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David Todd [00:00:03] Well, good afternoon, I'm David Todd, and I have the great privilege of being here with Dr. Jenni Pollack. And with her permission, our plan is to record 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 at Austin. And she would have all rights to use the recording as she sees fit as well.

David Todd [00:00:44] And I just wanted to make sure that that's OK with her. What do you think?

Jennifer Pollack [00:00:51] Sounds great. Sounds great to me.

David Todd [00:00:53] Well, good. Well, thank you so much.

David Todd [00:00:57] Well, it is Tuesday, February 8th, 2022, and it is about 2:25 P.M. Central Time. And my name is David Todd. I am representing the Conservation History Association of Texas and I am in Austin. And we are conducting a remote interview with Dr. Pollack, who is based in the Corpus Christi, Texas, area.

David Todd [00:01:25] Dr. Pollack is a professor in the Harte Research Institute for Gulf of Mexico Studies and at the Department of Life Sciences at Texas A&M University in Corpus Christi. She has been an active researcher and educator in the field of marine sciences and has made many contributions in understanding and protecting and restoring Eastern oysters.

David Todd [00:01:51] And today we'd like to talk about her life and career so far, to-date, and especially learn more about her work with the Eastern oyster.

David Todd [00:02:07] So with that little introduction, I wanted to to start us off by asking about your childhood and if there might have been any people in your early days who were a big influence in your interest in the outdoors, with coastal and marine resources, the Gulf, maybe oysters, even in particular.

Jennifer Pollack [00:02:31] Well, first of all, I'm happy to be here. Thank you so much for the opportunity to talk about, about what I do.

Jennifer Pollack [00:02:41] I was not born in Texas. And I was not born actually near an ocean at all. So my journey - I, I like to, to borrow a phrase from a TED talk about the danger of a single story. I feel like my journey has been very much not a single story. So I'm from the Midwest. I was born and raised in Minnesota. And as many people know, Minnesota is known

as the land of 10,000 lakes. So I spent my childhood outside, playing sports, just kind of exploring nature. And a lot of that involved being in the water, being in the creek near my house, being in lakes and ponds in the area. And I think I've just always really been drawn to sort of nature and observing things that you can see, you know, that I could see in my backyard even when I was a kid.

Jennifer Pollack [00:03:45] As I grew older, I, you know, moved to Chicago and went to college at Northwestern University and pursued a degree in environmental science, which is a pretty broad field, you know, that can range from learning about things like public health, to thinking about the environment and the way that it influences humans.

Jennifer Pollack [00:04:14] After college, I did what a lot of people do after college and tried to get some experience working in internships, in different organizations, in different parts of the country, and one of those was at a place called the Wetlands Institute, which is in coastal New Jersey. And that was really my first exposure or experience working in the marine environment, in the coastal environment, being part of a team of students and researchers who at that time were trying to understand changes that were happening to fish populations in a local bay, and trying to compare the current conditions of the organisms that lived there to the conditions 25 years ago.

Jennifer Pollack [00:05:02] And, you know, just combining being on the boat, collecting these samples, being in the water, as well as analyzing data, was just really, it really appealed to me. And that's where I sort of followed my heart into graduate school and then that sort of led me to where I am today as a marine scientist.

David Todd [00:05:29] You know, while you were a child, it sounds like you you're one of those privileged kids that actually gets to be outside, maybe on their own. I think after reading Richard Louv's book about Last Child in the Woods, it seems to be a rare thing. And I was curious if you had, you know, any any relatives or friends who would be with you and would sort of show you the ropes or show you the trees or whatever it might be?

Jennifer Pollack [00:06:03] You know, my dad is a very nature-oriented person and would take us to do things like shoot a bow and arrow in the woods. And I think that his influence and his sort of interest in being outside is probably what led me to being outside when I was young and just wanting to sort of follow him around. And then that stuck, you know: the interest in nature was something that I fell in love with as well, or being in nature is something that I fell in love with as well.

Jennifer Pollack [00:06:36] But you know, some of these memories, or a lot of these memories are really just being a kid, and being outside with other kids. You know, like people talk about staying outside until it was dark out, and you know, your mom called you for dinner. I mean, that's definitely an experience that I remember very clearly from my childhood.

Jennifer Pollack [00:06:56] And it's something that you know now, as a parent, that I tried to create for my kids as well. You know, we want them to go kind of be free-rein, and play with their friends in the neighborhood until dark, and take them camping and hiking and, you know, so that they can experience the outdoors as well. I think it's an important way of connecting and being invested in the places that we live, right? It's just another way of understanding or being a part of the community and the sort of environment where we have our homes, is being outside and seeing the seasons change and seeing the different organisms

come and go throughout the year. It's just something that I'm, I've always been interested in I have always been aware of and I have always sort of paid attention to as I was growing up.

Jennifer Pollack [00:07:53] Yes. It's interesting how these interests start so early, and it's nice that, it sounds like you're trying to pass on those opportunities to your kids.

David Todd [00:08:05] You mentioned going to Northwestern and then and then later on to the University of South Carolina for your graduate degrees, and I was curious if, if you ran across any professors, or classmates for that matter, who were influential for you, who really, you know, or encouraged you, in ways that you recall now as being important.

Jennifer Pollack [00:08:33] Yes, definitely. Graduate school was such a time of personal and sort of professional growth for me. My master's and Ph.D. advisor, Dr. Robert Feller, bob Feller, he was a, he has been a very strong influence on my development as a scientist. You know, it's going to graduate school in the natural sciences, and similar to a lot of other fields as well, it's very kind of personal and context-specific how you choose a graduate program and a graduate advisor and vice versa. I mean, they're really choosing the students that they want to have in their lab.

Jennifer Pollack [00:09:18] So I was very fortunate that he selected me from however many applications he had at that time. I started as a master's student in the marine science program in his lab, and I came in with a really small cohort of students are only four of us, so we are pretty close-knit group within the marine sciences, sort of followed each other throughout our professional trajectory, growing as graduate students.

Jennifer Pollack [00:09:51] I decided after I finished my master's degree, which took, I guess, two and a half years to finish my master's degree, I, I taught for a summer. I went up to Brandeis University and taught, which was great. I taught at a program that was for high school students, a marine science program in residence for high school students, and then decided to continue on in the same lab at the University of South Carolina for my Ph.D. and was able to reconnect with some of those same people that I had started with.

Jennifer Pollack [00:10:27] But I had this great opportunity of getting a graduate research fellowship so that I could move out to the marine lab. So the University of South Carolina is about two and a half hours from the coast. And if you're studying to become a marine scientist, that two and a half hours is almost like an eternity, you know, between the thing that you're trying to study and become an expert at, and where you're living and taking your classes. So once I was awarded this graduate research fellowship from the National Estuarine Research Reserve, I was able to go and live at the Marine Lab in Georgetown, South Carolina. And some of the most influential people in my life, still, were the people that I met and worked with in my time at the Baruch Marine Lab on the coast - you know, Dennis Allen, Paul Kenny, Dave Bushek. I mean, I have friends who are still working out there who have taught me so much about the coastal environment.

Jennifer Pollack [00:11:25] And there's something about the people who are living and working in those small coastal areas. You know, they're just very committed. You know, their whole lifestyle and livelihood is committed to living in these small places and studying these changes that are happening on the coast. And those, those are my people, and those were the people who taught me so much. And then those are the people that I still have friendships with and look to as mentors even today.

