

**A Comprehensive Assessment of Texas Coastal Ecosystems & Economies to Inform  
Ecological Restoration  
21-155-008-C880**

**Final Report  
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## **Project Background:**

The Texas coast is home to diverse estuaries that support wildlife, marine-based industries, and an abundance of waterborne activities. Consequently, these estuaries are vital to local and state economies. For example, coastal recreational fisheries contribute approximate \$1.85 billion annually (in 2011 dollars) to the state economy and commercial fisheries contribute \$194 million (in 2012 dollars; Ropicki et al. 2016). However, growing stressors associated with population growth in coastal watersheds, increasing fishing pressure, and changes in climate and hydrology, among other factors, have potential to negatively impact the health of these estuaries. Thus, there is a need for a standardized framework to assess the health of Texas estuaries to identify issues of concern and prioritize conservation and restoration activities.

The Harte Research Institute (HRI) has developed a framework for assessing coastal ecosystem health utilizing a stakeholder engagement process coupled with rigorous analysis of long-term datasets to identify and quantify trends in key indicators of ecosystem health. An important output from this process is the Texas Coast Ecosystem Health Report Card ([www.texascoastreportcard.org](http://www.texascoastreportcard.org)), which takes assessment findings and makes them widely accessible to stakeholders, including policymakers and the public.

A prototype Report Card was released in 2019, and here we report on the development of, and findings from, the 2023 Texas Coast Ecosystem Health Report Cards which improved upon the 2019 prototype based on feedback from stakeholders. Among the key improvements are: 1) incorporation of new ecosystem health indicators as well as indicators of coastal economic health, and 2) development of bay-specific Report Cards. Moving forward, it is the intent of the HRI to provide updated data assessments on select indicators every two years, results of which will be published on the Texas Coast Ecosystem Health Report Card website ([www.texascoastreportcard.org](http://www.texascoastreportcard.org)), and to conduct full assessments every four years.

## Task 1 Summary: Regional Stakeholder Engagement

The first series of stakeholder workshops were held with regional partners on the following dates via video conferencing:

Coastal Bend – 9/16/21 and 9/20/21 (22 participants)

Lower Laguna Madre – 9/28/21 and 9/30/21 (10 participants)

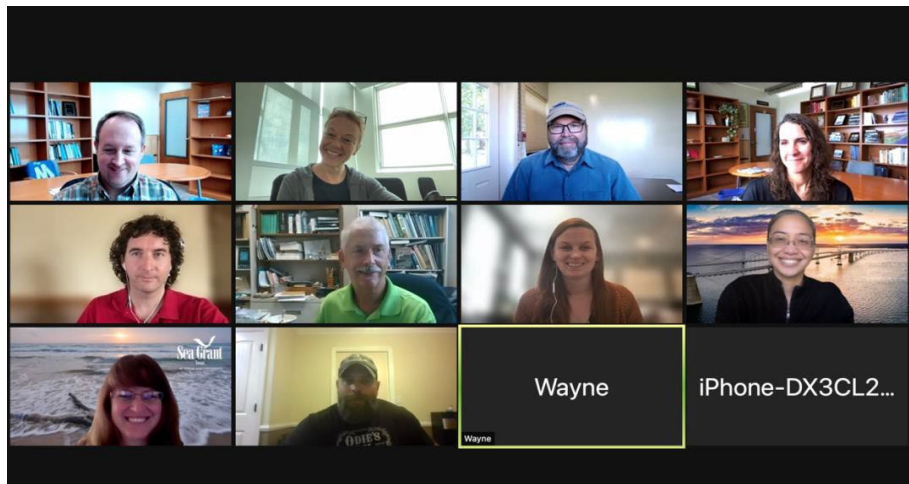
Matagorda – 10/12/21 and 10/14/21 (14 participants)

San Antonio Bay – 10/26/21 and 10/28/21 (9 participants)

