

## **TRANSCRIPT**

**INTERVIEWEE:** Gary Garrett

**INTERVIEWER:** David Todd

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**David Todd** [00:00:02] Okay. Well, good afternoon. David Todd here. And I have the great privilege of being here with Dr. Gary Garrett.

**David Todd** [00:00:12] And with his permission, we plan on recording this interview for research and educational work on behalf of a small non-profit called the Conservation History Association of Texas, and for a book and a web site 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** [00:00:38] And I want to stress that he would have all rights to use the recording as he sees fit. It is his.

**David Todd** [00:00:45] And I wanted to make sure that this arrangement sits well with you and what you might have expected.

**Gary Garrett** [00:00:51] Certainly.

**David Todd** [00:00:52] Okay, well, then let's get started.

**David Todd** [00:00:56] It is Wednesday, June 28th, 2023. It is about 2:15 p.m., Central Time.

**David Todd** [00:01:05] My name, as I said, is David Todd. I am representing the Conservation History Association of Texas and I am in Austin, and we are conducting a remote audio interview with Dr. Gary Garrett, who is based in the Mountain Home, Texas area.

**David Todd** [00:01:24] As just a really brief, superficial introduction to Dr. Garrett, he is a research biologist in the Department of Integrative Biology at the University of Texas, and that followed his tenure at Texas Parks and Wildlife, where he served as director of the Watershed Conservation Program and as a conservation biologist at the Heart of the Hills Fisheries Science Center.

**David Todd** [00:01:51] During his career, he studied many things and worked on many projects, but he had a special interest, as I understand it, in study and conservation of desert fishes, such as the Devils River minnow and the Pecos and Comanche Springs pupfish. And of particular interest today, he has also been really involved in the restoration of the Guadalupe bass.

**David Todd** [00:02:13] So, today we'll talk about Dr. Garrett's life and career, so far, and especially focus on what he has learned about the study and conservation of the Guadalupe bass and also several desert fish. And they will take as just examples, the Pecos and Comanche

Springs pupfish and the Devils River minnow, among many that I'm sure he's been engaged with.

**David Todd** [00:02:38] But, so with that little introduction, I wanted to thank him for doing this.

**Gary Garrett** [00:02:44] My pleasure.

**David Todd** [00:02:45] All right.

**David Todd** [00:02:45] Well, how about if we start, basically chronologically, and ask you about your childhood and early years and if there were some people or events in your life during your youth that might have influenced your interest in nature and and fish in particular?

**Gary Garrett** [00:03:02] Well, I suppose I had the good fortune of growing up on the coast of Texas near Corpus Christi, and as a teenager spent most of my free time on the beach, surfing and just enjoying life on the beach, as most kids that age would do. So, that was just otherwise just a pretty normal childhood.

**Gary Garrett** [00:03:27] Things really gravitated towards a career in biology once I went to the University of Texas and met Dr. Clark Hubbs and he took me in as one of his graduate students. And from there, the influence of Clark and fellow graduate students really opened my eyes to a wonderful world of biology, particularly freshwater fishes and the conservation that's absolutely necessary to keep them around for future generations.

**Gary Garrett** [00:04:06] So, prior to arriving at UT and meeting Dr. Hubbs and your grad student colleagues, was there any teacher or mentor or sort of informal adviser in your earlier years in grade school perhaps that might have been...

**Gary Garrett** [00:04:30] Not really. I was just a kid going to school, enjoying life. I really had no thought of going into biology or anything like that. Just, you know, trying to pass one grade and get to the next and get to the University of Texas and figure out what I wanted to do with my life.

**David Todd** [00:04:51] Fair enough.

**David Todd** [00:04:52] You know, something else we often ask people about is if there might have been some sort of informal kind of exposures, you know, to things in the culture - TV shows, movies, books - that you might have been in contact with and soaked up some interest in the outdoors and fish.

**Gary Garrett** [00:05:11] Not that could put my finger on. Like I say, mostly just camping out on the beach, surfing, just fishing, just, you know, living in a kid's paradise back in the late sixties. So just that kind of engendered a love of nature. It wasn't, like I say, until later that it dawned on me that maybe I could do something about helping it, you know, preserving nature for the future.

**David Todd** [00:05:43] Well, how about if we start with the origins of your career. As I understand you, you began work at Texas Parks and Wildlife in 1982. How did you start your tenure there?

**Gary Garrett** [00:06:03] Well, I applied for a job and fortunate enough to get it. I was the first Ph.D. hired by Inland Fisheries in Parks and Wildlife. So, and back in those days, Texas Parks and Wildlife really wasn't spending much time and effort on conservation and endangered species and things of that nature. They were a sportfish, hunting and fishing operation. And so I was kind of the oddball.

**Gary Garrett** [00:06:37] But Clark Hubbs had advised me that he said, "You know, you've really got a strong desire for conservation and appreciating nature. I've spent my most of my career fighting Parks and Wildlife on many issues from the outside. If you get on the inside, and gain respect and credibility, maybe you can do some good."

**Gary Garrett** [00:06:59] So being a fairly naive kid, I thought, "Heck yeah, I'll just go do that."

**Gary Garrett** [00:07:06] But began doing research at Heart of the Hills Fisheries Science Center. And had a variety of projects - some around bringing in exotic species to stock in the lakes, such as peacock bass and Nile perch, which I fought. But, they were my assignments. So, I just told my superiors that I'll do very good science for you, but I think I'm going to end up showing you how it's a bad idea. And indeed, that happened.

**Gary Garrett** [00:07:41] As I say, my interests were really more in endangered species and conservation, and native fishes in general. But there wasn't a lot of support for that.

**Gary Garrett** [00:07:56] But, Guadalupe bass turns out to fit both categories. It is a sport fish. The only place that occurs in the world is in the Hill Country of Texas. And it was also very rare. We were losing it.

**Gary Garrett** [00:08:13] As Clark had told me, and fellow graduate student Bob Edwards, he did his dissertation on Guadalupe bass and found it was hybridizing with smallmouth bass. We knew their numbers were going down because of habitat loss.

**Gary Garrett** [00:08:30] So, I convinced my bosses that it would be a good project to try and see what we can do to avoid this loss of a potentially very valuable sport fish. They agreed. We went on from there.

**David Todd** [00:08:47] Well, maybe you can give us a little bit of background about the Guadalupe bass, you know, the general outlines of its life history and the ecological niche that it fills.

**Gary Garrett** [00:09:02] It's, as I say, it's the only place that occurs in the world is, is in the Hill Country of Texas. It's a Texas endemic.

**Gary Garrett** [00:09:11] It's specialized for living in Hill Country streams. The only, I guess, part of the stream it doesn't live in is in the headwater spring environments that's taken up by largemouth bass. So largemouth bass and Guadalupe bass kind of split up the environment: largemouth are in the headwaters, as well as the deep pools in the streams. The Guadalupe bass are specialized for the fast-flowing riffles and rapids in between these deep pools, and they do quite, quite well in that, which makes them a very popular sport fish, even though they don't get very large. When they do take a hook, they tend to turn, kind of turn sideways into the current. And once you hook a Guadalupe bass, you think you've got something huge. It's just using the current to fight.

**Gary Garrett** [00:10:06] But they are are a lot of fun. As is often said, you just don't catch Guadalupe bass in an ugly place. It's just is in this beautiful Hill Country.

**Gary Garrett** [00:10:18] They, I guess, another interesting thing about what they do in that fast water: they don't just sit out there in those rapids, just burning up energy, fighting the current. They get behind rocks or stumps out of the current, but they watch the things coming down there, from small fish to insects. And they'll dart out and nab it and then slide back over out of the current again.

**Gary Garrett** [00:10:47] Which again makes it very popular for sport fishermen, fly fishermen as well, because they can then utilize that trait to catch the Guadalupe bass.

**David Todd** [00:11:01] Okay. So, you know, my understanding is that the Guadalupe bass was not always distinctly recognized. And there was some confusion over the status of it as a species that took a while to sort out. Is that right?

**Gary Garrett** [00:11:20] Yes. Of course, this was, there was confusion over Microperus bass in general in the twenties, thirties and forties. Initially, it was thought they were just one species and now there's two or three or four.

**Gary Garrett** [00:11:37] Guadalupe bass were thought of as just a, in fact, they were called the same thing as the smallmouth bass. They were thought to be the same. As I'm drawing a blank on the name. I'm just drawing a total blank. Anyway..

**David Todd** [00:12:12] It's too easy a question for you. It is just, I shouldn't throw you these kind of third grade questions, I guess.

**Gary Garrett** [00:12:22] Anyway, they were recognized finally as a their own unique species by Clark Hubbs in the fifties, I think, early fifties. It's spotted bass. I don't know why I wasn't pulling it. I just drew a blank on it.

**David Todd** [00:12:42] Yeah, yeah.

**Gary Garrett** [00:12:43] They got to be thought as the same thing as spotted bass, which occurred throughout East Texas and actually off the Plateau, on the coastal plain. So they're, spotted bass, are in the Guadalupe River, the Brazos River, the Medina River, all these rivers that the Guadalupe bass are in, but they're on, after you come off the Plateau, on the coastal plain.

