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David Todd [00:00:04] Good afternoon, my name is David Todd, and I have the good fortune to be with Bill Rodney and with his permission, the plan here is to record this interview for research and educational work on behalf of the Conservation History Association of Texas, a nonprofit group, and for a book and a website for Texas A&M University Press, and then finally, for an archive at the Briscoe Center for American History at the University of Texas at Austin. And Mr. Rodney would have all equal rights to use this recording as he sees fit. And I just want to make sure that's all agreeable with him.

Bill Rodney [00:00:55] Most certainly.

David Todd [00:00:57] Great. OK.

David Todd [00:00:58] Well, let's let's get started. It is Thursday, December 2nd, 2021. It's about 2:45 central time in the afternoon. My name is David Todd. I am representing the Conservation History Association of Texas, and I'm in Austin. We are conducting a remote interview, using an app called Ringr, with Bill Rodney, who is based in the Dickinson area today.

David Todd [00:01:32] Mr. Rodney is an oyster restoration biologist, and he works with the Coastal Fisheries Division at Texas Parks and Wildlife, where he's been since 2007. And in that capacity, he's worked in funding and permitting and contracting and overseeing and monitoring oyster reef construction and as well in mapping oyster habitat in Galveston Bay and other Texas systems.

David Todd [00:02:00] Today, we'll talk about his life and career, to date, and especially take this chance to focus on his work in oyster conservation and restoration.

David Todd [00:02:12] So that's the plan, and we usually start these interviews with just a question about your childhood, and I was hoping that you might remember back and tell us if there might have been any people who were a big influence in your interest in working with animals, and, and nature, and oysters in particular.

Bill Rodney [00:02:36] Well, you know, I think I was just born one of those people who feels a strong connection to nature. Like, you know you might have heard about these theories of alternative types of intelligence. I think maybe I'm one of those nature-intelligent types, because I just always wanted to be in the woods, catching things and looking at animals and tracking animals around and overturning rocks in the stream to catch crayfish and things like that. So I just think it was kind of in my DNA.

Bill Rodney [00:03:19] My father was a nuclear physicist and an astrophysicist, and he definitely was a big advocate for science and, and encouraged the scientific, you know, education and career.

Bill Rodney [00:03:39] And in my youth, I used to watch those shows that were on TV, I'm probably dating myself, but shows like Mutual of Omaha, Wild Kingdom and Jacques Cousteau. And I just always never missed any show like that, if it was on TV. So, you know, it was just the kind of kid I was, I guess, you know, I was just how I was hard-wired. And it followed me into adulthood.

Bill Rodney [00:04:11] In school, I didn't have any particular teachers that were really instrumental in steering me towards this sort of a career. I mean, I had plenty of great teachers in my, in my public education. But when I went to, my first college experience was West Virginia University, where I actually majored in journalism. And, of course, being up in the mountains of West Virginia, I was, it was just a short drive out of town to get immersed in some really great nature. And I did take some, some interesting classes there, including marine geology.

Bill Rodney [00:04:55] And so after graduating there with my bachelor's in journalism, I kind of, it was kind of hard for me to find a decent job in that, that profession, I guess I just didn't really have a great aptitude for it, I didn't think. But I sort of ended up being an audio-visual technician in the early '80s for a company that provided, you know, projection and all kinds of audio-visual services for, for conventions and trade shows in large hotels in the Washington, D.C., area. And I was working one of those, one of those types of conventions. It was for actually the National Wildlife Foundation. And it was there, you know, at a time where I was kind of like pondering, what am I doing with my life, that I saw, you know, all these people giving these interesting scientific talks about their conservation work. And I saw all the literature lying around. I think that was kind of a pivotal moment where I just said, "You know what, I want to be in this, this profession, this is where I belong, you know.".

Bill Rodney [00:06:10] So I decided to go back to college and I did. I got a bachelors at the University of Maryland in biology, and I had a lot of great influential professors there, including the shark lady, Eugenie Clark was one. I took some courses from her and there's a great marine ecologist there named Ken Sebens. And then there was also a Margaret Palmer and just a host of great, great ecologists that I was lucky enough to take courses from and interact with. And also, you know, wanting to kind of get things moving along because I was kind of a late bloomer in that particular, you know, discipline, I got a internship in the summer of my freshman year there at a wetlands sanctuary, Jug Bay Wetlands Sanctuary which is in Prince George's County, Maryland, on the Patuxent River, a Chesapeake Bay tributary. And it's, it's an amazing place with extensive marshes. And so that was great.

Bill Rodney [00:07:27] And through that, I was actually able to network my way into getting regular summer and eventually full time employment at Maryland Department of Natural Resources. So once I finally decided that, you know, focus on this stuff, I really started making things happen and things just kind of rolled on from there.

David Todd [00:07:51] That's, that's really fortunate. I mean, it's, it's, it sounds like you, you found the thing that excited you and interested you and led you into, you know, this work was with the Maryland DNR. Perhaps you can tell us a little bit about your work there.

Bill Rodney [00:08:14] Yeah, sure. Well, it started out not being all that glamorous. I was working for the fledgling aquatic toxicology program they had there. And mostly what I was doing was actually renovating a rundown house on the outskirts of Baltimore - Washington International Airport, and they were setting up an aquatic toxicology lab in this little house. So it wasn't really a whole lot of science or nature. I was, you know, busting out walls and carpentry and stuff.

Bill Rodney [00:08:55] So, but as a relief from that, they let me go out with some of the teams that were going out on Chesapeake Bay doing fish surveys and things like that. And like I said, that was a summertime employment. So through that, I networked into a better situation the following summer where I actually got to be an intern on one of those programs, one of those projects, that went out and did fish sampling and water quality sampling on Chesapeake Bay tributaries. So that's where I really started to get immersed in the, in the estuarine ecology stuff. I mean, I was looking at thousands of fish every day, all over the place and being out there on a boat, you know, cruising these tributaries, these tidal waters, seeing everything - bald eagles, dolphins, you know, it was just, it was just amazing.

Bill Rodney [00:09:50] And we did a lot of different types of sampling - everything, of course, the main focus was fish, but we also sampled water quality and sometimes sediments and, and also eventually, that became a full-time thing where I was full-time on that project. But I also did a lot of time, when I was available, I would work on the fresh water, you know, the Maryland Biological Stream Survey, freshwater sort of ecological assessment project of the streams that feed into the Chesapeake. So I kind of got to experience the Chesapeake Bay watershed from the tiniest little feeder streams to the actual, you know, open waters of the Bay and I got a real kind of comprehensive introduction and experience there. So that was great.

Bill Rodney [00:10:46] And on one particular sampling trip, we took to a very, very nice river in southern Maryland in a very, very rural area that was called the Wicomico River. But there happen to be three Wicomico rivers on the Chesapeake, so this isn't the big one on the eastern shore. This is the smaller one on the western shore, a tributary of the Potomac. And there we pulled this one seine net over, over an oyster reef. And really, you know, at that time, oysters weren't doing too well on the Chesapeake, so it was very, very rare to actually encounter that habitat in our sampling. But we did, and we drug up a whole different bunch of fish that I'd never seen before. After, you know, seeing tens of thousands of fish, we caught gobies and blennies and toadfishes, and I was just kind of blown away by how different it was, and how interesting these creatures were. And it kind of, kind of instantly made me recognize that oyster reefs are unique habitats with unique fauna.

