Photo Credit: Christine Jensen, TPWD

Status and Management of the Texas Oyster Fishery

Christine C. Jensen

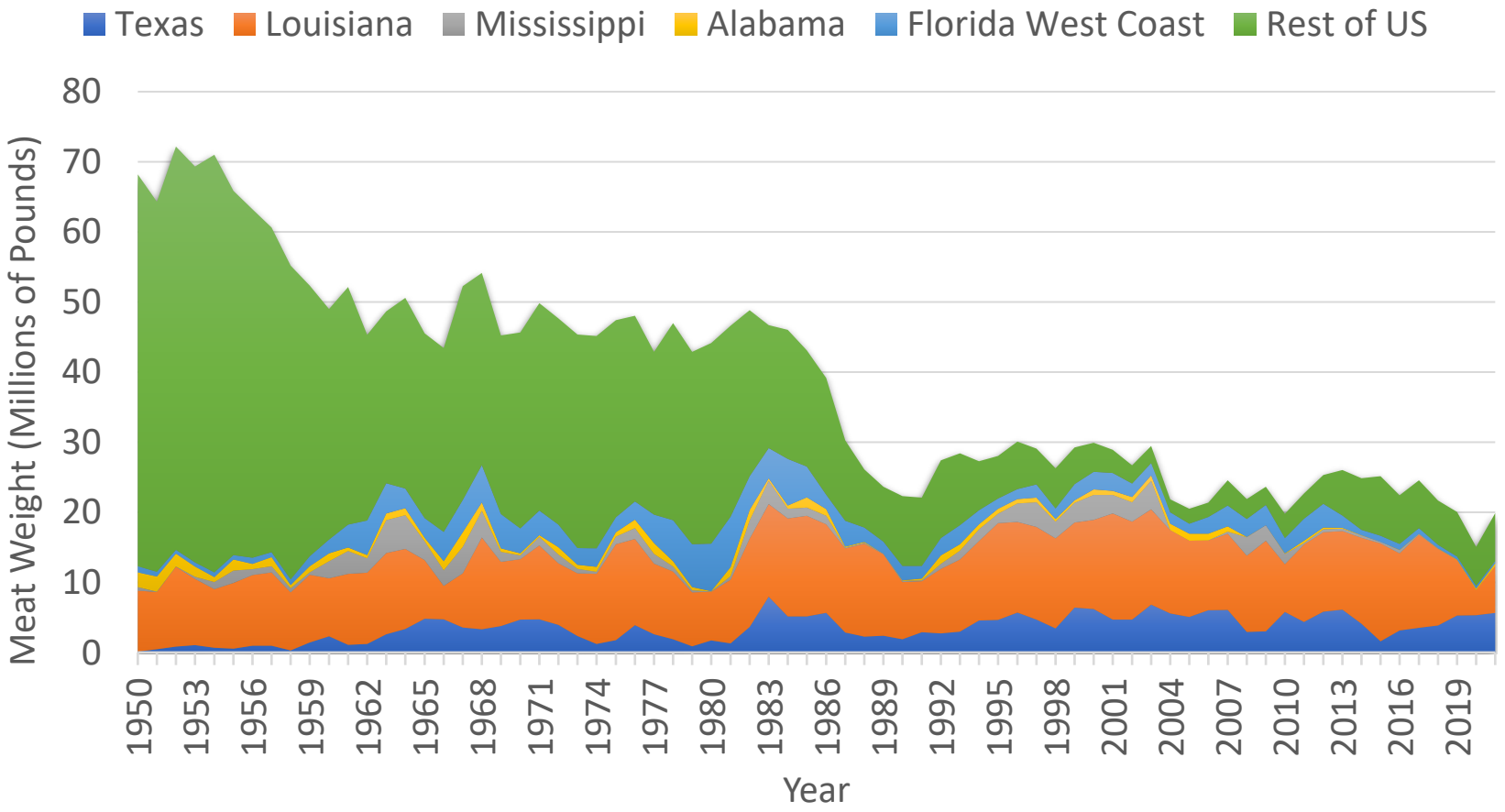
