

TRANSCRIPT

INTERVIEWEE: Larry D. McKinney

INTERVIEWER: David Todd

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

David Todd [00:00:04] This is David Todd.

Larry McKinney [00:00:06] Hi, David, Larry McKinney.

David Todd [00:00:08] Hey, good afternoon.

Larry McKinney [00:00:11] Same to you. Happy Thanksgiving in advance, a little bit.

David Todd [00:00:16] Well, to you and yours as well. It's nice of you to take time out. I know this week is busy for a lot of people as they try to wrap stuff up before the holidays. Thank you for that and just generally for being such a kind person to participate in this oral history project.

Larry McKinney [00:00:37] No, it's a great opportunity.

David Todd [00:00:40] Well, good.

David Todd [00:00:41] Well, I know your time is short, so maybe we should just dove into it unless you have any questions that I might be able to field for you.

Larry McKinney [00:00:52] No, no, I'm fine. However you want to go about it, I'm fine.

David Todd [00:00:56] Okay. Well, that's kind. Let me sort of lay out how these interviews usually go. I try to, first of all, kind of lay out what the project is about and the date, and day, time, you know, all those coordinates. And then give a very brief introduction to you and the particular topic we'll be talking about - the oyster issue. And then I really just go through the list of questions and do them just in the same order is what we've emailed back and forth. Of course, I will really emphasize the things that you mentioned in your email this last go-round, some things that are sort of highlights for you. And usually this takes about an hour, hour and a half, depending on how much time you want to devote to it, really.

Larry McKinney [00:01:55] Okay.

David Todd [00:01:56] That's really been the pattern. Does that sound good?

Larry McKinney [00:02:02] Sure, sounds fine.

David Todd [00:02:04] Okay, well, then in that case, let's get started. I'll say a few words, and then we'll start off with some questions.

Larry McKinney [00:02:13] Sure.

David Todd [00:02:15] Well, with your permission, Dr. McKinney, we plan on recording this interview for research and educational work on behalf of the Conservation History Association of Texas, and for a book and a website for Texas A&M University Press, and finally for an archive at the Briscoe Center for American History at the University of Texas here in Austin. And you would have all rights to use the recording as you see fit. We wanted to confirm that and then just wanted to ask if that's, you know, agreeable to you.

Larry McKinney [00:02:53] Yes, it is.

David Todd [00:02:54] Thank you. OK, well, good.

David Todd [00:02:56] Well, today is Monday, November 22nd, 2021. It's a little after 2:30 central time, and my name's David Todd. I am representing a nonprofit group called the Conservation History Association of Texas, and I'm in Austin, and we are fortunate to be conducting remote interview with Dr. Larry McKinney, who is, as I understand it, is based out of the Corpus Christi area.

David Todd [00:03:25] Dr. McKinney has worked in many important respects in Texas, in conservation. Some of the key places he's been have included as senior executive director and most recently chair for Gulf Strategies at the Harte Research Institute for the Gulf of Mexico. And before that, he served as director of Coastal Fisheries, senior director of Aquatic Resources and director of Resource Protection and Coastal Fisheries at Texas Parks and Wildlife. That's just a short part of his extensive CV, but maybe suggests the kind of realm he's been in. In these and other capacities, he's long been involved in protection and restoration of eastern oyster reefs in Texas bays.

David Todd [00:04:13] And so today we're hoping to talk with him about his life and career and especially focus on his work in oyster conservation as just an example of the kind of projects that he's been involved in.

David Todd [00:04:29] We typically start these interviews with just a question about your childhood. And so I wondered if there might have been any people who were a big influence as you were growing up that might have spurred an interest in working with coastal marine resources or the Gulf, or oysters in particular.

Larry McKinney [00:04:50] Well, I was, I was born out in West Texas, about as far away from the ocean as you can get before you start going back to it on the other coast. So not very close to the coastal area. But my, I had a science teacher in my small high school, a little town called Coahoma in West Texas, a fellow named, a man named Phil Wynn. And Phil was the science teacher, and he encouraged a number of us to, that were interested in science, to, to take that interest up, to the point that I was pretty much inspired like some folks were when I was in the seventh grade. This is back in the mid '60s. I was really inspired to look at oceans by Jacques Cousteau and his famous Silent World. I mean, out in the, out in the middle of the, of the plains out there and watched his show religiously and, and really decided that's what I wanted to do. And I remember having these conversations with Phil Wynn, and he organized a field trip for a number of us and took us to the coast for the very first time. And I went to Port

Aransas, and that's where I saw the oceans for the first time, as a, as a freshman in high school. And so that was really what, I made my decision then that I was going to be an oceanographer, a marine biologist and that's how that's how it all began.

David Todd [00:06:22] That's, it sounds like it was a real watershed moment for you.

Larry McKinney [00:06:26] It was when I saw the ocean. And people have asked me often and said, "Well, how in the world did a, did a West Texas farm boy and ranch, from working on ranch and farms... how in the world did you, how could you be comfortable on an ocean? You'd never, you'd never seen one until you were almost in high school." Well, I thought back on it, there is really not a lot of difference between the West Texas desert and the oceans. They're big open spaces. And, and the place where I become uncomfortable is in forests and places where I'm kind of closed in. So it's, it's not much difference there. So I have enjoyed that, that part of it as well.

David Todd [00:07:01] That's great. Well, you talked a little bit about your, your childhood and early education. Maybe you can touch a little bit on your later schooling. I believe you received the B.S. in zoology and later a Ph.D. From Texas A&M. And I was curious if there were any classmates or teachers while you were in school there who might have, you know, encouraged your interest in some of these aspects of nature and conservation.

