat areas over to cattle-dominant areas, and a system that works pretty well with maybe protecting sheep sort of gets overextended in an area where cattle are actually more common, but maybe not as vulnerable to predation. Is that fair to say, that it's just sort of an administrative fluke because these agencies, you know, have the system up and going, and maybe they apply it in the wrong place to the wrong animal?

Jim Shaw [00:51:27] Usually, the predator control specialists in the field were, they got really good about reading a carcass, and they could figure out whether or not, or the extent to which, there was a local problem with either sheep or, in some fewer cases, cattle. So, I don't think it was administrative. I think the agents, the ones I've known over the years and worked with, they're good observers, they know what they're doing. They don't always know how to trap

coyotes, but they, they know how to look at a carcass: "This was scavenged, but this one over here was a predator kill." Scavenging is not the same thing as killing the animal outright, because it died of something else. So that something else was probably the owner, but it's not necessarily a predator, just because it scavenged it.

Jim Shaw [00:52:19] It is pretty easy, with a little practice, to read whether or not a carcass we find that's been chewed on and partly consumed, was killed or if it had already died of other causes and was scavenged.

David Todd [00:52:36] OK. All right.

David Todd [00:52:38] Well, I guess one last question about decline. I mean, we talked a little bit about hybridization and predator control, and disease and parasites, and then the whole linguistic confusion. What do you think about just the land use changes in East Texas and maybe beyond? Was that a factor for the red wolf's decline?

Jim Shaw [00:53:02] I don't think it was much of one, because the red wolves have probably been restricted to the Gulf Coast areas for a long time, and the reason I think they held out there was when you get on the Gulf Coast of Texas, you get into salt marsh areas. That's really remote areas that's not very intensively used for ranching purposes, not, not like it is farther inland. And that's because that's salt marsh. It's remote, it's not very productive livestock habitat. So, there wasn't the intensity of use which would likely trigger more intensity of traffic, that accounted for getting rid of red wolves elsewhere, where livestock were really more abundant and more intensively managed. So that the ranches along the Gulf Coast, where I worked back in the '70s were really large tracts, and they were not very intensively used because they couldn't be. That's ... so you can't use salt marsh the way you use the mixed grass prairie, for example. You just can't run that many cattle in that intensive way.

Jim Shaw [00:54:20] So that I think Red Wolf survive there simply because there wasn't as much conflict, and certainly not nearly as much conflict on a day-to-day basis as would have been perceived farther inland where the, the numbers of livestock were higher and where people went out and looked, checked them every day and were quite aware if they, if they thought they had any problem with predators and then they'd call in the federal trappers.

Jim Shaw [00:54:50] So I think the reason they were on the Gulf Coast was not because that was especially rich habitat, although it certainly had a lot of nutria and swamp rabbits, but it was also a harsh habitat because it had a lot of parasites and diseases and flooding.

Jim Shaw [00:55:08] And, for that matter, I was never able to get a handle on how often alligators might have taken red wolves, but I know alligators really go for dogs. And alligators are all over that study area in Chambers County.

David Todd [00:55:23] I see.

Jim Shaw [00:55:25] So that it might have been another factor in keeping those numbers fairly low, which was depredation values.

David Todd [00:55:35] Mm hmm.

David Todd [00:55:37] So, you know, around the area, this just may be more towards Liberty County, but maybe not too far away, there's pretty extensive rice paddies and I I'm curious if

you think that the clearing and cultivation of those former prairies, you know, might have lost critical habitat for, for the red wolf?

Jim Shaw [00:56:04] Oh yeah, I think, I think that's a fair assumption that intensive rice production, like any kind of intensive agriculture, greatly diminishes the diversity of species that occur there, so it's less attractive to wildlife. So, yes, I think that conversion of those lands from salt marsh to say, intensive rice cultivation, which would have been detrimental to red wolves.

David Todd [00:56:31] Okay. All right.

David Todd [00:56:33] Well, thank you for giving us some ideas of why these, these animals have declined over the years and then finally, as I understand it, in the, what, '74-78 period, there was this decision made to collect whatever red wolves were still out in the wild. And that just strikes me as a really radical, unusual decision to just, to save this animal, we have to take it out of its habitat. And I wonder if you can give us any insight as to how that decision was made and, you know, how people went about actually capturing these animals that were in such a remote difficult-to-access area.