Texas Parks and Wildlife Department

Oyster-Producing Bays in Texas

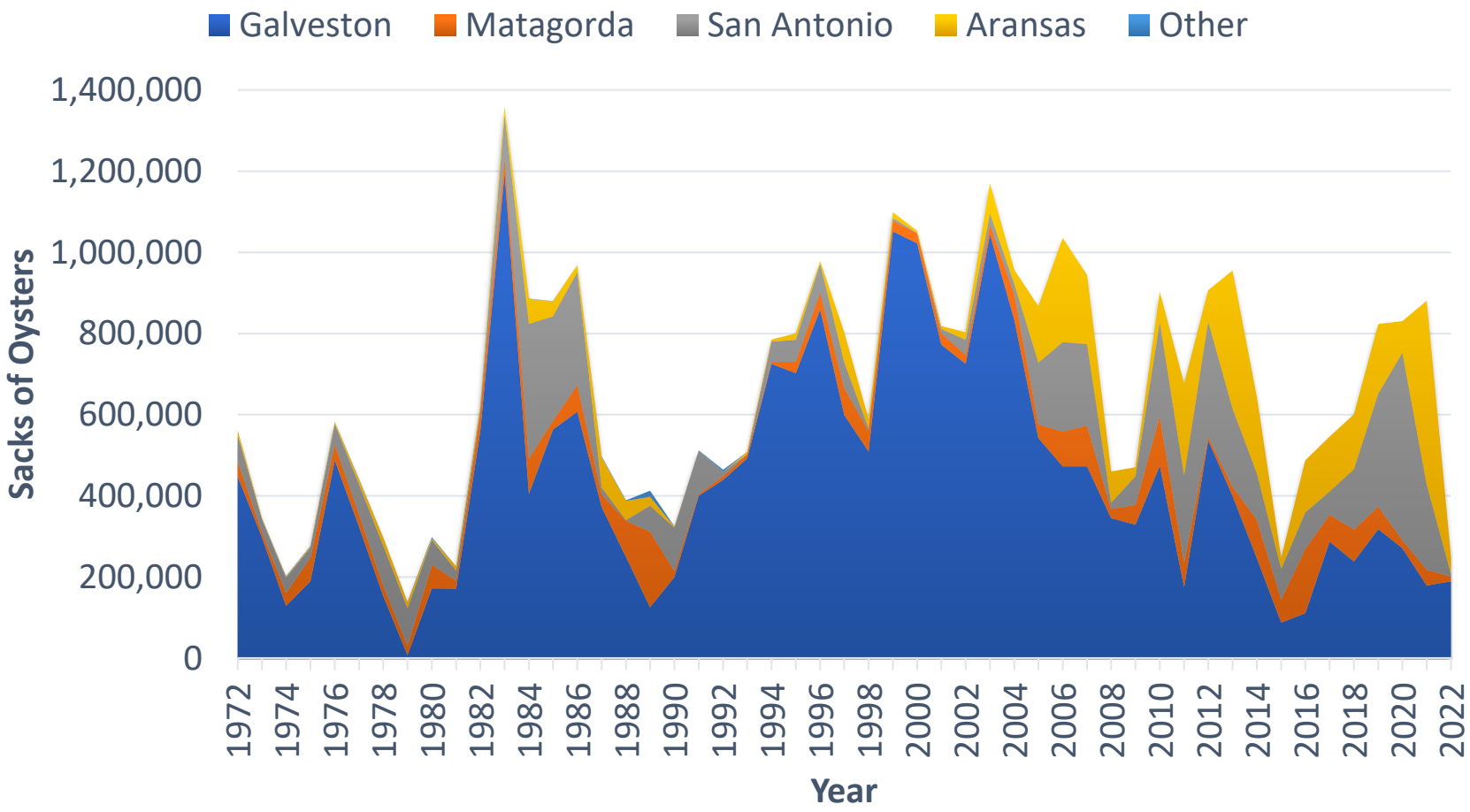
U.S. Commercial Eastern Oyster Landings