**Gary Garrett** [00:13:04] So they were just thought of as all being the same thing.

**Gary Garrett** [00:13:08] And Clark, as he told it, was, I think in the San Marcos River, I don't remember for sure. Maybe the Guadalupe was seining, and he seined up both spotted bass and Guadalupe bass, and he could tell them apart. It was right there at the juncture of the plateau in the coastal plain.

**Gary Garrett** [00:13:28] And from there proceeded to delve into that a bit more and went on to show that they were indeed their own species, decades later, with electrophoresis and other biochemical abilities, they were shown to, for sure, yes, they are, they are different species.

**David Todd** [00:13:51] Interesting. And then, I guess, shortly after you were able to sort out A from B, started to realize that A and B were hybridizing or that there was hybridizing going on between the smallmouth and the Guadalupe bass. Is that correct?

**Gary Garrett** [00:14:09] Yeah. Smallmouth were brought in to Texas, really, I think as early as in the fifties, but more heavily stocked in the seventies. It was back in the day when most agencies such as Parks and Wildlife kind of had a "do-it-and-see-what-happens" attitude. Didn't, weren't really aware of the sorts of harm they could cause. And really didn't think they could cause any harm.

**Gary Garrett** [00:14:36] So smallmouth bass don't occur naturally in Texas, of course. And they thought, "Heck, let's bring in another sport fish. This would be great." And they started stocking them.

**Gary Garrett** [00:14:46] The problem is because they've never evolved anywhere near each other, Guadalupe bass and smallmouth bass don't notice that they're different. In fact, maybe they find each other kind of attractive because they're a little bit different, act a little differently, look a little different. They look a lot different, actually.

**Gary Garrett** [00:15:03] But they started hybridizing. And that was kind of when I came onto the scene when this hybridization looked like it might be an issue.

**Gary Garrett** [00:15:14] So, one of the first things I did at the Heart of the Hills was we just started collecting Guadalupe bass throughout the range.

**Gary Garrett** [00:15:23] And we found that hybridization was anywhere from 30 to 50% of the population in these various rivers. Which clearly was not a stable situation. That was only going to get worse and we would ultimately lose the Guadalupe bass to hybridization. So, that just, we just couldn't let that happen.

**Gary Garrett** [00:15:49] The problem was how do you fix something like that? And that's never been fixed before, that we knew of at the time.

**Gary Garrett** [00:15:57] And the only thing I could think of to try was to raise millions of Guadalupe bass, pure Guadalupe bass at the research center, and just pour them into the rivers, starting with Johnson Creek, a tributary of the Guadalupe River that's right there by the research center. And, just see if we could just overwhelm the population and dilute the hybridization down to, get it as near zero as possible.

**Gary Garrett** [00:16:28] Turns out that works. Takes a long time, takes a lot of effort, takes some money, but it works.

**Gary Garrett** [00:16:35] The other thing was Parks and Wildlife, once we found this issue, agreed to stop stocking smallmouth bass within the range of Guadalupe bass.

**David Todd** [00:16:51] So I guess this work was part of the Guadalupe Bass Restoration Initiative. Is that right?

**Gary Garrett** [00:16:58] It wasn't. I was doing that in the late eighties, early nineties. It really wasn't. I mean, so we have that focus, that effort to do it, it wasn't really until about 2009

when Tim Birdsong came along, and just really had the vision of dramatically increasing the program. And we worked together to develop the Guadalupe Bass Restoration Initiative and secure funding through the National Fish and Wildlife Foundation.

**Gary Garrett** [00:17:27] Tim is just a genius at finding funding sources. He has this awesome vision of how things can come together and work. So, partnering with him was just awesome. And just the whole program just took off from there.

**David Todd** [00:17:49] Well, maybe you can talk to us a little bit about some of the strategies of trying to restore the Guadalupe bass. As I understood it, one of the tactics was to create sort of strongholds, refuges, for the Guadalupe bass and maybe other rare species. What was the thought there?

**Gary Garrett** [00:18:13] This is something else that collaborating with Tim we came up with. And again, I credit Tim's vision and hard work for this.

**Gary Garrett** [00:18:21] We created the Native Fish Conservation Areas of Texas. We now have 20 of these. But it evolved first with us looking at Guadalupe bass and what all we could do. Understanding that just purifying the species, removing the hybrids, wasn't enough. They need good habitat. They need healthy biodiversity. But then all fishes do, and then everything else that lives around it - in the uplands, on the riparian areas - everything needs that.

**Gary Garrett** [00:18:57] So, what we did was... You know, Texas is a big place and there's no way we could just do it all, do everything everywhere. So, we spent some time developing, going through the data, and looking at where there were areas that we could delineate that either were in pretty good shape and we could work very hard to keep them that way, or they needed help, and it was possible to help. There's some places that are just so hammered, just not going to do much about it. But there were places that needed a little help, a little love, and we could bring them back.

**Gary Garrett** [00:19:37] So these Native Fish Conservation Areas, each one has its own suite of focal species, we call them - the ones that we're really trying to help, or the ones that are really good indicators of what's going on, good or bad. And in that way, we could focus our efforts in a more concerted way, in a more efficient way to enhance or preserve these areas, and throughout the site. As I say, there's 20 of them throughout the state.

**David Todd** [00:20:15] So I think that, from what I've read, the conservation work for the Guadalupe bass involved restoration for three rivers and then preservation of intact populations in another seven streams. And can you maybe give us a little bit of insight into what you would do for one of these rivers that needed to be restored, and then another for what you did if you felt like you had a pretty intact stream, but it needed to be preserved.

**Gary Garrett** [00:20:52] Yeah, two of them. The one that's needed a lot of work was the Guadalupe River. And that, as I say, entailed reducing the hybridization back down to at least below 10%. Getting it down around one or two is ideal. But part of that, though, is then there's so many other things that need to be done. It's public education. It's getting other conservation agencies or interested people involved. It's getting local politics, cities and counties, involved in reducing erosion, restoring riparian habitat, protecting it, limiting sediment inflows. And letting people understand, helping them understand how it's not just for that fish, or those fish, or that bird or anything like that. It's for the whole thing and it's for you as well.

**Gary Garrett** [00:21:50] Good quality flowing water is good for everybody. And conversely, if you don't have that, it's bad for everybody.

**Gary Garrett** [00:21:59] So it's kind of getting those light bulbs to come on. But having the Guadalupe bass as kind of our our iconic species helps a lot. If it was just, you know, one of our minnows or a pupfish or something like that, they just don't engender the kind of public support that you, at least the broad public support, but a really cool fish like the Guadalupe bass, a sport fish that's really now worth millions of dollars a year, brings in to the local economies, that helps people see it's not just some, you know, Dicky Bird, kind of a tree hugger sort of thing. You know, as we were called back often in those days.

**Gary Garrett** [00:22:46] But yeah, so the Guadalupe bass is kind of our our iconic species that helped drive the whole system. But then once the light bulbs come on, people say, "Oh, okay, this all makes sense now."

**David Todd** [00:23:01] And then I gather there were some other streams that were in pretty good shape.

**Gary Garrett** [00:23:07] The Llano was at the other extreme. Yeah, that's in in very good shape. So what we do there is work to keep it that way, and make sure people understand what's good about the shape that it's in and how that's, again, how that's good for them.

**Gary Garrett** [00:23:22] The Llano River supplies a vast majority of of drinking water for Austin, for example. Most people in Austin didn't know that. So they make sure they understand that.

**Gary Garrett** [00:23:33] Even the people up in the headwaters - Junction and downstream to Llano, Mason, through there - they love the river, but, you know, you just take it for granted. It's human nature to just take things for granted.

**Gary Garrett** [00:23:44] And if it slowly starts to degrade, it's so gradual that you just don't notice it and get used to it.

**Gary Garrett** [00:23:51] So it was developing local support. The Llano River Watershed Alliance was developed around this, too, to help with that. Texas Tech University's field station in Junction was heavily involved.

**Gary Garrett** [00:24:09] And it's more just getting people to understand what's good and what's bad - how low-water crossings or bridges can be harmful, or they can be built properly and be just fine.

**Gary Garrett** [00:24:23] The, a healthy Llano River brings in a lot of kayakers and fishermen. That's worth lots and lots of money to those local economies: making sure they understand that. And seeing and doing the research to show them the data of how many dollars are actually flowing.

**Gary Garrett** [00:24:39] Birdwatchers: spend lots of money. They're taken for granted. You don't think about it. You know, you don't do much more. But once they understood the value of that to their communities, it helped a lot to have things done right.

**Gary Garrett** [00:24:54] Llano river State Park is there, and that's a great source for education locally.

**David Todd** [00:25:02] So, I sort of picked up on you talking about low-water crossings. And, you know, I had heard before about the hybridization risk from the smallmouth bass stocking. But, I really hadn't thought about the flow alterations. And I was curious if you could talk some about how the hydrology of some of these streams connects with whether the Guadalupe bass does well or does less well.