Larry McKinney [00:07:33] Well, and yes there were. And that's, and that's where I really first began my journey with oysters, and that I was incredibly lucky to have contact with three of the most important oyster biologists in the Gulf of Mexico. Those were Dr. Johnny G. Mackin and Dr. Sewell Hopkins and Dr. Sammy Ray. All three of them are world-famous oyster biologists. I didn't know this at the time, of course, when I was an undergraduate going to school.

Larry McKinney [00:08:07] I, my first invertebrate zoology class was taught by Dr. Mackin and then my advanced invertebrate zoology class... I became very interested in invertebrates and fisheries while I was going to school, taking my undergraduates, and so I took advantage of, of an advanced invertebrate zoology class that was taught by Dr. Sewell Hopkins. And eventually, when I obviously, I knew I was going to be a marine biologist, I knew that I had to, I needed to get to the coast to go to some summer classes that were being held by A&M in Galveston, and that Galveston laboratory was directed by Dr. Sammy Ray.

Larry McKinney [00:08:48] So I had, I took those courses from them, not really knowing eventually the influence that they would have on my career. Dr. Ray was one, for example, when I, when I knew I wanted to go to, I needed to go to Galveston to take those summer courses and be on a boat and go out in the Gulf and in the bay and that type of thing. I really couldn't afford that by myself. I had to... normally, I would have to work during the summers. And mostly I worked in oil fields and refineries and those type of things, because the pay was really good, and that would pay for my school for the, for the next year. So, mostly, I had the, I didn't know how I was going to be able to go to school during the summer and then pay for my final year.

Larry McKinney [00:09:34] So I had that discussion with Dr. Ray, and just told him what I was trying to do and, and Dr. Ray said, well, just by chance he had he had a job opening as a janitor, a cleaner, someone to help clean up the laboratory around what's called Fort Crockett. That's where they taught the class, taught classes in Galveston. And so I took him up on that job. And so I was able to go to school and work as basically a janitor. And then later on in the

summer, I actually worked in his, his laboratory working on oysters. I didn't know it at the time. This was something that Dr. Ray had done for many students. The job, he'd made it up, basically, as I found out, I mean I found out years later he made that job just to give me a chance to go to school because he knew I really wanted to do that. So apparently he was, he did that for any number of students.

Larry McKinney [00:10:23] And so my first actual work in a laboratory of any kind, science laboratory, other than schools and classes, was in Dr. Ray's oyster lab, where I learned to, to dissect oysters and to work with all types of laboratory equipment. So it was really a wonderful opportunity and, and I would not be, I would not have been able to pursue really what I wanted to do if it had not been for, for Dr. Ray giving me that chance and he and working with oysters.

David Todd [00:10:54] You know, it's interesting, I guess a lot of folks would think of teachers as being somebody in the front of the class that's leading discussion, or writing on the blackboard, or discussing some text. But you know, that kind of boost to just provide you with some funds so you can attend school at all must have been really significant.

Larry McKinney [00:11:11] Yeah. You know, of course, at the time, I didn't understand all that. I later learned and Dr. Ray, became a, I mean, I was, of course, obviously, I loved that guy, basically. As I found out that he was, I mean, I worked for him on a number of projects and became a close colleague and, and throughout my career, he and I kept in touch and we worked on things until he unfortunately passed just a few years ago. So that started a life-long, a career-long relationship that was both one of friendship and collegiality and science. So he was in my mind, there's, he's probably next to my father, one of the, one of the people I admire most.

David Todd [00:11:58] That's great. Well I understand while you were a graduate student, some of your research was funded by a project that explored oysters and the dredging impacts on and particularly how, how might be ramifications for whooping cranes. Could you maybe tell us a little bit about that?

Larry McKinney [00:12:22] Well, yes, I will, and I want to kind of preface that by, by just commenting on, on oysters and how, how important actually it was to, to Texas A&M. Again, I didn't know this until later that I started studying it as really, as a more mature adult. But part of, as I mentioned two other individuals in that influenced me, Dr. Johnny G. Mackin and Dr. Sewell Hopkins, who was there, and Sammy Ray, of course, those three gentlemen, the work that they did at A&M working with oysters, they started a project that was called Project 9. I don't know why they call them this, but it was a major research project at the university, and it was in relation to looking at oysters and the impact of oil and gas development. Of course, in those days, they were just beginning to drill in bays, you know, they hadn't moved offshore very much. They were still looking at drilling in bays and that type of thing. So a direct impact on oysters. So this project was put together at A&M and it was led by Dr. Hopkins, but Drs. Ray and Mackin, were, were important participants in it.

Larry McKinney [00:13:40] And eventually, as I understand it, that Project 9 turned into another project. I think it was the Project 23, which followed up on, on this same issue. One of the things that they were finding that the people who were harvesting oysters were, were blaming oil companies for the death of oysters, entire oyster reefs,. And one of the discoveries of that project was, in fact, they found a disease called dermocystidium that was actually

causing the death. And so that changed all that relationships. It was a very complicated, interactive project.

Larry McKinney [00:14:16] But the, the importance of it for the A&M system was that because that project brought in so many, so many funds, it actually established the marine science, the marine science program at A&M, and eventually that allowed them to establish that school at Galveston at A&M. So very much of all of the A&M's history, their growth in marine sciences, the development of the Port Crockett and the A&M at Galveston, all was based on, on oysters at that time, and Dr. Hopkins led that, that work.

