

S1E4: The Edge of the Sea

The Gulf Podcast

Introduction

[Dr. Jen Brown]: Hi Gulf Podcast listeners. This is Jen. Thanks for joining me for today's episode, "The Edge of the Sea."

<<upbeat jazz music¹ starts and ducks under narration>>

If you can imagine the Texas coastline, it curves around the northwestern Gulf of Mexico. The coast is made up of a series of bays and estuaries fed by about a dozen major rivers. Estuaries are simply defined as partially enclosed areas where freshwater meets saltwater. The freshwater that flows into them is called, well, freshwater inflow. And that's today's topic. <<music fades out>>

It seems kind of mundane, right? But sometimes the most ordinary topics can be the most significant. "The edge of the sea is a strange and beautiful place," Rachel Carson reminds us.² In Texas, everything from oysters and shrimp to redfish and people rely on estuaries and freshwater inflow. In short, saltwater needs freshwater. That's absolutely fascinating to me, and something that doesn't readily come to mind when you think about the Texas coast.

Chapter One: Ecosystem Services

[Dr. Paul Montagna]: People go to the coast, not to look at the phytoplankton, they go to the coast to go fishing for redfish, or flounder, or black drum, right? The hardest sell over the years is to convince the people who only care about redfish, that if you want to build more redfish, it's the field of dreams, you got to build a healthy bay and estuary, and if you build it, they will come, and if the bay and estuary is not healthy, they are going to disappear...Everyone understands, you know, a two-foot-long redfish (laughs) and holding it up in front of a camera, but how do you take a picture of just some bay water and come to the conclusion, that's great redfish habitat? It's harder.³

[Brown]: That's Dr. Paul Montagna. He's a likable and funny down-to-earth guy, you know, someone who you might see out mowing their lawn on the weekend. And you wouldn't know it, but he's also a leading researcher of coastal ecosystems. Most people don't have a 46-page-

¹ Pierce Murphy, "Hey Mercy," *This Isn't Magic It Is Just Music*, July 4, 2018, https://freemusicarchive.org/music/Pierce_Murphy/This_Isnt_Magic_It_Is_Just_Music/Pierce_Murphy_-_This_Isnt_Magic_It_Is_Just_Music- A_Demo_-_10_Hey_Mercy. This song is licensed under a Creative Commons Attribution License.

² Rachel Carson, *The Edge of the Sea* (Boston: Houghton Mifflin, 1944), 1.

³ This and other clips come from Oral History Interview of Dr. Paul Montagna (Part One), interviewed by Jen Brown, February 23, 2017, <https://library.tamucc.edu/exhibits/s/sts/item/275>.

long résumé, but Paul does. He's currently semi-retired, and still working at the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University-Corpus Christi.

On today's episode, we'll hear more from Paul Montagna, who has devoted much of his career to studying estuaries and freshwater inflow. Then, I want to go back in history, to the dramatic changes in Texas after World War II, and how this transformed the state's coast and the water that flows into it. Finally, we'll hear more about how Paul and others rewrote state law to make Texas a national leader in maintaining freshwater inflow.

As it turns out, the uniqueness of the Texas coast really helped Paul's research.

[Montagna]: We have all these estuaries aligned perpendicular to the coast, and they lie on this gradient, and they're all dramatically different in terms of inflow and climate. It's like nature created a perfect experiment for us so that we can pair inflow effects just based on the inflow patterns alone because both the tidal variables and the geological variables have been held constant. The entire Texas coast is what we call microtidal, the tidal range is very small, and the entire Texas coast is very flat, and we have what are called bar-built estuaries, they're the barrier islands in the front, a bay in the back, and it's a very flat, fed by some river systems. For a scientist who studies inflow effects in estuaries, it's been the perfect place to set up these kinds of long-term studies.

[Brown]: In the thirty-five years that Paul Montagna has been studying the Texas coast, he's been able to document the importance of estuaries and freshwater inflow for people.