<u>Texas avg - last 10 years:</u>

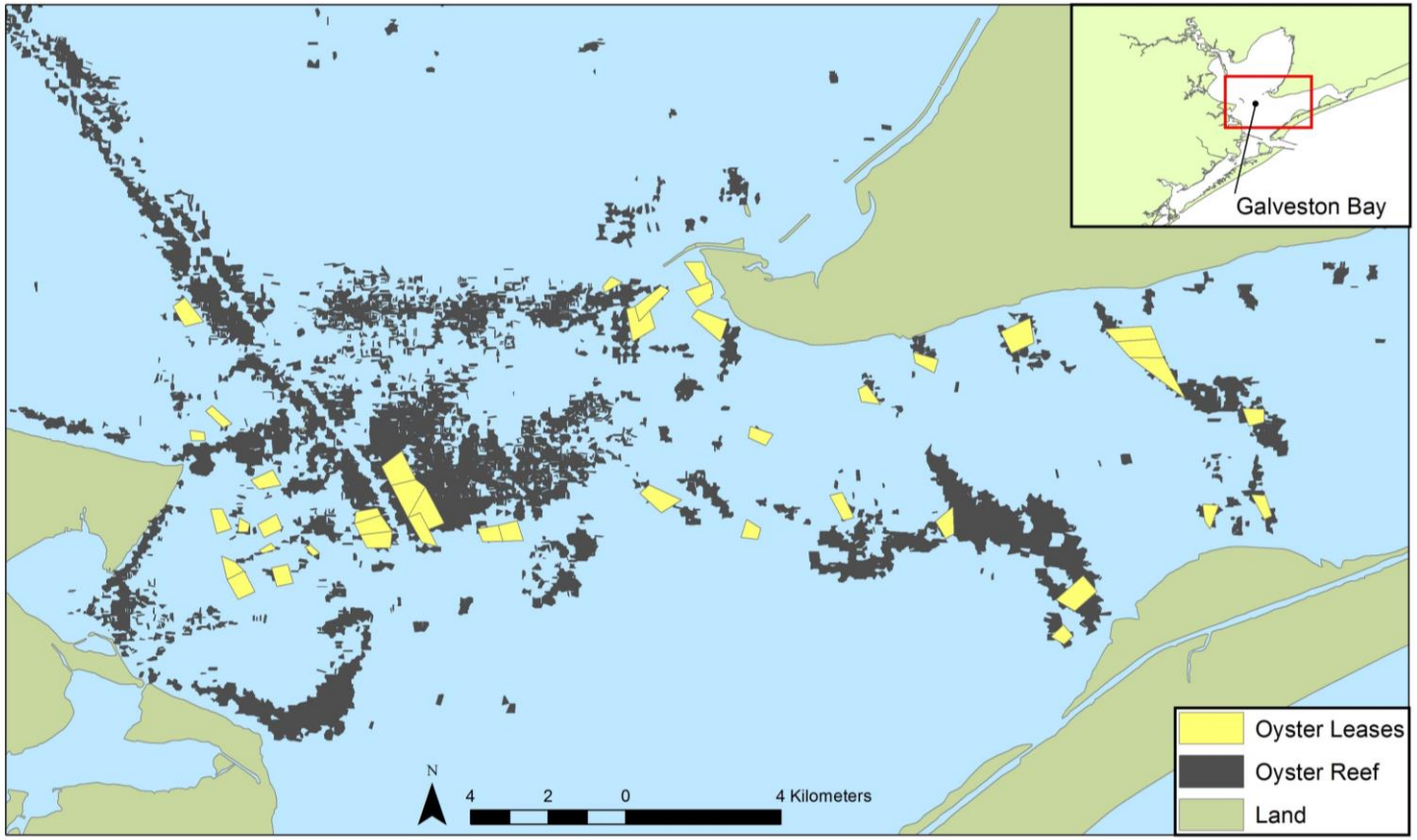
- 21% of US
- 30% of Gulf
- 4.4 million lb
- $22.9 million dockside value



