

OH SHUCKS: OYSTER AQUACULTURE AND THE QUEST FOR HEALTHY
COASTAL BEND OYSTERS

by

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DEDICATION

This thesis is dedicated to my high school journalism teacher, Bill Defries, and my community college journalism advisor, Robert Muilenberg. Thank you for believing in me.

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	v
ABSTRACT.....	vii
CHAPTER	
I. The Pier.....	1
II. A Call for Help.....	5
III. The Human Footprint.....	8
IV. Walking on Water.....	11
V. A Liquid Cash Crop.....	13

ABSTRACT

The Coastal Bend, located along the south-central coastline of Texas, consists of 12 counties covering 515 square miles of bays, estuaries and bayous. The water conditions here have been optimal for oysters, and in turn, they act as an important biological and economic resource, especially to northern Coastal Bend oyster fisheries. However, according to the Harte Research Institute (HRI) at Texas A&M Corpus Christi, changes in water quality due to decreases in freshwater inflow have caused Coastal Bend waters to become more corrosive and saltier. These conditions have placed stress on local oyster reefs and estimates suggest oyster populations in the Gulf have fallen between 50% and 85%. According to researchers interviewed for this thesis, these changes in the Coastal Bend and in the state are only expected to be exacerbated as climate change persists. Through original story-telling and journalistic reporting, this thesis investigates how and why Coastal Bend oysters are under threat and how the region's upcoming oyster aquaculture industry can be a part of the solution. This thesis was done by conducting interviews with HRI researchers, technicians at the HRI research oyster farm in Palacios, Texas a member of the local seafood industry. This thesis also contains a video, photographs and graphics and can be viewed online in its entirety. The purpose of this thesis is to bring to light a critical issue in a unique region of Texas through a creative, journalistic lens. The online version of this project can be viewed at <https://spark.adobe.com/page/nsCmXHyyYaweC/>.

I. The Pier

PALACIOS, Texas — It’s an overcast windy day as Ellis Chapman walks down a long pier facing Tres Palacios Bay. With his waders in hand, he wears a hat that says, “The Oyster Farm Company.”

This is a therapeutic escape for Chapman who makes the walk nearly five days a week, Monday through Friday. The pier looks out onto the small bay, which is an extension to the much larger Matagorda Bay located in the northern Texas Coastal Bend.

At the end of his walk, about 100 feet in both directions, are two growing systems used for oysters farming, or oyster aquaculture. From this vantage point, the systems appear to be nothing special and could easily be mistaken for trash or abandoned fishing material. However, a closer look into the shallow waters reveals cages of nearly perfect, fully grown Coastal Bend oysters.



Harte Research Institute technician Ellis Chapman shucks an oyster, Thursday, March 18, 2021, at Harte Research Institute's oyster farm in Palacios, Texas.
Photo by Gabriella Ybarra

Chapman, a Virginia native, says up north the bivalves take two to four years to grow to the harvestable size of 2.5-3 inches. Here, under warmer conditions, they can grow to that size in as little as six months.

Wild oysters can be found in this bay, too. When the tide recedes, the wild oysters along the bottom of the pier stick out of the sand, discolored and brittle — a stark contrast from those grown through aquaculture means. The raccoon tracks surrounding what is left of these oysters hint they have now turned into a midnight snack.

Wild oyster populations in the Coastal Bend follow a north-south gradient — they are plentiful in the north but become sparse farther south, specifically in Corpus Christi and Nueces Bay, which have grown saltier and acidic. These unfavorable water conditions, compounded with decades of abuse and the onset of climate change, have led to an overall decline in populations.

However, this humbly sized oyster farm could provide the solution to solve oysters' problems, one that could have big, economic implications for the Coastal Bend. Chapman is a technician with the Harte Research Institute (HRI) at Texas A&M University-Corpus Christi tasked with promoting oyster aquaculture in Texas following the approval of the practice — a move seen as long overdue for the lone star state.