David Todd [00:11:52] That's so interesting, it's it sounds like there was a community of researchers, but, but they're sort of ensconced in this, these little coastal towns and, you know, it's so connected to the estuarine world as well. It must be a really intense kind of experience.

David Todd [00:12:14] So, you know, some people also get a lot of encouragement, at least maybe in the early years from just the culture around them, you know, that they sort of absorb like by, by osmosis or something - you know, the TV shows, the movies and the sort of general readership books that might be floating through their household. Was there anything like that, that there was significant for you?

Jennifer Pollack [00:12:46] I mean, yeah, we were the, the family that had National Geographic's from however many decades beforehand around the house, encyclopedias, things like that. You know, I was a big reader, and so I loved to get my hands on books and magazines that talked about nature in the, in our area and just kind of around the planet as well. And so that was one place, I think, where I was inspired.

Jennifer Pollack [00:13:17] I, I also had great science teachers. So in high school, my AP biology teacher was definitely somebody who, who, you know, I had this interest in nature, but that kind of connected that to biology, like where my interests sort of really was within all of the different fields of science kind of identified that as being in the field of biology, really helped me. And then, you know, I for, for probably all of my time in high school and then the beginning of my time in college, I think like a lot of kids, or students, who like biology, I really thought that if you liked biology, you became a physician - you know, that that was the place that, that was the career for you. But it just really wasn't where my heart was. And so it took a little while to sort of figure out, where do you go if you like science, but you don't necessarily want to be a nurse or a doctor? Where else can you go with that?

Jennifer Pollack [00:14:26] And so I've learned about just being a researcher and doing science and being an applied scientist. You know, I've always been really interested in science to solve problems. I, you know, the worst thing that could happen to me after I give a presentation is somebody raises their hand and says, "Who cares?", about the work that we've been doing. You know, the work that we're doing is for a reason. So learning about how you can apply science to situations like helping the coast, helping the marine environment, helping solve problems that are out there that are not just related to human health, but that really connect back to the nature that got me interested in science in the first place, was really a place I didn't realize existed. But it's sort of the place that I found that is the perfect niche for me.

David Todd [00:15:18] So with that interest in nature and biology and and applied research, I gather that kind of set of interests took you to an academic career. And from what I understand, you, you came to Texas A&M - Corpus Christi in 2007 and, and in the years since have also worked at the Harte Research Institute for Gulf of Mexico Studies. Maybe you can give us a little synopsis of how you ended up there. I mean, as you said, you grew up in Minnesota, and studied in Illinois and then in New Jersey, and you've made the full loop all the way down to Texas. That's a long way. How did you end up there?

Jennifer Pollack [00:16:04] That's right. You know, it seems like probably in a lot of fields, the longer that you're in that field, or the more that you sort of study and specialize, the smaller the world of people that you interact with gets. And that's sort of the place that I'd gotten to in completing my doctoral studies. I was looking for, as I was completing my Ph.D.

work, I was looking towards a post-doctoral training opportunity. So I wanted to continue learning and training, but no longer as a student. This is a pretty typical path for someone who's going into academia in my field, and a lot of fields, would be that you finish your Ph.D., you do a post-doc, or even multiple post-docs, and, or something similar, and then you would apply for a faculty position. So I actually came from the University of South Carolina straight to the Harte Research Institute to work with Dr. Paul Montagna, who also has been an incredible mentor, and just somebody that I've learned so much from as a scientist.

Jennifer Pollack [00:17:21] He actually, in this small world, had completed some of his graduate work at the University of South Carolina many, many years before and was sort of in a similar network of people studying benthic ecology. Benthic ecology would be another way to describe what I study, which is things that live on the bottom of the bay - so, worms, clams, oysters, things that are sort of, you know, seagrasses and things that are on the bottom. So I came here to the Hart Research Institute. Dr. Montana actually had just left the University of Texas Marine Science Institute and had to come here. And so he didn't really even know what to tell me about how the situation would be.

Jennifer Pollack [00:18:03] But coming here was just so wonderful because it's a marine institute, but it's, it's actually become a model for other marine institutes around the country in that, we're trans-disciplinary in nature. So we not only have natural and physical scientists, which is what you would kind of traditionally find in a marine lab. But we also have social scientists representing fields like, you know, the human dimensions of, of science. It's socioeconomics, policy and law, so we have a lot of ways that we can take different perspectives to help solve problems in the Gulf of Mexico.

Jennifer Pollack [00:18:48] So, as a post-doc in Dr. Montagna's lab, I was kind of being raised in that environment, if you will, and came to learn about the importance of taking multiple viewpoints to attack a problem. So I worked at the Harte Research Institute as a post-doc, moved into an assistant research scientist role, and then a faculty position opened up in the Life Sciences department, and in 2011, I was offered a position as an assistant professor, a tenure-track professor, in the Department of Life Sciences.

Jennifer Pollack [00:19:23] So I left the Harte Research Institute, just walked across campus, became part of the Department of Life Sciences, you know, took on a role as a, as a teacher. So I was teaching classes as well as advising undergraduate and graduate students. And then in 2017, after earning tenure in the Department, I was offered a position here back at the Harte Research Institute, and now I have sort of a, a dual appointment, if you will. So I'm a chair here at the Harte Research Institute, and I still serve as a faculty member in the Department of Life Sciences. So it allows me to do teaching as well as to continue to do research.

Jennifer Pollack [00:20:07] And coming back to the Harte Research Institute, to be honest, just sort of felt like a homecoming for me because again, I sort of was raised professionally in this trans-disciplinary training and coming back to it really just felt like such a natural progression of my career to come back to that, those perspectives?

David Todd [00:20:33] Wow, what a route. And it sounds like you were in the fast lane. So, a lot has happened.

David Todd [00:20:41] You know, and it seems like you're, the environment you're in at the Harte Research Institute is, is so well-suited to something like the oyster, which has, you

know, fascinating biology, but also has such an important role in lots of socio-economic and public health issues that it just must, you know, be interesting to you in lots of respects.

David Todd [00:21:12] I was hoping that you might be able to just give us a little introduction to the life history of the Eastern oyster and, you know, for, for those of us who are new to this.

Jennifer Pollack [00:21:25] Sure. Well, I like to joke that even if you don't like to eat oysters, not everyone likes oysters, but when you learn about them, everybody can sort of find a reason to be excited about more oysters being in the water.

Jennifer Pollack [00:21:39] So as you said, it's really become an area where so many people have become interested in learning about oysters, protecting oysters, getting more oysters in the water, whether it's through restoration actions or preserving habitat, as well as understanding all of the beneficial services that the oysters can provide for humans.

Jennifer Pollack [00:22:06] So just a little basic biology lesson: oysters there're, there're actually male and female oysters, even though they all kind of look the same, kind of look like, you know, little rocks under the water, but they're, you know, the oyster is a bivalve, just like a clam. It has two shells, hinged, two paired shells that are hinged. They're male and female oysters inside of those shells. They're individuals, sorry, male and female oysters. They release sperm and eggs into the water column. They do that typically twice a year in Texas. Usually they do that in the springtime when the temperatures are warming. They can do that sort of continuously throughout the summer. And then sometimes we see a big pulse again of spawning in the fall before the winter time. Usually it's kind of quiet in the winter.