Bill Rodney [00:11:54] And at that time, the whole, the whole science of oyster restoration was just kind of in its infancy. And so having that experience at that point in time and then starting to, you know, cue in on the emerging literature, it just kind of, it, it just jazzed me and I kind of decided I wanted to go back to grad school and study that stuff.

David Todd [00:12:19] And what year would this have been? Oh, this would have been probably around '90. Well, let me think about that a second. No, it would have been. OK, so, yeah, probably about '93. OK. I mean, fairly earlier in the '90s. Probably then.

David Todd [00:12:48] Well, it's interesting because, that you sort of point out that this is a new and evolving science of understanding oyster reefs and all the, you know, sort of aspects of that. So you returned to grad school now and what did you study there?

Bill Rodney [00:13:07] Excuse me?

David Todd [00:13:10] No, I was just going to ask you, so you get the experience of, of learning about these oyster reefs and it is appealing and attractive to you and you go back to grad school. And what did you study there?

Bill Rodney [00:13:27] Well, basically, I studied ecology. But the ecology that I studied was very focused on, you know, the estuaries and the oyster reefs because I was in the lab of Kennedy Paynter, who is an oyster biologist. And so, you know, he seemed like the logical choice for me, and he was willing to take me into his lab and mentor me. So, so that's that's what I did. That was around 2000, when I left Maryland DNR and went into grad school. But that incident with the oyster reefs actually happened several years earlier, and I kept working at Marilyn DNR even while I was, you know, sort of, you know, pondering things. But eventually it did lead me to, to leave, to go to grad school full time to study oyster reefs.

David Todd [00:14:19] Mm hmm. And so you, what was your thesis on while you were in grad school?

Bill Rodney [00:14:27] My thesis was comparing the macrofauna assemblages on restored oyster reefs to those on degraded natural oyster reefs in the Maryland portion of Chesapeake Bay. By macrofauna, I mean the invertebrates and small, you know, vertebrate fishes that, that, that live on oyster reefs.

David Todd [00:14:54] OK, well, we should return to that because I'm really curious about the role of reefs, not just in and of themselves, but as, as a substrate, as a home, I guess, habitat, for all these other creatures.

David Todd [00:15:09] Well, maybe as just a way to introduce us all to the oyster and to reefs, could, could you talk a little bit about the life histories of a typical Eastern oyster?

Bill Rodney [00:15:24] Sure. Oysters have a pretty interesting life cycle, actually. They are what you would call broadcast sponsors, meaning that rather than like incubating their eggs inside their bodies or releasing eggs that are already fertilized, the males and the females all put their gametes out into the water column, where they are, where they mix, and they're fertilized externally from the organisms themselves, just out in the water through, you know, chance encounters.

Bill Rodney [00:16:02] So another interesting aspect of that is that oysters are something that we call, "protandrous hermaphrodites", which means that when they are small adults, as they're growing, they are males. They're mostly all males when they're small. But as they get larger, it's more strategic for them to transform into females, because females, you know, need, need to make eggs and eggs require a lot of a lot of energy, a lot of, a lot of mass. So a larger individual can, can better function as a female, whereas sperms are very small and don't require a lot of energy and mass. So when, when an oyster is small, its best strategy is to be a male.

Bill Rodney [00:16:59] And, and because of the sort of, the some of the chemical signaling they can do to each other, they can sometimes sense that there's either not enough males or not enough females in the local population. Some of them can revert back, if they need to. That's, that seems like a, you know, a good strategy. I'm not saying they have an actual

strategy that they're aware of, but some of them will revert back because males are needed in the population or something. They can do that. It's, it's pretty amazing.

Bill Rodney [00:17:33] So anyway, once the gametes are fertilized out in the water, they become a larvae and the larvae go through some different, different stages. The larvae are called "trochophores", basically, and they grow in the water for two or three weeks. It's highly temperature dependent. And then once they're about ready to settle out and become an oyster, they reach what they call an "eye larva" stage, when they develop an eye spot, which isn't really an eye, is just called that.

Bill Rodney [00:18:09] And then at that point, they will start kind of testing the bottom with their sensory apparatuses, seeking a hard and relatively clean surface to attach and metamorphosize into a small oyster, which we call a "spat". And so in Texas, because of where we are, relatively warm waters here, that whole, that whole cycle from spat to being an adult can take eighteen months to two years. Whereas it takes longer up on the East Coast, where summers are shorter and waters are generally cooler. It can take as much as two to three years for an oyster to reach that, what they call a "market size", about three inches or so.

David Todd [00:19:09] And how do they build this, this extraordinary shell that they've got?

Bill Rodney [00:19:14] Well, they have, um, they secrete calcium carbonate from glands in their, in their tissues, in their mantle, and they secrete it out and it forms sort of like successive layers. You can actually sort of see the growth rings on an oyster, in a manner similar to, you know, tree rings or something like that.

David Todd [00:19:46] And I gather that they, they tend to group together, is that right?

Bill Rodney [00:19:52] Yes, they're what we call, "gregarious". They sense the presence of each, of other oysters through, probably, we think, well, for one thing, there's a lot of new science about this, about the sensory capabilities of oysters, but we always believed that they sort of could taste the water and find like the metabolites, the excretions, of, of adult oysters and sort of track those through the current to where the reef is and then find, you know, the oyster reef and settle there.

Bill Rodney [00:20:25] There's also been recent work that indicates that they might actually be able to hear oyster reef habitat. That is, oyster reefs are noisy places, especially in the South. We have, you know, snapping shrimp are very abundant on oysters, and they make a lot of noise. So oysters might actually be able to find reefs by hearing the noise being generated by the faunal community.

Bill Rodney [00:20:52] And I wanted to say that a little bit more about the life cycle of oysters, that they go through some different, different intermediate stages of larvae, from fertilized eggs to something called the trochophore, which kind of metamorphosizes into something called a "veliger", which looks kind of like a little oyster with cilia to swim around in the water. And then they become a pediveliger, which means they're sort of developing a foot-like organ, and that, that foot is actually kind of what they use to test the bottom substrate and find, you know, a suitable, hard, hard surface, usually another oyster, to, to land on and then attach to and grow, and turn into a spat and then an adult oyster. So it's a very interesting cycle.

David Todd [00:21:47] Yeah, well, and it's, it's great because they, when you, when you see them in the wild, they seem inert and very stable, almost like rock, but have this whole life cycle that's pretty dynamic. It's really interesting.

Bill Rodney [00:22:06] Mm hmm. Mm hmm.

David Todd [00:22:08] Well, and I think you mentioned that these reefs are host to other creatures besides oysters. I mean you mentioned the snapping shrimp, and then I guess earlier you were talking about some of the, the creatures that you saw when you were out surveying the blennies and the toadfish and so on. Can you talk about these communities that are often found on the reefs?

Bill Rodney [00:22:39] Sure. Once I started, after that fateful day where we dragged our seine over that oyster reef, I became aware of these, of the different kinds of organisms on these reefs and started learning about it in the scientific literature and then eventually sampling them myself with my graduate school work. And what I saw was that an oyster, a healthy oyster reef will have a really high density with a lot of different types of creatures. There's these small crabs that we lump together as "mud crabs", which are crabs of the family Xanthidae. And there's actually usually at least two or three or four species of Xanthid crabs on an oyster reef. And there, there's lots of them, of many different sizes. They, they are very, very abundant on a quality oyster reef of course.