“Texas is the last state to start an oyster farming industry,” Chapman says. “This is not a new thing. Every state that can have an oyster farming industry has one.”

Oyster aquaculture is the process of growing oysters under managed conditions in bags and cages either suspended in water or in floating pontoons. This approach allows oysters to grow faster than those seen in the wild as they are held higher within the water column where food sources are more abundant.

The belief is that oyster aquaculture can help meet the demand of the half-shell market and allow fisheries to relieve pressure on existing populations. This alternative source for human consumption could help curtail what is left of Coastal Bend oysters and allow them to repopulate.

“(Oyster aquaculture) is the future,” says Brad Lomax, owner of Water Street Oyster Bar in Corpus Christi. “What we are doing now — and I’m so sick of saying this word — is unsustainable.



Raccoon tracks surround the wild oysters growing along the pier, Thursday, Feb. 25, 2021, at Harte Research Institute's oyster farm in Palacios, Texas. **Photo by Gabriella Ybarra**

In 2019, [House Bill 1300](#) and [Senate Bill 682](#) directed the Texas Parks and Wildlife Department to establish rules and regulations to guide the development of an oyster aquaculture industry in Texas. Texans interested can simply apply for a [Cultivated Oyster Mariculture Permit](#) and begin their own oyster aquaculture business.

Lomax, who was one of the first to apply for a permit, is among those who have been looking toward HRI’s farm for guidance on how to best navigate this new industry.

He helped install HRI's second oyster farm facility in Copano Bay and became familiar with the oyster aquaculture process.

To receive an oyster aquaculture permit is a two-stage process, says Emma Clarkson, Texas Parks and Wildlife Department team lead for habitat assessment.

“There’s a conditional permit that’s issued before a final permit, and that’s because there’s actually a lot of state and federal agencies that have authority over aquaculture and mariculture in Texas,” Clarkson says. “We also have to make sure that none of those other permits were left out of the loop and that everything that is being done on one of our approved permits is also in compliance with all those other programs.”

According to Clarkson, two Texans have been approved for a conditional oyster aquaculture permit in Texas, and one of them is Lomax.

[Water Street Oyster Bar](#), a popular downtown seafood spot, began serving Gulf coast oysters from local suppliers in the early 1980s. According to Lomax, about 600,000 raw oysters a year are sold by the restaurant. However, while oysters seemed plentiful for the first several years, Lomax says he noticed a change during the late 90s – supplies started getting spotty.

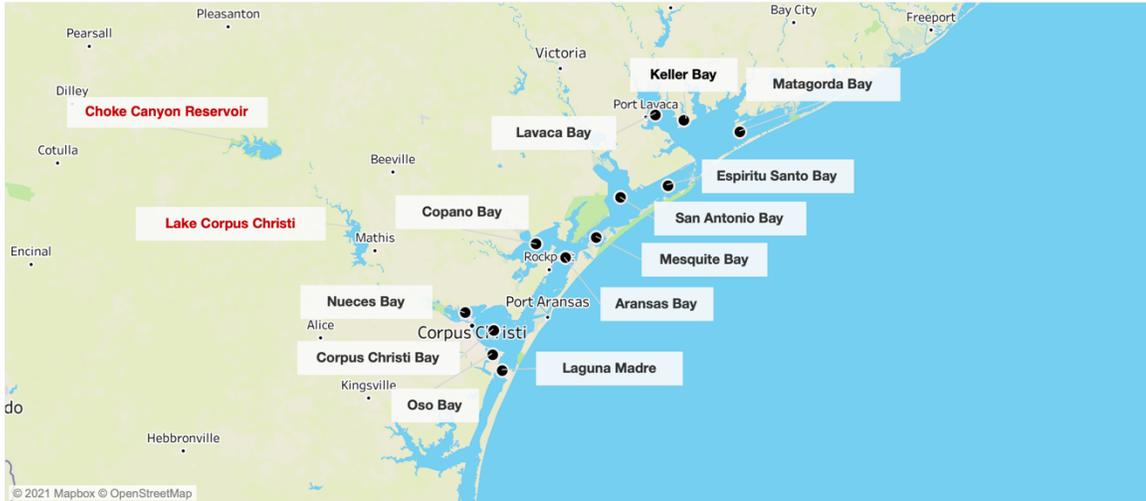
This led seafood restaurant owners like Lomax to seek oysters elsewhere.