**Gary Garrett** [00:25:31] Well, the easy one is the low-water crossings themselves. In the old days, they were just made as cheaply as possible. Why would a local county government or whatever want to spend extra money on making a gold-plated one, if they could do a simple one.

**Gary Garrett** [00:25:48] Problem is that it does change the flow. It backs water up. It reduces or totally eliminates movement of fishes up and down the stream. And of course, that's part of the fish's life cycle to do that. They often blow out, which then creates all sorts of other issues.

**Gary Garrett** [00:26:09] But even the bridges themselves, the way they're designed, was typically just to allow that water to flow - a hole underneath it, basically to flow through. And the inevitable floods come along that tend to scour out around it, cause major erosional issues.

**Gary Garrett** [00:26:29] So, in bringing in some of the science of what was known about that, we worked with a lot of local authorities on that. Basically the simple thing is you build a bridge, an opening underneath that bridge, way, way wider than the stream itself. That's the simple version of it. So, that when it does flood, it still doesn't cause any issues.

**Gary Garrett** [00:26:52] That's great for the people to build bridges because it doesn't blow the bridges out too, just costs a little more to build it in the first place. So again, it's just bringing the science and the data to these people to convince them to modify their actions a bit.

**Gary Garrett** [00:27:12] So, I gather that a lot of these Hill Country streams have a big spring component, ground water connection. Do you feel that there is a connection between the amount of pumping in these aquifers and the kind of flow that those creeks and streams are seeing?

**Gary Garrett** [00:27:34] Absolutely. In fact, not a lot of them - every single one of them depends on spring flow. Every one. And as we pump the aquifers down, the stream flows less. So there's less water available. Also the water heats up more, evaporates more, because there's not as much flow. There's all sorts of issues.

**Gary Garrett** [00:27:57] That's an issue that, I don't know, I've done a lot of work, and we can talk more about that later, in the deserts with spring flows, because it's even more apparent and more critical in desert springs.

**Gary Garrett** [00:28:11] But, the problem with that is a state law, for one, the Rule of Capture. It's kind of, it's weird that surface flows are regulated for the good of the public, but aquifers are totally unregulated, so a person can pump just as much as they want to. There's not... it used to be even worse. There are some regulations on that now that helps out a bit, but there's still not the level of regulation that is needed.



**Gary Garrett** [00:28:49] And it's ironic to me, I mean, I've talked to and worked with a lot of private landowners and they'll first come up with, you know, "Well, it's the water underneath my land: it's my water. You can't... that's private property."

**Gary Garrett** [00:29:01] See, the problem is when you're pumping that water, or even worse, when your neighbor's pumping the hell out of that water, he's taking your water too. You know, it's not a fixed amount just under your land. So it's, it doesn't make sense to allow that.

**Gary Garrett** [00:29:18] The kind of example I gave, have given to landowners.

**Gary Garrett** [00:29:23] I'd say, "You understand how things are on the surface."

**Gary Garrett** [00:29:26] You'd say, "The surface is mine and I can do whatever I want to with it. If I want to, I can just bulldoze down everything on my land, I can do it. I know it's dumb, but I can do it."

**Gary Garrett** [00:29:36] I'd say, "Yep, you sure can."

**Gary Garrett** [00:29:38] But what about if your neighbor did that and bulldozed everything down and took all the soil off his land? You'd say, "Stupid, right?"

**Gary Garrett** [00:29:45] "Yep."

**Gary Garrett** [00:29:45] "Well, what about when he did that, the soil in your land flowed over and filled his back up, and then he carried it out again and sold it all again?"

**Gary Garrett** [00:29:56] "And then more of the soil on your land went over and filled it back up."

**Gary Garrett** [00:29:59] You'd say, "He's stealing your land, right?"

**Gary Garrett** [00:30:01] They'd say, "Well of course."

**Gary Garrett** [00:30:02] That's how aquifers work.

**Gary Garrett** [00:30:05] So they'd go, "You know, I hadn't seen that."

**Gary Garrett** [00:30:07] But that is how aquifers work. So you're taking everybody's water when you're pumping.

**Gary Garrett** [00:30:12] So more regulation is needed.

**Gary Garrett** [00:30:14] But, you know, you get into the whole issue of population growth. There's more water needed.

**Gary Garrett** [00:30:21] I don't know. That's, that gets way, way above my pay grade to deal with that.

**Gary Garrett** [00:30:27] But it is, I feel, it's inherent to point it out.

**David Todd** [00:30:35] Of you know, when we were talking earlier about the kind of partnerships that you've had to organize to try to work on the Guadalupe bass, I think you mentioned that that some of these municipalities, you would talk to them about trying to reduce sediment transport and runoff.

**David Todd** [00:30:52] And I was hoping that you could talk a little bit about this effort to protect not just the stream, but the corridor that it sits within, the riparian segments and...

**Gary Garrett** [00:31:06] The watershed.

**David Todd** [00:31:08] Right. Right. How would you try to improve conditions for the Guadalupe bass by working on the the basin around the creek where it might be found?

**Gary Garrett** [00:31:19] Well, and we do. It's, that's purely totally education. That's the PR part of it, and giving talks to local groups, working with county and city authorities, really just everything we can to educate the value.

**Gary Garrett** [00:31:42] For example, a lot of landowners love to buy some land right on a river. And the first thing they'll do is come in and clear out all those weeds and plant carpet grass, because that's what they're used to. Problem with that is that carpet grass doesn't have a root system that's any good at all. And sooner or later you're going to start losing your property as it erodes away. So, not only are you losing your property, but you're adding a lot of sediment to the stream. So, you're sickening the stream as well.

**Gary Garrett** [00:32:13] So, we've worked with landowners and we've given workshops, gosh, hundreds, probably by now, workshops on alternative ways to have a beautiful setting, right, with people enjoying their land, but do it in a way that preserves that land and preserves the quality of the habitat, that riparian habitat it's called.

**Gary Garrett** [00:32:41] But then also then you move further up away from the river: fertilizers are a big problem. People just, you know, fertilizer away to make things green. And of course, most of that fertilizer just washes off into the stream. Again, polluting the stream, killing off a lot of the organisms, ultimately it may reduce biodiversity and you lose species and the health of the stream goes down. The more people that do it, the worse it gets.

**Gary Garrett** [00:33:10] Septic tanks are another.

**Gary Garrett** [00:33:13] I worked, for example, with a golf course in Del Rio. The Devils River minnow is there. And they, like all golf courses, just fertilize because golf courses need a lot of fertilizer. We convinced them to leave a 10- to 20-foot buffer along the stream (San Felipe Creek flows through the golf course): leave a buffer there of just native wild plants, which they didn't have to mow that part. And then they realized, oh, those native wild plants are flowers and some of them are kind of pretty, and we don't have to use as much fertilizer anymore, and we don't have erosion issues. And the golf course still just functions just fine.

**Gary Garrett** [00:33:53] So it's really just, what we always try to do with people is point out alternatives that they can live with.

**Gary Garrett** [00:34:03] It's kind of human nature not to want to sacrifice. So it's okay, you don't have to sacrifice. Just do it a little differently. And you'll be happy, and you'll have a healthier, happier environment around you as well.

**David Todd** [00:34:20] That's awesome.

**David Todd** [00:34:22] You know, something else I think I understood was that while the Guadalupe bass was a sort of iconic, charismatic species that you're really interested in, that I think you were also arguing that things that benefited the bass had sort of cascading effects to help other species in the same stream or maybe in the basin. Is that correct?

**Gary Garrett** [00:34:47] That's correct. Exactly. It's, we call the Guadalupe bass our indicators disease. We've got indicator species all over the place, but that's the iconic one. But when the Guadalupe bass is doing well, for the right reasons, everything else is doing well.

**David Todd** [00:35:08] And so the idea of using the Guadalupe bass is that it gives you a target or some sort of rallying poster child.

**Gary Garrett** [00:35:19] Mm hmm. Yeah, it's that.

**Gary Garrett** [00:35:21] And then, of course, once when we got it named the state fish of Texas, that helped too. Texan pride kicks in at that point. But it was, you know, it was named State Fish for a reason. It represents something really special about Texas - the beautiful Hill Country, the free-flowing streams and the endemic species, the fish that's there. Some of that wording is in the enabling legislation that named it the state fish.

**Gary Garrett** [00:35:57] Now is is that something that you're sort of familiar with, the process of getting the Guadalupe bass recognized in that way? And how did that come about?

**Gary Garrett** [00:36:08] There was a third grade class in Decatur, Texas. The teacher called me and said they were doing a little program on the state things. And they realize there's no state fish.

**Gary Garrett** [00:36:22] So somehow she got my name and asked. And she'd done a little research and she said, "I think the Pecos pupfish would fit." She said, "Wouldn't that make a great state fish?" And I said, "Nope, it wouldn't. I love it, but I just don't think that we'd get that through the Texas legislature. But I've got one that would and that's the Guadalupe bass."

**Gary Garrett** [00:36:45] So I worked with those kids. We got T-shirts made, we got buttons made. We went before the Texas Legislature, and the Natural Resources Subcommittee, I believe it was, and gave testimony. To have those little kids walk up there, you know, with their prepared little speeches was just so cute.