Jennifer Pollack [00:22:57] Those eggs and sperm form fertilized embryos in the water column, and those larval oysters go through several metamorphic stages. So they are tiny plankton at that point, floating around in the water column, sort of at the mercy of the currents. And their final metamorphic stage, about two to three weeks after they were originally formed, they are in their final metamorphic stage that we call pediveliger with that "pedi" referring to the fact that they have a foot. So they, at that point, they come down out of the water. They become negatively phototactic. They're looking for dark, the darker part of the water. So they're going down towards the bottom of the bay and they're looking with that foot for a hard surface to attach to.

Jennifer Pollack [00:23:50] And in our bay systems, the most common place that they're going to attach to, or the place that's most reliably going to be found for them to attach to, would be an existing oyster reef, so the shells of the older generations of oysters. And so that's typically the way that an oyster reef forms, is that larval oyster then attaches itself to that, to the shells or to the backs of the, the older generations of oysters. They cement themselves in place and then they're there for the rest of their lives. So oysters don't move around at that point. They form their adult shell that we, you know, come to recognize them by. And that's, that's how an oyster forms. You have those, you know, the shells are sort of the internal part of the oyster reefs, as older oysters and dead shells. And the outer part of the oyster reef is a veneer of living oysters.

Jennifer Pollack [00:24:42] So that's how you get a reef, that's sort of the biology of the oyster.

Jennifer Pollack [00:24:48] This life cycle is actually pretty important to know, to understand some of the challenges to managing oysters because oysters are both a habitat, so they form

this reef, but they're also a fishery resource themselves, so we harvest oysters to eat. You know, I like to eat oysters; lots of people like to eat oysters. The challenge, of course, is that, if you are fishing, you know, hook and line or something for a fish, you're not taking the habitat with it when you catch that fish. Right? You're leaving the seagrass in place or you're leaving the water in place. But with the oysters, they're harvested using a dredge, which is essentially a heavy metal kind of rake that gets pulled behind a boat. It gets dragged over the reef and that dislodges, that rake dislodges the oysters. They go into a bag that's attached on to that dredge and then brought to the surface.

Jennifer Pollack [00:25:44] So as I said, those shells are so important for the younger generations of oysters to attach to. So in harvesting the oysters for the resource, the fishery resource, we also harvest the shells because they're one and the same. Therefore, we depend on this really delicate balance of making sure that we aren't harvesting too many so that we still have enough habitat left for the oysters to sustain themselves into the future.

David Todd [00:26:16] That's very helpful. Nice description of this, this challenge nd this balance that I guess folks have been trying to reach for a number of years between maintaining the habitat, but then also providing people with the oysters they like to eat.

David Todd [00:26:38] You know, you told us a little bit about the dredging. This, a lot of this is probably before you were in-state, maybe even some before you were even born, but can you fill us in a little bit about the long history of, of dredging oysters, either for aggregate, or for chemicals, or for the yummy flesh?

Jennifer Pollack [00:27:03] Yes, I mean, it's really an interesting story that's pretty unique to Texas. You know, in the, you know, I'm not going to get the dates exactly perfect, but in the I guess, early to mid-1900s, there were, there were industries or there was an industry that existed specifically for dredging what they called mudshell out of the Texas bays. So what that meant is instead of dredging the oysters on the surface, the live oysters for the oysters that we eat, instead, those industries or those companies were dredging the shell that was down below the surface, the sediment surface at the bottom of the bay, and digging up those historic oyster shells to use them, as you mentioned, like as an aggregate for construction, road building and industrial purposes.

Jennifer Pollack [00:28:05] So as I described how that oyster reef forms, you could almost think if you could take a slice of vertical slice of an oyster reef from the surface down deep into the sediments, and look at it, it almost is sort of like an iceberg, where just the tip of the, of the oyster reef, the living oyster reef, is exposed above the mud. But down deep in the mud is generations and generations and generations of dead shells from those older generations that have, you know, lived through time, that have been buried by the sediments in the bay.

Jennifer Pollack [00:28:42] And, as you know, the Texas coast is not a place that has a lot of, it's not, it's not a rocky coastline, right? It's, it's not easy to go find rocks or boulders or gravel that can be used for construction. But what the Texas coast has had is oyster reef. And so there are actually maps that exist that actually span the entire Texas coast, I mean from the southern border with Mexico to the northern border with Louisiana, showing the extent of roads that were paved with oyster shell. And it, it spans the entire distance of the coast, it goes up to Beaumont, you know, around Houston. And it was a, it was a readily available, hard, structured material that could be used for these other resources or these other uses.

Jennifer Pollack [00:29:44] So that's also been a challenge for managing oysters is that the shells still have value. It's not just the oysters themselves that has a value, but the shell has a value because, as you know, people like to still use them in parking lots and their driveways and in their gardens, and they can, you know, they still grind them up and use them in chicken feed. And there are lots of other places where oyster shells have value.

Jennifer Pollack [00:30:16] So holding on to those shells and leaving them where they're most needed, which is in the bays to help sustain the resource itself, has been an additional challenge to the sustainability of oysters.

David Todd [00:30:35] Yeah, it seems like there's this rivalry, this competition, between the use of shells in the bay and out of the bay.

David Todd [00:30:47] So I think that, that one of the things that might be good to talk about is just how oyster production in Texas has, has fared over the past decades. You talked a little bit about the mudshell dredging, which I guess really kind of tapered off, if I've got this right, in the late '70s or so early '80s.

Jennifer Pollack [00:31:17] I think that's right.

David Todd [00:31:18] Is that correct? OK.

Jennifer Pollack [00:31:20] I think that's right. It's, I don't have my dates, correct, but yeah, you're in the right ballpark.

David Todd [00:31:26] Okay. Well, you know, it seems like the reefs have continued to be used for dredging for, for, you know, oysters on the half-shell or to be, you know, used in other ways for eating. Maybe not, you know, that sort of more boutique sense of oysters on the half-shell, but, but, you know, when they're breaded and fried and all those yummy things. But, but I understand that the production of these oysters has, has had some really tough challenges, and I was hoping that you might be able to help us understand, you know, the role of, of some of these major hurricanes that have come through, and changes in freshwater inflows, and you know, some of the other factors that you know a lot better than I do.

Jennifer Pollack [00:32:22] Sure. Yeah. So oysters in Texas and not just in Texas, I mean, oysters really globally, in the Gulf of Mexico and beyond have, have suffered severe losses over the past 100, 150 years, and there have been a number of recent studies that have addressed this, have tried to look into the historical record and understand what was the extent and distribution of oystering habitats in the past and what is it today? And, you know, the result is that we understand now that oyster reefs are one of the most threatened marine habitats in the world. And we're talking about estimated losses of 85 to 90 percent, plus, compared to sort of pre-human exploitation days. So these are what we have today is really just a fraction of what existed in the past.

Jennifer Pollack [00:33:30] And some areas are in much worse shape than others. So the Gulf of Mexico actually has been sort of heralded as a location that has the best opportunity for sustainable fishing and sort of conservation and restoration of legacy reefs to, to occur hand in hand. You know, to be able to find a way to balance preservation of the resource and sustainable fishing for, you know, harvest for, for human consumption.