Jim Shaw [00:57:22] Well, to begin with, the captive propagation of endangered species is really not all that rare, especially if it looks like it's going to become extinct if you don't do it. And a good case in point is what happened to the California condor. The California condor at one point was exclusively in captivity. And they were able to breed them successfully in captivity and then were able to reintroduce them into the wild. So, I think it would have been a pretty strong consensus about the red wolf that by the mid-'70s we needed a captive breeding population as, as insurance against eventual extinction.

Jim Shaw [00:58:07] Because with each passing generation, there was more opportunity for hybridization. And of course, that's irreversible. You can't, you can't reverse engineer a hybrid back to a red wolf. So, I think the main reason that they were taken out of the wild was concern that they couldn't be sustained in the wild, given the threats that were arrayed against them - hybridization being one big one.

David Todd [00:58:40] So, how was this done? I mean, I gather that at one point these red wolves got down to just very, very low and scattered numbers. I think I read in one of your pieces - one per 66,000 acres in Jefferson County. How did they manage to collect these, these remaining red wolves?

Jim Shaw [00:59:07] Well, it really isn't that hard if you know what, if you know what you're doing. One of the ways you can do it is you go out and do the howl surveys and since the howls of red wolf is so different from that of a coyote and presumably, hybrids, it's relatively easy to find out where there's still some left.

Jim Shaw [00:59:29] Also an experienced trapper can go through and look at track size. And that's a muddy area - the road that go out in the salt marsh, in the coastal prairie, are unpaved for the most part, most of all unpaved. And with all that rain you get, you see lots of tracks. And just an experienced field person can distinguish wild canid tracks from dog tracks. So, once you make that distinction, it's a matter of size, how big is that track.

Jim Shaw [01:00:05] So between the howls and the track sizes, it would be pretty easy to find areas where you had at least one or two of these bigger animals and you can concentrate trapping in that area until you get them.

David Todd [01:00:23] And was there any particular way to lure them in, once you knew where they were in that locality?

Jim Shaw [01:00:32] No, no, they just used a modified steel leg-hold trap with tranquilizer tabs and they were not staked down. They were put on a drag so that the animal's chances for injury were greatly reduced. And that's how, that's how the ones were caught for my study. So, Glynn Riley brought them. It was just a conventional steel leg-hold trap, with tranquilizer tabs applied so the animal, when it's trapped, chews on the tab and it calms them down, so it doesn't fight the trap and doesn't injure itself. And the traps were never staked down, they were put on a drag instead: a little harder to find the animal, but much less likely to be injured.

David Todd [01:01:15] I see.

David Todd [01:01:17] And then once they got these red wolves together. I think I read that they were taken to Anahuac, is that right?

Jim Shaw [01:01:26] Well, we, we temporarily kept some there, where we were trying to figure out the morphological differences and differences in size and some behavioral traits like the tendency to gape or not to gape. But those were temporary situations. Those were, those who are not part of a captive breeding program, and that was, once it was established, that was at the Point Defiance Zoo in Washington, State of Washington, for many years.

David Todd [01:01:58] You know, I was really interested in your, you know, perspective about how these coyotes and wolves respond to a threat so differently because I've read that there was a lot of confusion about trying to distinguish them on the basis of morphology - you know, all these measurements about their hind legs and their skull shape. And can you talk a little bit about those sort of morphological efforts to distinguish coyotes and wolves and maybe some of the hybrids?

Jim Shaw [01:02:39] Well, one of the one of the most obvious characteristics is the difference in size. In other words, the animals who are the best candidates for a captive breeding propagation were the least coyote-like. They were much larger. Now, the drawback of doing that is, of course, you're pulling your big breeders out of the wild and you basically undermine that population in the wild. And that's exactly what happened. But by then, there were some in captivity.

Jim Shaw [01:03:09] And as you know, they tried to reintroduce, with mixed success, into mainly North Carolina. And it's very difficult to sustain red wolf populations in that part of the world, because you're dealing with a large carnivore that has a big home range size. And you have to have a viable population, which means you've got to have a number of breeders, not just two or three or four or five. It's got to be bigger than that.