**Gary Garrett** [00:37:06] Then I got up as the expert witness. And this is no lie. I couldn't believe it. I gave the whole spiel about why it is special and why it would make sense for it to be the state fish.

**Gary Garrett** [00:37:19] And one of those legislators held his hand up and said, "That's all well and good. But the Florida bass is a much more popular sport fish. So, don't you think that really should be our state fish?"

**Gary Garrett** [00:37:31] The other legislators turned and looked at him, and said, "The Florida bass as our state fish? That doesn't make any sense."

**Gary Garrett** [00:37:38] So they laughed that one out, and moved forward with it. And we got it named the state fish, which was great. It kind of, you know, put a spotlight on it.

**Gary Garrett** [00:37:52] At that time, there were rumblings, some talk within the Fish and Wildlife Service, you know, your researching on Guadalupe bass has shown us that this probably should be listed as a threatened species? It's met all the criteria of threatened or even maybe an endangered species. So maybe we should list it.

**Gary Garrett** [00:38:08] And, you know, you're going to you're going to walk into a buzzsaw in Texas trying to do that.

**Gary Garrett** [00:38:14] But if we get it named the state fish, that's probably, for Texas, that's probably going to get it more protection than the Endangered Species Act. And I say because it's going to be protected. It's just going to be.

**Gary Garrett** [00:38:29] And so anyway, we avoided that issue as well by, naming it the state status.

**David Todd** [00:38:35] That's really interesting. I think about the experience in a similar part of Texas with the vireo and the warbler, where I guess there was a regulatory approach, sort of the stick.

**Gary Garrett** [00:38:48] Right.

**David Todd** [00:38:48] And with naming this fish the state fish, that you may be went more with the carrot. Is that a fair way to look at it?

**Gary Garrett** [00:38:58] Exactly.

**Gary Garrett** [00:38:59] I mean, it helped, it was essential, that it was a sport fish. So that helped a lot as well. But yeah, being the state fish, and as I say, we, I helped write that enabling legislation that it represents some of the unique special characteristics of Texas, that is the beautiful Hill Country with its flowing beautiful streams. So you kind of put all that that together, and ball it all up, and that's hard to get people to say that's bad. You know, it just represents good things about Texas.

**David Todd** [00:39:34] That seems seems politically savvy.

**David Todd** [00:39:40] Well, to get back to some of the sort of scientific strategies that you employed, I was interested that your, some of the first things you tried in the eighties was just to, I guess, you kind of swamped, just tried to dilute these hybrids. And I gather that a big part of that was the role that the hatcheries played in supplying all these fingerlings. And are you familiar with how that came about, and how the hatcheries could gin up, you know, to produce all these fingerlings?

**Gary Garrett** [00:40:14] Well, it was just a right place, right time sort of thing.

**Gary Garrett** [00:40:18] The Heart of the Hills Fisheries Science Center was actually a hatchery up until the seventies. It was the first oldest. It's the oldest existing hatchery site. The oldest was at Barton Springs, but it's long gone. But they built Heart of the Hills in 1925. So it was a hatchery up until the seventies.

**Gary Garrett** [00:40:39] It was then converted over into a research center and we use the hatchery ponds for research. So we've done a lot of different studies there. The dumbbass experiment I did there: our native largemouth bass is actually a more aggressive port fish than the Florida bass is. We did that in the ponds, some fishing experiments there.

**Gary Garrett** [00:41:07] But anyway, having those ponds available to us allowed us to just raise the Guadalupe bass right there. So, we started in Johnson Creek, which runs right by the research center, and we could just raise up hundreds of thousands every year and stock Johnson Creek. So, we started small, something we could get our arms around, and monitored the change and showed that yes, indeed, we are gaining ground.

**Gary Garrett** [00:41:32] So, from there, we expanded out to the North Fork and South Fork of the Guadalupe River, started working our way down.

**Gary Garrett** [00:41:38] And then after several years, the San Marcos Fish Hatchery, the State Fish Hatchery, came on board and started helping us as well. And they started raising a lot of fish. And biochemistry had evolved quite a bit by this time. So they were assuring pure fish a lot more accurately than we were back in the earlier days.

**Gary Garrett** [00:42:02] So it's just continued from there.

**Gary Garrett** [00:42:06] Now it's, I think, solely at San Marcos. They really have much better facilities for that.

**David Todd** [00:42:16] So I think that you touched on this before, but maybe it's worth emphasizing and maybe kind of elaborating a little bit is that this work with Guadalupe bass was, you know, on streams that pass through a lot of private property and required collaboration with the folks that owned that property. And I was wondering if you could talk a little bit about how you would engage, how you would sell this idea to a maybe a skeptical rancher or farmer who wasn't quite sure that this Guadalupe bass was his or her most highly interesting topic.

**Gary Garrett** [00:42:59] Yeah, it's well, the best ones to work with are those that actually love the river or the creek or the stream, whatever. And many ranchers and farmers do. They really appreciate it. It's just a part of the value of their whole area.

**Gary Garrett** [00:43:16] So in approaching it that way and just talking about how these things can go away, the "old canary in the coal mine" sort of approach, you know, that the first one to go may not bother you, but it's indicative of a trend. So that ... they could be engaged there.

**Gary Garrett** [00:43:36] The other thing is not coming in and saying, "Here's what you need to stop." We tried to work really hard with, "Here's what we would like for you to modify a little bit. Here's the things you can just keep on doing. We're trying to work with you to, we know you've got to make a living, but we know you love this river as well. So let's find ways that we can do both."

**Gary Garrett** [00:44:02] The hard ones that you maybe just never, you never crack that nut - were the ones that don't care. It's just some water flowing by. They don't really care what's in it. And they say they want that carpet grass, the lawn that goes down to the edge, and they just don't, they're just hardheaded. They don't want to listen to you.

**Gary Garrett** [00:44:22] But even there, if you can get some of their neighbors on board and understanding it, those neighbors see them all the time, much more often than I or any of my colleagues do. So over time, that even helps - that they can slowly kind of move towards a better way of doing things and avoiding certain things.

**David Todd** [00:44:46] So maybe a little peer pressure?

**Gary Garrett** [00:44:48] Peer pressure's pretty powerful.

**David Todd** [00:44:52] You know, something else I thought was kind of a thread going through what you've been telling me about the Guadalupe bass is that this is a sport fish.

**Gary Garrett** [00:45:03] Yes.

**David Todd** [00:45:03] And I was hoping you might be able to tell us about the role that fishermen and guides might have played in trying to promote the fish and its conservation.

**Gary Garrett** [00:45:16] Well, that's a, you know, I give most credit to Tim Birdsong, that he's he's spoken to a lot more fishing groups than I have. He's even gotten Trout Unlimited to be involved in Guadalupe bass restoration. But what we all do is we talk to them about it. They value the sport aspect of it, of course. And a lot of them have very tunnel vision on that.

**Gary Garrett** [00:45:42] But, if you have them widen their vision just a little bit and understand that, you know, you want to have this good sport fishing next week. But, next year and ten years from now, there are some things that need to happen and there's some things that don't need to happen. And that gets them more engaged in it.

**Gary Garrett** [00:46:01] But then, you know, it's human nature of "what's in it for me" kind of thing. So, we want to make sure that there is something in it for the fisherman: access. Access is tough in Texas. It's really tough. And again, this is something that Tim Birdsong really initiated and has seen through to a great degree of success, and that is access points where, through grants, he's worked with private landowners to allow access, canoe, kayak access points - put-ins and take-outs up and down the river, to where they can go in. And they, the landowner gets paid a little bit of money and, you know, of course, they got to take care of it, and the fishermen have to take care of it, or else they'll trash it out.

**Gary Garrett** [00:46:48] But it gets these fishermen into places they could never get to. And that's awesome to them.

**Gary Garrett** [00:46:54] So now they're out there doing a lot more to help this whole project succeed, to continue that access, but knowing that accessing it means you've got to take care of it.

**Gary Garrett** [00:47:09] The other thing, too, just along the lines of access, one thing we've really tried to push is paddling trails in Texas. That's a big deal in Texas. Again, it's an access sort of thing. And the paddling trail program has done that throughout the state to where kayakers and canoers can get into places they've never gotten into before, through and with cooperation with landowners.

**Gary Garrett** [00:47:34] And there, you know, we'll talk to them and say, "If you want to go fishing, that's great. There's going to be some good fishing there, possibly."

**Gary Garrett** [00:47:41] But what we're trying to, you know, we're trying to make sure is, but there's also so many other things to do - birdwatching, just looking at trees, just listening to the sounds. It's a "whole nature" experience. And we're trying to get more people.

**Gary Garrett** [00:47:54] You know, it's a double-edged sword. To get more people out there on the rivers means there's that much more, you know, feet tromping around.

**Gary Garrett** [00:48:02] But on the other hand, if people can't access it, they can't use it, then it doesn't have much value to them. So we try to get more people out there using it and appreciating it, but also taking care of it.