Jennifer Pollack [00:34:07] We, we because we're on the Gulf Mexico, because we know that the situation is, is better than in some cases, it's allowed us to be more successful in some of our restoration and conservation actions. We know that there are enough oysters out there right now that can be protected. Or that if you restore an oyster reef or if you rebuild, if you put new hard material back into the bays, at the right places, at the right times, essentially, if you, if you create that attachment surface, if you create that building block, that fundamental building block that those larval oysters need to attach to, there are enough oysters out there producing those larvae, producing the baby oysters, that they will attach to your reef if it's in the right place, like I said at the right time and can quickly become populated with oysters and form new reef.

Jennifer Pollack [00:35:04] It's sort of that "if you build it, they will come" luck that we have in the Gulf of Mexico, in many places in the Gulf of Mexico, I should say.

Jennifer Pollack [00:35:13] In other places, they're not so lucky. And so in order to try to get oysters going again in places where there aren't enough natural populations left, you have to actually bring the live oysters back to the bay. So that might be working with a hatchery, having them spawn oysters in big tanks and then bringing those small baby oysters back into the field. That might mean moving live oysters from one location to another. I mean, it can be very expensive and labor-intensive when the oysters are not there to to kind of serve as the source population moving forward.

Jennifer Pollack [00:35:52] Whereas in a lot of our bays in Texas, we are lucky and we do have that situation. But the challenge, as I've mentioned, is that we see the oysters in Texas seem to be, keep getting, they keep getting knocked down and they don't get fully up again before they get knocked down again. So they, you know, they're constantly being harvested in most, in a lot of the subtidal areas of the bay during the commercial harvest season. So that's something that I've described already.

Jennifer Pollack [00:36:21] We also know that when storms come through, they can lead to oyster mortalities, either by resulting in a change in salinity. So a ton of fresh water being dumped on our bays means that the salinity of our, our bays, which are sort of this balance between salt and freshwater - they're brackish in their salinity - all of a sudden they can become almost like freshwater lakes, and the oysters can't sustain themselves in the long term at really low salinities.

Jennifer Pollack [00:36:53] We also have the opposite where we have long droughts, and then the salinity in the bays gets extremely high, and that allows marine predators that might be normally limited to the Gulf of Mexico to, to penetrate deeper into the estuaries, and that can be detrimental to oyster health as well.

Jennifer Pollack [00:37:14] We also know that storms bring a lot of rain to the land, which then drains back off into the bays and can bring a lot of sediments with them. So after Hurricane Ike, for example, in 2008, this was the biggest issue for oysters in Galveston Bay was sedimentation. So these oysters, which are filter-feeders, they feed on phytoplankton in the water column, were all of a sudden buried under six inches, a foot, two feet of mud, and smothered to death, essentially. So then not only do you lose the oysters, but because it's buried under mud, you also lose those essential hard structures needed for the next generations of oysters to recruit, you know, settle, recruit and attach and grow and kind of continue the cycle of oysters.

Jennifer Pollack [00:38:06] So, there's just, like I said, it sort of seems like each time the oysters have been knocked down, they've had a little bit of time to come back, get back up again, and then some other disturbance sort of knocks them back down again. So they're, they're just really, oyster populations in Texas have been up and down.

Jennifer Pollack [00:38:27] And really in the past, in the recent past, there's been a lot of calls from conservation organizations, community members who are concerned that oysters are in bad condition, and really putting a lot of sort of voice behind the need to protect what we have before it's gone.

David Todd [00:38:58] Well, I love this sort of multi-generational aspect to oysters that they, you know, have a value and a, a role, I guess, in and of themselves as living oysters, but there's also this substrate that is, you know, the mudshell and the historic shell that I guess supports the living layer.

David Todd [00:39:22] My understanding is that that you have been interested and have been involved in trying to make sure that there's enough shell being returned to the bays in Texas, so that that substrate continues to exist. And I was hoping that you could talk to us a little bit about the "Sink your Shucks" efforts. I love that phrase, "Sink your Shucks" - that program, and then some of the opportunities that you see for working with this Shell Bank. These are all new ideas to me, and I'd love to hear what you, what you've learned.

Jennifer Pollack [00:40:06] Yeah. So, you know, as I mentioned, when oyster shells are removed from the bay they are, they're taken away from the place where they're needed most, you know, on those reefs to sustain the new generations of oysters. So in the cases where the reef has been degraded, or the shell resource is missing, or, or is in short supply, habitat restoration programs have been developed to sort of step in and try to, to fix the problem. And in places like Texas bays, for the most part, where, as I mentioned, you have these existing source populations of oysters, you don't need to worry about putting the oysters back, but you need to worry about putting that material back for them to attach to.

Jennifer Pollack [00:40:58] And the most reliable thing, the most natural hard substrate for them to attach to, of course, is the shells of oysters, as I mentioned, like they would on a natural reef. So we developed an oyster shell recycling program, again because a lot of the shells, because the shells do have other things that they can be used for. We found that if we didn't step in and try to reclaim the shells ourselves, they probably wouldn't make them their way back to the bays. So we've worked with local restaurants, seafood wholesalers, festivals, and we work with them to reclaim the shucked oyster shells.

Jennifer Pollack [00:41:38] So after people have, you know, eaten the oysters, we reclaim the shells. We work with the restaurants, for example, to put those shells in a separate bin and we come and pick up those bins from outside the restaurants as often as is needed. Sometimes it's once a day, sometimes it's once a week, depending on the demand, and we take those reclaimed oyster shells. We do the same thing, as I said, from seafood festivals. For example, we go to Fiesta Oyster Bake in San Antonio. We've collected oyster shells from the Austin Oyster Festival.

Jennifer Pollack [00:42:14] And we take all those shells and we stockpile them. We have some land that we lease from the Port of Corpus Christi. And, as you can imagine, you don't really want shells in your backyard that have been recently shucked, because they still have, you know, they've got some cocktail sauce on them, they've got some oyster tissue still

attached to the shells. So we put them out there at the Port of Corpus Christi and we let them bake in the sun, basically, sun bleach for at least six months, which is a rule in the state of Texas, before we put them back out into the bay.

Jennifer Pollack [00:42:47] So we recycle those shells, we make sure that resource goes back where it's needed most. Once we have enough shells stockpiled, we, we use our science. So we've generated maps that help us identify the sites in the bays in Texas that have the highest chance of success for restoring oyster reefs. And then we put those shells back into the bay in those locations and then we monitor them.

Jennifer Pollack [00:43:16] And so what happens is once those shells go back down to the bay bottom, we, we wait. We know what times of year that the larval oysters are in the water looking for a place to attach. We put the shells down in the bottom around that same time, and we look for the oysters to attach and then we measure their growth. We measure how many of them are attached to the reef. And we compare that to natural reefs nearby to understand how well are we doing at replacing or reestablishing lost habitat and places where it's been degraded or lost in the past.

Jennifer Pollack [00:43:53] And, and I guess one piece that I haven't touched on yet. You know, I've talked a lot about the oyster shells and the oysters providing habitat for oysters. But the other thing that we know about oysters and oyster reefs is that they provide habitat for a whole community of other organisms in the estuary that is not hosted by any other habitat. So we know oyster reefs have a unique community of fish and shrimp and crabs and worms and marine snails and, and all sorts of organisms that live sort of in the nooks and crannies of those oysters, as well as in the sediments that surround the reefs. And many of those organisms aren't there unless the reef is present. So when the reefs are degraded or destroyed, you also lose all of that biodiversity that's associated with the oyster reef.