Bill Rodney [00:23:38] And then there's these small fishes called "gobies", and the most common one is the naked goby, which is is found usually in very high densities on a healthy oyster reef. They like to live inside the dead shells, but the shells that are still attached to each other, what we call a box, then they can go use that, make that their little hobbit hole, sort of. And they'll live inside that box and come out to forage around and they'll lay their eggs inside that box as well.

Bill Rodney [00:24:07] And then there's also blennies, which are another sort of reef fish that scoot around on the bottom - very, very interesting looking. And there are two or three species of those that are pretty common on oyster reefs. And the oyster toadfish is probably the largest fish that generally is a reef, oyster reef, specific fish. And you know, they can get to being almost a foot long. And, you know, they're pretty, pretty scary looking things with lots of little, little fins poking out of different parts of them, big jaws. And then that's kind of focusing right now on the vertebrates.

Bill Rodney [00:24:49] There's also other types of, of shrimps and crabs that, although most of them probably aren't dependent on the reef, they still utilize it for, for shelter and to forage for smaller invertebrates to eat.

Bill Rodney [00:25:05] And then there's a whole 'nother community, which is often, you'll often hear it called the "fouling community". And these are the kind of organisms you'll see on your, your pier pilings or your boat hull if you don't clean it often enough. And that would consist of all kinds of different invertebrates, such as, well, small colonial, single-celled things like bryozoans and hydrozoans, and also tube-building worms and free sort of roaming worms, polychaete worms. There are abundant barnacles and mussels and certain types of anemones that all grow on the oyster reefs. So it's really a vibrant, diverse, interesting community, just like a coral reef.

Bill Rodney [00:25:58] I often say to folks that oyster reefs have a PR problem, because unlike the coral reefs, with the nice gin-clear, you know, tropical waters, they exist in these murky, turbid estuaries where you never can see them. They're really hard to, you know, film and photograph. So it's, people aren't aware of what's out there. So it's unfortunate because it's pretty fascinating.

David Todd [00:26:29] Yeah, that, that comparison with coral reefs is, is a powerful one. Can you talk a little bit more about how an oyster reef might compare with a coral reef and how it functions?

Bill Rodney [00:26:45] Well, yeah, sure, that they're both biogenic structures, right? They're both three-dimensional structures created by living organisms. And so therefore, oysters and corals are both keystone species because of their role in their ecosystem is greater than just their numerical abundance, because they actually create habitat for a whole community of other organisms, organisms that are kind of dependent on them.

Bill Rodney [00:27:16] And although coral reefs, they, they have symbiotic algae living in their tissues, zooxanthellae, that actually photosynthesize and excrete their nutrients into their host coral polyp. That's not at all similar to oysters, where oysters filter the water and sort of remove the phytoplankton from the water and eat it. So they function kind of differently in terms of how they feed and get their energy, although they're both dependent on photosynthesis ultimately. And the oysters filter the water, the corals probably not as much. Corals live in very nutrient-poor water. And that's why the water is so clear. There's not a lot of phytoplankton in the waters around coral reefs. There's not a lot of nutrients to, to feed a phytoplankton population, whereas oysters live in estuaries that are very, very full of nutrients and the resultant phytoplankton. And therefore, you know, they have a different kind of a function in the estuaries than in corals do in in the tropical oceans.

Bill Rodney [00:28:47] But they still both create three-dimensional hard structures that are, you know, habitat for a diverse community of fishes and other invertebrates. So they're very similar in that respect. And they both can protect shorelines from, from erosion. I mean, the typical coral reef usually fringes an island and protects it from the wave energy of the ocean. And oyster reefs can do a very similar thing in the estuaries where they, when they grow, intertidally or in the nearshore subtidal, they can reduce the energy of incoming waves and therefore help reduce erosion.

David Todd [00:29:34] Well, I'm glad you mentioned that, because I thought that might be a good next topic to talk about is, is these sort of environmental services that oyster reefs provide, I mean, the, as you said, this this sort of armoring of the coast to protect against storm surges, is a really interesting one. And then I think also you mentioned earlier the role that oysters playing in filtering water. Could you talk about those two aspects, maybe?

Bill Rodney [00:30:12] Yeah, sure. Well, first of all, the water filtration thing is, is very important with oysters. Adult oyster can filter as much as 50 gallons of water in one day. And when you consider that there's millions of them on just one oyster reef and then, you know, many oyster reefs in a estuary, it's a lot of filtration going on.

Bill Rodney [00:30:37] But it's not just filtration, because what they're doing is they're, oysters have this weird thing that a lot of other bivalve mollusks do not do. That is oysters are selective. They filter a lot of stuff, but they don't eat everything that they filter out. They actually sort through all that stuff, pick what they want to eat, and then they, they eject the

rest as something called a pseudofeces, which is just all that stuff they don't want to eat, kind of bound up in mucus and excreted out of the oyster shell as what we call a pseudofeces. And these pseudo feces kind of tend to be deposited on the bottom where they are a food source for the creatures that live on and near the oyster reefs. And so therefore, they have a role through their filtering of not just helping clean the water up, but they also transfer energy and nutrients from the aquatic, the water column ecosystem, to the benthic subsystem, the bottom of the bay - kind of look at it as a separate kind of ecosystem. So they are kind of an intermediary taking that energy from the water column and redistributing it to the upper benthic subsystem.

David Todd [00:32:03] [Can I stop you there, Bill? I think your phone is picking up a good deal of background noise. Are you maybe moving around or what, what might be?]

Bill Rodney [00:32:17] [My arm was pretty close to that, to the phone and I was kind of rocking in my chair. That might be what you're hearing, actually.]

David Todd [00:32:23] [Yeah, you'd be amazed. These mics are super sensitive, so to the extent you can be as still as still as an oyster, that would be best. We'll get a better recording. Anyway, I'm sorry to interrupt you, but I just wanted to give you a heads-up there.].

David Todd [00:32:41] So you're talking about water filtration before I rudely interrupted you.

Bill Rodney [00:32:46] So, yeah, so that the is one of their major ecosystem services is the filtration of water and the transfer of energy and nutrients from the water column to the benthic system, which is sometimes here called benthic pelagic coupling. So they do that. And but they at least, like I said, when they build these, when they, when they form their reefs in areas on the fringes of marshes or just the land in general, then that they can actually also reduce the erosive power of incoming waves as the waves kind of flow over the oyster reefs, the energy is kind of broken up and dissipated, and therefore it doesn't reach the shoreline with quite, quite as much energy. So in situations like that, oyster reefs can, can be a part of a prevention of, you know, coastal erosion and marsh erosion strategy.

David Todd [00:33:46] Well, I guess that's important in Texas where we don't have real, rocky shores that resist wave erosion. Is that true?

Bill Rodney [00:33:58] True. No, not naturally, although that's a typical approach for waterfront property owners is to armor their shorelines with riprap and concrete. But that that does the ecosystem a pretty big disservice by eliminating that sort of land / water margin, which is habitat for a lot of creatures, including lots of birds, small mammals and as well as invertebrates and fish and things like that.

Bill Rodney [00:34:32] And also, the filtration of oysters can also help to reduce turbidity in an estuary and therefore allow light to penetrate deeper into the water. And that's helpful to encourage the growth of sea grasses, which is another very important, you know, that type in the estuary.