Larry McKinney [00:14:55] And so when I, when I finished my undergraduate degree, I was kind of casting about for what I wanted to do next. I actually thought I was going to become a teacher, I'd just thought I'd go into teaching because I enjoyed that. But Dr. Hopkins, because I'd taken his invertebrate class and had at least talked with on many occasions, he came to me and asked, you know what, what was I going to do? And I said, "Well, I thought about going to graduate school." He said, "Yes, you need to go to graduate school." So he he literally signed me up for graduate school, and helped me fill all the, all the paperwork, which was not much at this time. This was back in the, you know, early '60s, so it wasn't such a big deal as it might be now.

Larry McKinney [00:15:37] But there was a project that was, that he was starting on, and it was related to looking at the impact of shell dredging on whooping cranes in San Antonio Bay, and they were looking for students to help work on that project. And Dr. Hopkins knew I was, I had enjoyed working out in the field and had worked with oysters, so that's why he came to me. And, and so the, what started, what was the basis of the project was that, which seems kind of incredible in some sense, but you, in those days, it was allowable for, for a company with a giant dredge come into bays like San Antonio and other bays on the Texas coast and not dredge live reefs, although in the years before that, in the '50s, they actually did that: they dredged live reefs to build roads and that type of thing, apparently.

Larry McKinney [00:16:32] But at this stage, they could find fossil reefs that were buried under the sediments, sometimes next to live oyster reefs, and they could dredge those out. Those fossil oysters out, that, you know, they were buried, and then they could use those for very high-end concrete, for roads, for various supplements, for actually chicken feed, of all things. But the place on the Texas coast where this fossil oyster shell was most abundant was San Antonio Bay. And of course, it just so happens that on the, on the shores of San Antonio Bay, the Aransas National Wildlife Refuge was where the whooping crane would come back and winter. And in those days, in the '60s, they were, there were not many of them compared to today they were very few indeed.

Larry McKinney [00:17:22] And so the project, again, you learn these things in the past, as a graduate student, I just this was just an opportunity to go to school and to be paid to go to school, which was amazing to me at the time. But the genesis of the project, the dredgers had been getting a lot of pressure because of their activity, and they were forced by the Corps of Engineers, who granted them permits to do this dredging, they were forced to do this study to see if they had any impact on the oysters, on the whoopers at all. It was basically a ploy by the dredging companies just to keep dredging. They knew that their time was short, but they, they, they knew they could put it off for at least a couple of years by doing this study. And so they funded the study.

Larry McKinney [00:18:12] And that's where I had the opportunity as a, as an undergraduate to, to work with oysters. [Excuse me, had to cough there.] So the, the project was, was really my first science-based activity working directly with Dr. Hopkins, and it went on for, for almost a year and a half. I learned how to work in the field as a biologist working on oysters and, and how to really write scientifically. And it was my very first scientific writing was, of all things, with Dr. Hopkins too. If you can imagine a lowly graduate student like myself, I actually wrote two chapters in a book on the impacts of shell dredging on whooping cranes and oyster reefs. I wrote two chapters in that book with Dr. Hopkins. One, the first one, as the second author. He was the first, he was the lead author. But the second chapter I was the lead author. That was the first time I ever wrote a scientific paper in which I was the actual lead author and Dr. Hopkins gave me, gave me that opportunity. And so he was, he along with Dr. Ray, and of course, that, that, that project really continued my relationship with Dr. Ray later on. But, but the fact that I started my career with two of the greatest oyster biologists in this country, or ever, was a pretty sound foundation for the appreciation of oysters going forward.

David Todd [00:19:48] Well, that's fascinating and so heartwarming that again, there were these mentors that, you know, not only teach you how to write scientifically, do field research, but they, they give that kind of boost that you get from being a first author. You know, that's wonderful to hear.

Larry McKinney [00:20:08] Yeah, I mean, like I say, I didn't understand all this. I mean, I was just, I mean, even though, I mean, I'm this poor ranch, ranching, farming family guy. I mean, my, my uncle did go to college and became an entomologist. That's, that he did, he did manage to do that. My father started to college, but World War Two interrupted it and he ended up going, you know, joining the service and never, never went back in. So I had no experience with it. And of course, I was a pretty naive person and I didn't, I don't know why I managed to fall into such a wonderful situation with both Doctors Ray and Mackin was helpful. I knew him some too. But it was really Sewell Hopkins and, and Dr. Ray. I had no idea why they took me under their wing, but they did. And, and it was really only later that I realized that that wasn't all that common, I guess. I mean, it was maybe not everyone had that opportunity to have, have mentors like that. So I was extremely fortunate in both of those, and having both of those men help me move forward.

David Todd [00:21:14] Well, I see. Well, and, you know, could you summarize any of the, the results of this research that you did so many years ago, about the impact of dredging on the cranes and the oyster reefs?

Larry McKinney [00:21:27] Yeah, it had a yeah, it had an even more significant impact on my future in that, that once I had finished and got my degree, I went back and got my degree, and actually I had, there's a whole road there where I was actually ended up, I was going out to Scripps Oceanography to work on, on a master's degree and, and the individual that I was working, going to work with there, unfortunately passed away before the project got started. So I kind of got hung up in that regard. But that's maybe that's a different story not related to the oysters.