Jennifer Pollack [00:44:42] And when you restore those reefs, part of what we're monitoring for and measuring is the ability to recreate or, you know, recreate the habitat that then hosts all of that important biodiversity that we count on in the bay.

David Todd [00:45:01] That's really fascinating and that that these oyster reefs are home not just for oysters, but also, as you say, for fish and shrimp and crabs and snails and worms, I mean, just a whole host of creatures.

David Todd [00:45:16] You know, while we're talking about the, the value of oyster reefs for things besides oysters, this might be a good time to just to hear your thoughts about, you know, the role that oysters play, as I've heard, I don't know enough about this, but for stabilizing shorelines and for filtering in the bay waters. Is there anything you could teach us about that?

Jennifer Pollack [00:45:44] Yeah, that's a, that's a great question. And this, this is why I feel like depending on whom you're talking to, or maybe it's regardless who you're talking to, that people can kind of get behind oysters and be on Team Oysters, because they do so many great things.

Jennifer Pollack [00:45:58] So, you know, we, kind of, we've talked about their fishery, right? So, if you like to eat fresh seafood, oysters might be one of the things that you enjoy.

Jennifer Pollack [00:46:07] They provide this habitat that hosts biodiversity.

Jennifer Pollack [00:46:10] They, if they're oriented along a shoreline, you can think of them almost as a living breakwater, right? So they, they form this three-dimensional reef that has high complexity. And as waves are moving across the bay, those reefs can really slow down the wave energies before they interact with the shorelines. So if the shoreline, is, is composed of a sensitive habitat, a softer habitat that's very erosional, like a salt marsh, for example, that reef can really help protect those additional habitats, you know, salt marshes. Another one would be seagrass beds, as well as the services that they provide. So we know that they help stabilize sediments and protect shorelines.

Jennifer Pollack [00:46:59] We also know, as I mentioned before, that are suspension feeders or filter feeders, so they feed on phytoplankton and organic particles in the water column. And as they're doing that, they're also removing excess nutrients and wastes from the, from the water column. And in doing that, they help to clean and clear the bay waters as well. So if you, for example, went out and grabbed a bucket of bay water with oysters in them and you looked into it, you know, our Texas bays are notoriously kind of like chocolate milk, and you probably couldn't see the bottom.

Jennifer Pollack [00:47:35] But give it an hour, maybe, and you could look back into that bucket of water and it would be completely clear. And you could see all of the oysters. They're just incredibly efficient at filtering the water for their food. And in the process, they really help make a cleaner, clearer set of coastal waters for us.

Jennifer Pollack [00:47:57] One of the other benefits that we're really just starting to learn about, I mean, really barely starting to learn about, is the role that oysters may play in capturing, capturing and storing carbon. So there's, you know, we hear a lot about carbon sequestration, and you know, "blue carbon" is something, another term that people may have heard of, which is the ability of coastal habitats, usually referring to coastal vegetation like mangroves and marshes and seagrass beds and kelp beds, to take up carbon dioxide from the atmosphere and store it. And we're learning about the ability of oysters and oyster reefs to do that as well, which may help locally, as well, to draw down CO2 from the atmosphere.

Jennifer Pollack [00:48:47] So there's just so many economic and ecological and environmental benefits that oysters provide that, like I said, I feel like you can usually get somebody to be a fan of oysters for one of those numerous reasons.

David Todd [00:49:06] That's great. Well, you know, you've mentioned how you have this, you know, wonderful set of values and uses for oysters, and that there's usually some aspect that appeals to people to be on, I think you said, "Team Oyster"? I was hoping that you could talk a little bit about the, the chance of, of using some of these oyster restoration efforts as a way to engage citizens and teach them about how the natural world works and how you can make, you know, a meaningful dent in trying to protect it.

Jennifer Pollack [00:49:49] Yeah, I think this is such an important part of what we try to do here at the Harte Research Institute, and in my lab specifically, is to, to teach people about the importance of the coastal environment and the resources that it provides. So a lot of the work that we do, as you mentioned, is related to habitat restoration, to rebuilding oyster reefs where they've been lost and to studying how well they do at replacing the lost benefits that we know used to be present before reefs were degraded.

Jennifer Pollack [00:50:29] But a lot of oyster reef restoration work is placing large amounts of material into specific places on the bay bottom. And that usually involves, you know, dredges and and drag lines or cranes and putting this material, scooping it off of a barge and placing on the bay bottom. And so unless you happen to be out there on the day that the reef is being reconstructed, or the materials being put on the bay bottom, or the couple of weeks when that's happening, you don't really know that it's happening. You know, the oyster reefs that we're restoring are under the water 100 percent of the time. You know, the tide doesn't go out and you can't view where these reefs are.

Jennifer Pollack [00:51:12] So it's unless you saw it being built, you wouldn't know it's there. So what we've done is we've extended these efforts to the community through these public, volunteer-based oyster reef restoration events that we've been hosting since 2009, I believe was our first one, in partnership with Goose Island State Park.

Jennifer Pollack [00:51:36] And what we do there is we take some of those recycled oyster shells that we've reclaimed from restaurants and seafood wholesalers and festivals, and we bring them out to Goose Island State Park. And we have a truck of them brought to us from our stockpile at the port, and we bag up those oyster shells into bags of, into mesh bags to essentially hold them in place. And we take those bags of shell, we carry them down to the, the water's edge and we sort of set them there to kind of mobilize our efforts. And we have groups that are bagging up oyster shells for maybe an hour, you know, scooping the shells with shovels, working with a partner, filling these mesh bags. After we have a certain number of bags filled, and I mean, people can fill a thousand bags in an hour or so, then we, we work with that group of volunteers who's there and we carry those bags of oyster shells out into the, out into the water to a place that we've kind of pre-staked out. And we will rebuild an area of oyster reefs sort of bag by bag, kind of brick by brick, almost like you would kind of build a wall, where we place that shell material in mesh bags back on the bay bottom. And we replace those, those necessary attachment places for the larval oysters to recruit and attach and survive and grow.

Jennifer Pollack [00:53:06] And so, on one hand, you have these large-scale reef rebuilding efforts with the barges where you can create acres and acres and acres of, I mean, you know, tens of acres of habitat. And on the other end of the scale, you have these very small community-based efforts where people are rebuilding a reef, you know, literally shovelful by shovelful of shell into mesh bags and placing those out in the bay. They're much smaller, but we find them to be very, very important because of the way that they connect people to the water in their backyard, where they live.

Jennifer Pollack [00:53:44] You know, a lot of people, I mean, I can't tell you how many people, from kids to adults, have said, "You know, this is the first time that I really got into the bay, that I understood what was out here." You know, I've done, a lot of people will do beach cleanups and things like that, but they don't they don't necessarily connect to what's under the water, that's living under the water. I mean, they know that there are fish out there swimming, but unless they have a boat, they may not have really interacted with habitat. And I just find it incredibly rewarding to kind of teach people about what's been there sort of in front of them all of the time.

Jennifer Pollack [00:54:19] And it also creates, I think, a culture of sort of stewardship of wanting to take care of your, where you live, the environment where you live, because you can kind of go back and point to and say, "I built that reef right there. I was a part of building that reef. I want to protect that reef. You know what's happening to the habitats in my area?"