Jim Shaw [01:03:38] So if you do some arithmetic and you look at the territory size and how big an area it would take to sustain a red wolf population entirely in the wild, you're looking at about county-size area. And the problem is, if you look at the original range of the red wolf as we understand it, it is basically the southeastern United States, roughly from Virginia, south into Florida and west to, well into East Texas. And that was basically the geographic range.

Jim Shaw [01:04:13] Well you look for federal lands where they could be protected, on a big scale, and you don't have them there the way you have them in the West, you know, where you get places like Yellowstone National Park which is big and protected. And that's just part of the problem with trying to sustain red wolf.

Jim Shaw [01:04:33] You don't want to keep in captivity indefinitely because they lose learned traits. And they're not as hardy. What are you going to do with them? Is it OK just to have them in the zoo and captive, and if they're not extinct? Well, to be really a wild species, they need to be, some of them, need to be in wild.

Jim Shaw [01:04:53] And then the problem becomes, how do you find a large enough area to sustain, and I'm a little rusty on my genetic models, but I would just, to give a rough estimate, I think you would need at least 20 to 30 pairs of red wolves all in the same general area to sustain that population genetically and demographically. And if you add up those territory sizes that are pretty darn big, that means a huge area has to be protected. And that's been a real thorn in the side of red wolf recovery all along because there aren't huge national parks in the southeast. There aren't really huge national wildlife refuges like there are in Alaska, for example. They're not big enough to sustain this population.

Jim Shaw [01:05:56] So, based on that restriction, probably the most viable way to sustain red wolves in a sort of a wild fashion is to have smaller populations than can sustain themselves entirely on their own, and keep supplementing those with captive-bred animals being introduced in that general area to replace those that are lost to various causes.

Jim Shaw [01:06:27] That's not entirely satisfactory, obviously, because you've still got human interference. But that's a lot better than having them go completely extinct in the wild.

David Todd [01:06:39] Is it difficult to take a captive-bred animal and introduce them to the wild? I mean, do they learn, um, you know, the nature of their habitat and how to predate and so on, or is it a pretty slow process?

Jim Shaw [01:07:00] It, it's, it's very difficult because things like wolves learn to hunt from their parents. And there's no way they can learn that in captivity.

Jim Shaw [01:07:12] Now if you look at the way the wolves who reintroduced into the northern Rockies, those were wild-caught wolves from Canada. They weren't captive-bred wolves.

Jim Shaw [01:07:22] And they kept them in these holding facilities in places like in and around Yellowstone, to get them acclimated to the area. And they fed them things like carcasses of, of elk. So, these were wolves that came out of the wild, and they knew something about hunting large mammals. And they got to eat elk, and they got acclimated to the place, and they open the doors and released them.

Jim Shaw [01:07:47] So they adapted pretty quickly, but they were not captive-bred. And that's a real problem for red wolves, is that captive-bred means they'll maybe learn, maybe learn to hunt relatively small prey. But to take something a little the size of a white-tailed deer is a little trickier to learn how to do that in captivity, which you really can't. So that, that is a, that's a drawback.

Jim Shaw [01:08:17] But they have succeeded in getting red wolves back into the wild. They've adapted and they've reproduced, but they don't have the numbers that can sustain themselves. So I think the only thing, the only way I can see managing red wolves, is to have a backup of captive-bred animals that you keep feeding into these small populations to keep them from going extinct.

David Todd [01:08:45] I see.

Jim Shaw [01:08:47] It's imperfect, but it's better than extinction.

David Todd [01:08:52] Right. Well, just to pick up on that theme of, of extinction and how it, it seems kind of like an elusive thing to me because I understand that while the species, you know, may be hybridizing and diluting and becoming scarcer, their, their genes, I think they call them, what, "ghost alleles", may be popping up in animals that are still wild and I've been interested in reading about these wolf-like canids that have been found on Galveston Island and maybe in South Louisiana. Have you been following that? Do you have any thoughts about those hybrids and the genes they may still carry on from the red wolf?