David Todd [00:34:55] I see. OK. Well, you've taught us a little bit about the oyster itself and the role these reefs form for the larger fauna around it and then, and then their role with water quality and storm surge. Maybe this would be a good time to talk about trends for reefs,

you know, over the past number of years. Could you speak a little bit about the, you know, the status and the, the past arc of, of their extent and area in Texas?

Bill Rodney [00:35:39] Yeah, sure. There was a paper that came out quite a few years, quite a few, several years ago that the Nature Conservancy and some academics teamed up on, and they did a sort of a global analysis of the status of shellfish reefs all around the world. And they came up with a number that 85 per cent of shellfish reefs globally have been either destroyed or severely degraded. The shellfish reefs actually are the most imperiled type of marine habitat, and that's not a very well-known fact outside of, you know, the ecological community, the sciences, the scientists, but true nonetheless.

Bill Rodney [00:36:27] So in Texas, actually there was a paper I think it came out in the '80s by a guy named [Michael Xavier] Kirby, and it was very important because it sort of did a historical analysis of reef and reef degradation and fishery collapse on the North American coastline. And what he saw was that there was a sort of a trend that began back in the early 1800s in New England, where the very first oyster industry developed, and it was, you know, not regulated and it was basically unsustainable. And oysters were, were very much in demand, and they were sampled and harvested under very unsustainable conditions. And the oyster reefs, or the oyster fisheries, in the New England area collapsed. And then the fleets up there sort of moved down the coast to Maryland, and then things got pretty out of hand in the Chesapeake Bay and eventually that collapsed. Basically, it was like a domino effect going down the coast, from New England all the way down to Florida, and eventually around and into the Gulf.

Bill Rodney [00:37:52] And so when I first got this job here, actually, I told my old boss that Texas was going to be like the oyster's last stand, because it's like the end of that, you know, domino's line. At that time, oysters were still doing pretty OK in Texas, although we were aware that already that there was problems with the quality of the reefs and the heavy fishing pressure, but it wasn't really out of control, yet. And Louisiana was also still pretty healthy, had a pretty healthy oyster industry and populations.

Bill Rodney [00:38:31] But then came Ike and the Deepwater Horizon spill and Mississippi River floods, record floods. And suddenly Louisiana was hammered, and Texas was the last, you know, pretty good, what we call a "wild oyster fishery" where people are harvesting wild oysters. And then the pressure got really big on Texas. And so, you know, it started leading to issues in the fishery, which was not doing so well for a while there.

Bill Rodney [00:39:05] And so it's a big, it's caused a lot of hand-wringing and actually some legislation and changes in management regimes and things to sort of keep it from completely, you know, really flattening. So it's, it's, it's a lot of it is just nature and the hurricanes we get here. You might say that there's an element of global climate change involved in the hurricanes, but also that market forces are also, you know, encouraging our already too-big oyster fleet to, to, you know, work those reefs as hard as they could because there's so much demand out-of-state with the collapse of all the other oyster fisheries. So, put us right where we didn't want to be, just like Kirby would have predicted.

David Todd [00:40:05] Well, and I think when you were telling this, this really interesting story of how these dominoes started in New England, then, you know, toppled over down in Chesapeake and Florida and then into the Gulf. I guess that was mostly for folks who wanted to dredge or tong them to eat them. I understood that the Texas had its own slightly different industry that was on top of that, and that was the, the sort of dredging for aggregate and for

raw materials for lime and bleach and chicken feed and so on. Can you tell us much about that?

Bill Rodney [00:40:51] Well, a lot of that happened long before I got here, so I only sort of have read the, the literature that Texas Parks and Wildlife produced. We have a whole literature series in-house here called the, so what is it called? Management Data Series. And there's some papers describing that situation where there was a pretty, pretty big oyster shell mining industry in Texas. It was concentrated mostly in Galveston, and San Antonio Bays. But the rules about this fishery, once it became, you know it, once it started to impact the oyster industry, the actual, you know, oyster -for-food industry, that was that they were not allowed to harvest the actual functioning reefs, but they are able to go after the buried shells around these reefs. And that created additional problems in terms of silt and sediment plumes for the healthy reefs. So there was a lot of, a lot of conflict between the oyster fishery folks and the, and the oyster shell mining industry. And the oyster shell mining industry eventually was, was terminated by the Legislature. It was made, it was made illegal to mine the oyster reefs. But not before extensive damage was done.

David Todd [00:42:34] Well, I'm sorry, go ahead.

Bill Rodney [00:42:38] Looking at some old maps about that, I think I remember something like around half the oyster reefs in Galveston Bay, were probably destroyed or impacted by that industry before it was finally terminated.

David Todd [00:42:55] Wow. I had heard that there was a pretty extraordinary reef called Redfish Bar that crossed Galveston Bay. Do you know much about that?

Bill Rodney [00:43:12] I know a little bit about that. Yeah. So, back pre-Industrial Revolution, Redfish Bar basically separated Galveston Bay into two halves. And to the north of Redfish Bar was practically freshwater, like a big freshwater lake, almost. Very low, it wasn't a lot of exchange between that part of the Bay and south of Redfish bar, which was more of a high salinity, more of a typical, you know, coastal estuary. So there was just a tiny little, you know, channel connecting those two halves of the bay. And you know, you've probably heard that farmers used to be able to drive their cattle across Redfish Bar at low tide from one side of the bay, on the west side to the east side and back, and with only them having to kind of wade through a little channel to get across.

Bill Rodney [00:44:15] But then with the Industrial Revolution and you know, the boom in shipping and commerce that it brought about, the Redfish Bar was breached to create the Houston Ship Channel. And what that did was it allowed for greater mixing of fresh and salt water and actually, through an act of man, created a larger area where the water chemistry, the salinity in particular, was, was optimal for oysters. So following the initial breach of Redfish Bar, in the early days of the Ship Channel, that actually created the conditions that allowed a lot of reefs to form in the vicinity of Redfish Bar, both north and south of it. So Redfish Bar actually expanded in area, even as its vertical relief was being stripped away. But it expanded in the area and actually allowed the evolution of that Galveston Bay oyster fishery, which for a while was, I think, the second most productive estuary in the country, accounting for 75 percent of all Texas oysters. And so for a while there, you know that, that was actually that the Ship Channel actually allowed the expansion of oyster reefs in Galveston Bay in Redfish Reef and other reef systems.

Bill Rodney [00:46:00] But because, you know, boats which are shipping boats, what do you call them? The container ships, cargo vessels were larger and required deeper, wider channels, that did not persist. So, at some point, you know, it probably became detrimental to oysters that the Galveston Ship Channel got so huge.

David Todd [00:46:39] That is - what a fascinating story, I mean, that, and ironic, that this sort of construction and dredging of the ship channel and breaching of the Redfish Bar might have actually led to the expansion of the oysters, at least temporarily.

Bill Rodney [00:47:03] Eric Powell and some other scientists describing that whole process.

David Todd [00:47:11] Great. Well, always good to have some references to follow up on that.

David Todd [00:47:18] So I guess the dredging for the Houston Ship Channel and for just using the reefs for aggregate and for all these other raw materials and of course, just for eating them, that must have taken a toll on oyster reefs along the Texas coast. Could you talk about some of the other stressors for oysters along the Texas coast? I think that one that I've heard mentioned is, is just sheer pollution - you know, whether it's red tide or nutrients or heavy metals, oil spill risks. Any of those, you know, that you can address would be great to hear.