“We started reaching out, and I bought some Florida oysters and Mississippi (oysters)...so that was kind of our first move away from Texas,” Lomax says.

The Texas coast has historically been a desirable place for oysters. The Coastal Bend, which encompasses 515 square miles of bays and estuaries, can support oysters with its mix of freshwater from rivers and saltwater from bays. With warmer

temperatures, this combination has helped maintain livable salinity and pH levels, creating excellent conditions for oysters to thrive.

Bays of the Coastal Bend



Locations of Coastal Bend bays, including reservoirs along the Nueces River basin. **Map by Gabriella Ybarra**

Estuaries provide biologically productive areas for a variety of fish, shellfish, marshes, seagrasses and microscopic marine life. This, coupled with the economic benefits they provide through recreational and commercial activities, makes estuaries beneficial for both locals and the environment.

Coastal waterfront views and 113 miles of Gulf Coast beaches just in Corpus Christi alone — the largest and most populated city in the Coastal Bend — have made it the sixth most popular tourist destination in Texas. This area’s coastal charm makes its seafood offerings a key part of its tourism experience.

Perhaps one of the most critical components to the economy is the Port of Corpus Christi, which utilizes water from estuaries to export crude oil and agricultural products around the globe, making it the [3rd largest port in the U.S.](#) in total tonnage and the 2nd largest exporter of crude oil.

II. A Call for Help

While oyster reefs in Corpus Christi and Nueces Bay can be found scattered throughout the area, most are either dead or buried. They are nearly non-existent in the lower Laguna Madre — a narrow backwater bay separating Padre Island from the Texas coast — as it is one of six hypersaline lagoons on the planet, meaning it is saltier than most oceans.

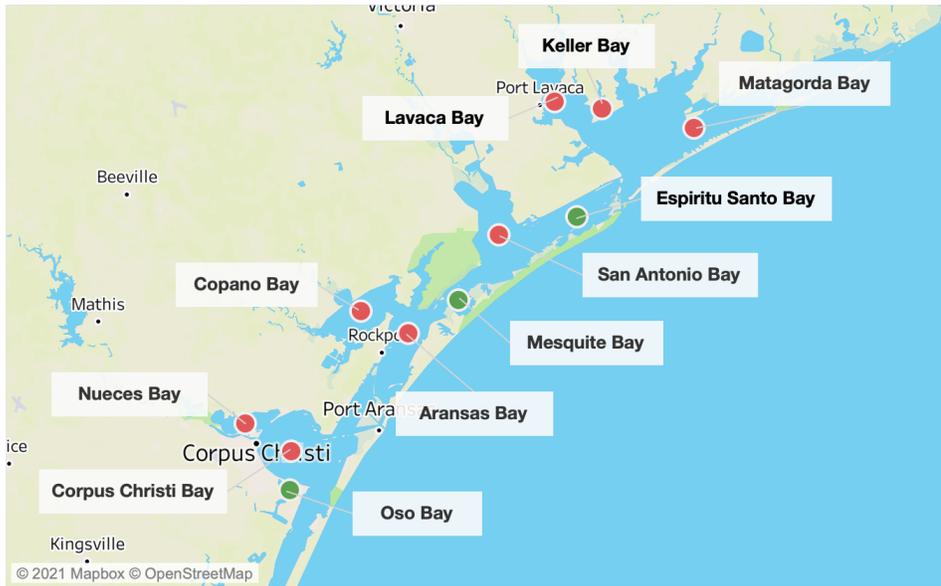
This should not come as a surprise to the region as oyster populations globally and state-wide have plummeted for a variety of reasons, including decreased freshwater flow, overfishing, hurricanes, floods, droughts and pollution. According to [Nature Conservancy](#), a global environmental organization, an estimated 85% of oyster reefs globally have been lost due to these factors. Along the Gulf Coast, only an estimated 20-50% of original oyster reefs remain.