Texas Commercial Oyster Landings

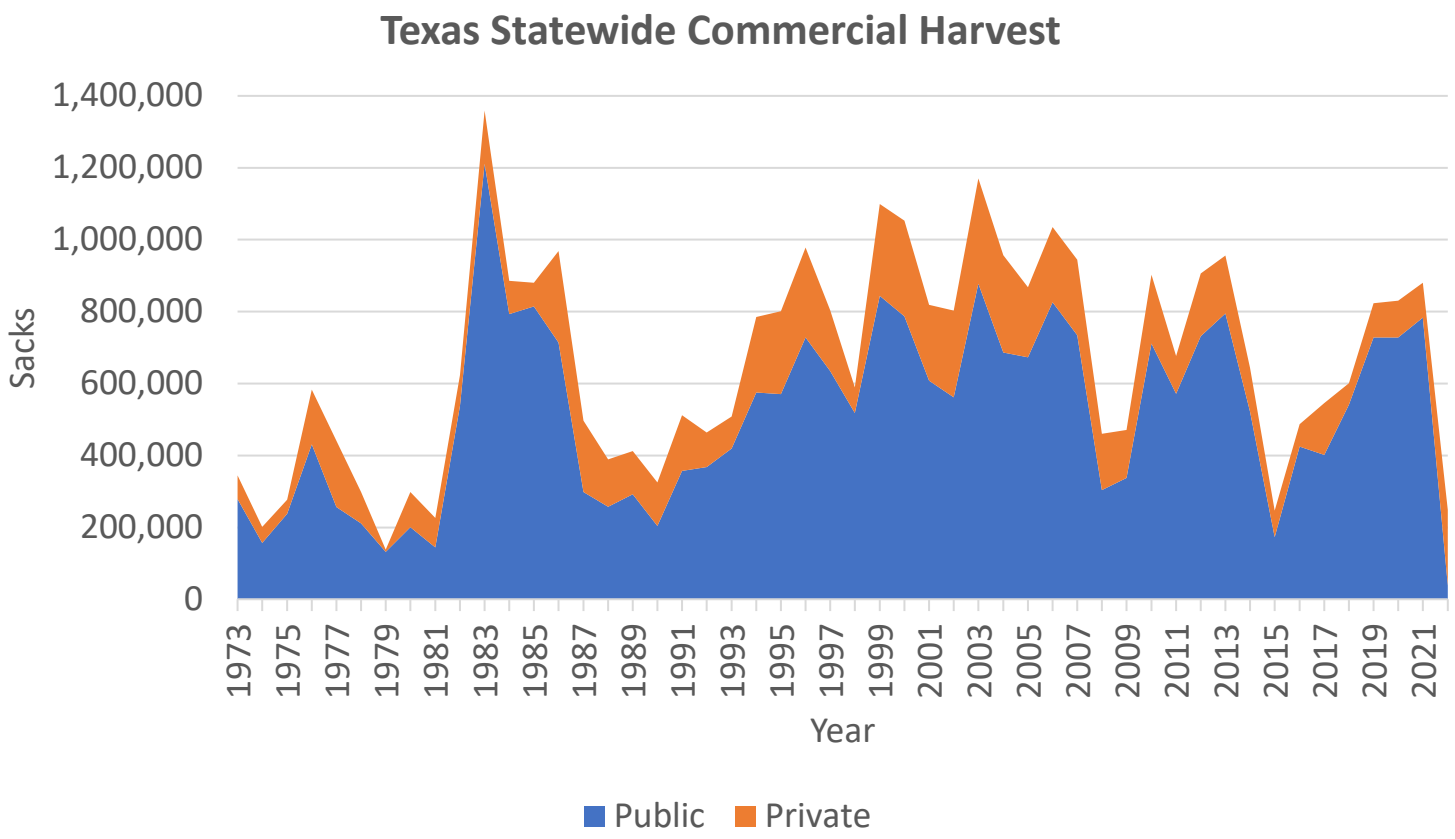


- Galveston Bay makes up majority of landings
- Historically 71%
- Last 10 years 42%
- Increase in harvest from southern bays