**David Todd** [00:48:17] That's interesting. I guess you have to know it to love it to save it.

**Gary Garrett** [00:48:24] Exactly.

**David Todd** [00:48:24] Yeah.

**Gary Garrett** [00:48:26] You know, back in the early days, almost the way conservation was advocated was to, you know, almost build a wall around it and keep people out.

**Gary Garrett** [00:48:37] That just doesn't work, because people won't support that.

**Gary Garrett** [00:48:41] So how do you keep it pristine, if people don't want it to be there?

**Gary Garrett** [00:48:45] So you've got to let people access it.

**Gary Garrett** [00:48:48] You just need to do it in a wise way.

**David Todd** [00:48:53] So, I guess this aspect of allowing people access goes to getting political support and and community buy-in. But I guess some of this, like you said, the landowner needs to be paid. How would you develop the funding to support something like the Guadalupe Bass Recovery effort? How did you track down the dollars to do something, especially when I think, as you pointed out, Parks and Wildlife was more sport fish oriented in the early days?

**Gary Garrett** [00:49:27] Yeah, well, as I said earlier, with Tim Birdsong getting the National Fish and Wildlife Foundation support that was, that put millions of dollars into the program.

**Gary Garrett** [00:49:39] But we also had a program called the Landowner Incentive Program at Parks and Wildlife. And we used a lot of that, working with the Wildlife Division, to kind of bring together wildlife goals and fisheries goals because they really are interconnected. So Landowner Incentive Program grants for landowners. The state wildlife grant program provides millions, over time.

**Gary Garrett** [00:50:06] So, it's just really cobbling together a variety of sources. And, kind of, you have to have people constantly going after grants too. But sometimes they, you know, as they're successful, they self-perpetuate. Granting agencies like to give money to successful projects.

**David Todd** [00:50:31] You know, something else, I think, if we go all the way back to the beginning, it sounds like this puzzle of how do you restore a fish that's hybridizing was ... the solution wasn't really clear, I mean, the answer wasn't really evident. And I'm curious how you made the case that, "Yes, you know, there may be a way to just genetically swamp these hybridized fish and try to recover the Guadalupe bass in that way." How did you make this argument?

**Gary Garrett** [00:51:08] Well, one, it's the only argument I could come up with. It was the only approach I could think of.

**Gary Garrett** [00:51:13] But, just logically, you know, I just, I said, I mean, take an extreme example. You've got a thousand fish out there. 30% of them are hybrids. I put a million more in, and now you've got a 1,000,1000. And the vast, vast, vast majority are pure Guadalupe bass. So that, in itself, is going to swamp it out over time.

**Gary Garrett** [00:51:40] By putting in so many Guadalupe bass, only a small percentage of them survived, by the way. People don't always understand that. You can't throw a million fish into a creek and think they're all going to live. The creek doesn't support that. But even there, those hybrid babies are now competing with those millions of Guadalupe bass babies to grow up. So again, the odds switch over in favor of the Guadalupe just because numerically there's more of them.

**Gary Garrett** [00:52:15] So that's the logical thing.

**Gary Garrett** [00:52:17] But, convincing people to spend money and let me do that ... I finally convinced them. They said, "Well, give it a try. We'll give you a few years. Give it a try and see what happens."

**Gary Garrett** [00:52:27] So, we did. And we could show gradual progress over time, enough to where they said, "Okay, continue the program, continue the program." And it kept getting better and better and better.

**David Todd** [00:52:41] Well, you know, something else that occurs to me, I think you mentioned this before, is that at the outset, before electrophoresis, it was probably not totally manifest whether something was one species or another or a hybrid of the two. How did you figure out this is a pure one that we're going to breed and release in the hundreds of thousands?

**Gary Garrett** [00:53:05] Yeah, well, initially, the thing is you can look at them and be pretty sure it's pure, but not perfectly clear. So if that was all we could do, we would have done it that way.

**Gary Garrett** [00:53:21] But we also had the good fortune of having a stock of fish in the Nueces River that didn't belong there.

**Gary Garrett** [00:53:32] So it was back in the seventies when it was, as I said earlier, the "do-it- and-see-what-happens" days, some Parks and Wildlife biologists said, "Hey, let's put some Guadalupe bass down in the Nueces River." And this was before hybridization. So we had a pure population down there.



**Gary Garrett** [00:53:47] We also took that pure population and put it at Lost maples State Park so that we had it in two locations now - in the Sabinal and the Nueces. So we had known pure fish we could start with. So that was great.

**Gary Garrett** [00:54:07] And it got us started and we knew they came from the Guadalupe River, because that was another aspect down the line as we expanded the program. Trying to do as great a job as we could and not cause unintended harm, Guadalupe bass going, as I say, are in each of the rivers of the Hill Country. But they've been separated from each other for maybe millions of years. So, are they all exactly the same, or does each one have maybe a few adaptations to its local stream that makes it a little better in that stream?

**Gary Garrett** [00:54:40] So, as biochemistry came along, or was improved and we could tell, you know, from tissue samples just how pure something was, that was what was used to then stock fish in the other streams. The Pedernales, the Medina, so that we could get fish from the Pedernales and stock them back into the Pedernales, fish from the Llano, stock them back into the Llano.

**David Todd** [00:55:06] That's fascinating.

**Gary Garrett** [00:55:10] Well, that would a nightmare just to do all this work to save them and then find out, "Oh, man, I just wiped out the Llano population by putting Guadalupe bass from the Guadalupe River in there, you know.

**Gary Garrett** [00:55:21] So we want to make sure we didn't have any unintended consequences.

**Gary Garrett** [00:55:25] Gosh. Well, so this has been really interesting to talk about the Guadalupe bass, and it's a story that has been successful, from what I understand. I was hoping that we could maybe take a little bit of a diversion here and talk about desert fish, because I know that you were chair of the Desert Fishes Council and editor of the Proceedings of the Desert Fishes Council. And always had this this interest, as I understand it, in desert fish.

**Gary Garrett** [00:55:58] And I was hoping that you could just, at the outset, say, you could sort of give us a basic status report in what the situation is and what some of the conservation challenges are. And then maybe we can talk about three of these species as just examples of that - Comanche Springs pupfish, the Pecos pupfish and the Devils River minnow - and you can kind of lay out what the kind of general outline means in those particular circumstances. Does that sound fair.

**Gary Garrett** [00:56:29] Yeah, as a little background, but I guess the main reason the desert fishes were so interesting to me from very early on in my career was that they live in the most extreme environments and they're fish. You don't think of water in the desert at all, but of course there is. And they've got some extreme adaptations.

**Gary Garrett** [00:56:50] As a biologist, this is fascinating. Just how do they how do they live there?

**Gary Garrett** [00:56:56] The pupfish especially, is an extremely well-adapted fish for a very, very harsh environment.

**Gary Garrett** [00:57:05] As you know, saltwater fish: you take a saltwater fish and throw it in freshwater, it'll die; throw a freshwater fish in saltwater, it will die.

**Gary Garrett** [00:57:12] That doesn't bother pupfish. They can live in pure, almost distilled water and it can then evaporate down to so salty that their salt is precipitating out of the water and they're doing just fine.

**Gary Garrett** [00:57:28] Their osmoregulation can switch directions and that I mean, literally, I've caught fish in those two extremes, the same species. So right there, it's like, you know, wow, that's fascinating. As a biologist, just the biology of it. How do you do that?

**Gary Garrett** [00:57:48] But, the other thing then, as a conservationist, the extreme challenges posed by the desert, you kind of figure, you know, if we can perform successful conservation in this place, in this environment, we can do it anywhere. So just kind of starting with the hardest, but it needs it the most, because things go south on you in a hurry in the desert.

**Gary Garrett** [00:58:14] So, with that in mind, and the fascination of just those animals, that's, I started doing a lot of research out there that early in my career, and then throughout my career.

**Gary Garrett** [00:58:28] These environments are heavily impacted. Desert springs are especially heavily impacted. It's typically not that people want to ruin the area. They need it. Farmers pump water out of the aquifer to raise crops. They don't want to dry up the aquifer. They want to raise crops.

**Gary Garrett** [00:58:51] The, as I mentioned earlier, the Rule of Capture really applies in the desert. In fact, a little aside here, the, I don't know if you know this, the Rule of Capture actually was, came to be because of some desert springs. The Comanche Springs in Fort Stockton was the, I guess one of the largest, if not the largest spring in Texas. It flowed something like 28 million gallons a day. That's a lot of water.

**Gary Garrett** [00:59:29] And there were a lot of farmers that used that water - surface water. They didn't pump it. They used the surface water after it came out, flowed downstream, and they then irrigated their fields with it.

**Gary Garrett** [00:59:40] In the fifties, some people started pumping the aquifer down. And Clayton Williams is one of them. And they made a lot of money pumping that water out and raising pecans and cotton and things like that. And they pumped it so hard that the springs started drying out.

**Gary Garrett** [01:00:01] So the local City of Fort Stockton depended on it for their drinking water as well. Fort Stockton and the farmers took them to court and it went all the way to the Texas Supreme Court. And in a very famous ruling by the Texas Supreme Court, they said that the workings of the aquifers were, quote, so secret, occult and concealed that it would be impossible to administer a set of protective rules.