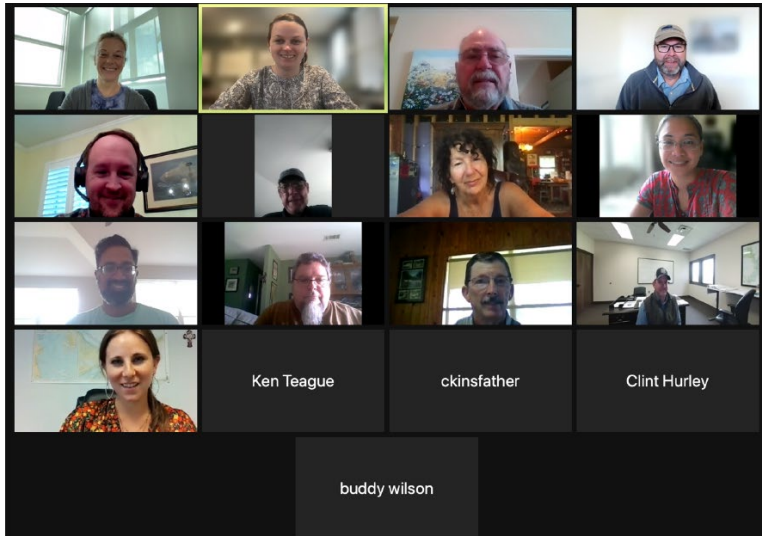
During each workshop, participants discussed issues of concern specific to their local bay system and, through an iterative process, they worked with the research team to identify key indicators of ecosystem health and possible datasets to be evaluated. Below are some pictures of the participants in each bay's workshop:



### Coastal Bend workshop #1.



### Lower Laguna Madre workshop #1.



### **Matagorda Bay workshop #1.**



### **San Antonio Bay workshop #1.**

A second set of stakeholder workshops were held in person on the following dates:

Coastal Bend – 10/18/22

Lower Laguna Madre – 10/27/22

Matagorda – 10/19/22

San Antonio Bay – 10/25/22

During the second set of workshops, draft scores for each indicator were presented for additional stakeholder input prior to inclusion in the final version of the Report Card. In addition, the team solicited from the stakeholders’ key “talking points” about the importance of their respective bay system as well as a list of “success stories” for inclusion in the Report Cards.

## Task 2 Summary: Data Compilation and Analysis

Based on input received from stakeholder workshops and solicitation of expert opinion, it was decided that each Report Card would consist of four high-level indicator categories: Water, Habitat, Wildlife, and Community. Within each category, data on two or more indicators was analyzed to provide an overall assessment of that category. Datasets were identified through input provided by the aforementioned groups as well as research team familiarity with existing datasets. The indicators and datasets for each were as follows:

### Water

1. Nutrients – Texas Commission on Environmental Quality Surface Water Quality Monitoring Program
2. Beach bacteria – Texas Beach Watch.
3. Freshwater inflow – Texas Water Development Board (freshwater inflow), Texas Water Development Board/Texas Coastal Ocean Observing Network/Texas Commission on Environmental Quality (salinity).
4. Plastic pollution – not quantified due to lack of data.

### Habitat

1. Wetlands – National Land Cover Database.
2. Seagrass – Dr. Ken Dunton at University of Texas Marine Science Institute.
3. Tidal flats – not quantified due to lack of data.

### Wildlife

1. Colonial waterbirds – Texas Colonial Waterbird Society\*.  
\*Assessed species included Black Skimmer, Great Egret, Reddish Egret, Roseate Spoonbill, Tricolored Heron, Great Blue Heron, Brown Pelican, Caspian Tern, Forster's Tern
2. Finfish – Texas Parks and Wildlife Department\*\*.  
\*\*Assessed species included Spotted Seatrout, Black Drum, Red Drum, Atlantic Croaker, Southern Flounder
3. Shrimp – Texas Parks and Wildlife Department.
4. Blue Crab – Texas Parks and Wildlife Department.
5. Oysters – Texas Parks and Wildlife Department.

### Community

1. Coastal economies – Texas Parks and Wildlife Department (commercial fish landings), Travel Texas (coastal travel and recreation).
2. Community resilience – American Community Survey of the U.S. Census Bureau.