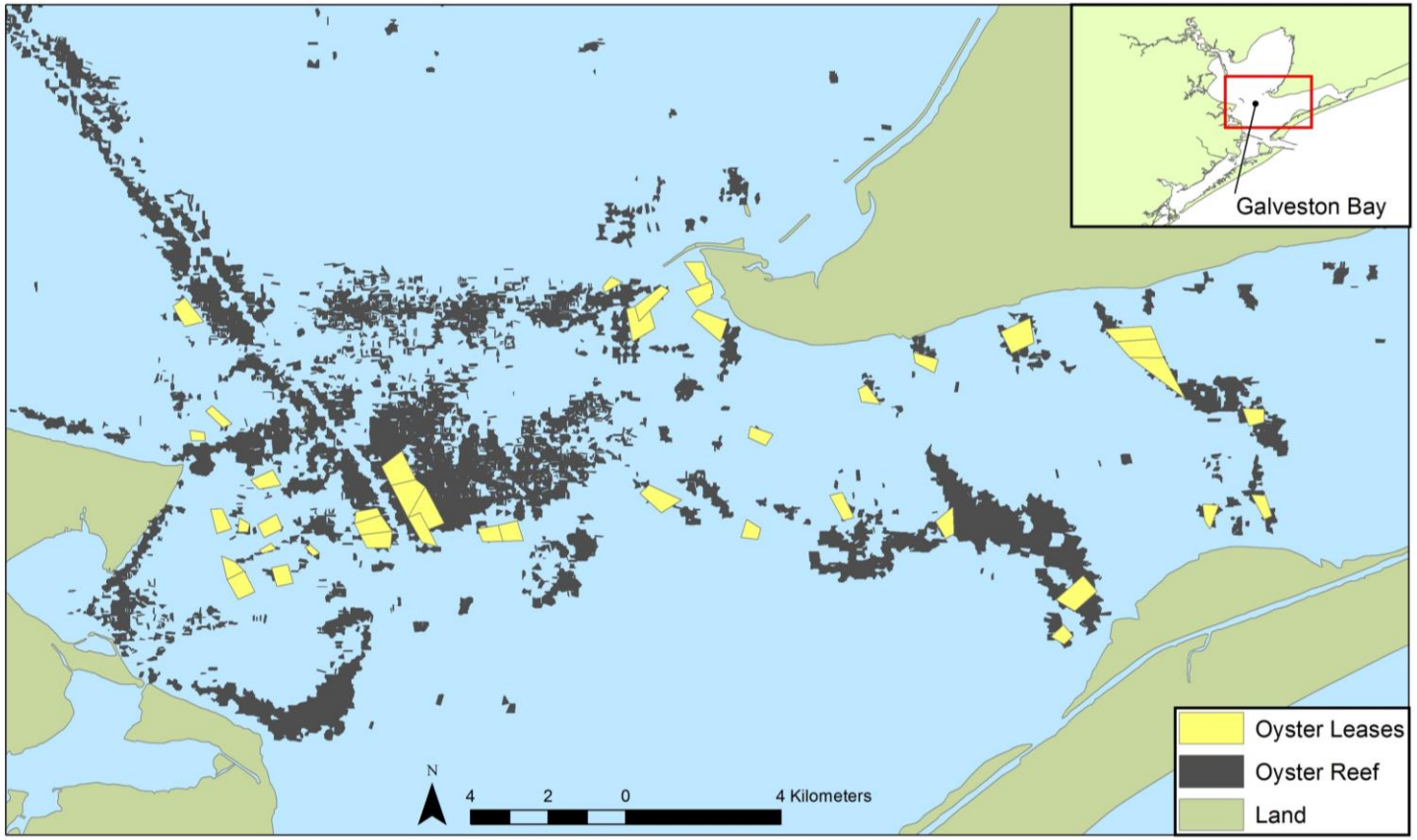
Certificates of Location
(a.k.a. Leases)

- 43 locations
- 2,322 acres
- All in Galveston Bay
- Size range of 11-100 acres
- No more than 300 acres controlled by one individual, business, or corporation
- 15-year term (next up for renewal in 2032)
- Annual rent = $24 per acre
  - Increases every 3 years based on CPI