Bill Rodney [00:48:01] Sure. Well, some of those things are sort of interconnected, like the freshwater inflows bringing lots of nutrients into the bay as our, as our waterways have become more loaded full of nutrients from sewage treatment plants and farming and animal waste and whatnot, there's actually, you know, more nutrients, more nitrogen and phosphorus in the water than there used to be. And that facilitates, under certain conditions, these, these harmful algal blooms, your red tides. And the big red tide organism in Texas is something called "Karenia brevis", and I'm not sure I'm pronouncing that quite right. And it's pretty common in estuaries all around our coasts, and on the East Coast as well. And oysters can concentrate the toxins from that organism, you know, in their, in their tissues at times when, when the organism is very abundant.

Bill Rodney [00:49:19] However, I will say that there's, there's some studies that indicate that, although that happens, oysters are not as good at concentrating the toxins in their bodies as some other organisms are, including clams and mussels, which oysters seem to be able to to expel it at a faster rate than the other mollusks that take that stuff up. So it's still it can, it can be a hazard, though, and therefore, you know, when we have these harmful algal blooms, we have to close the oyster harvest areas until it's safe to eat oysters again. And so, that's, you know, the harmful algal blooms are linked to the freshwater inflows in terms of the water flowing in has more of these nutrients that can facilitate the algal blooms.

Bill Rodney [00:50:17] But oysters need that water coming in, the fresh water, because oysters are a truly estuarine organism. They don't do as well in full-strength seawater as they do in seawater that's diluted with a good amount of freshwater. So it's important for oysters to have a sort of a what we call a mesohaline sort of environment.

Bill Rodney [00:50:45] And on either extreme of that - go up towards the, farther up the estuary where the water's more fresh, oysters are not going to reproduce as well and grow as fast and typically you don't see as many oyster reefs in those parts of the estuaries.

Bill Rodney [00:51:04] And then the opposite, down closer to the, to the inlets to the Gulf, where the waters are saltier. Those are better environments for the diseases that can kill oysters and also a lot of the predators that eat oysters. So there's a sort of a happy middle ground in the salinity gradient that is optimal for oysters.

Bill Rodney [00:51:31] But estuaries being what they are, they're very dynamic systems. They don't just kind of stay the same, in the same state constantly. When you have a rainy period, the profile, in general, that's one that is optimal for oysters, will shift down-estuary, towards the Gulf. And then in times of drought when there's less freshwater coming in, that optimal salinity will move up-estuary into areas that would be typically more fresh. So all this variation in where the salinity is, it's kind of what oysters are involved with, and it's kind of an important part of their, their regime because in places where the disease gets bad, it's actually beneficial to have a big rain event that makes the water almost fresh. It will drive the disease and the predators out of the estuary and allow oysters to sort of bounce back like a relief from all that pressure. So not only is it important to have like the optimal salinity, but you also have to have the optimal variation in salinity for oysters to really thrive. And that's just because they're a true estuarine organism that has evolved in the, you know, very dynamic and variable estuarine environment.

David Todd [00:53:05] I see, well, maybe you can give us a couple of examples of, of how dynamic, say, Galveston Bay can be. You know, perhaps talk a little bit about Hurricane Ike and its impact on oysters. And then also these sort of inland rainfall events, Memorial Day and Tax Day floods, and then, of course, the Harvey storm, which was such a record breaker.

Bill Rodney [00:53:36] Yeah. Harvey and Ike were two very different kinds of floods. I came down here and started this job just a few years before Ike. And at the time, we were experiencing kind of a droughty period here. And in the middle portion of the bay around Redfish, all the places that were typically, you know, the most productive for oysters and oyster reefs, there was a lot of dermo disease, and there was a lot of drills, and the, and the oystermen were, you know, were, were hurting and they were complaining about it. And some of them blamed the Ship Channel for kind of being a highway for, for salinity and disease and predators to cruise up the Bay. And in a way that was kind of happening, but it wasn't just the Ship Channel. The whole Bay was just getting saltier because not as much fresh water was coming in.

Bill Rodney [00:54:38] And then, so it was a droughty period, and during that period in the northern part of the Bay, you know, around Trinity Bay, where there are oyster reefs up there. And during that period, those oyster reefs were, were doing pretty well. They had a lot of live oysters on them. And disease wasn't as bad up there because they still had some freshwater inflow coming in.

Bill Rodney [00:54:59] But then, you know, Ike came along and Ike just sent this incredibly huge amount of sea water up into Galveston Bay and that storm surge hit, it rolled over, you know, the, the marshes of Anahuac on the eastern shore and up into the bayous. And then when it receded, it just brought a lot of silt and debris with it as it receded. And, and it really caused a lot of siltation on the oyster reefs, especially in East Galveston Bay, where the receding storm surge kind of had a lot of detritus and mud from the marshes on Anahuac. And that stuff all got deposited down on the bottom of East Bay. And it basically buried a lot of, a lot of the oyster reefs and killed a lot of the oysters. So the main impact from, from Ike was sedimentation for oysters.

Bill Rodney [00:56:02] And, but in in the opposite scenario, like Harvey or those other big storms you mentioned, usually the siltation is less of an impact than just the fresh water. Oysters can't take really low salinity, or no salinity, for more than a few weeks at the most before they die. So when you have an event like Harvey, which just pumps tons of fresh water and turns the whole bay into a freshwater lake for such a long time, you're just having a massive die-off of oysters. And that's a horrible thing.

Bill Rodney [00:56:44] The upside of that is when that happens, the oyster shells are still exposed. The habitat's still there. The dead oyster shells are ready to be, you know, colonized by oyster larvae. They're not buried under, you know, inches of anoxic mud. So it's a better, it's an easier impact to recover from for oysters, then something like Ike which, once that sediment gets deposited, it may never, you know, go away. And so that reef could be permanently destroyed.

Bill Rodney [00:57:26] Although there's some, there's some research by a guy at Texas A&M, Tim Dellapenna, who thinks it might be happening, that these big Northers that we have, that kind of blow all the water out of the Bay, might also, over time, be sort of blowing out some of that sediment that was deposited during Ike and re-exposing the oyster reefs, at least at some level.

David Todd [00:57:56] So, OK, well, so you had mentioned Ike and Harvey and these, these big sort of acute events, you know, that are limited in time, but they're just really dramatic. I have read and I'm such a, you know, greenhorn here, I don't know enough about it, but that upstream dams have put stress on some of these oyster reefs because they just, sort of lowered, in a kind of chronic long-term way, the amount of freshwater coming into the bays all along the Texas coast. Is there some truth to that?

Bill Rodney [00:58:40] There is very much some truth to that. When you starve an estuary of freshwater, then the general trend is that the estuary is going to get saltier, which is going to facilitate oyster disease and oyster predators moving up, farther up, the salinity gradient than what they on average would be doing. So there's definitely cause for concern of starving our estuaries of freshwater.

David Todd [00:59:14] I see. Well, I guess with all these, these changes in the oyster reefs and the population of oysters along the Texas coast, there's no doubt it's had a big impact on the, the landings of, of oysters, and on the oystermen's industry. Have you had much exposure to that? Have you talked to any of them and gotten a sort of firs-hand experience of what, what's been going on for them, for the oystermen, the marinas and the dealers and so on?