Once appropriate datasets were identified, analysis of data for each indicator commenced for purposes of determining an overall score that represents the health of the indicator. The steps taken for analysis of each indicator were as follows:

1. Determination of a reference period. This varied for each indicator based on factors such as available data, life history, etc., and was determined in consultation with experts on a particular indicator.

2. Binning of data (if necessary). In some cases, data was binned by season, month, or location. Binning was decided upon in consultation with experts on a particular indicator.
3. Calculation of thresholds for each indicator. Thresholds were determined for each indicator and represented a range of values that would typically exceed normal/unimpacted conditions during the reference period. A percentile-based approach was typical for thresholds. Thresholds were determined in consultation with experts on a particular indicator.
4. Establishment of an assessment period. The period of data that was analyzed to determine a health score for each indicator varied by indicator based on a variety of factors and was determined in consultation with experts on a particular indicator.
5. Calculation of the number of observations that exceeded a set threshold.
6. Based on attainment or exceedance of thresholds during the assessment period, a score was assigned to each indicator.

An example of the components of the scoring for Colonial Wildlife can be found below:

Scale	Score
> 2 years	1
2 years	1.5
1 year	2
0 years	3

Source: Texas Colonial Waterbird Society

Data description: Number of years in last 7 years where total number of nesting pairs was < 25<sup>th</sup> percentile calculated over the period from 1992-2021 for each species.

Scored species: *Black Skimmer*, *Great Egret*, *Reddish Egret*, *Roseate Spoonbill*, *Tricolored Heron*, *Great Blue Heron*, *Brown Pelican*, *Caspian Tern*, *Forster's Tern*

Full details on reference and assessment periods, scoring for each indicator by bay, and interpretation of scoring can be found in the Expanded Document:

[https://issuu.com/harte\\_research\\_institute/docs/expandeddoc\\_final4](https://issuu.com/harte_research_institute/docs/expandeddoc_final4)

### **Task 3 Summary: Texas Coast Report Card Production**

The Texas Coast Report Card assessed conditions in each bay of the Texas coast, with individual bay scoring found in the Expanded Document:

[https://issuu.com/harte\\_research\\_institute/docs/expandeddoc\\_final4](https://issuu.com/harte_research_institute/docs/expandeddoc_final4)

These individual bay scores were then aggregated for determination of coastwide ecosystem health assessments. Scores and assessments for the individual indicators are synthesized below, while complete details can be found in the Texas Coast Report Card online document:

[https://issuu.com/harte\\_research\\_institute/docs/tx\\_issu2](https://issuu.com/harte_research_institute/docs/tx_issu2).

### Nutrients



### Freshwater inflow



### Beach bacteria

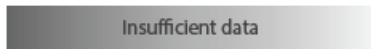


*Water:* No large-scale *nutrient* issues were observed, with only localized challenges being noted (e.g., Baffin Bay). *Freshwater inflow* displayed regional challenges, notably including more frequent and intense low inflow conditions being observed in bays of the north and central Texas coast (Corpus Christi to Galveston) compared to historic conditions. *Bacteria* levels are generally good on the Texas coast, although pollution concerns were noted around Matagorda and Corpus Christi Bays.

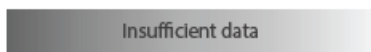
### Wetland area



### Seagrass coverage



### Tidal flats area



*Habitat:* Net *wetland* loss has occurred in every bay system in Texas due to erosion, rising sea levels and coastal development. *Seagrass* data was insufficient due to lack of routine monitoring and/or limited spatial coverage, but the limited data that was sufficient indicates concern over seagrass loss in Aransas Bay and Upper Laguna Madre. *Tidal flats* provide critical habitat for many species but are not currently assessed in Texas.