Public Reefs vs. Private Reefs

- Private Harvest
  - ~25% of Statewide
  - ~40% of Galveston Bay

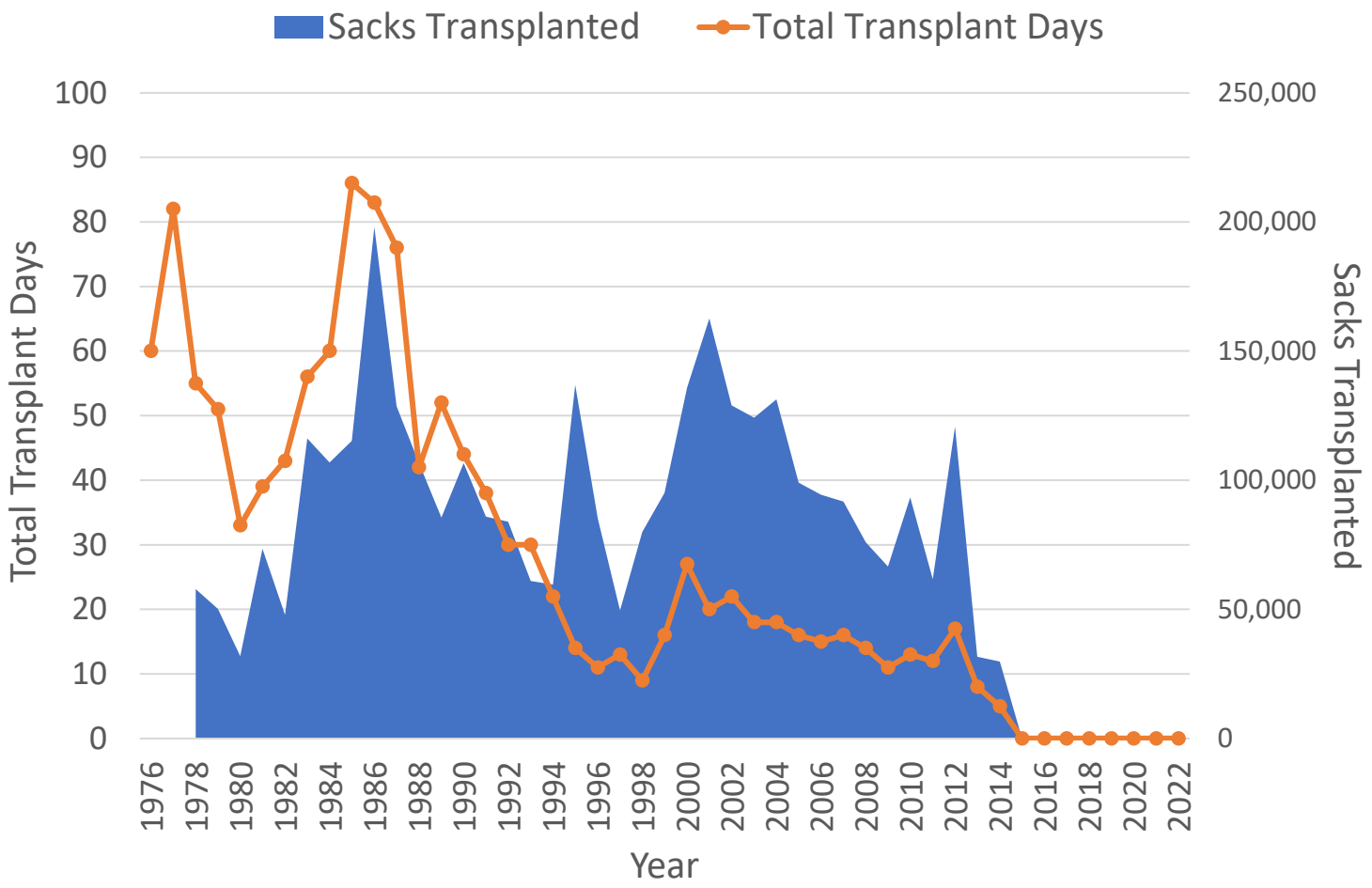


Certificates of Location
(a.k.a. Leases)

Original Objectives:

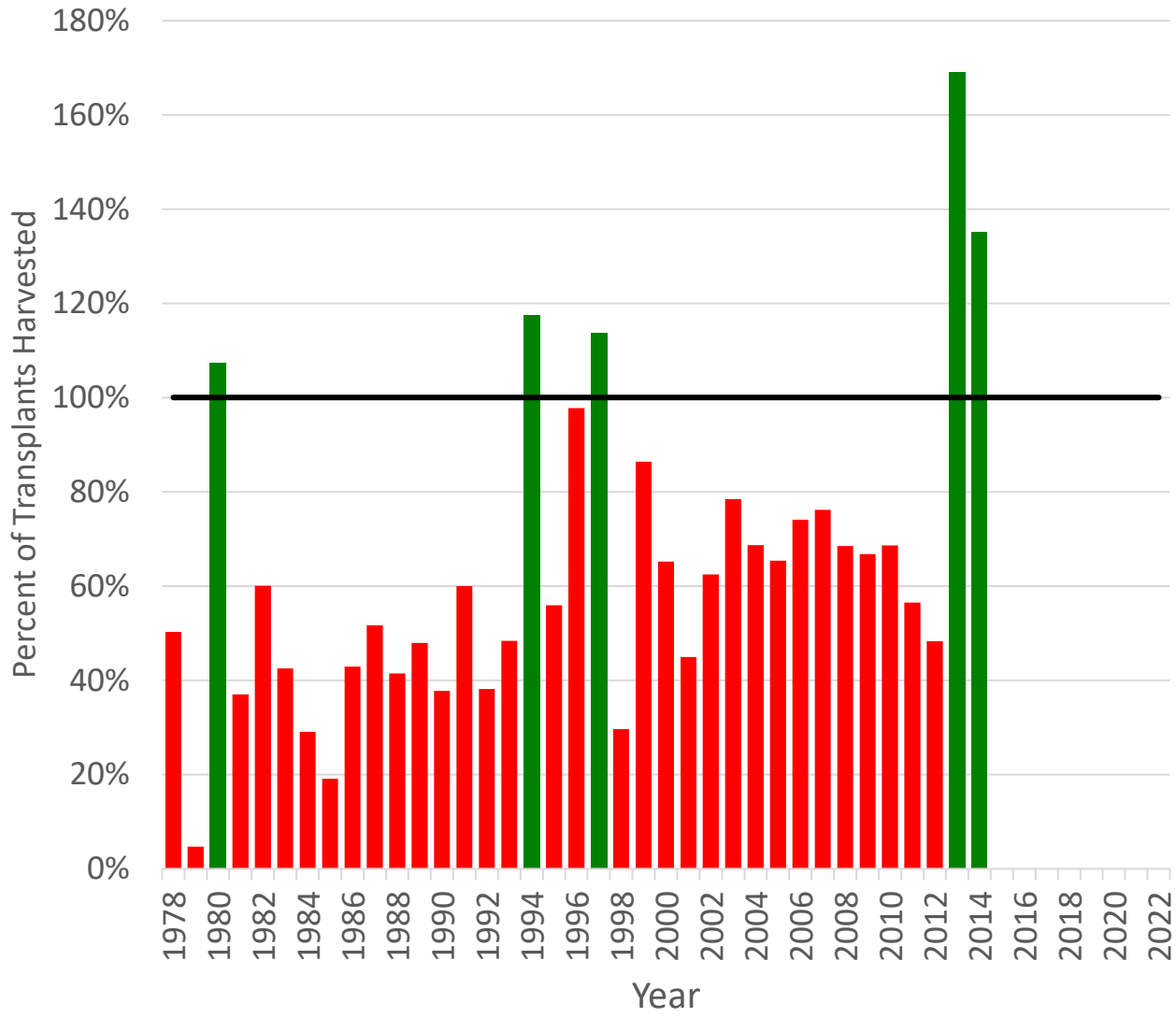
- Reduce illegal harvest in restricted waters and protect public health
- Opportunity to harvest reefs in restricted areas