**Gary Garrett** [01:00:28] Therefore, they used the rules that were in place for oil. And that is, put a straw in it and pump it out. So that's the Rule of Capture.

**Gary Garrett** [01:00:38] And that's really not been, as I say, it's been slightly ameliorated since then, but it's still an issue.

**Gary Garrett** [01:00:47] In Texas, in the deserts of Texas, West Texas, the Chihuahuan desert, there were some 100 or so moderate to major springs, and today only 50% of them are left. 50% have been dried up.

**Gary Garrett** [01:01:05] These aren't little seeps. These are moderate to major springs.

**Gary Garrett** [01:01:09] So, it's affected wildlife dramatically.

**Gary Garrett** [01:01:13] So, things need to be done. It's not easy, you know, but we've got to try.

**Gary Garrett** [01:01:21] So that's part of the nature of these, the strongholds that we're developing out there, trying to find some areas that we think we can get our arms around and do some good for them and at least maintain.

**David Todd** [01:01:36] Well, speaking of strongholds, maybe we can talk about the Comanche Springs Pupfish and the Balmorhea cienega that I think you worked on extensively.

**Gary Garrett** [01:01:47] That's our, that's one of our our best success stories, I think.

**Gary Garrett** [01:01:51] So the spring at Balmorhea State Parks, San Solomon Spring, was a little bit smaller than Comanche. It only flowed 23 million gallons a day. So still a pretty large, large spring.

**Gary Garrett** [01:02:06] And prior to development out there, prior to really people coming in and developing the area, these were, both of these created what's called a "cienega". And a cienega is the Spanish word for swamp or wetland or marsh. And they were hundreds of acres of wetlands. So you can imagine the value of that to wildlife, waterfowl, mammals, birds, insects and fish.

**Gary Garrett** [01:02:38] So over time, we talked about what happened in Fort Stockton at Comanche Springs, and San Salomon, as farming came in and developed, they dried up the cienegas, built canals out from the springs. San Salomon is the big one, but there's several others in that complex. And they built canals out to their farms.

**Gary Garrett** [01:03:02] So, they dried up the cienega. The fish there, a lot of them survived. Some may have gone extinct, and we'll never know what they were. But, some of them survived in these canals. But, you can imagine that wasn't the greatest place for them to live.

**Gary Garrett** [01:03:17] So it so happened, as I was working out there, the City of El Paso started buying up ranch land around Balmorhea, which is hundreds of miles away, for the express purpose of putting in water farms. And they were going to put pumps and a pipeline back to El Paso to pump that aquifer down.

**Gary Garrett** [01:03:37] So obviously, there were some consternation, local consternation.

**Gary Garrett** [01:03:42] And I met with the local water district and the local farmers. And of course, they were very hesitant to talk to me because I was a government person and I liked to save endangered species. All the wrong things in their minds.

**Gary Garrett** [01:03:58] But they did because they were concerned.

**Gary Garrett** [01:04:01] And I just pointed out, I said, "You know, what happened down at Fort Stockton? Their farms turned to sand and dirt, and blew away. They're gone."

**Gary Garrett** [01:04:10] And it could happen here. And the state water law will not protect you. The Rule of Capture allows this.

**Gary Garrett** [01:04:17] But, there's one thing that can protect you. And you know, you can hold your nose if you want to, but it's called the Endangered Species Act. Federal law would keep that from happening.

**Gary Garrett** [01:04:29] So I got their attention.

**Gary Garrett** [01:04:30] They said, "What? How do we do that? What can we do?"

**Gary Garrett** [01:04:33] And I said, "We can build a small cienega on Balmorhea State Park, but I need some of your water, some of your irrigation allotments. But all I need to do is flow through our cienega and it will flow back out the other side, and go right onto your farmland. So you will lose some water to evaporation. And you'll lose some water to evaporation in the desert. But call that your insurance plan for preserving your water."

**Gary Garrett** [01:05:00] And then as long as this endangered, and there's really two endangered species - the Comanche Springs pupfish, the *Cyprinodon elegans*, but then also *Gambusia nobilis*, the Pecos gambusia, a mosquito fish - two federally endangered species.

**Gary Garrett** [01:05:16] So they co-operated with us.

**Gary Garrett** [01:05:18] We then got TXDOT to come in and provide engineering and big machines and manpower and all of that to dig this out.

**Gary Garrett** [01:05:27] And the local prison, in Fort Stockton: we went over and talked to them and they said they were always looking for projects for inmates to do some good in the world. And they agreed to bring them over. And they'd ship them over in a van every day.

**Gary Garrett** [01:05:42] And they did, they planted riparian vegetation around the perimeter. They helped build a rock wall that has a, we built a large glass viewing area to where you can walk down and see underwater and watch, you get a better appreciation of what's going on.

**Gary Garrett** [01:06:00] And, it all came together. All really worked well. Everybody saw what was in it for them and how it would do some good.

**Gary Garrett** [01:06:09] And the local community loved it because that just enhanced the tourism at Balmorhea State Park. And the local schools loved it. The kids came out. We made a very interactive sort of thing. At just one piece, an edge of the cienega, we built a platform where you could walk out on it and look out and, you know, interpretive signs, you know

what's going on. And then beside that is that window wall. You can't go around the rest of the cienega and disturb anything.

**Gary Garrett** [01:06:36] But it's been quite popular. And there's literally tens of thousands of more Comanche Springs pupfish and Pecos gambusia in the world because of that. And they're finally back and a similar, something similar to the native habitat.

**Gary Garrett** [01:06:54] It worked so well that we then, years later (this was in the mid-nineties), some ten or 15 years later, got some more funding and support to build yet another cienega on the park and its named the Clark Hubbs Cienega, in Clark's honor. And it's right there by the tourist courts, the hotel kind of place that they've got there, so people can just look right out at that cienega as well.

**Gary Garrett** [01:07:24] So yeah, it's been a great success. Just, it took certain things coming together at the right time. And took having a state park right there that we could use that land to build those cienegas.

**Gary Garrett** [01:07:34] But yeah, it was a wonderful experience. But sometimes, you know, sometimes you, you don't lose. Sometimes things work out. And it felt good.

**David Todd** [01:07:46] Well, that sounds very creative and resourceful.

**David Todd** [01:07:50] Well, maybe we should shift focus and talk a little about the Pecos pupfish, another desert fish that I think you've been involved with.

**Gary Garrett** [01:07:59] Yeah, well, in fact, I did my dissertation work on the Pecos pupfish. That one's not been so successful, unfortunately. With that, that one and the Leon Springs pupfish, another one that's just north of Fort Stockton, in a little spring system there.

**Gary Garrett** [01:08:17] Both of those fish were doing fine over the millennia until apparently somebody with baitfish from the coast, with the sheepshead minnow, which is also a pupfish, but it's one that lives in the coast, were hauling them somewhere - New Mexico or what. I don't know what they were doing. But they stopped to freshen their water, apparently, and they got out. And they are in both of those systems, got into both of those systems.

**Gary Garrett** [01:08:44] And they hybridize like mad.

**Gary Garrett** [01:08:47] That's the thing about desert fish. They will hybridize like crazy. And I think it's just, my feeling is, it's part of their adaptive abilities. When you live in a harsh environment, that can change extremely fast in an extreme direction, if you see a potential mate that's a little different, it might not be a bad idea to mate with them, just to kind of mix the genetics up a little bit just so that maybe some of your kids might be a little better adapted to the next weird thing that comes along.

**Gary Garrett** [01:09:21] But anyway, that works really well until people dump the wrong fish in.

**Gary Garrett** [01:09:25] So Leon Springs, we caught that in time. That was back in graduate school. We went out there and literally seined up every fish out of Diamond Y Draw, Leon Creek, and put the good ones aside in Styrofoam buckets, and killed all the rest and rotenoned the stream, killed all the fish out.

**Gary Garrett** [01:09:45] And then when it was done and cleared out, we put the native fish back in. And, with some ups and downs over time, it's worked well, and that one's saved.

**Gary Garrett** [01:09:57] The Pecos River is a whole different animal. That's just too much, too big. And the Pecos River remains a hybrid swarm.

**Gary Garrett** [01:10:08] But there's, Salt Creek is a little tributary up near the border with New Mexico that does have a pure population of Pecos pupfish, and we've done everything we can to maintain that.

**Gary Garrett** [01:10:22] The problem is it's a little creek with spring seeps in the desert. And particularly with a lot of oil well drilling in the area over the last decade or so, that one's in bad shape. So, I don't know what the future is for that, but it doesn't look very good.

**David Todd** [01:10:43] And so, the connection and the risk from the oilfield development up there is the tertiary water that's been used? Can you lay that out?

**Gary Garrett** [01:10:55] Yeah. Mm hmm. Yeah. They, they need a lot of water for fracking. So there's all sorts of potential problems with fracking. And the locals will tell you earthquakes are a big one, and they've got a lot of issues with that. But also just pulling that much water out of an aquifer that doesn't have a lot to spare.