Bill Rodney [00:59:55] I don't get a lot of first-hand interactions with the oystermen and the marinas and the dealers, but I get a little bit of that. I also have recently been working on another project, sort of looked at the last 20 years of landings for all the oyster-producing states in the U.S., so I got a pretty good idea of what did what the general trends are in that regard, just from that particular project.

Bill Rodney [01:00:32] And what you see is that, for the longest time, for, I'm going to go back 20 years. For the last 20 years, Texas has been the second largest producing oyster-producing state, second only to Louisiana, which, we're not a very close second to Louisiana. Historically, Louisiana has produced more than twice as many oysters as Texas. Texas has still been pretty, pretty productive and consistently number two, up until around 2013. And of course, it changes a little bit whether you're talking, you're looking at the data in terms of pounds of

oyster meat or in dollars, you know, dollar value of the dockside harvest. But the trends are basically the same.

Bill Rodney [01:01:29] And that is, in the mid-2000s, things started to change. Texas started to slip. It lost its number two seat in terms of dollars. And around 2013, suddenly it became third and fourth and seventh, then it was fourth again for a few years, then crept back up to number three, and it was number two in 2020, in terms of the dollar value of its harvest. Whereas Louisiana stayed number one until 2020, where it became number three. And for the first time in over 20 years, Virginia became the number one oyster-producing state in terms of dollar value. Like you talk about pounds of oysters harvested right to up until 2015, where it's ranked to third for three years, then crept back up to second and was actually number one last year. And last year was the first year that, in terms of pounds of oysters harvested, that Louisiana sank down to number two, and Virginia was in the number three position there.

Bill Rodney [01:02:45] So basically what we're seeing, nationwide, in oysters is that tthe U.S. estuaries, particularly the Chesapeake and New England areas, have, their wild oyster fisheries, have never really come back. But they've started promoting aquaculture, oyster farming, and so that they really, Virginia in particular, oyster farming has taken off. And because the aquaculture industry produces a very, very high quality oyster product, the value of their oysters is higher than the value of our wild-caught oysters. So the the overall value of oyster has risen very rapidly in the last 20 years, whereas the actual harvests have kind of remained more or less, with a bunch of peaks and valleys, but they haven't risen at the same kind of rate as the, as the value of the dollar value of the oysters meats. So that's having an effect on, on, on the fishery as well, because of the increased value of the product results in more harvest pressure.

Bill Rodney [01:04:07] But the thing is, we're not, we're not producing that, you know, high quality half-shell oyster that, that the farmers on the East Coast, and in some Gulf states, are producing. So now we've got competition. And Texas is starting to develop an oyster farming, oyster mariculture industry, but it's fledgling and it won't really be up and running for at least probably a few years. But, but that's, that's good. It'll, it'll happen.

Bill Rodney [01:04:45] And that might, if, if, if some of the scientists and economists are right, it might help take some of the pressure off the wild oysters and help the reefs kind of survive and come back, perhaps a bit. So.

David Todd [01:05:03] I see. Not all gloomy. No, I think there's an exciting story of, of recovery that I think you're hinting at here. And in fact, I was hoping that you could talk now about the efforts to restore some of these oyster reefs that you've been involved with and sort of recognizing all the good values that oysters bring, whether it's, you know, food, or water quality, or, you know, storm surge protection. Maybe you can talk a little bit about, you know, how you go about rebuilding some of these oyster reefs.

Bill Rodney [01:05:49] Sure. So when I first got hired down here, around 2007, the funding was coming from, you know, federal funding, appropriations from Congress to basically help the oyster industry get back on its feet after Hurricanes Katrina and Rita. And that, you know, basically started out this this program that I was hired on to. And our, our approach back then, and for a long time, was just, you know, restore oyster reefs for the benefit of, you know, the oyster industry, recognizing that there will be, you know, other ecological benefits that will come with that - more oysters will mean more filtration, better habitat, and all those things. Perhaps not, you know, the, the shoreline protection aspect because the commercial reefs are

out in the open waters on the bottom. They are they're not going to, you know, protect the shorelines too much.

Bill Rodney [01:07:00] But so that was how it started out. We kept getting money coming in from appropriations from Congress to help us recover from storm impacts. Of course, Ike, Ike was a huge storm impact and that, that brought a bunch of federal dollars in and we did extensive restorations after Ike. And that, that sort of situation continued for several years and then different storm, different funding sources started to roll in, and a different sort of a dynamic started to develop. And that was that the science of oyster reef ecosystem services was, was growing and it was becoming recognized that these, these, these habitats are probably worth more for the ecosystem services that they provide, than the, the, the monetary value of the oyster harvest itself.

Bill Rodney [01:08:08] So then we started to look at how can we make these reefs more more resilient and sustainable so that they can continue to produce ecosystem services longer? And one of the ecosystem services is providing, you know, product for the industry. So that's another ecosystem service of oysters that we shouldn't overlook. But so we started changing things up a little bit. We used to just put a thin layer of of rock on the bottom, and I'm going to introduce you to the term, "cultch" here, which is a term that the oyster industry and oyster scientists use for any hard substrate that you put on the bottom to create an oyster reef. And it can be oyster shells, of course, but it can also be like pea gravel or crushed limestone or recycled, crushed, clean concrete. And there's a bunch of different things that oysters will grow on so long as it's hard and not already covered with barnacles or something else attached to it. So that's called cultch.

Bill Rodney [01:09:31] So we were putting down a thin layer of cultch at first to cover as much area as we could to get the oyster industry back on its feet as fast as possible. And I'll tell you, it worked pretty well. Those oyster reefs that we built, they were colonized by oyster larvae and they took off and after a couple of years of being closed, to allow the oyster population to develop, they were opened and there was a lot of oysters for the industry. And I recently sampled some oyster reefs that were built, you know, 10 years ago or so. And I found, I was, I was happy to see that they were actually still producing and had quite a few, you know, large oysters and lots of small oysters still still on them so that they're holding up pretty well after 10 years.

Bill Rodney [01:10:29] But then, we started to do something a little different because there was science coming out that said, vertical relief was important for oyster reefs to optimize oyster growth and ecosystem services. So rather than making these thin layers of flat, you know, habitat on the bottom of the bay, we started building mounds. And the initial design was based on the, the volume of a typical, typical track hoe bucket, which the guys, the contractors we were working with back then, their buckets were four cubic yards of volume. So it turns out that plopping down a four cubic yard track hoe bucket on the bottom would create an oyster reef that was usually around two feet tall and around 10 feet wide. And so we started building them that way, and we feel that this will help them flap longer and also to be more productive during their lifetime.

Bill Rodney [01:11:40] And so that's the general model we usually use now is to do a sort of a field of mounds that are spaced out 20 feet apart center to center. So 10-foot gaps between their edges. And these more kind of, more kind of imitate the natural oyster reefs that you would see if there was not, you know, such heavy fishing pressure flattening them out. And that's been our standard approach for a while now, and now that approach is evolving still to

something even more, more complicated, if you will, with certain funding sources now where we're having to restore oyster reefs, both subtidally and intertidally. And the reefs that we're building intertidally, we're going to experiment with different geometries to try to, to try to maximize the shoreline protection aspect of them. And so we're going to ... change is coming in the how we do that in the near future.