Jim Shaw [01:09:52] I'm aware of those efforts. It's not an effective conservation strategy because you can't unscramble a hybrid. You know, they may they have some alleles from red wolves, but they're not red wolves anymore. And you can't, you can't reverse that process. And I think that, combined with wishful thinking, well-intentioned people think, "Well, there's a population of red wolves on Galveston Island that has been there all this time, that coyotes haven't gotten to yet, but nobody really looked at them and realized that. So, I'm going to look at them and I'm going to prove them wrong and make this big contribution."

Jim Shaw [01:10:35] But Galveston Island was always within that *Canis rufus rufus* range. And those animals were hybrids for a long, long time. And yeah, you may get some, some that are bigger than coyotes, and some that have more of a reddish tint than most coyotes. That doesn't make them red wolves. They're hybrids, and there have probably been hybrids on Galveston Island for a long time.

Jim Shaw [01:11:00] Now Louisiana might have a little more promise because that's a lot farther away from where coyotes occurred for a very, very long time. But same thing applies: if you can't demonstrate, and now with molecular genetics, you can come close to testing these things thoroughly, if there's any detectable hybridization in there, you can't really get rid of it. It's there.

Jim Shaw [01:11:26] So I think there's some wishful thinking, combined with, with a failure to understand that you can't reverse hybridization.

David Todd [01:11:41] You know, it's interesting to me how this genetic testing has, has had an impact on understanding the, the trajectory of these red wolves. And I guess you've worked through that whole period when it has become more common, is that fair?

Jim Shaw [01:12:05] I don't think I followed the first part of your question. Could you repeat that?

David Todd [01:12:09] Well, I'm just curious to see, and maybe you can explain it, because you, you were working in the earlier days when, you know, you had to look at more sort of gross elements of what makes a species distinct, you know...

Jim Shaw [01:12:24] Yes.

David Todd [01:12:25] Look at the morphology, the way they gape, or the color of their fur. And now there's this incredible opportunity of using genetic testing where you can be so precise. And I was curious if you could tell us a little bit about what that's meant to, to some of your research.

Jim Shaw [01:12:44] Well, I really haven't used molecular genetics in research, and that came along after I had something to do with red wolves. We did a little bit of allozyme genetic comparisons and found some, some differences that were consistent with the morphology. And again, that's between the animals on one side of Galveston Bay and on the other side of Galveston Bay. Those were really different, different animals. They, there was a difference in size, difference detectable genetically. And there was a difference in the behavioral characteristics that was found to have a genetic component.

Jim Shaw [01:13:18] So that was about all we had back then. We didn't have the type of genetic mapping that is common today.

David Todd [01:13:27] I see. Yes.

David Todd [01:13:30] Well, you told us a little bit about the future role you see for the red wolf, at least the way it might be sustainably maintained in the wild. And I was curious if you had any thoughts about these other animals that are, you know, hybrids, but that be out on this same Southeast Texas landscape. Do you think that they, they serve a similar ecological role, although they are not red wolves, but they are preying on the nutria, and the beaver and other animals?

Jim Shaw [01:14:12] Oh, yeah. I think the ecology is probably quite similar. As I understand it, from Russell Clapper, a few years after I left, the nutria began to diminish in abundance. And that often happens with an exotic introduction. You know, they'll go like gangbusters for a while. And then some of the local parasites, diseases or the predators, or some combination, will become better at exploiting them. And they'll start to go back, start to go down. I don't think the nutria are as abundant as they used to be. There's still a lot of nutria though, and there's plenty of rabbits.

Jim Shaw [01:14:55] And I think that the ecology, if we just look at food habits back in the early '70s in Chambers County, versus whatever is in Chambers County now, that, that we'd find that population is pretty much the same foods as the red wolves did 50 years ago.

David Todd [01:15:16] That's interesting, so there is this, I guess it is, it's at such a rapid rate, but is this a form of evolution or what, what do you, how do you view this transition from the red wolf in Southeast Texas to these hybrids?

Jim Shaw [01:15:37] Well, as I said earlier, we used to think that interspecies hybridization among vertebrates, other than fish, was extremely rare. We now know that it's, it's more common than we thought and furthermore, human activity can greatly increase the chances of interspecies hybridization, as it did with the, with the, with the coyote, because producing wolf numbers increases the chances you're going to get some hybridization with coyotes.