**David Todd** [01:11:24] Well, let's just try one more of these desert fish. They are so interesting.

**David Todd** [01:11:28] The Devils River minnow: tell us what you can about its life history and its niche and then the conservation challenges that it's faced.

**Gary Garrett** [01:11:39] Well, it was a, one of the common minnows in the Devils River primarily, but also San Felipe Creek, which is the urban stream that flows through Del Rio, also Los Moras Creek, near Brackettville. And that was the extent of its range.

**Gary Garrett** [01:11:59] And, I don't remember now, maybe the 1990s, the Fish and Wildlife Service proposed listing the Devils River minnow as threatened or endangered, endangered, I guess, based on some preliminary data that showed that it looked like it was declining.

**Gary Garrett** [01:12:21] But they held (this is a funny story), they held a public hearing in Del Rio to talk about this. And it got so contentious that people were literally talking about tar and feathering these guys in the meeting that the Fish and Wildlife Service folks shut the meeting down, jumped in their car, left. And the word went out to everybody was like, just don't worry about Devils River minnow. We're not going to touch it.

**Gary Garrett** [01:12:54] And so, it languished for another ten years or so.

**Gary Garrett** [01:12:59] So, with part of my ... Things had evolved at Parks and Wildlife. You know, I mentioned earlier, they weren't too interested in threatened and endangered species. Things evolved over time. By the nineties, the 2000s, there was a much greater appreciation for the value of all native species and habitats.

**Gary Garrett** [01:13:18] So, I was allowed to do a lot more work. And one of them was the question, "What's going on with the Devils River minnow?"

**Gary Garrett** [01:13:26] And I'd been out there a few times, with Clark Hubbs as a graduate student. So we went out there and sampled throughout the Devils River, top to bottom. Lots of fun because you have to do it by kayak and canoe because you just can't get into places. So we lived on the river for five days.

**Gary Garrett** [01:13:42] And we found a total of five Devils River minnows. So it's like, "Yeah, things are pretty bad. Things are pretty bad."

**Gary Garrett** [01:13:50] So, I mean, obviously there were a lot more than that. We didn't catch all of them, but they weren't one of the most abundant minnows.

**Gary Garrett** [01:13:58] So, I went back to Fish and Wildlife Service and said, "Guys, do your job. Endangered Species Act requires you to do this, but let us be involved, the state agency as well."

**Gary Garrett** [01:14:09] So, we convened some meetings with people and it got contentious again, really rapidly. But, this time we told them the landowners and the city, "Look, this is going to happen. You've got a choice. You can work with the Fish and Wildlife Service, with the federal agency, or you can work with the state agency. We'll be glad to intervene on your part and we'll translate things to the feds, but you can just work with us."

**Gary Garrett** [01:14:36] So, they saw us as the lesser of two evils.

**Gary Garrett** [01:14:39] So, they grudgingly worked with us, but then that allowed to have some meetings. Again, a lot of frowning faces when I would get together with these landowners. They didn't like this at all. And literally, no exaggeration, talked about feds coming in with black helicopters and confiscating things and stuff like that. They were really scared.

**Gary Garrett** [01:15:00] So, over time, they, I think, came to understand we weren't crazy. We weren't going to do anything. And I said to the landowners, "I can't find (the ranchers), I said, I can't find anything that you're doing wrong, not a thing that you're doing wrong. So, I would, my recommendation to Fish and Wildlife, if they list it, is they don't stop you from doing anything, other than doing harmful things. They'll not stop you from doing anything you're doing now."

**Gary Garrett** [01:15:28] But, what we would like to see stopped is no one allowed to pump the aquifer out from under you. They said, "Oh, no, that's our river. We love it. We don't want it to be pumped."

**Gary Garrett** [01:15:39] We won't allow, we'll put protections in place so it can't be polluted.

**Gary Garrett** [01:15:42] And they said, "Absolutely, we love our river."

**Gary Garrett** [01:15:45] So, getting, finding common ground was essential. So we found that common ground.

**Gary Garrett** [01:15:51] Then it allowed a little more dialogue. And they were like, "Why do you care so much about little minnows? There's plenty of minnows out there."

**Gary Garrett** [01:16:00] So, that's when we went back to the old canary in the coal mine example. You know, I said, "They've been around for millions of years. They've been doing fine. And now they're not. I can't tell you what's wrong in the Devils (I've got some ideas in San Felipe Creek, in Del Rio), but in the Devils, I can't tell you what's going wrong."

**Gary Garrett** [01:16:19] "But, I can tell you that something is changing, and it's not for the good. So do you want to wait until you don't have any fish, or you only got one species left, or something like that, before you get worried?"

**Gary Garrett** [01:16:31] And they were like, "No, no, not at all."

**Gary Garrett** [01:16:34] Once they saw that as an indicator species, they totally changed to where I had landowners who would never allow any government person, federal or state, on their land, I had a key to their gates. I could go out there anytime I wanted to, because they saw we were there to try and help protect something that they held dear, and that was the river itself and its health.

**Gary Garrett** [01:16:57] So that changed totally. So it allowed us to do a lot of good on the Devils River. In the meantime, Parks and Wildlife was able to buy several, some ranches and make state parks out of them. The Nature Conservancy came in, bought some more land. It still owns that. So there's a lot of protected area there as well.

**Gary Garrett** [01:17:18] The landowners initially didn't like that so much but then they said, "Well this keeps these from being turned into housing developments or anything like that." So they saw the value in that.

**Gary Garrett** [01:17:29] In Del Rio, the problem there was it's an urban stream and all that, all the insults that urban streams get. I mentioned earlier about the golf course there. There's huge algal mats at the edge of the golf course in the stream, just from all the herbicide, well they put herbicides and pesticides as well, but all the fertilizer. So, we got that reduced dramatically with the buffers.

**Gary Garrett** [01:17:58] The City itself was in the midst of developing a major plan to make the stream that flows through the city something like the San Antonio Riverwalk. They saw that as a huge success, and they wanted to make it like the Riverwalk.

**Gary Garrett** [01:18:14] And I just said, "Dude, don't do that. You're going to spend millions of dollars concreting right up to the edge of the stream. You're going to kill the stream. Look at San Antonio River. It's not healthy through San Antonio Riverwalk. It does well for goldfish, and that's about it."

**Gary Garrett** [01:18:30] But the other thing is people aren't going to drive to Del Rio to see this. They're going to go to San Antonio. What people do drive to Del Rio to see, or would, is, for example, birds.

**Gary Garrett** [01:18:43] Millions of dollars are spent every year by birders in the Rio Grande Valley. A lot of them drive right through Del Rio on their way. You need to make this a natural-looking environment that's beautiful for your citizens, but it also brings in a lot of money.



**Gary Garrett** [01:18:58] So they haven't done it as well as I would like. But they did shift gears and there is much more of an appreciation for keeping it natural. And the Devils River minnow also, because it's federally listed as threatened (I skipped over that part of our deal with the landowners and the City is, "How about if we tell the feds, let's not list it as endangered. We'll just list it as threatened?"

**Gary Garrett** [01:19:27] And they thought, "Well, okay, that's a lot better."

**Gary Garrett** [01:19:30] Of course, threatened still gets protection. So anyway, we've, that helps a lot. By being listed, it opens the doors for grants. So grant money has been made available not only to some landowners in the Devils River, but for work in the city to, you know, do some good things for the stream and the riparian area, through grants because of the Devils River minnow.

**Gary Garrett** [01:20:02] So, I'd call it kind of a partial success. But as a result the Devils River minnows are doing better.

**Gary Garrett** [01:20:09] We have Parks and Wildlife biologists that I think annually, if not every other year, they go out and do full-blown surveys of not only the Devils River minnow, but there's also six other state and federally listed species of fish that occur on the Devils River. So they're looking at all of that and monitoring that and staying on top of it.

**Gary Garrett** [01:20:32] The Devils River is really a fascinating place and it's like, why are there so many rare species there - fishes and other things, plants and other animals?

**Gary Garrett** [01:20:43] And it's because of where it occurs. It's at the junction, or the intersection, of the Texas Hill Country, the South Texas Tamaulipan scrub country and the Chihuahu Desert. They all butt up against the Devils River: it flows through all of it. So it's got all of these different environments kind of overlapping right there, which makes it its own kind of unique environment. So it's a fascinating place. It's the most, that and the lower Pecos, are the most beautiful rivers in Texas, and the most pristine.

**David Todd** [01:21:22] So maybe we can zoom out a little bit. You've given us some wonderful detail about these three desert fish. But, I was hoping you might be able to give a little commentary about the issue of invasive species and desert fish and, I guess, wildlife in general. I mean, you gave this wonderful example of the sheepshead minnows, some poor bait fisherman, you know, does something thoughtlessly and just causes all kinds of havoc.

**Gary Garrett** [01:21:56] Yeah.

**David Todd** [01:21:56] But, I guess this is repeated in so many different kinds of.

**Gary Garrett** [01:22:00] Certainly is. Yeah.

**David Todd** [01:22:02] What's your view of invasives in the world of wildlife and conservation?

**Gary Garrett** [01:22:07] Well, at least certainly the non-natives have caused so much problems and cost so much money.