Jennifer Pollack [00:54:39] It just creates a more personal connection to what's happening in the bay. And it also creates, you know, an ability for kids to learn about science and get excited about getting wet. I mean, we've got kids out there that, like I said, just haven't interacted with the water at all. You know, when we start our event, they'll stand on the shoreline and you know, are totally uninterested in getting in the water. You know, they don't want to get dirty. They don't want to get wet. They don't want to get money. And by the end, they're, you know, totally head-to-toe soaking wet and have a huge smile on their face.

Jennifer Pollack [00:55:16] And it really is a sort of one of those, I think it's can be sort of like a life-changing, you know, very significant event for a lot of people to participate in just because of, you know, again, it's, it's they didn't go to a foreign place to experience this. They, they came right here where they lived and did something that they may have never experienced, or thought about in the past. And now it's something that they realize is important and want to connect to, hopefully more in the future.

David Todd [00:55:50] That's great. Well, you know, changing hearts and minds. That's a big part of it.

Jennifer Pollack [00:55:59] You know, you talked about the impact on some of these volunteers with these relatively small restorations, at least in terms of acreage, not in terms of their impact. Could you talk a little bit about some of the, the other reef restoration efforts that I guess are more industrial-scale and you know how you managed to pull in all the partners and get the permits and you know, logistics of pulling one of these massive efforts off. It would be really intriguing to hear about that.

Jennifer Pollack [00:56:42] Sure. You know, when you want to restore habitat, probably of any type in the coastal bays in Texas, you have to apply for a permit from the Army Corps of Engineers. You have to get a nationwide permit for habitat restoration. So that requires, you know, filling out an application, providing some maps, schematics, descriptions of what you're going to do, how you're going to do it, what you're going to use. And you have to do the same thing and request a surface lease from the Texas General Land Office. So, you know, there's a kind of a coordination, logistical coordination piece that has to happen well in advance before you can put anything on the bay bottom.

Jennifer Pollack [00:57:31] So we, we go through that process and then we, we use some of our science, as I've mentioned. So we have created what we call Restoration Suitability Index. We've created a series of maps that cover all of the bays, the whole coast of Texas. And actually those are available. Anybody can look at them. They're freely, you know, widely accessible on our website, on a website that we've developed called "oysterrestoration.org". The idea is that you can pull up a map to a bay that you're interested in, and it's colored, it's color-coded. So you can see, OK, the blue or the purple areas are more suitable for restoration. If I, if I have money and I want to restore some habitat, where are my best places? We want you to put your money in your best places where your best chance of success are. So you can see that.

Jennifer Pollack [00:58:22] You can also see, you know, the more red areas are more risky, so we wouldn't recommend that you put your money to restore habitat. We also have maps that help people to understand if they were going to rebuild habitat, what does the, what does the condition of oysters on legacy reef look, legacy reefs that are nearby look like? So if they're going to restore a reef, they could sort of compare what the number of oysters on their reef

looks like, and the size of oysters on the reef looks like compared to some nearby existing legacy reefs.

Jennifer Pollack [00:58:57] So we're trying to really put the tools in the hands of all the restoration practitioners to try to take any of this money that's being directed towards restoration and make it more successful. I'll say that, you know, we are on the smaller end of the scale here at the University in terms of, or we at the Harte Research Institute, I guess, are at the smaller end of the scale.

Jennifer Pollack [00:59:25] There are larger groups that are, are, are restoring larger, you know, more acres of oyster habitat. We've all sort of found our niche. So, for example, Texas Parks and Wildlife Department now has a, has a program in which commercial oyster harvesters need to replace a certain fraction of the shells, the cultch material that they've removed from reefs during the, due to their harvest activities. They have to replace those in the bay. Or they can pay Texas Parks and Wildlife to replace that material back in the bay. And so Parks and Wildlife now is doing a lot of reef restoration work on these commercially harvested reefs to help replace what's removed through harvest activities.

Jennifer Pollack [01:00:13] And then there are groups like the Nature Conservancy who's restored a number of large reefs throughout Texas with an eye towards conservation, so trying to create reefs that are providing the ecological benefits that are lost, but not necessarily built to sustain the commercial fishery. So there's, there's and you know, and we're sort of in that same space where we're restoring smaller-sized reefs, but to restore these ecological functions that are lost, but not necessarily to be directly harvested.

Jennifer Pollack [01:00:50] So all of us, sort of all these efforts sort of go together, if you will - different shaped puzzle pieces, different ways of replacing what's been lost in the bays and to sustain different aspects of the benefits that we know that oysters can provide.

Jennifer Pollack [01:01:08] OK. You know, I think you've talk about these efforts at the Nature Conservancy and at the Harte Research Institute and, and at Parks and Wildlife and, and, and it seems like each of these is really with the goal of putting oysters on the bay bottom. And, and I was hoping that you might also tell us a little bit about some of these recent efforts to build a mariculture industry in the state, that's more, as I understand it, about suspending oysters in the water column. And maybe you can correct me or fill in some of the details there to help us understand that new, new effort.

Jennifer Pollack [01:01:59] Yes, you're right. So Texas was the last coastal state in the United States to allow oyster aquaculture or what, what's being called oyster mariculture in the state of Texas. So we have a long way to go in being able to develop this industry. The oysters were allowed to be put in the water, I guess late in 2021, it would have been, I think September of 2021 would have been when the, when, when it was allowable to start to put oysters in the water for oyster farming. I believe now that two different entities, two different groups, have made their way through the permitting process, which is different for farming oysters than it is for restoring oysters, and have put, have put seed oysters, which can be, you know, maybe the size of your pinky fingernail, into the water, into cages in the water, baskets in the water, and then will be allowed to grow, and then will be harvested by these oyster farmers who own these, or who lease areas of the bay bottom for farming.

Jennifer Pollack [01:03:11] And there's a number of ways in which oyster farming can occur. As you mentioned, so they, one way is that they can be suspended in the water column or at

the surface of the water on baskets that are threaded through a long line, if you will, that is suspended between two posts that are driven into the bay bottom. And so oysters that are then put into these baskets and are thinned into lower densities as they grow.

Jennifer Pollack [01:03:47] And when they reach a size that is marketable, which for oyster farmers is, is for, for wild oysters that are dredged on oyster reefs, that size is three inches. So if you're going to harvest oysters with a dredge, a commercial oysterman, you have to have a three-inch size oyster. But for oyster farming, the interesting thing is that the demand sort of drives the size. So oyster farmers are typically trying to produce an oyster for the half-shell market like a prettier, kind of cupped, consistently-sized oyster. If you can think about when you go to a fancy restaurant and order a plate of oysters on the half shell, you know, the presentation, the way that those oysters look, is a big piece of this, and that's what these oyster farmers are really trying to cater to. So, so what they harvest depends on sort of what people want to eat, what that experience is going to look like for them.

Jennifer Pollack [01:04:42] We are really just at the very, very, very beginning of oyster farming in Texas. It's very exciting. We've seen oyster farming develop in, in other states and of course, across the world as well. So we know where we can go with this. One of the exciting things I think for folks who are getting into oyster farming is that we know that oysters take on the flavor of the waters where they grow, because they are filter-feeders. So, you know, if oysters are grown in an area of the bay that's more fresh, has fresher water, maybe it's near a river mouth, for example, those oysters tend to have a sweeter taste because of the fresh water. Whereas if you are growing oysters in a saltier part of the bay, you're going to have that real kind of briny, salty flavor in the oysters that you're harvesting. And so you, you can almost sort of market or brand the oysters and the consumer can understand sort of the flavor profile of oysters that are produced by different oyster farmers because of the different geographic locations of their oysters.