Larry McKinney [00:22:06] But as I was working at Texas A&M in Galveston, I did take a position there working on a research project, and as part of the university, teaching invertebrate zoology myself. I had an associate contact me about Texas Parks and Wildlife, and they were looking for a biologist to help them establish what they were calling the Resource Protection Division. And what the basis of that was that the Texas Legislature had just finished a Sunset Review of Texas Parks and Wildlife. This is, this is a process that every

state agency would go through periodically, say, every five to 10 years. I can't remember the exact time length. But basically the agency was dissolved and had to be recreated by the Legislature. It gave the Legislature an opportunity to make revisions at an agency to address shortcomings and that type of thing.

Larry McKinney [00:23:03] But it just so happened that that during this Sunset period, and this was in the late '70s, early '80s, the Legislature in its wisdom, and yes, the Texas Legislature used to be pretty wise. Some people may think differently these days, but what they would do smart things. And what they, what was recognized during this Sunset was that if Texas Parks and Wildlife was really going to do something to protect the fish and wildlife of the state, they couldn't just manage seasons and bag limits, and those things, to manage those animals for which they were charged, the game animals, and that type of thing.

Larry McKinney [00:23:43] They had to look at the issues that affected these animals outside hunting. And they recognized that, and for marine animals, it's water quality and habitat and all of those types of issues that that would have an impact on whether the animals did well or not. The deer, the red fish, the trout, the shrimp, oysters, all of those types of things that if Parks and Wildlife was going to do its job to actually perpetuate these species, then they had to have the capacity to address water quality issues, habitat loss and those things.

Larry McKinney [00:24:21] So they directed the, the agency to establish a Resource Protection Division, and they had no one who could really do work in this area. They had, they had only fisheries biologist and wildlife biologists. So the idea was that that they needed to bring in scientists, for example, Ph.D.s, which they didn't have in the department then either that had specialties, that understood, understood all that, the habitats that these animals depended on and their biology and that type of thing.

Larry McKinney [00:24:56] So they asked me to take time off from the university to come and work at the department to help establish this science organization within the agency to look at this. And frankly, I was pretty tired of, of what I was doing. I was, I was, at the time, doing a lot of research, and I was very successful in bringing projects together. And I had established what was called the Environmental Engineering Laboratory in Galveston, and I had about 15 to 20 biologists and others working for me. And we were, you know, basically a grant-writing outfit. And it was so successful that I was mostly writing grants. I wasn't doing science. So I was getting a little burned out. And so I decided I would take a basically a sabbatical.

Larry McKinney [00:25:44] And I said, Okay, I'll, for three years. I will, I will take the time out to come to Parks and Wildlife and help establish the, the Resource Protection division. And then I would go back to academia. Well, I ended up staying there, staying there for 23 years. And one of the reasons, one of the things that that helped make that happen was that as I formed up, helped form up the Division of Resource Protection, one of the responsibilities of the Resource Protection Division was to oversee the permitting of shell dredging along the Texas coast, what we just talked about. Surprise, surprise, I was about to become the, the person who oversaw regulations and permits for something that I had spent my first part of my scientific career studying the impacts of. So I knew this science really well.

Larry McKinney [00:26:42] And so as I moved forward in working with the Research Protection Division in this permitting process, I had the opportunity to rewrite all the rules and regulations that would allow this to go forward. Now, by this time, there was still shell dredging going on, it was only, it was much reduced than it was when I first started this

project. There was only one or two dredgers operating, but I was able to rewrite the regulations and the requirements to get that permit that was soundly based on science to the point where, frankly, no one could actually get one of those permits. They couldn't meet the, they couldn't meet the qualifications of getting the permits because they couldn't prove up the science, because I knew what I was talking about in putting those rules together. And so that was the end of shell dredging on the Texas coast, actually. And shell-dredging actually still goes on along the East Coast. It's hard to believe, but it still exists, but not in Texas.

Larry McKinney [00:27:44] And so I'm sure that's kind of a long story on this, but, but what it, what it did for me is that, that it, it showed me what could happen if you had good science and had the opportunity to apply it, you could, you could really accomplish something important for the environment, for the Texas coast. And so that was an inspiration for me to, to stay with, stay at Parks and Wildlife, and, and to use science to actually improve the situation, and it was all based around oysters and oyster dredging that really set the direction of my, my career for the next 23 years.

David Todd [00:28:26] Wow. Well, that must have been a great contribution. I'm curious what one of the sort of most difficult aspects of a permit might have been to meet. I guess there were these scientific hurdles that needed to be cleared for a permit to be issued for dredging. What might have been one of the most difficult things for an operator to prove up?

Larry McKinney [00:28:54] Well, the, these fossil oyster reefs, of course, they had to be, you know, non-living. That's, that was already a requirement. But the only way you could get at them, they had to be buried. Well, in Texas bays, I mean, oyster reefs have been growing in the same place, or close to the same places, for perhaps millions of years. I mean, I'm sitting here looking at my desk right now at a, at an oyster shell from, from some of those, in those areas, and they had obviously been buried literally for millions of years.

Larry McKinney [00:29:25] And so where the fossil oyster was, well, almost in nearly every situation, there was a live oyster reef very close to it. Now when you dredge, and this is dredging, and you're dredging down from the, from the bottom of the bay, perhaps as deep as another 15 to 20 feet digging these oysters out. And of course, in Texas, bays are full of sediment, so there would be a huge plume of sediment - muds and clays and silt - coming up with those oyster shells. The oyster shells would be ground up by these giant, giant rotating drums that would pick them up and with water, suck them into and onto the dredge where they would be washed over a screen. And the silt would be, of course, washed back into the bay.