[Montagna]: Well, it's interesting. Estuaries in the coastal zone make up only five percent of the world's oceans, but it's ninety-five percent of the world's productivity, marine productivity. They're clearly very important just for providing food for people, but the other thing that's really important that people don't realize is that they provide an incredible buffer for storms, they provide natural protection during hurricanes and other big storms. So when estuaries get degraded, you lose two of those important, what we call ecosystem services, benefits to people, they no longer buffer the coast and we see storm effects get greater and greater as we degrade estuary systems and of course we have less food production, whether that's oysters, fish, or crab, or shrimp, or other things that have what we call estuarine-dependent lifestyles and are really important to people. And the third thing that I think is super important is that estuaries are natural filters. They have this ability to naturally clean the environment so when we have a natural estuary, and the estuary is in a healthy state, it literally will remove all the pollution for us, completely free of charge (laughs). And yet, the opposite is true, once they get degraded, they can be overloaded, you know, just like your vacuum cleaner gets overloaded and no longer sucks the dirt out of your rug (laughs). If an estuary gets overloaded, it has this, what we call assimilative capacity, and once that gets filled, the pollutants will start to build up, build up, build up, and then all kinds of nasty things happen, the water turns ugly colors, it might get a little smelly, we might actually get toxic events like red tides occur, so that's why a healthy estuary is so important to people.

Chapter Two: “Drought of Record”

[Brown]: Before I tell you about how Texas safeguarded estuaries, I want to go back in time a bit.

<<musical transition, instrumental folk/blues music⁴>>

World War II transformed Texas. The U.S. home front manufactured most of the materials needed to win the war against fascism. <<factory sounds slowly building in⁵>> In Texas, they built new military bases, air fields, aircraft factories, shipyards, and of course produced the oil to fuel it all. After the war, Texas continued to grow. Factories and industries popped up around the state. The coast was becoming rapidly developed. And more and more people moved into cities.⁶ <<factory sounds fade out>> All of these industries and people needed water.

Then, a drought hit. The drought of the 1950s wasn't just a year or two. It dried up Texas for most of the decade. It was the worst drought in the state's history. Interestingly enough, Paul Montagna would later work with someone who lived through the drought in West Texas. I'm talking about Dr. Larry McKinney, also semi-retired and the former director of the Harte Research Institute.

[Dr. Larry McKinney]: There was no water. I mean, in our area I don't think I saw moving water until I was in the first grade or something like that...because it had not rained, the sandstorms were so intense growing up that when at the end of the day at school when we had to go to our buses, and the buses had to be parked a few hundred feet away from the school, you know, in a big lot. There were times when the sandstorms were so intense and the visibility was so limited that we would have to assemble in the classrooms and all of us would hold hands and the teacher would take us to the bus because they were concerned we could get lost and not find the bus and be lost in the sandstorm. That was how tough it was.

[Brown]: Larry grew up on a West Texas cotton farm during the drought. When the rains stopped, his family was forced to sell all the cattle because the range had dried up. Then his grandfather had to sell some of the land. For farmers and ranchers, “that's as bad as it gets,” he said. His father had to work three jobs to get out of debt.

[McKinney]: So, it was really, really difficult, uh, and it was difficult on a lot of people. I didn't understand this, but I was, you know, for the first, until three or four, I never really had a toy that was bought. My father made all of our toys for Christmas and everything because we just

⁴ Doctor Turtle, “Unexpected Hoedown in the Bagging Area,” *Flush Your Rolex*, February 15, 2016, https://freemusicarchive.org/music/Doctor_Turtle/Flush_Your_Rolex_1416/unexpected_hoedown_in_bagging_area. This song is licensed under a Creative Commons Attribution License.

⁵ Inspector J, “Ambience, Machine Factory, A,” September 26, 2016, <https://freesound.org/people/InspectorJ/sounds/385943/>. This sound is licensed under a Creative Commons Attribution License.