“(Oysters) have this narrow salinity range they can live in, and when you start to go outside of that, like what we’ve done here in Nueces Bay and Corpus Christi Bay, where it’s now too salty, they just can’t live and grow in those environments,” says Dr. Michael Wetz, HRI’s chair for coastal ecosystem processes.

Wetz co-authored a 2020 study examining water quality trends in Texas estuaries. According to the study, Corpus Christi Bay, Nueces Bay and six other neighboring bays saw a significant annual increase in salinity. The study also found a significant annual drop in pH (which causes water to become acidic) in Corpus Christi Bay, Nueces Bay and eight other bays.

These trends are not ideal for oysters, as they rely on a healthy, balanced water quality to thrive.

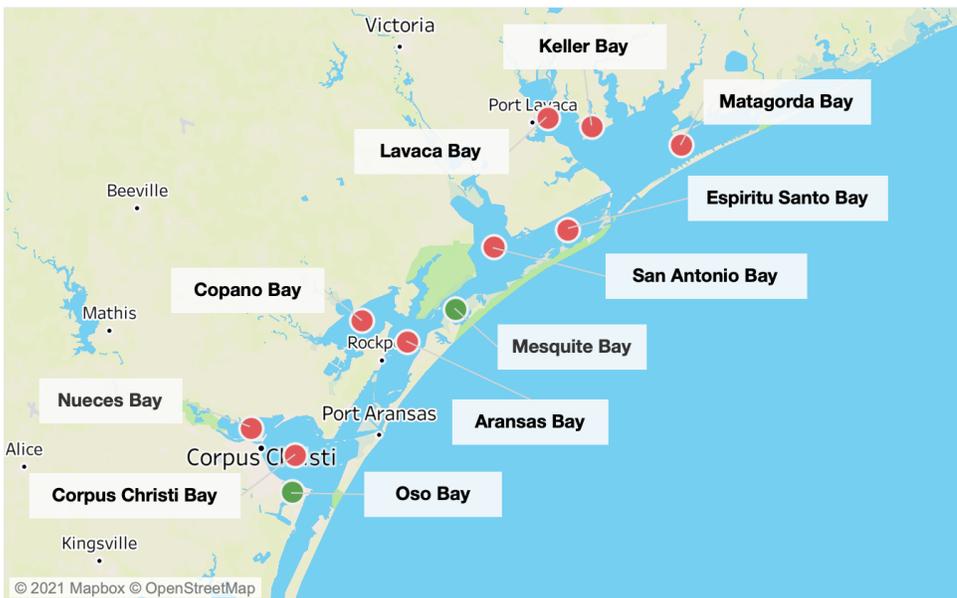
Coastal Bend Bays with Increasing Annual Salinity



Annual Salinity
 ■ Suitable
 ■ Unsuitable

Locations of Coastal Bend bays with increasing annual salinities. **Source:** Harte Research Institute, Texas A&M University - Corpus Christi. **Map by Gabriella Ybarra**

Coastal Bend Bays with Increasing Acidity



Annual pH
 ■ Suitable
 ■ Unsuitable

Locations of Coastal Bend bays with increasing acidity. **Source:** Harte Research Institute, Texas A&M University - Corpus Christi. **Map by Gabriella Ybarra**

While oysters can technically survive in waters with salinities between [2-40 parts per thousand \(ppt\)](#), water with salt content between 35-40 ppt is enough to strain an oyster. Chapman says he has personally observed salinities up to 60 ppt.

“That is just incredibly stressful for any kind of animal, especially oysters. So, in terms of water quality, salinity is the biggest issue here in Texas,” Chapman says.