Jennifer Pollack [01:05:50] So if you think about how you can go to an oyster bar in Austin or wherever, and you can get Blue Point oysters and you can get Kumamoto oysters. You know, you get like a tasting plate of oysters that come from different parts of the world. The exciting thing will be in the future to be able to get that tasting plate of oysters have come from different parts of Texas and have that variety of flavors and sort of that, you know, kind of fun experience of, but with the fresh seafood coming from right here in Texas.

David Todd [01:06:24] This is, it seems so interesting, a different way to, to raise oysters, you know, that they're suspended and that they're in these crates and not on the bay bottom. And that they're essentially, as I understand it, privately-owned, it's not an open-access system as the, you know, a lot of the reefs seem to be, except I guess in Galveston. Could you help us sort of understand and compare, you know, these mariculture oysters versus the more traditional wild oysters?

Jennifer Pollack [01:07:10] Sure. So the, the species of oyster is the same. And you're right. I mean, one of the main differences is that the oyster farmer owns that product, right? So they've, they've either purchased seed oysters, like I mentioned, from a hatchery. Or potentially, they've put some sort of a, you know, maybe they've put oyster shells out so that there could be natural recruitment of the larval oysters from the bay to their oyster shells that they then grow up in their cages, so that they are sort of just like a farmer with their field or a rancher with their stock, their livestock. They are managing their, their own resource on an area of the, in an area of the bay bottom that they've leased. So, you know, you or I, we

couldn't just go and open up their cages and pull out oysters. You know, that's their personal stock of oysters that they would, they would sell.

Jennifer Pollack [01:08:08] For the rest of the state, and the way that it's always been, is that you have to have a license, a commercial license, to harvest oysters. Again, it would be conducted using an oyster dredge, which is pulled behind a boat, so you'd need to have a boat as well, and with a dredge with specific characteristics. And there are public oyster harvesting areas essentially from the Copano and Aransas bay system all the way north through the Galveston Bay system. And you would have an oyster harvesting license for the whole state. So you could, you know, if I wanted to harvest oysters in Copano Bay, I could, or I could harvest oysters in Galveston Bay. It's not very specific.

Jennifer Pollack [01:08:57] The, like you mentioned, the one difference, kind of special case, is in Galveston Bay. They have some private oyster leases which have existed for a very long time and exist only in the Galveston Bay system. And those are parts of the bay bottom that are almost, I used to call it "farmed", but I hate to use that word now. They're sort of cultivated and managed year after year after year by specific oyster houses that manage those leases. And so they actually, you know, have different rules. You know, they probably have the most consistently harvested oysters in Texas, but they can harvest year-round, whereas for the rest of the wild oysters in Texas, that oyster season goes from November through April. They also can sort of almost conduct restoration activities on their reefs, so they are harvesting oysters, but then they're taking those shells or other materials, you know, river rock, maybe concrete limestone pieces, and they're putting them back out on their harvested lease areas because they know the importance of that substrate for maintaining the oysters on their reefs.

Jennifer Pollack [01:10:16] So you sort of have this, the farmers who are, who are typically going to be farming their product in these baskets. You have the wild sort of public harvesters that are on public reefs where it's a public resource and they can dredge as long as the area is open. And then you have these private leases, which are sort of in-between, in terms of what's available to them, but have, you know, like I said, can be fished year-round and are only available, you know, anybody with an oyster license couldn't go onto those private leases, whereas anybody with an oyster license could fish on any of the public oystering areas in Texas.

David Todd [01:10:58] Well, you know, this is just the view from the outside, but I've, I've read that, that, you know, some people would describe the oyster industry as being over-capitalized and that there's, with these open access reefs, there's kind of a risk of a Tragedy of the Commons where there's just too many resources chasing too limited a resource. Do you see that as a, you know, as a problem for the oyster industry? Or is that not significant?

Jennifer Pollack [01:11:38] It's, it's definitely of concern. So, the, you know, the, the number of oysters, so it's a, it's a limited-entry fishery at this point. So it's, if I wanted to get into the oyster fishery, I would have to buy a license from somebody who already owns a license. I couldn't buy a license from the state anymore. It's closed. It's, you know, no, nobody new can get into the, the fishery.

Jennifer Pollack [01:12:07] However, when they decided to do that, when they decided to close the fishery to new licenses. In between 2004 and 2006, or 2005 and 2006, the number of oyster licenses that were purchased, when they knew that change was coming, almost doubled the number of oyster licenses that are sort of out there on the market.

Jennifer Pollack [01:12:32] And, although the overall number of licenses has slowly declined over time since that point, we know that there are many more licenses, there have been many more licenses out there than have been fished. So what this means is that people are holding on to those licenses because they know they have value.

Jennifer Pollack [01:12:53] So in a situation like we're seeing we've seen recently where bays in Alabama and Mississippi are in really bad shape, for example, Louisiana, a lot of Louisiana in really bad shape, those people can purchase a license to fish in Texas waters instead because there's this kind of glut of additional licenses out there that aren't being fished that still exist. So that's one challenge.

Jennifer Pollack [01:13:18] The other challenge is that, as I mentioned, your license applies to the whole state. But, you know, typically if you're fishing, you're going to fish in the area, in a specific area, or the area where you live. And so you, you typically aren't going to drive all over the coast all week long or all oyster season long, you're going to concentrate your efforts.

Jennifer Pollack [01:13:39] Well, as different parts of the bay, of the coast, get closed to harvest, and that might be because of too many under-sized oysters. It could be because of a red tide, you know, that would close a bay. It could be a number of reasons that could close areas of the coast. As those areas get closed, you can imagine that same number of, that same amount of fishing pressure now gets concentrated to a smaller area. And so that's when, you know, that can cause quite a bit more damage more quickly on these reefs because the harvest pressure just increases substantially on a much smaller area of the resource than it would normally experience.

Jennifer Pollack [01:14:25] And that's where we start to see, as I was talking about before, sort of the oysters can't get up before they're knocked back down again. They just can't sustain the pressure and the reefs just start to become degraded.

Jennifer Pollack [01:14:45] So we've talked a little bit about the, the risks to reefs from harvest pressure. I think that there's also some concerns that I've read about that are more sort of global in nature and aren't at least directly human-caused, but, I guess, can be traced back to climate change. You discussed it a little bit earlier about, you know, the role that these oysters can play in sequestering carbon. But I, I have heard and gosh, I sure wish I understood this better, but that the extra carbon is being absorbed by the ocean seems to be acidifying the water and that that may have an effect on the ability of oysters to actually form their shells. Is that, is that a real risk? Is that a concern that you hold?