⁶ Robert A. Calvert, Arnolde De León, and Gregg Cantrell, *The History of Texas*, 5th ed. (Chichester, UK: Wiley Blackwell, 2014), 331–333.

didn't have money...and it took him fifteen years to recover from the drought of the fifties to the point where he had paid back all his debts and really reestablished himself. So it was difficult...it really completely changed the landscape of farming from small farms like ours. I mean many others went out of business, but farms got incrementally larger because that's all they could do. So that started the whole shift in agriculture in the state of Texas from the small farming, and people moved into the cities because you can't make a living on the farm. So, it was a big sociological change going on.

[Brown]: The drought hit coastal communities hard too. Freshwater inflow brings nutrients, sediments, and fresh water into estuaries, that's why they're so productive for marine life. In the fifties, the lack of freshwater inflow caused fish kills and declines in crabs, shrimp, and oysters.⁷ And when the fish and shellfish decreased, this in turn, hurt tourism and coastal economies.

The drought also spurred big changes in how the state of Texas thought about water. They passed a Water Planning Act (1957), created a series of water plans, and then embarked on a dam building spree.⁸ Many reservoirs were constructed. For a state that only had a couple natural lakes to begin with, this created an entirely new landscape.

[McKinney]: It finally came to a point where we were diverting so much water from these estuaries because the Texas population was growing like crazy, it was decided that we needed to do something to determine how much freshwater each of these estuaries needed to keep themselves healthy to produce commercially and recreationally important species, shrimp, crabs, and fish, and all that. So I was charged with putting a program together to figure that out.

[Brown]: At his former position at Texas Parks and Wildlife, Larry McKinney put together a diverse team of scientists and attorneys.

[McKinney]: We spent almost ten years developing recommended freshwater inflows for every Texas bay. And that was used to go into regulations and legislations to help set aside some of that water to try to make sure that we didn't destroy the entire Texas coast by taking the freshwater away from it. That was really what we were aiming at.

[McKinney]: You see a lot of my career just keeps going back to the drought of the fifties.

⁷ Paul A., Montagna, Terence A. Palmer, and Jennifer Beseres Pollack, *Hydrological Changes and Estuarine Dynamics* (New York: Springer, 2013), 29.

⁸ Montagna, Palmer, and Pollack, *Hydrological Changes and Estuarine Dynamics*, 29. See also the Texas State Library and Archives Commission, Water in Texas digital exhibit, modified May 26, 2016, <https://www.tsl.texas.gov/lobbyexhibits/water-extreme>.

<<musical transition, instrumental folk/blues music⁹>>

Chapter Three: Texas Takes the Lead

[Brown]: Since that drought, Texas has constantly adapted its water plans. Eventually those plans included freshwater inflow. It all kind of came together at the right time. In the mid-eighties, Texas was in the middle of an oil bust. Oil has always been boom-and-bust. This time, it followed one of the most prosperous periods in Texas. It might be cliché, but I envision the seventies boom period as oilmen in polyester suits and big ten-gallon hats. But, by the time stagflation caught up with the industry, the bottom fell out.¹⁰ So when the state legislature met in the mid-eighties, they struggled with budget problems. They needed to desperately diversify the economy. When the governor addressed the legislature, he said “Water is the oil and gas of our future.” He wanted to ensure the health of bays and estuaries for the seafood industry as well as for coastal tourism and sportfishing.¹¹

This took place just as Dr. Paul Montagna began studying Texas estuaries and freshwater inflow.

[Montagna]: Yeah, it’s kind of amazing. You know, I moved here in 1986, and in 1985, the legislature passed a law that required that any new water permits would have to consider the effects on downstream bays and estuaries, and, of course, this also follows on a very devastating drought in the 1950s where people first started noticing big changes in coastal resources when the salinities went sky high. Texans have always been very concerned about protecting bay health, and understanding that rivers flowing to the coast were largely responsible for bay health along the Texas coast...So we have this long history going back to the fifties to certainly 1985, where the state has enacted laws that protect flows to the coast, that protect the bays and estuaries. What’s interesting is there are really only two other states in the country that have laws like that. Florida passed laws like this in the 1990s, California didn’t pass a law like this until 2010 so Texas has been one of the national leaders when it comes to the issue of environmental flows and protecting downstream receiving bodies of those freshwater flows.