Larry McKinney [00:30:16] And so one of the issues that we made sure of is that if you're going to dredge oyster shell, you could not, the plume, the sediment plume, could not impact a living oyster reef right next to it. So it was almost impossible to dredge next to a live oyster reef and not severely impact it or even, you know, destroy it. So they could, it became quite clear that, that you had to maintain a hundred yards, several hundred yards, away from live oyster reefs in order to dredge. And they could not find enough resources because there are so many live oyster reefs. For example, in the San Antonio Bay, you couldn't get far enough away from a live oyster bed anywhere in the bay to meet that qualification.

David Todd [00:31:05] That's fascinating. Well, this might be a good time to just give those of us who know very little invertebrate biology just a crash course in the life history of an oyster. And I guess some of these oysters' lives are very tied in with this whole sort of, you know, fossil tradition and inheritance of, you know, hundreds of thousands of years of oysters

underneath them. But could, can you sort of walk us through the typical life cycle of a given oyster?

Larry McKinney [00:31:44] Sure. Well, oysters, of course, are bivalves, you know, related to clams and that type of thing. And as with most bivalves, they are filter-feeders, which means they bring water in through one part of their body and through their biological structures, which are called palps or gills type structures. They can actually filter that water and remove food particles, which they then digest and, and use for building their bodies and reproduction and all that type of thing. Oysters happen to be particularly efficient filtering mechanisms. An individual oyster, for example, can filter up to 50 gallons of water a day.

Larry McKinney [00:32:33] And oysters occur typically in reefs. They, they, unlike other mollusks or bivalves that just bury into the mud, oysters do best on a hard substrate, and they're physiologically adapted to, once they can find a hard substrate, they exude basically a glue, if you will, and attach themselves to that hard, hard structure. And the thing that they, and Texas bays are not a lot of hard structure around, of course, it's mostly soft bottom. So the things that they would adhere to most readily are other oysters.

Larry McKinney [00:33:12] And they, and these oysters, and oysters are also amazingly fecundate. A single oyster can spawn in our warm waters here in the Gulf, can spawn perhaps twice a year, producing a million to a million and a half eggs each time they spawn. And those, those eggs are fertilized in the water column. Eggs and sperm are released at the same time. So these millions of eggs begin to float around in the water. They typically go through oh, three or four life stages while they're in, in the, floating in the water as eggs and larvae, and this type of thing, as they drift by current, because they don't have any real ability to swim before they start to settle down after a few weeks seeking some kind of hard substrate.

Larry McKinney [00:34:05] And if they find a hard substrate, they attach and they grow into what's called spat and then they grow from there. And within a year or less, they have reached a stage where they can reproduce. So one oyster, and understand that when, even though they're producing these millions of eggs, oyster eggs and larvae are like candy in bays. They're so, typically in Texas, there's so many of them they are a main food source for just about everything else. So as they go through each life stage, only about 10 percent or less survive to the next stage. That's why they produce in such large numbers.

Larry McKinney [00:34:46] But a single oyster can, it can typically replace itself, but often from 10 to 100 other oysters can be produced from each oysters. So you can get the idea of how prolific they can become. For example, a typical oyster reef of an acre in size, about the size of a football field, they can have anywhere from 800 or 900,000 oysters on that acre. So you multiply, you have that number of oysters producing, each producing a million eggs times 900,000 per acre, you get the idea of how prolific they can be. And so that's, that's kind of the life history of oysters, if that helps to explain why they're so important.

David Todd [00:35:34] It does. And maybe something you could add, I think you referred to some of the oyster larva as like candy. Maybe you can talk about the role that the oyster might play in a Texas bay's ecosystem and how it interacts with all the other creatures that you find down there.

Larry McKinney [00:35:56] Right. They do so in several ways. First of all, as, as larvae floating about and getting ready to settle, they, because they are so abundant, all of our, all of our Texas bays, particularly north of Aransas Bay and Corpus Christi Bay, going northward. It

gets too, it's almost too salty, for oysters to do well in Laguna Madre itself. But going northward, we have oyster reefs in every one of the bays. And, and I've looked back over the, some of the historic reports, some of the first surveys of the biota and what lives in Texas bays, and oysters are always prominent. And many of the authors, like Paul Galtsoff and others, talk about oyster reefs that they surveyed that would run for a miles - several hundred feet wide and running a mile.

Larry McKinney [00:36:50] And in fact, in some of our, our bays, like Nueces Bay, one famous reef reached all the way across the bay from what's called North Beach in the city of Corpus Christi to another little town called Portland. The reef was over a mile and a half long, and it was so wide and just, and the reef came close to the surface of the water that it was actually used as a road. They had stakes in the oyster reef and wagons would pass from one shore to another.

Larry McKinney [00:37:20] In Galveston Bay, which is our largest bay, that is, it is the, it has the mother lode of oyster reefs. It was actually, the reef was so abundant, that cattle were driven across the bay by going from one reef to another and swimming between the reefs, which wasn't that, wasn't that far. So that just gives you an idea of the number of reefs of oysters.

Larry McKinney [00:37:41] And of course, you're producing all these eggs. And there's two main food sources for, for animals in all of our bays. One is plankton, of course, which is, which is the sunlight growing in the algae and those types of things growing. Many filter feeder use that, including oysters, living, living on those. But another food source was, of course, our bays are so productive that there was always something spawning. And so there's always eggs and larvae floating around in the water. And the thing about eggs and larvae is because they are growing when they're released from whatever species is producing them, they are full of proteins and nutrients, heavily loaded in fats and all these types of things. So they're a wonderful food source. They're very, very, yield a lot of resources to whatever can consume them.