David Todd [01:12:56] I see. Well, you make it sound simpler and more obvious and easier than I'm sure it is. Are there some challenges, hurdles that you've had to clear, in or, you know, issues you've just had to learn about and resolve in building these reefs? It sounds like there's been a lot of sort of learn-as-you-go. I mean, this is a really developing science.

Bill Rodney [01:13:25] Yeah, it's mainly pertain to just, there's a lot of paperwork that goes into, you know, restoring an oyster reefs. So you have to get permits from the Army Corps of Engineers and the leases from the Texas GLO, General Land Office. So those aren't really obstacles. They're just part of the process that you have to go through. Also, we have to make sure we're not damaging any cultural resources like shipwrecks and whatever historical sites that are on the bottom of the bay. And so that's, that's sometimes becomes an obstacle and we have to have these surveys done and they discover something's down there. Suddenly that part of our project area is off limits to us. So these things happen.

Bill Rodney [01:14:23] I think that basically we're learning as we go. But we've been very successful for the most part. Well, one thing I did learn - a more recent project we did in the Upper Bay was that this project was undertaken during the droughtier years, when the oysters were thriving in that part of the bay. And then by the time the grant was, was funded and all the permits were in place and it was time to, to construct the oyster reefs, the climate regime had kind of shifted to a rainier sort of period, you know, and oysters weren't doing as well up there. So we built these reefs and we weren't seeing the kind of initial larval cultch colonization that we're used to seeing on our previous projects. So that that was kind of a surprise, you might say, and I guess that it shouldn't have been. But we kind of got ahead of the science a little bit there.

Bill Rodney [01:15:29] There has been recent, you know, recent progress in understanding these like longer term cycles of boom and bust for oysters. And it turns out they're kind of linked to to these sort of hemisphere wide processes and in particular, the El Nino / La Nina cycle in the equatorial Pacific, where when you have a strong El Nino, Texas has lots of rain. So we've kind of come through the period recently where we've had a lot of strong El Ninos and we've seen a lot of these big rain events and just generally wetter, wetter, which has pushed the salinity down the bay. So these upper bay areas aren't really optimal for oysters, but as luck would have it, or perhaps not luck, just the natural cycle of things, right now, it looks like it's starting to shift back.

Bill Rodney [01:16:35] NOAA recently declared that it's officially a La Nina, and that means less rain, which means the salinities are going to rise in the upper bay. And those areas will probably start seeing more oysters showing up in the reefs. They're going to start thriving. So hopefully that's a trend. These things, these cycles, tend to last for three to four to five years before they switch around. So right now, it looks like we're at the beginning of a La Nina cycle, which might mean droughts for some people, but for oysters, that's kind of a good thing.

David Todd [01:17:20] So you told us a little bit about the origins of these restored oyster reefs and then some of the, the climatic forces, El Nino and La Nina, that affect these reefs. Can you talk a little bit about the, the human aspect to this, you know, both the volunteers that I

think you've recruited to help care for these places and then also the oystermen and you know, how their dredging or tonging on these restored reefs affects them.

Bill Rodney [01:17:59] OK. Sure. Well, you know, I like to eat oysters as much as the next guy. And I know that the dredging, it's not, it's not too beneficial to the reef to have these, you know, heavy iron-toothed dredges dragged over them. And the oyster reefs are still incredibly resilient to that, as long as it's not too much. And for a while there, it was getting to be too much. We had meetings with the oyster industry folks, and they knew something had to be done to. They were, they were basically coming to us and saying we got to do something. And so we all got together and we agreed on taking some measures.

Bill Rodney [01:18:49] And one of the measures was that, we would start sampling some of these oyster-producing areas. And when our sampling saw that there were not enough market-sized oysters, and lots of sub market-sized oysters, that we would close down some of these areas. And we set up a system. Basically, it was Christine Jensen here at the DML, Dickinson Marine Laboratory, who found this method where we have what we call the stoplight method. Where, when the, when the data says that there's not enough large oysters and lots of small ones that will be killed by the fishing activity, we'll close down the area until subsequent sampling says it's ready to be reopened. So that's the green light.

Bill Rodney [01:19:46] So what certain data, certain indicators or thresholds, once they're crossed, it's a red light. We shut the area down. And then once we get a new threshold to reopen, we reopen it. That's the green light. So that's the stoplight method. That was one of the things we came up with in our meetings with the industry folks, and I think it's helped.

Bill Rodney [01:20:07] Although it has been hard on them. It just turned out that we all agreed on this method, and then suddenly by our own, you know, rules that we all agreed on, we had to shut down lots of areas of the Bay, Galveston Bay in particular. And what that did is it shifted the fishing pressure down the coast to other smaller bays, and then they started seeing some pretty bad impacts. And those places started getting shut down. And then the fleets were, were starting to go into, you know, environmentally sensitive, shallow small sub-bays and impacting, you know, those areas.

Bill Rodney [01:20:48] And eventually, there had to be some legislation that, that made those areas off-limits. But this legislation also made a 300-foot wide buffer along the margins of all, all Texas bays off-limits to oyster dredging. So now we have basically these, these sanctuaries, that are now going to allow oysters to develop on with no fishing pressure, and these will become oyster larvae factories, which will help produce larvae for the areas that do get fished. And that's a sort of a new strategy we're adopting, not just through that legislation, but in some of our restoration projects. We're starting to build in unharvestable, what we call brood stock reefs, or brood stock sanctuary reefs, where there'll be up a dense population of large larvae-producing oysters, which will export their larvae to nearby fish reefs to help them bounce back after the fishing season closes.

Bill Rodney [01:22:04] So, like I said, that the, the approach is evolving, rapidly, and I think it's going to be good.

David Todd [01:22:14] Well, that is really interesting and this this sort of cooperative venture with the oyster industry, which I guess, these, a lot of these oystermen know that the system as well as anybody and know one is being over-used.

David Todd [01:22:33] Is there any sort of tender loving care that these reefs need? I thought at one point that there were volunteers involved in maintaining the reefs after they've been built up by the agency. Is that is that correct or not so much?

Bill Rodney [01:22:53] You are referring to one particular project that I did and around 2009, 2010, and that was what we call a community, community-based restoration project. So we were already spending millions of dollars, or planning to spend millions of dollars on the oyster, you know, on the oyster industry building these large reefs. But I got a small grant, and the idea was to create oyster reefs in the near-shore waters. This was done right off of the town of San Leon, on, on the western shore of Galveston Bay, south of Kemah, if you know where that is.

Bill Rodney [01:23:39] But so I recruited the waterfront property owners there to sort of become stewards of these new reefs that would be built right off of their piers. And during that time, at that time, those waters, while they still are closed to commercial oyster fishing because of the bacteria levels are unhealthy, unsafe, to eat oysters harvested in those waters. So that provides sort of a de facto sanctuary protection to these reefs that were in these waters.

Bill Rodney [01:24:14] And so that in order to kind of teach the waterfront property, the community, about oyster ecology and the value of these habitats, we had them grow oysters in mesh, plastic mesh bags stuffed with shells which hung from ropes from their pier. With help from the Galveston Bay Foundation, and together, we, we, we taught a lot of property owners to do what we called, "oyster gardening", growing baby oysters in these plastic mesh bags full of shell. The oyster larvae would find the shell and attach and be growing inside these bags, and the water was flowing through them. And they're up in the water column, not getting, you know, silted over or anything. So they, they were growing a lot of oysters to put out on the new reefs to kind of give them a jumpstart in producing and developing an oyster population. So they were doing that for quite a few years, and I think they still are if I'm not mistaken.