[Brown]: In terms of water, this was pretty unique because it focused on water *quantity*, not quality.¹² Fast forward a couple decades later, and the state improved the law to protect the

⁹ Doctor Turtle, “Unexpected Hoedown in the Bagging Area,” *Flush Your Rolex*, February 15, 2016, https://freemusicarchive.org/music/Doctor_Turtle/Flush_Your_Rolex_1416/unexpected_hoedown_in_bagging_area. This song is licensed under a Creative Commons Attribution License.

¹⁰ Calvert, De León, and Cantrell, *The History of Texas*, 407–409.

¹¹ This is found in Texas House of Representatives, *Journal of the House of Representatives of the Regular Session of the Sixty-Ninth Legislature of the State of Texas*, Volume 1 (Austin: Texas House of Representatives, 1985), 114–122, quote on p. 115, accessed February 4, 2021, <https://texashistory.unt.edu/ark:/67531/metaph125384/>.

¹² For discussions of water quantity and quality, see among others, Montagna, Palmer, and Pollack, *Hydrological Changes and Estuarine Dynamics*, v; P. A. Montagna, E. M. Hill, and B. Moulton, “Role of Science-based and Adaptive Management in Allocating Environmental Flows to the Nueces Estuary, Texas, USA,” *WIT Transactions on Ecology and the Environment* 112 (2009): 560.

ecosystem. Since Paul had worked on the issue for decades, Governor Rick Perry appointed him to a committee to study environmental flows. That led to the passage of Senate Bill 3 in 2007.

[Montagna]: And a big part of the problem was the way the '85 law was conceived. It was really conceived to protect harvestable resources like red drum, and black drum, and oysters, and shrimp, and blue crab. The problem is that flow doesn't affect natural resources directly, it only affects natural resources indirectly, and that's what took us about twenty years to figure out. What river flow to the estuary really does, is it changes the water quality of the bays, it brings in nutrients and sediments that can build habitats, and it also dilutes the salinity in the bays, and it's the combination of these three things that create what I like to call estuary condition, and the biological resources then respond to those conditions. When Senate Bill 3 was passed in 2007, it changed our management goal. It changed our goal from trying to manage the bays to produce just seven species to trying to maintain the ecological soundness, what ecological soundness was basically moved us toward an ecosystem-based management approach, and now what we do is we try and manage our coastal systems to protect the entire ecosystem and not worry about winners and losers in terms of individual, particular species.

[Montagna]: I was pretty fortunate to be able to have an impact so that science had an impact on crafting what I think is a pretty good law.

Conclusion

[Brown]: Rethinking freshwater inflow and Texas water law hasn't always been perfect.¹³ But one thing that Senate Bill 3 created was an adaptive management process and more stakeholder involvement.¹⁴ That's pretty important for a growing coast.

[Montagna]: We have to always balance the need for water for people and water for the environment, and I'm an eternal optimist. I still believe that even in areas that are water-stressed, like it is in South Texas, we can figure out ways to take care of both.

[Brown]: This is Dr. Jen Brown and you've been listening to The Gulf Podcast. The Gulf Podcast is made possible by the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University-Corpus Christi. For over twenty years, the Harte Research Institute has sought science-driven solutions for Gulf of Mexico problems in order to advance long-term sustainable use and conservation. Thanks to my production assistant Max McClure. Music and sound from this episode came from Pierce Murphy, Doctor Turtle, and Inspector J. You can find episode scripts as well as oral history recordings and transcripts on our website.

<<waves/shore sounds build in>>

¹³ See, for instance, Katherine A. Roach, "Texas Water Wars: How Politics and Scientific Uncertainty Influence Environmental Flow Decision-Making in the Lone Star State," *Biodiversity and Conservation* 22, no. 3 (Mar. 2013): 545–565.

¹⁴ Montagna, Palmer, and Pollack, *Hydrological Changes and Estuarine Dynamics*, 30–32.