Larry McKinney [00:38:33] So between the two main food sources, for most of our animals in our bays, plankton or the larvae of other, other organisms, and oysters, by far and away, are the most, fecundate, most productive in this regard. So that's the food side of this equation.

Larry McKinney [00:38:50] But because they produce all these reefs that I was talking about, they are, the oyster reefs themselves, provide tremendous habitat for all kinds of animals. I often refer to oyster reefs as Texas' version of coral reefs because the shells are, are glued to one another. There's all types of spaces in between the shells, so there's always algae and periphyton growing on them. There's crabs crawling through them. There's all types of worms crawling around them. And other fish are attracted to these, or fish are attracted to these oyster reefs to feed on them and to hide out themselves.

Larry McKinney [00:39:29] So when you swim and dive across oyster reefs - when you can see it - most of the time the waters in Texas bays are not particularly where you can actually see anything. But I've dove on them many, many times and they look, and I've dove on coral reefs as well, and they look almost identical. They're just alive with animals all around them. You can, by some of the scientific studies that I've seen done, you can find 200 times as many organisms on an oyster reef as the bare bottoms next to them, for example.

Larry McKinney [00:39:59] So, so they, they are a keystone species in Texas reefs because of the food they supply in that regard, and the habitat that they provide.

David Todd [00:40:12] That's really interesting. And it helps me understand why you focus so much attention on this, both at Texas Parks and Wildlife and later at Harte.

David Todd [00:40:25] You know, I think one of the things that I've read people have become increasingly interested in, and concerned about, is the role of oysters in protecting the coast from storm surge. It's not so much about the, the role that play in the ecosystem, but just, you know, for the sheer protection of life and limb for people who live along the coast and the property there. Can you talk a little bit about, you know, the, the role that the reefs play in that regard?

Larry McKinney [00:40:55] Well, as I mentioned, oyster reefs, oyster reefs are quite extensive in Texas, and oysters, as I talked about, are filter-feeders. So it is very natural, and this is how things evolved with oyster reefs, that, that the most successful oyster reefs, the ones that that grow the most, grow almost perpendicular to currents. Makes sense, right? Because if, if currents are washing over the top of your reef, that's bringing food to you and you're going to grow in a way that, that is exactly, not parallel to the current, but perpendicular to it. So you can take advantage of, of that. So that means that, and as currents come in, are moving along the Texas coast along the shoreline, these oyster reefs grow parallel to the shorelines.

Larry McKinney [00:41:49] And so they, they formed this hard structure between, in Texas and most of our, we have very few rocky shorelines, none at all, really. So our entire coastline is, is mostly either emergent wetlands or in some cases, submerged seagrasses. And that means that when storms come in, those areas are subject to a great deal of turbulence. And as waves crash in destroying the, those wetland areas and that type of thing, well, just like a sea wall that we build to protect cities and ports - we do that ourselves - oyster reefs form natural seawalls to act as barriers to this turbulence and the waves washing ashore.

Larry McKinney [00:42:37] And the, the interesting thing about the oyster reefs is that no matter what the sea level rise is, and we're talking about sea level rise these days, and it has risen on the Texas coast, for example, over the last hundred years up on the upper Texas coast sea level, the sea level, relative sea level, has risen almost two feet. In the southern end of the coast, it's almost a foot, nonetheless. So something between one and two feet we've seen as sea level rise. That's a combination of actual sea level rise because of climate change, and also subsidence of the shore because of removal of water and oil and gas.

Larry McKinney [00:43:14] So what we see happen with oyster reefs, because oysters build on top of each other, oyster reefs have a natural mechanism that allows them to adjust to sea level. And so as sea level has risen, oyster reefs have risen as well. So the first thing to do, as we were talking about, is the reef itself acts as a buffer to storm surge, and to waves, to allow the shoreline behind them, these emergent marshes, to grow and stabilize.

Larry McKinney [00:43:44] The other thing that it does that people have not thought about, but we're looking at more and more these days, is that if there's an area of water between the oyster reef and the shoreline, like a lagoon behind the oyster reef and the shoreline, what we've seen in some parts of the coast that when these reefs have become established, that has made the water so calm that seagrass has been able to grow.

Larry McKinney [00:44:07] So not only do you have the, the oyster reef to the front taking the brunt of any storm surge or wave, but right behind it, you have a lawn underwater that's seagrass, and then behind the seagrass is emergent, an emergent lawn or seagrass there that acts as further protection. So it's a triple layer of protection to our coast. And that's one of the reasons that that areas that have maintained their reefs and their emergent wetlands and their seagrass are so resistant to storm surge that that it acts as protection for anything behind it. It is a tremendous barrier in that way.

David Todd [00:44:50] I see. Well, that's a great explanation.

David Todd [00:44:54] And I guess the follow-up question on that would be to sort of understand how dynamic this stuff is, I mean, my understanding is that the reefs and actually the harvest levels have, have changed over time. And could you talk a little bit about how that's happened and the, the extent of it?

Larry McKinney [00:45:16] Come again, I didn't quite get that. I must have missed something.

David Todd [00:45:19] Well, I was just curious if you might be able to talk about how these oyster reefs have changed over time, particularly after Western settlement. What sort of evolution in the location and extent of these reefs that we've seen in Texas?