Jim Shaw [01:16:14] Furthermore, whenever you apply any kind of stressors to a population, your, may it be predator control, or be it a new disease or parasite, that destabilizes that population. It changes the behavior of the survivors. It changes the way they go about their life history. So, you get all that. Human activity is, is really creating more opportunities for genetic changes, such as to hybridization.

Jim Shaw [01:16:47] Now, that said, hybridization between species, even before there were humans around, no doubt happened, and it no doubt influenced the evolutionary pathway of a fair number of, of species of vertebrates. But it was probably minor. I mean, it's not like it's a huge thing, but it's always been there. Yeah, it's, it's, it's, you can see it in evolutionary context. It's something that happens quickly rather than over large expanses of geological time.

David Todd [01:17:24] That's really helpful, thank you for explaining that.

David Todd [01:17:29] Well, as we wrap up, you've been so generous your time, I was curious if there might be anything else that you would want to tell us about, you know, from your career and the insights you've gained on wildlife in general, but maybe the red wolf in particular, as just an example of the many things that you've thought about over the years.

Jim Shaw [01:17:56] Well, I think I've given a thumbnail sketch as to how I think they could manage red wolves using a, in a sense, it's a hybrid model between captive propagation and life in the wild. So, using the, you sustain the wild population by introducing on a regular basis a few more from the captive population and somehow hope for the best. That seems to be about the best chance the red wolf has.

Jim Shaw [01:18:28] Now over time, it may still be that there are enough coyotes, to where it's going to be very difficult to sustain them in the wild genetically. And if you look at the red wolf overall, you look at the area required to sustain a population, which is vast. You look at the lack of protected federal lands of that size in the Southeast. And you throw in the constant threat of hybridization with coyotes. That's not an endangered species that has as good a chance to recover as, as, say, the bald eagle, which is now delisted, or the California condor, which is doing reasonably well in the wild now.

Jim Shaw [01:19:19] It's, the red wolf, presents a huge challenge because of the unique characteristics of the lack of expansive areas of protected land, the hybridization threat - those make it a real challenge. And it will require pretty intensive management. That is to say, the animals in the area would have to be tested genetically, really every, probably every two or three generations, to make sure that you're not getting some detectable change drifting towards coyotes. And we do have the genetic tools that we didn't used to have that do make that possible to monitor at a pretty close level. But at the same time, it's going to require some effort. It's not going to be an easy recovery in any circumstances.

David Todd [01:20:14] Yes. Well, I guess it points to, all the more, the value of the work that you did, now almost 50 years ago to understand them when they were still, you know, persisting in Southeast Texas.

David Todd [01:20:32] So thank you for your contributions there and then just for talking to us today.

David Todd [01:20:39] Is there anything you'd like to add as we wrap up?

Jim Shaw [01:20:43] No, I will make an effort to try to locate Glynn Riley. If I do find something, I'll let you know.

David Todd [01:20:52] I'd greatly appreciate that.

Jim Shaw [01:20:53] If there's anybody that really, if there's one person that you could interview for the red wolf, that, that would be my number one choice straight away. I'll also checked with Dave Mech. Mech might have some contact with him. So, I'll check that way, too.

David Todd [01:21:10] Well, that's very kind of you.

Jim Shaw [01:21:15] All right?

David Todd [01:21:15] Thank you very much, Dr. Shaw. I really appreciate your help today, and then also your kind offer to see if there might be others who could tell this, help fill in the story about the red wolf.

Jim Shaw [01:21:28] Yeah, I think it would help, it would help you in your understanding if you can track down that Natural History article that Peter Jordan and I published in the 1977, December 1977, Natural History magazine. I think that article summarizes what we knew then very, very well. There's a lot of detail in there, and that might help you too.

David Todd [01:21:54] Okay. Well, very helpful advice, and thank you again for taking time out. I know you're busy with your pending move. So, my thanks.

Jim Shaw [01:22:06] OK. You're quite welcome.

David Todd [01:22:08] All right. Good talking to you, I appreciate it.

Jim Shaw [01:22:11] Bye now.

David Todd [01:22:11] Bye.