These changes have resulted in the northern migration of oyster populations to areas with more suitable salinities. Today, oyster populations in the Coastal Bend can be found in areas of Copano, Matagorda and San Antonio Bay.

III. The Human Footprint

According to Wetz, the trends seen in Corpus Christi and Nueces Bay can be attributed to a long-term decrease in freshwater flow due to damming along the Nueces River, which feeds into Nueces Bay. River damming in the Coastal Bend is done to divert waters for human use, such as for industry, irrigation and drinking.

“Historically over the past 50 to 60 years, (rising salinity levels) have been due to damming. So, we’ve built these big reservoirs up in the watershed, and that holds waters back that would otherwise flow into the bay,” Wetz says.

According to the [Coastal Bend Bays and Estuaries Program \(CBBEP\)](#), freshwater inflows into the Nueces Estuary, which consists of the Nueces River Delta, Nueces Bay and Corpus Christi Bay, have [decreased](#) by 47% since 1940.

[Lake Corpus Christi Reservoir](#), built in 1958 with the completion of the Wesley Seale Dam, is one of the largest artificial bodies of water in Texas and is reserved for Corpus Christi’s municipal water supply. Prior to 1958, the dam, paid for by President

Franklin Roosevelt's New Deal, was smaller in size but has since transformed into a hefty dam creating a lake covering 21,000 acres of land.

About 40 miles north within the Nueces River basin, is the [Choke Canyon Reservoir](#), also reserved for Corpus Christi municipal water. The massive reservoir encompasses a surface area of 25,438 acres with over double the capacity of Lake Corpus Christi. The reservoir was created after the completion of Choke Canyon Dam in 1982 on the Frio River, which connects with the Nueces River.



A sign stands outside the City of Corpus Christi dam operator's private residence, Thursday, April 1, at Choke Canyon State Park in Three Rivers, Texas. **Photo by Gabriella Ybarra**

While freshwater flows into the Coastal Bend through three main watersheds, the Nueces River basin is by far the largest, extending as high as northwest San Antonio. Wetz says geologic materials within the northern Nueces watershed have a significant influence on bay water chemistry. For example, water from the Nueces River, which

derives primarily from the [Edward's Aquifer](#) — a karst aquifer located in south-central Texas consisting of limestone — has the ability to neutralize acidic waters.

“That material gets in the river and flows into the bays and it helps buffer the bays from changes in the pH. So, when we see a long-term decline in the amount of fresh water coming in, that can lead to decreases in the pH and other changes in the bays themselves,” Wetz says.

While human modifications along the river play a role in water chemistry, so do participation patterns within the region. Areas of the Coastal Bend have already been in “abnormally dry” or “drought” conditions for the past 12 years. This may be heavily influenced in the future as climate change persists.

“We tend to see a lot more extremes in (the Coastal Bend) in terms of participation variability,” Wetz says. “There’s a lot of evidence suggesting that...with climate change, we could be sort of at the forefront of even larger scale participation changes.”

According to [Nature Conservancy](#), due to global climate change, extreme rainfall events will become more frequent in the Coastal Bend, but dry days between each event may increase, leading to longer dry periods. These periods are expected to place pressure on groundwater resources, such as aquifers, and lead to less flow downstream to bays and estuaries.

“All the models right now are predicting it’s going to be hotter and drier along the Texas coast with less rain,” says Dr. Paul Montagna, chair of HRI who studies the effects of climate change along the Gulf Coast. “There’s big parts of (Texas) that are already relatively dry in the western part of the state, and as long as western watersheds get drier,

we'll have even less flow going down to the coast.”

Without a steady flow, pH levels can drop to acidic levels. Oysters and other shellfish rely on water chemistry to form their calcium carbonate shells and skeletons. When pH levels drop, oysters are less able to form these crucial support structures.