Larry McKinney [00:45:37] Yeah, there's some. And oysters have long, have been associated with, with the peoples of our coast long before Europeans came. There is a good friend of mine, an author named Jack Davis, who, who wrote the book, "The Making of America's Sea", which is about the Gulf of Mexico. He won the Pulitzer Prize for the book, and he brought out a thesis in his book that has, that struck me after I read it about how all this started is that when Europeans came to the Gulf, primarily Spanish explorers and this type of thing, they were astonished by the health of the people they encountered that the Native Americans here were large-framed. They were all healthy compared to other, other folks they'd seen - bigger than themselves. And they couldn't really understand it.

Larry McKinney [00:46:36] And what, what it was based on was that if you go up and down the Texas, any of the Gulf Coast, but I'll say the Texas coast for now, you can find what are called middens, which are large, tall piles of oyster shell, primarily, some others, too, but mostly oyster shell. And so what Native Americans found out long, long ago, as they moved into these areas that they had, that they would never have to go hungry, that there were, oyster reefs were so abundant they were standing on a food source, that all they had to do is reach down and pick them up, and they learned this lesson well.

Larry McKinney [00:47:14] And Europeans, as a matter of fact, as Dr. Davis talked about in his book, they didn't understand that. And there're, of course, stories about the Spanish explorers who were stranded on the Texas coast that starved, and they may well have died right on top of a food source, oyster reefs, right in front of that they never recognized.

Larry McKinney [00:47:35] So, from the very beginning of humans along our coasts, they were exploiting oyster reefs as a food source and they were abundant all along the coast. That, that whole relationship between humans have continued. You know, there was a time in the '20s and '30s that oysters were considered the food of the poor because they were so abundant. Again, if you couldn't afford anything else, you could afford oysters, and oysters

were so abundant that that's all they were considered for was, was food for those who couldn't afford any other food.

Larry McKinney [00:48:16] In fact, oysters were so abundant that that they began to be dredged, as we talked about earlier, to form the basis of road. I've got photos of here in Corpus and in Galveston, and really all across this country, but since we're talking about our coast, of piles of oysters that were five and six stories tall, that trucks drove over. Of course, and these were dredged out live because oysters were considered so, so worthless. There were so many of them and so abundant they didn't even worry about it, and they addressed these oysters to build roads and this type of thing. So that was the beginning of oyster dredging, as we talked about earlier, too.

Larry McKinney [00:48:55] So for a while, that, the, the, our first impacts on oysters were to destroy that reef structure itself physically by mining those oysters or for things like that. So that happened for a long period of time. And then after in the '50s or so, '50s and '60s, oysters took on, they were not quite so abundant. We'd already, we had already begun to have an impact on the reefs. But we began to use oysters as a food in restaurants and as, and on our own tables and like that. So the value of oysters as a food source began to outweigh their value as a road bed, basically.

Larry McKinney [00:49:37] So we changed, our focus changed and we began to tong oysters and actually dredge oysters with, with boats and dredges because we had destroyed all the oyster reefs close to shore. You couldn't drive out on oyster reefs even longer. All of those have been mined. And so you only could get to oyster reefs by boat and, or walking into the water, in shallow water and that type of thing. You could still tong oysters, but the most of the oyster reefs that existed were accessible only by boat. So we learned how to dredge them. And so we dredged them not for our roads, but, but for our food.

Larry McKinney [00:50:14] And then in the '60s and '70s, we began to change the Texas landscape, in, in that we had the famous drought of the '50s, the worst drought on record, and that caused the state to decide we had to do something to make sure we had enough fresh water for a growing state. So we began to build reservoirs. There were only two natural reservoirs that I understand in the state of Texas before really the '50s - one in Caddo and another out, out in West Texas. There were no reservoirs like we have today. And all of that reservoir building began and we built dams on all the rivers that supplied water to our estuaries that, that made estuaries work.

Larry McKinney [00:50:57] And one of the impacts of building all of those reservoirs is that we decreased the fresh water reaching those coasts. What people didn't appreciate was that what the main thing that, that creates estuaries upon which oysters depend is freshwater flowing into these bays and mixing with seawater to have the zones of much less, much lower salinity. Oysters depend on that.

Larry McKinney [00:51:21] An example: when here in Corpus Christi, where I am now, in 1982, they built what was called Choke Canyon Reservoir and closed that reservoir, cut off a little over half of the fresh water that reached, that would, that could reach Corpus Christi Bay. By 1990, all the oyster reefs in Corpus Christi Bay had basically disappeared. The reefs were still there, but there were no living reefs because the salinity was just too high. It came too high, too quickly. And that happened all up and down the Texas coast for the most part. The one place that, that seemed to defy that was in Galveston Bay because there was so much

freshwater coming into Galveston Bay from other sources that that no matter how many dams they built, there was still enough freshwater there, fortunately.

Larry McKinney [00:52:07] So that that has evolved in that regard to today, where we've reached the point where, in the opinion of many of us, myself included, is that our existing oyster reefs are really too valuable to be mined for food. We ought to be doing, we ought to be using oyster aquaculture and other, other things that these oyster reefs are so important ecologically for the health of our bays that we can no longer allow, we can no longer allow dredging oyster reefs for food. And that's the, the fight that we're in now.

Larry McKinney [00:52:39] And the final straw that that is, that is really challenging oyster reefs is climate change. And in two ways: the temperatures of our waters are warming, which, which is allowing more disease and parasites to gain access to the reefs we have here in Texas. And as I talked about, it's changing our sea level to a point, maybe it's, maybe it's even fast, so the sea level is changing even fast enough that oysters, as prolific as they are, cannot keep up with them.