Jennifer Pollack [01:15:47] Yeah, we see, you know, we see this happening in certain places, you know, ocean acidification or coastal acidification. We, where we are here, it hasn't been an issue. I'll give you a comparison. So the Pacific Northwest, where there are a lot of regular upwelling events in the Pacific Ocean along the coast, say, of Washington and Oregon, they have these regular upwelling events where the winds will drive the surface waters away from the coast. And you have the deeper, colder waters sort of flowing into its place. And that deeper, colder water tends to have a lower pH, tends to be more acidic. And the oyster farms out there, for example, there have been a number of studies showing the detrimental impacts on oysters, particularly the larval oysters, when they're developing shells, showing sort of the pitting and and the, you know, the kind of malformations in those, those oyster shells. And of course, if the oysters are not able to develop properly at the younger size, you're going to have a kind of collapse of the fishery, it's not going to grow into a larger oyster.

Jennifer Pollack [01:17:01] We have been, we're pretty fortunate where we are in Texas, in that, you know, there's a lot of buffering capacity that comes down from our rivers, that helps to sort of guard against those large pH changes in our bays. A lot of it's typically tied to the freshwater inflow from our rivers. So we have been pretty lucky.

Jennifer Pollack [01:17:28] You know, there are some places like Mobile Bay and Alabama, for example, where the pH is quite a bit lower and the oyster shells do degrade more quickly than they do in our bay system. So for us, for example, I've been talking about oyster shell recycling, so you can take those shells and put them back into the water, and they provide a place for young oysters to attach to and grow. If you were in a lower pH, or more acidic environment, those shells may dissolve more quickly and may not be as reliable of a substrate for oysters to attach to, or reefs to be formed out of.

Jennifer Pollack [01:18:06] And so where we are, as, as I said, we've sort of have been guarded against that, so we're sort of lucky. But we do know, as I mentioned, that there is this, this ability that we're just starting to learn about now, that oysters, as filter-feeders, to kind of take up CO2 from the atmosphere. And so the way that they're doing this, we know, we know that plants do that. Right? We say like plant a tree to help, you know, clean up the atmosphere or draw down CO2. The way that plants do that is they're photosynthesizing. So they're taking up CO2 from the atmosphere and creating tissue, creating, you know, the tissue of the plant, you know, the, the leaves and the trunk and the roots.

Jennifer Pollack [01:18:53] The way that the oysters are doing this, they're, they're not plants, they're not photosynthesizing, but they're eating, as I mentioned, those phytoplankton. So the phytoplankton are tiny, you know, microscopic plankton, little plant, little plant-like organisms floating around the bay. The oysters and the phytoplankton are taking up CO2 from the atmosphere. Huge amounts of it. And the oysters are feeding on these phytoplankton. And when they eat these phytoplankton, they remove those plants, you know, those microalgae from the bay, and they transfer it to the sediments. And they do this in feces or something that they produce called pseudofeces, which is that oysters just can keep filtering material out of the bay and transferring it to the sediments. They kind of repackage it and place it on the bay bottom.

Jennifer Pollack [01:19:45] And by doing that, those sediments then get buried over by more sediments and more sediments, more sediments. They've removed that carbon that was first in the atmosphere, then in the phytoplankton or other organic materials, and now they've buried it away in the sediments that surround them, and they've sort of locked it away from circulation with the atmosphere. And in that way, they have been able to draw down atmospheric carbon dioxide locally.

Jennifer Pollack [01:20:12] And like I said, we're really just at the beginning of learning about how well do oysters do this, what are the factors that may change their ability to do this effectively, you know, does it matter if they're young oysters, old oysters? Doesn't matter how deep they are? Does it matter if they're shallow and next to a seagrass bed or next to a marsh? So we have so much to learn, but we are excited about understanding this environmental benefit because it just gives us another reason to sort of protect and conserve and restore and invest in oyster reef habitats.

David Todd [01:20:56] That's very helpful. Thanks for explaining that.

David Todd [01:21:00] I guess another aspect of of this sort of interaction between oysters and climate change that would be good to get your help understanding is, is, you know, as, as temperatures rise and sea levels also rise, do you see a risk that, that the locations of current reefs won't really be sustainable in the long term because the depths will change and they'll be further submerged? Or is that kind of a remote concern for you?

Jennifer Pollack [01:21:36] That is certainly a concern in some parts of the US. The parts of the US that have, like on the east coast of the US, the oyster reefs are predominantly intertidal. So they're in that zone where it's, where the reefs are covered over by water at high tide, but at low tide, they're exposed to the air. So those intertidal reefs depend on that specific sort of inundation and exposure pattern, and they are very susceptible to the effects of sea level rise, you know, being drowned out as they become subtidal.

Jennifer Pollack [01:22:17] In our area, in the Gulf of Mexico, our oysters in the northwestern Gulf are typically, predominantly, subtidal oysters, so they're already covered over by water 100 percent of the time. And so for our subtidal reefs, we have less of a concern than we would if we had mostly intertidal reefs. But what we are concerned about is the effects of rising temperatures and what that does to evapotranspiration and changes in salinity in the bays. So we don't know, as temperatures rise, do the more northern bays do, the environmental conditions in our more northern bays - Galveston Bay, Matagorda Bay - do they start to represent more of a Corpus Christi Bay in the future? Are the temperatures warmer, and are the salinities saltier in the future because of climate change? And if so, what does that mean about the oysters that live there today? Are they going to be able to adapt to those higher temperatures and salinities? Or would there need to be some sort of management action to respond to those changes?

Jennifer Pollack [01:23:31] This is also really of concern to oyster farmers as well. So how do I pick the right stock of oysters to grow in my farm that are going to be able to be resilient to the environmental changes that they're going to experience in the location where I've sited my farm?

Jennifer Pollack [01:23:50] So there, there are, there are a lot of concerns, and those concerns vary depending on where you are, but they certainly will have implications for oysters moving forward.

David Todd [01:24:05] Well, moving forward, I know you have other things to do in just a few minutes. So if I could just ask one more question and that is just a general one. You know, you've, you've addressed lots of issues here and have been very helpful. But I was wondering if there was anything that you'd like to add that maybe we didn't give good justice to earlier.

Jennifer Pollack [01:24:32] I think, if I could sort of leave any, kind of have a final say at anything, it would sort of be the importance that I've been learning recently of different groups coming together to address the need for protecting and restoring and sustaining coastal habitats and coastal resources like oysters into the future. So, you know, working with resource managers whose job is to make sure that the, the fishery is still going to be there into the future, but also managing oysters as a habitat, working with, you know, recreational angling groups who value oyster reefs for their ability to create a habitat that then supports, you know, recreational fishing, sport fishing activities, working with like we've talked about sort of volunteer groups and small organizations, student groups, who want to come out and just sort of experience, be part of a, you know, be part of an activity that connects them to the bay.

Jennifer Pollack [01:25:43] And then, you know, the role that I think that I've been able to to play, and the role that my lab has been able to play, in providing the science to help support conservation decisions moving forward so that we can all sort of get to that goal of having more oysters in the bay and having those oysters in the bay, you know, into the foreseeable future.

David Todd [01:26:10] That's great. Well, I want to thank you for talking to us about your work and of course, couldn't talk to us if you weren't doing the work. So thank you very much for educating us about all this and I wish you the best with having more oysters in the bay and maybe having an oyster for dinner every now and then. It's very kind of you. So I hope our paths cross sometime in the future. But for today, just thank you so much for the visit.

Jennifer Pollack [01:26:46] Thank you so much. I appreciate the opportunity. This has been fun.

David Todd [01:26:49] Good. Fun for me too. Thank you so much.

Jennifer Pollack [01:26:52] Thanks.

David Todd [01:26:52] All right. Bye now.