IV. Walking on Water

Oysters did not always live under these conditions in the southern Coastal Bend. In the mid-1800s, a large oyster reef spanned the mouth of Nueces Bay and served as a bridge between Corpus Christi Bay and its neighboring town, Portland.

Oyster reefs were reportedly so dense in Aransas Bay, the Pamoque Indians would cross the 10 miles from the Lamar Peninsula to San Jose Island by just following the reefs in the shallow water.

By the turn of the 20th century, populations in the Coastal Bend surged and [heavy construction in Corpus Christi](#) with the use of shellcrete, a combination of water, sand and oyster shells obtained from reefs, caused the reefs to disappear — most of which had been settled for thousands of years.

The process of dredging these oysters destroyed the bay's hard-bottom surface needed for oyster reefs to grow, turning it into mud. Then came the diversion of the Nueces River water to meet the demands of the growing population and industry, further eliminating any future opportunities for oyster reefs to repopulate.

“The state at the time was allowing companies to harvest shell out of the (Nueces) Bay, dead shell. We really weren't quite sure how dead (the oyster reefs were) but there was an awful lot of shell dredging out of Nueces Bay and other Texas bays,” says Ray

Allen, executive director of the Coastal Bend Bays and Estuaries Program.

“Those shells are the substrate for the oyster reefs, and so once they are gone, there’s really no place for oysters to even grow, so it’s much more difficult to get (oyster reefs) restarted out there,” Allen adds.

Dredging is also seen in modern-day wild oyster harvesting — the process of using a metal rake-like device attached to a powerboat to scrape up oysters from a reef into a bag. It’s a process that has garnered much controversy due to its ecologically destructive nature.

While oysters seem like simple animals, they do more than supply the half-shell market. Oyster reefs are an important asset to estuaries as they provide habitats for other marine organisms and reduce shoreline erosion. Oysters also help improve water quality by filtering large quantities of water — as much as 50 gallons a day per oyster, earning them the name “nature’s vacuum cleaners.”

“The fact that we eat (oysters) is probably the last benefit to them,” Chapman says. “I went to a conference two years ago, and I will never forget this quote, ‘Oysters are too valuable to dredge’ ... They do too many services for us that they are too valuable for us to just rip them apart just so we can eat them.”

With oyster populations in Texas dwindling, oyster fishermen are asking the Texas Parks and Wildlife Department, which serves as their managing agency, for lower daily sack limits due to worries of areas being fished out completely. These fears led to the [early closing](#) of Copano Bay to oyster harvesting in 2018.

V. A Liquid Cash Crop



A video with Harte Research Institute oyster farm technician, Ellis Chapman, explaining how oyster aquaculture is done at the farm. **Video by Gabriella Ybarra.** Link: <https://youtu.be/uPwYdimU7YA>

With the approval of House Bill 1300 and Senate Bill 682, there is hope oyster aquaculture can be the solution to solve oysters’ problems.

With the adoption of oyster aquaculture in Texas, prospective oyster farmers hope having an alternative source for human consumption can allow fisheries to relieve pressure on existing wild oyster populations.

“If we can take the oysters that we farm and leave the reefs alone, we will propagate more reefs through doing that,” Chapman says.

The oyster aquaculture process begins in a hatchery where broodstock, or oyster parents, are fed and given nutrients until they are full of eggs and sperm. Once the eggs are fertilized, the oyster larvae will metamorphosize into “spat”, or baby oysters, meaning they are ready to attach to a surface and grow. These spat, commonly referred to as “seeds”, are then delivered to farms where they can begin the growth process.

At HRI's oyster farm, one of the growing systems used is an adjustable longline system which is a series of cylindrical cages suspended from a horizontal longline. This line is attached to posts containing vertical clip mounts that allow the cages to be raised in and out of water. The second system is a floating, pontoon-style system which is a line of floating cages attached to one another.