Larry McKinney [00:53:10] So that's the history of oysters, in a nutshell, I guess. So sorry, it took a little bit long on that.

David Todd [00:53:14] No, no, that's, that's really helpful. And maybe you can sort of fill out the, the little bit larger context of this, how the Texas trends in oyster dredging and use might have compared with other parts of the Gulf Coast region, or even up the Atlantic Seaboard. Any sort of larger background you could give us here?

Larry McKinney [00:53:41] The story of Texas oysters is very much parallel, parallel throughout the Gulf of Mexico and, and the East Coast. And I think, like for example, of Chesapeake, the Chesapeake Bay, Chesapeake is even, it was even more severely impacted by all these activities and really have never recovered.

Larry McKinney [00:54:03] The difference between the East Coast and in the Gulf is that because we're in a warmer climate here, oysters are, have been, are more productive and have been able to recover when they've had the opportunity to take advantage of it. So that has been a situation.

Larry McKinney [00:54:22] Over in Louisiana, which is this country's greatest oyster-producing area, and they still are, the primary reason that they have survived is because the Mississippi River, which drains over 60 percent of the United States in North America, you know, it has continued to produce, to bring so much fresh water and keep their, they have so many wetlands, so much area that, that despite all that has been done to, to destroy those wetlands, they're still there, even though every 20 minutes they're losing a football field area of wetlands to subsidence, sinking away, so they're under assault as well.

Larry McKinney [00:55:03] But the story of the fate of oysters in Texas very much is a reflection of what's happening to oysters around the world. And it's the reason that oyster reefs are the, is the most threatened of all marine habitats. Almost 80 to 90 percent of oyster reefs around the world have disappeared.

David Todd [00:55:27] Wow, that is a frightening thought.

David Todd [00:55:32] Well, so I think you talked about the impact of the oyster reef changes on the coast, and I'm curious if you have been exposed to some of the impacts on some of the oyster men and marinas and dealers that I guess relied on oyster harvests through the years. How have they fared?

Larry McKinney [00:55:59] Yeah, it's a, it's a, it's an interesting story. I know, I know many, many oystermen. Because in my role at Texas Parks and Wildlife, I became, eventually became the director of all aquatic resources, and, and coastal fisheries in particular. And so I worked routinely over those, those many years with commercial fishermen - shrimpers and finfish and trappers and oystermen. And you know, I found them to be some of the most fascinating individuals I ever worked with. They are true, true characters. There are cowboys in Texas and there are oystermen in Texas and commercial fishermen, if you will. And they're, and they are wonderful, hard-working people - characters, many of them and all of them in that regard.

Larry McKinney [00:56:49] And, but there is a common feature with them that oystermen share and that is there, in our, in our situation in Texas, the commercial fishermen are always what I would call over-capitalized. They are always on, on the margin. They're having to borrow money to buy their boats and equipment and that type of thing. And just like farmers, they have good years and bad years, and they are typically caught in this cycle of no matter the status of the fishery, because you have to remember that, as we've talked a little bit about, the Gulf of Mexico is this very dynamic system and our bays are very dynamic. We are in the semitropical area. And we have droughts and we have floods, and that has a direct implication on the health of the ecosystem. These systems are used to being very dynamic and that they'll have good years where they'll have a big crop of young oysters and bad years when they don't have any.

Larry McKinney [00:58:01] But it doesn't matter to the oystermen because they have to make a living. So they're going to, they're going to fish as hard as they can. They'll either have larger, abundant oysters or they'll catch a lot, or dredge up lots of smaller ones. And so they can't, have never been in a situation, and they're always competing against one another because it's always it's always a race. They have a season. They may have limits of size that they can take, but they're competing against one another. And frankly, there's always been too many of them. And so they can, it's difficult for it to be a sustainable operation, and this is common throughout the Gulf, but certainly in Texas. And so it's, the life of an oysterman is, is a difficult one in that regard.

David Todd [00:58:58] Well, I suppose one of the other things that you've dealt with - I believe you were the oil spill response coordinator for Texas Parks and Wildlife - and could you talk a little bit about the oil spill risk for oysters? I guess this goes back to some of your early work where you found out there's actually a parasite that was affecting oysters, but maybe you can talk a little bit about the, the effects of oil spills or maybe the use of dispersants and the other aspects of dealing with spills.

Larry McKinney [00:59:29] Yeah. And this is, of course, something that we saw over, particularly in the early '60s and moving on forward till Deepwater Horizon in 2010. I mean, oil and gas is *the* industry in the Gulf of Mexico. Now, for the most part, oil and gas exploration and development moved offshore into the continental waters. But in the '60s and, and forward, going forward, there was oil and gas development within our Texas bays.

Larry McKinney [00:59:58] And more importantly, the, even with the oil and gas being done offshore, the places where the oil and gas had to be shipped to, either by pipeline offshore to

the refineries, they were right on the Texas, in our case, the Texas coast. And once the oil was refined, it was typically shipped out on barges or ships to go offshore and so forth.

Larry McKinney [01:00:24] So our bays have always been in the center of the oil and gas business in one way or another. And what we started to see happening in our bays as the refineries developed almost I think the number is something like 80, maybe 90, percent of refining capacity in the entire U.S., is located in Texas and Louisiana. So all of the oil produced, just nearly all of the oil produced in the Gulf of Mexico passes through our Texas bays several times, going in to be refined and moving out to be sold. So it raises the risk.