### Colonial waterbirds



### Finfish



### Blue Crab



### Shrimp



### Oysters



*Wildlife:* Many *colonial waterbird* species are showing up in fewer numbers than in the past because of erosion of nesting islands and degraded feeding habitats. Except for select species (i.e., Southern Flounder), *finfish* and *shrimp* populations are generally healthy. *Blue Crab* are declining in select bays. *Oysters* are declining coastwide because of environmental stressors and unsustainable harvest practices.

### Coastal economies



### Community resilience



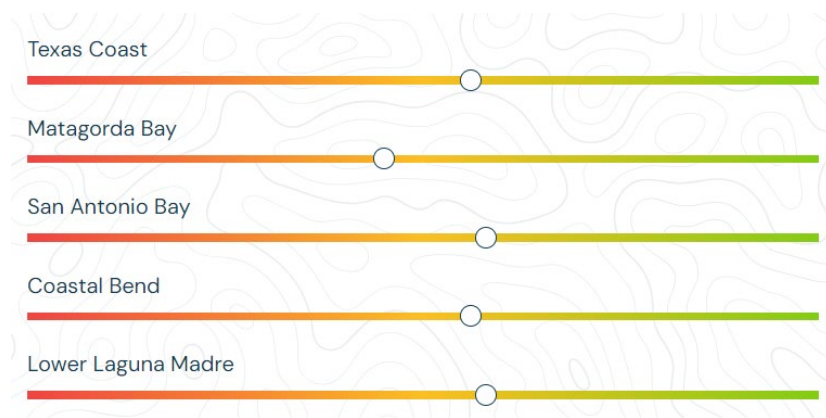
*Community:* *Coastal economies* are generally healthy on the Texas coast, although growth has been relatively slow in the Lower Laguna Madre region. *Resilience* of coastal communities indicates vulnerability due to threat of natural and manmade hazards as well as community risk factors (poverty, poor infrastructure, etc.).

Findings indicated that the Texas Coast is in a vulnerable condition due to a growing suite of stressors including but not limited to rapid population growth, natural and human-driven climate variability/change, and increased harvest pressure. However, a lack of data on select indicators (habitat in particular) was a major challenge that needs to be overcome to fully understand the health of the Texas coast. Despite concerns about its health, the Report Card process identified many conservation success stories at the local level that can serve as a model for larger-scale restoration and conservation efforts in coastal Texas.

#### **Task 4 Summary: Bay-specific Report Card Production**

Assessments were conducted for four bay systems on the Texas coast:

1. Matagorda Bay: [https://issuu.com/harte\\_research\\_institute/docs/mat\\_issu](https://issuu.com/harte_research_institute/docs/mat_issu)
2. San Antonio Bay: [https://issuu.com/harte\\_research\\_institute/docs/san\\_issu](https://issuu.com/harte_research_institute/docs/san_issu)
3. Coastal Bend Bays (including Copano and Aransas Bays, Corpus Christi and Nueces Bays, Baffin Bay and Upper Laguna Madre):  
[https://issuu.com/harte\\_research\\_institute/docs/cb\\_issu](https://issuu.com/harte_research_institute/docs/cb_issu)
4. Lower Laguna Madre: [https://issuu.com/harte\\_research\\_institute/docs/llm\\_issu](https://issuu.com/harte_research_institute/docs/llm_issu)



Like the Texas Coast as a whole, each assessed bay system was determined to be in a vulnerable condition. The contributing factor(s) to this vulnerability varied depending on bay system and are detailed on individual bay Report Cards at the links above.

#### **Task 5 Summary: Report Card Website Production**

On February 29<sup>th</sup>, 2024, HRI released a dedicated project website to the public: [www.texascoastreportcard.org](http://www.texascoastreportcard.org). The website was designed to not only share findings from the Report Card, but also to provide a platform for educating the public on factors affecting the health of *their* coast. It was designed with flexibility in mind, specifically to allow for future updates that may include, e.g., graphical outputs that show how ecosystem health is changing over time as new data are analyzed and assessed.

#### **References**



Ropicki, A., C. Adams, R. Caffey, and M. Haby. 2016. Texas Sea Grant: A vital part of our state and supporter of its marine industries. 18 pp.