A floating pontoon filled with growing oysters floats in the water, Thursday, March 18, 2021, at Tres Palacios Bay in Palacios, Texas. **Photo by Gabriella Ybarra**

Once a week, Chapman and his co-worker and HRI technician, Baliey Schacht, will expose the oysters to sunlight to “desiccate” biofouling, which is the growing of other organisms on oyster shells. Dredged oysters are typically found with these organisms which can prevent them from accessing food and nutrients.

“That’s one of the problems you see with dredged oysters, is that a lot of the time they’re deformed. (There are) barnacles, mussels (and) stuff growing on them. The oyster

looks less healthy,” Chapman says.

This process allows unwanted material to dry out, keeping the oysters clean. Chapman says this simple action can help promote the overall health of the oyster and result in higher quality “meat” inside the shell.

Oyster aquaculture may also have the potential to boost local economies.

[According to researchers with Texas A&M AgriLife](#), oyster aquaculture, which is already a \$200 million industry in the U.S., can provide jobs and other economic opportunities to areas along the Texas Gulf Coast.

“Take small towns like Palacios, these farms in five years can produce 500,000 to a million oysters depending on (its) size,” Chapman says. “From the hatchery to the farmers, to the (oyster) bars and the gear proprietary people and the processing houses, (aquaculture oysters are) a liquid cash crop.”

“There’s plenty of room for everybody to get a piece of the pie,” Chapman adds.



Ellis Chapman holds a shucked oyster in his hand, Thursday, Feb. 25, 2021, at Harte Research Institute's oyster farm in Palacios, Texas. **Photo by Gabriella Ybarra**

After purchasing 200 floating cages, Lomax is eager to open his eight-acre oyster farm in Copano Bay this summer. Lomax was convinced to start his farm after his experience with HRI and its close proximity to the city. He has two people on payroll and is planning on hiring more for hourly positions to work for the farm.

“It’s not Amazon moving to (the Coastal Bend) but it’s an opportunity for people who live in rural Texas coastal communities to make a living and do it in an environmentally friendly way,” Lomax says.

The farm, which will be separate from Water Street Oyster Bar, will sell Coastal Bend oysters to Water Street and other restaurants in Texas. Lomax anticipates within three years he will be utilizing all eight acres of his farm and will expand to have an oyster nursery facility on site. Lomax’s goal is to sell 1 to 2 million oysters a year just at this location alone.

The environmental benefits and having a healthy, stable product are both a plus and a rare combination, Lomax says. He also notes that many tourists visit cities because of the unique foods they offer. With the rise in popularity of the "bay to table" approach, Lomax sees this as an opportunity for the Coastal Bend's tourism industry.

“Dining out is a big part of the travel industry. I mean, you go to New Orleans and you go to San Antonio for the different types of cuisine,” Lomax says. “The more local fresh, quality offerings that I can provide and other restaurants in our area can provide is going to enhance the tourism industry,” Lomax says.

Influenced by seafood restaurants where “the oyster menu rivals the wine menu,” Lomax says he looks forward to a landscape in which people all across Texas can experience the different flavors of Coastal Bend oysters, which he says varies by the bay.

“A steakhouse in Midland can serve fresh oysters and know the source of the bay and how long ago they were in the water, so it’s going to be fun educating the populace about the difference between a Copano Bay oyster, and if you go 12 miles to the east, the difference in the flavor of an Aransas Bay oyster,” Lomax says.

HRI’s farm, which operates under a grant, is not allowed to sell the oysters produced at its location; however, this does not mean they aren’t being put to good use.

After partnering with the Matagorda Bay Foundation, HRI has been sending its oysters to west Matagorda Bay where they are being dropped in waters near "Dog Island" to help propagate new reefs. According to Bill Balboa, executive director of the Matagorda Bay Foundation, in November 2020, HRI and The Matagorda Bay Foundation [planted over 50,000 oysters](#) only a few miles away from where their parents were originally sourced.

“When (the Harte Research Institute) wanted to do something with the oysters, we had already discussed, you know, relocating them somewhere in Matagorda Bay, and Dog Island was a really, really good place to do it," Balboa says.