Bill Rodney [01:25:24] But I after I got that rolling, I sort of stopped being too closely involved, and it's Galveston Bay Foundation who are spearheading that stuff now. So yeah, that was a very, very rewarding project and we did get the community involved and they kind of became stewards of their reefs off their piers. And they, you know, they will report any oyster boat that comes into those waters and is illegally, you know, harvesting in polluted water, so. Even though the waters are technically polluted with bacteria, that's not bad for the oysters. The oysters are thriving. It's just that they're dangerous for people to eat, especially raw, and especially if you're immune compromised in any way, because there's vibrio bacteria out there that's very dangerous.

David Todd [01:26:24] I see. Well, you know, you told us about the reconstruction of these reefs, both the ones, I guess, that are offshore and then these ones that are closer to the coast. I thought this might be a chance to talk a little bit about whether the reef restorations help create any areas for marsh replanting is easier just because some of this wave energy is being absorbed by the reef. Is that, is that a possibility?

Bill Rodney [01:27:00] That's a possibility. I haven't been involved in any projects like that, yet, although there's some things coming down the pipeline where that's going to be tried. Galveston Bay Foundation has done a little bit in that regard. Some of their, some of their properties and some of their small projects around the Bay where, where they are using like breakwater reefs in conjunction with planting, you know, replanting grasses and other things

- sort of what you call "living shorelines" approach, with not just restoring oyster reefs, but maybe at the same time, you know, restoring some marsh habitat as well, and trying to make it, protect it, by having these, these fringing reefs reduce the incoming wave.

David Todd [01:27:55] I see. Well, that's, that's exciting, that's, that's a nice way to, I guess, couple these two kinds of shoreline restorations.

Bill Rodney [01:28:05] Some of the projects that are coming down the tubes that are funded by the Deepwater Horizon settlement are going to include these types of designs. So we'll be seeing more of that sort of thing in the near future.

David Todd [01:28:19] I see. Well, you've told us about the reconstruction of these reefs and and I guess the, the productivity in terms of shell and the yields for, for the fishermen there. I'm curious, you know, to just sort of cycle back to where you started in your master's thesis. I think you'd been interested in how the macrofaunal assemblages on restored and unrestored oyster reefs compared. I mean, when you try to rebuild one of these reefs, is it possible to put back all the, you know, the shellfish, invertebrates, and finfish that are part of a mature reef?

Bill Rodney [01:29:09] Yes, it is. In fact, like when you restore an oyster reef, at least for the first several years, it sort of functions like a super reef. What you'll see is an incredibly high densities of all kinds of organisms, beyond what you would see in a typical natural situation, because suddenly there's just a lot of clean, fresh hard substrate for oyster larvae to attach to and grow. And so you'll have a really, really good initial spat set and a lot of baby oysters all at once. And they grow pretty fast and form these, you know, three-dimensional complex structures that are, that are, you know, home for all these organisms. And these organisms, most of them, have planktonic larvae as well. So they find these things pretty quickly and colonize them. So it's, there's a lot of literature out there that, that shows the same kind of results I saw on my master's thesis.

Bill Rodney [01:30:21] And what I've seen here in Texas is that initially a restored oyster reef just explodes with life at incredible densities, oysters and everything else. And then they stay that way for a long time, actually.

David Todd [01:30:41] That's really encouraging. It's nice that you can put these things back together again. It's, it's, it's like a very difficult jigsaw puzzle or Lego kit. I'm impressed.

David Todd [01:30:57] Well, so I guess as we kind of wrap this up, I was wondering if you could talk about any of this kind of limiting factors. I've read, and you'd know a lot more about this, but that, that some of the, the big trends in carbon emissions around the world may be having, you know, problematic effects on pH levels in the oceans and that it may hinder the ability of oyster shells to be formed. Is that, is that something that you consider a real threat or do you think it's not an immediate problem? What are you thinking?

Bill Rodney [01:31:37] It's potentially a very real threat. I haven't seen proof that it's happening in a big way right now around here. But on the West Coast, in the Pacific Northwest area, they've seen some pretty drastic changes in pH. And what happens is that the carbonate cycle, the cycle that, of carbon and calcium, combined in the water, sort of shifts to a more acidic state. And once it gets to a certain point, oyster larvae can't form their initial shells when they're developing as larvae. So that's, that's a pretty scary situation because it's going to kill the larvae before they even have a chance to, you know, metamorphosis into an oyster.

Bill Rodney [01:32:34] But even if there are, and also oysters will also dissolve faster. Oyster shell will dissolve faster in these more acidic waters, so, and that'll threaten the existing reef structures as well. So, but right now, I mean, I've heard some talk from some scientists who are studying Galveston Bay that they're starting to see what they think might be indications that that's beginning to happen. But it's still, you know, pretty preliminary. So I think that we'll see. Time will tell. And, you know, whether we take appropriate action to try to get a handle on this or not will determine, you know, the fate of the oyster reefs.

David Todd [01:33:23] Yeah, boy.

Bill Rodney [01:33:28] Yes, if acidification doesn't turn out to be as catastrophic, then the other impacts of carbon, of global climate change, will be - you know, rising sea levels, stronger hurricanes and all these things could, could impact oysters, stronger hurricanes in particular. Rising sea levels could also sort of change the salinity gradient in the bays and disconnect the optimal salinity from where the actual reefs are, so that the places that are best for oysters don't have any oyster reefs for larvae to find and detach and grow on. So we have to stay on top of this stuff if we're going to keep the estuary healthy.

David Todd [01:34:20] Boy, you, you've got your work cut out for you.

Bill Rodney [01:34:24] Luckily, I don't have to do it all by myself, you know. We've got a team effort going here and I got a lot of, a lot of smart and good people.

David Todd [01:34:37] Well, that's great. Well, is there anything you'd like to add about what you've learned or done with these oysters, and you know what you see for the future or what you learned about the sort of trends to date?

Bill Rodney [01:34:56] I don't want to make it sound too gloom and doom. There's hope. There's hopeful things that I see as well. Greater public awareness of the importance are a reason. And we've got some pretty good funding sources that are going to be consistent, that will allow us to keep restoring oyster reefs. And so, you know, there's there's a lot to keep us at least cautiously optimistic.

David Todd [01:35:27] Well, good. Well, maybe we should end on that note.

David Todd [01:35:32] Thank you so much, Bill, for your time today and for teaching us so much about oysters, something that like you, I enjoy eating and with your help, maybe we will all be able to do that for many years to come.

Bill Rodney [01:35:52] I concur with that statement.

David Todd [01:35:56] Well, we're, we're in agreement then. Well, really lovely to talk to you. And again, thanks for your time today.

Bill Rodney [01:36:04] Thank you for your interest in me and my work.

David Todd [01:36:08] Well, it's, it's, it's wonderful what you're doing, and I wish you all the best with it.

Bill Rodney [01:36:13] Thanks.

David Todd [01:36:15] All right. You take care.

Bill Rodney [01:36:16] You, too. Happy holidays.

David Todd [01:36:18] All right. You too. Bye now.

Bill Rodney [01:36:20] Bye.