**Gary Garrett** [01:22:17] One big example going on right now is zebra mussels, throughout a lot of the reservoirs in Texas. These things are extremely detrimental. They'll clog up intake pipes for cooling - either for water supply or cooling for generation, electrical generation. They just infest areas. They carry diseases.

**Gary Garrett** [01:22:46] And so, but in general. So that's an extreme example. A lot of them don't seem to cause a lot of harm on the surface, but they really do. If they get established at the very basis of it, if they're established, that means they're taking up space and resources that native species would have used.

**Gary Garrett** [01:23:07] So they have, by definition of being there, they have reduced, sometimes eliminated, native species.

**Gary Garrett** [01:23:13] They, some have said to me, "Well, big deal, just replace one minnow with another."

**Gary Garrett** [01:23:19] Well, that doesn't always work. The minnows that are here have been here a very, very long time. They have seen and survived the crazy swings in the environment, from droughts to floods, to heat to cold. The new ones haven't been through all that. So they may come in and replace, and then we have one of our extreme things that happens in Texas and they crash. And then the whole system crashes. So that's an issue.

**Gary Garrett** [01:23:49] I mean, we have this everywhere.

**Gary Garrett** [01:23:50] The axis deer versus whitetail deer is an issue throughout Texas that we just have to live with. But I've seen it here on our ranch. We used to have huge herds of axis deer, and for decades.

**Gary Garrett** [01:24:07] And then the drought of 2011, the axis deer pretty much disappeared within a couple of years.

**Gary Garrett** [01:24:18] Whitetailed deer all of a sudden exploded. And I've got more white tailed deer than I've seen in 40 years, and hardly any axis deer.

**Gary Garrett** [01:24:26] So it's just that they're competing with each other is the point of that story.

**Gary Garrett** [01:24:30] Fortunately, they didn't wipe out the whitetail because once the drought knock those axis back, we wouldn't have had any deer.

**Gary Garrett** [01:24:38] But so this happens in the fish world all the time. And it's quite problematic.

**Gary Garrett** [01:24:44] Carp? Everybody knows about carp. They take up a lot of resources that native species should have been using, but they're here to stay. Unfortunately.

**Gary Garrett** [01:24:59] Funny story about carp. I mentioned way earlier in our interview that the first hatchery in Texas was at Barton Springs. This was, I don't remember what we were called back then. It was the Fish and Oyster Commission or something like that. But, it was the first iteration of Texas Parks and Wildlife.

**Gary Garrett** [01:25:19] And they had that little hatchery there. And someone had the great idea of said, "Let's bring in European carp. They're a great fish. They're really popular in Europe." And they are.

**Gary Garrett** [01:25:29] They brought them in and they started stocking them. And Texans hated them so bad that they went to the Texas legislature and complained so much that the Texas legislature shut down Parks and Wildlife. They fired everybody and locked the doors. And that was the end of that for several years, before they reinstated it in another another form, and came back.

**Gary Garrett** [01:25:56] But carp were that big a disaster that everybody got fired over it.

**Gary Garrett** [01:26:00] But unfortunately we didn't always learn our lessons, I'm afraid.

**David Todd** [01:26:06] That's a great story. You know, I guess Europeans are different from Texans - their, at least, their fish attitudes.

**Gary Garrett** [01:26:15] Yeah, I've tried to eat carp and they taste fine, but there's too many bones. They're just not worth it.

**David Todd** [01:26:21] Okay.

**David Todd** [01:26:21] Well, you know, talking about fish and we sort of talked about this invasive problem. But I've heard that freshwater fish, in general, in Texas at least, face a lot of problems, and that over half of them are in some sort of, you know, poor condition, worsened condition. And I'm curious if you could talk a little bit about what is it that makes them vulnerable and at risk these days?

**David Todd** [01:26:59] A general question. But I wonder if you could give us an elementary kind of introduction.

**Gary Garrett** [01:27:02] It's complex. Yeah, it's a variety of issues hitting them all at once.

**Gary Garrett** [01:27:10] Let me give you an extreme example, and that's the Rio Grande, particularly through the Big Bend region.

**Gary Garrett** [01:27:15] And you think - Big Bend - that's a pristine natural area. The river isn't. The river is a tiny fraction of what it used to be. But also about half the fish species in that area are non-native. So that knocks your native populations down because they don't have all the resources available to them. They're being taken up by these non-native invasives. So that weakens those populations.

**Gary Garrett** [01:27:47] And then you have extreme droughts and extreme floods and, you know, pollution, all these things. We lose species. We've had several species in the Rio Grande go extinct.

**Gary Garrett** [01:28:00] We've worked to try and restore one of them - Rio Grande silvery minnow. It's a federally endangered species, and largely unsuccessful. We just can't get it established back in there. And we think it's all these factors continue to be at play.

**Gary Garrett** [01:28:15] So. But then, I mean these things ... [Excuse me.] ... go on across the state. It's just in the extreme environments, you see extreme outcomes, more rapid outcomes, I guess.

**Gary Garrett** [01:28:29] But we don't have a river in the state that doesn't have non-natives.

**Gary Garrett** [01:28:36] And I'm distinguishing between non-natives and invasives. Non-natives are often invasive. But you can have natives that are invasive. An example of that is probably familiar to a lot of Texans is mountain cedar, in the Hill Country. It's an invasive species, but it's totally native, totally native. It has taken over a lot of habitat that it didn't normally occupy because of fire suppression more than anything else, but also poor land management practices in other ways.

**Gary Garrett** [01:29:13] So, you can have native species that are invasive, but it's because the environment and the natural balance of things is out of whack.

**Gary Garrett** [01:29:22] Now, non-natives come in, if they get established and by definition, they're invasive because they, a lot of times, they don't have any of the natural caps on their population expansion.

**David Todd** [01:29:36] So for freshwater fish and maybe it's not one smoking gun, it's just a kind of war of attrition there, there are just lots of things.

**Gary Garrett** [01:29:44] Just getting back to our whole Native Fish Conservation Areas project that Parks and Wildlife continues with. That's why we're, it's, we say native fish, but it is the entire watershed. We want the entire watershed to be as healthy as possible. That allows these fish to be more resilient, these populations to be more resilient.

**Gary Garrett** [01:30:08] I realize all animals and plants can be more resilient when it's healthy around them.

**Gary Garrett** [01:30:12] When there's other detrimental things going on - bad land management, invasives, non-natives, pollution, things like that - it just makes it that much harder for these things to survive.

**David Todd** [01:30:30] Yes. I guess when there's change of any kind, you want to be able to, you know, bend and bounce back.

**Gary Garrett** [01:30:36] And that's it. That's it. And I mean, my gosh, it's Texas. You know, how extreme things are in Texas. And we have these plants and animals that have lived here, done fine here, evolved here over the millions of years. So they know how to do that.

**Gary Garrett** [01:30:50] It's when humans come in and throw something totally different at them, like polluting their stream or cutting off their water or whatever. They don't know what to do about that. You know, that's a tough one.

**David Todd** [01:31:03] Well, you've been very generous. Thanks for your patience with us.

**David Todd** [01:31:10] I would just ask if there is something that we might have skipped over or given short shrift to, something that you'd like to emphasize about fish in general or Guadalupe bass or maybe some of these desert species that you've been interested in.

**Gary Garrett** [01:31:30] I think we've been through pretty thoroughly. Obviously, it's very important to me. It's a love of my life.

**Gary Garrett** [01:31:38] But it is very important, because I'm proud of it. I'm a proud Texan. It's very important that my grandkids and their grandkids have a Texas that at least resembles what we've got today. I know things are changing and not always for the best, but, it's, you've just got to keep plugging away to try and keep things special.

**Gary Garrett** [01:32:04] And that's just not easy. Sometimes you want to give up, but that doesn't do any good. They win when you give up.

**David Todd** [01:32:14] All right. Never give up.

**Gary Garrett** [01:32:15] Never give up.

**David Todd** [01:32:16] Even if the hail, baseball-size hail, hits you, you've got to keep going.

**Gary Garrett** [01:32:21] Persevere!

**David Todd** [01:32:22] That's right.

**David Todd** [01:32:24] Well, Dr. Garrett, thank you so much. I really appreciate what you've done, and I wish you the best.

**Gary Garrett** [01:32:35] Great. My pleasure.

**David Todd** [01:32:35] Keep plugging away.

**Gary Garrett** [01:32:36] Yeah, this has been a lot of fun. We've been talking about things that are very dear to my heart.

**David Todd** [01:32:42] Well, that's clear. And we're all the better for it. So thank you so much.

**Gary Garrett** [01:32:46] Okay.

**David Todd** [01:32:46] I'll hit a button on my end here and stop recording, and you can go on about your way.

**David Todd** [01:32:51] Thank you again, though, for your time.

**Gary Garrett** [01:32:53] Okay. Thank you so much.

**David Todd** [01:32:55] All right, Bye now.

**Gary Garrett** [01:32:56] Bye.