[Brown]: I'm going to leave you today with a passage from Rachel Carson's 1955 book *The Edge of the Sea*:

"On all these shores there are echoes of past and future: of the flow of time, obliterating yet containing all that has gone before; of the sea's eternal rhythms—the tides, the beat of the surf, the pressing rivers of the currents—shaping, changing, dominating; of the stream of life, flowing as inexorably as any ocean current, from past to unknown future."¹⁵

¹⁵ Carson, *The Edge of the Sea*, 250.

Bibliography

- Burnett, John. "When the Sky Ran Dry." *Texas Monthly* (July 2012), <https://www.texasmonthly.com/articles/when-the-sky-ran-dry/>.
- Calvert, Robert A., Arnolde De León, and Gregg Cantrell. *The History of Texas*. 5th ed. Chichester, UK: Wiley Blackwell, 2014.
- Carson, Rachel. *The Edge of the Sea*. Boston: Houghton Mifflin, 1955.
- Copeland, B. J. "Effects of Decreased River Flow on Estuarine Ecology." *Journal (Water Pollution Control Federation)* 38, no. 11 (Nov. 1966): 1831–1839.
- Darnell, Rezneat. *The American Sea: A Natural History of the Gulf of Mexico*. College Station, TX: Texas A&M University Press, 2015.
- Doctor Turtle. "Unexpected Hoedown in the Bagging Area." *Flush Your Rolex*, February 15, 2016. https://freemusicarchive.org/music/Doctor_Turtle/Flush_Your_Rolex_1416/unexpected_hoedown_in_bagging_area. This song is licensed under a Creative Commons Attribution License.
- Freshwater Inflow. <https://www.freshwaterinflow.org/introduction>.
- Inspector J. "Ambience, Machine Factory, A." September 26, 2016. <https://freesound.org/people/InspectorJ/sounds/385943/>. This sound is licensed under a Creative Commons Attribution License.
- McKinney, Larry. Oral History Interview (Part One). Interviewed by Jen Brown, December 17, 2020, <https://library.tamucc.edu/exhibits/s/thegulf/item/1525>.
- Murphy, Pierce. "Hey Mercy." *This Isn't Magic It Is Just Music*, July 4, 2018. https://freemusicarchive.org/music/Pierce_Murphy/This_Isnt_Magic_It_Is_Just_Music/Pierce_Murphy_-_This_Isnt_Magic_It_Is_Just_Music_-_A_Demo_-_10_Hey_Mercy. This song is licensed under a Creative Commons Attribution License.
- Montagna, Paul. Oral History Interview (Part One). Interviewed by Jen Brown, February 23, 2017, <https://library.tamucc.edu/exhibits/s/sts/item/275>.
- Montagna, Paul A., Crystal Chaloupka, Elizabeth A. Del Rosario, Amanda M. Gordon, Richard D. Kalke, Terence A. Palmer, and Evan L. Turner. "Managing Environmental Flows and Water Resources." *WIT Transactions on Ecology and the Environment* 215 (2018): 177–188.

Montagna, P. A., E. M. Hill, and B. Moulton. "Role of Science-Based and Adaptive Management in Allocating Environmental Flows to the Nueces Estuary, Texas, USA." *WIT Transactions on Ecology and the Environment* 122 (2009): 559–570.

Montagna, Paul A., Terence A. Palmer, and Jennifer Beseres Pollack. *Hydrological Changes and Estuarine Dynamics*. New York: Springer, 2013.

Powell, Gary L., Junji Matsumoto and David A. Brock. "Methods for Determining Minimum Freshwater Inflow Needs of Texas Bays and Estuaries." *Estuaries* 25, no. 6 (Dec. 2002): 1262–1274.

Roach, Katherine A. "Texas Water Wars: How Politics and Scientific Uncertainty Influence Environmental Flow Decision-Making in the Lone Star State." *Biodiversity and Conservation* 22, no. 3 (Mar. 2013): 545–565.

Texas State Library and Archives Commission. Water in Texas digital exhibit, modified May 26, 2016. <https://www.tsl.texas.gov/lobbyexhibits/water-extreme>.