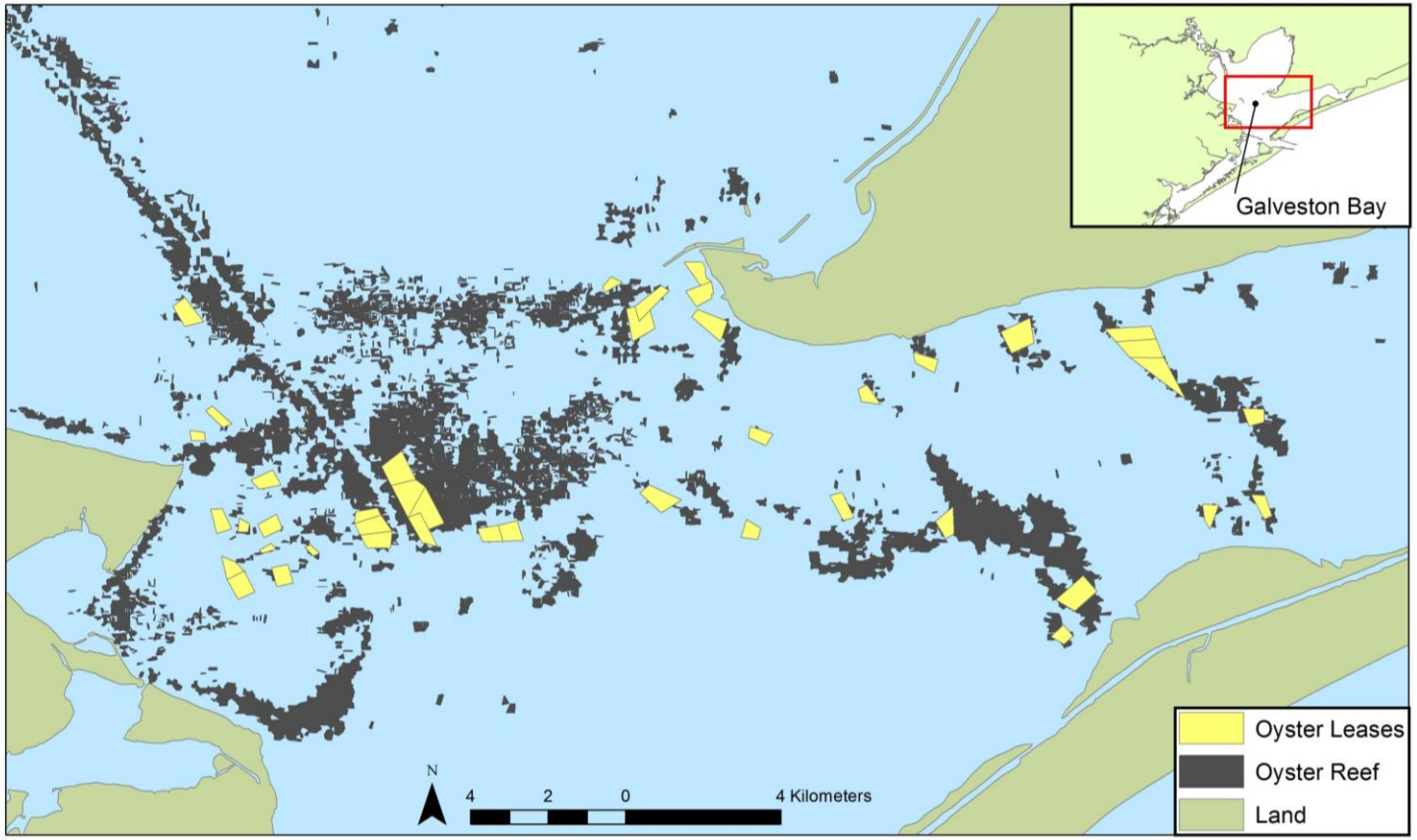
Transplants



Transplants

- Transplant more than is harvested
- Traditionally have not culled, so cultch, undersize, and market oysters are transplanted





Certificates of Location
(a.k.a. Leases)

- SB 1032 just passed
- Redefined “natural oyster bed”
  - From at least 5 barrels of oysters within 2,500 sq ft of any position
  - To substrate that is predominantly composed of oyster shell or live oysters
- Removed the requirement for COL renewal to depend on “the need for depuration of polluted oysters”
- New COL for restoration purposes
  - May have different fees, approval requirements, lease terms, renewal procedures, maximum acreage, and siting and marking requirements than commercial COLs
- TPW Commission
  - Encourage private harvest to reduce pressure on public reefs
- Anticipated that COL:
  - May expand in Galveston Bay
  - May expand to other bay systems

Current Regulations

- Season
  - Nov 1 – Apr 30
  - Sunrise to 3:30
- Bag limits
  - 30 sacks/day
  - No more than 110 lb/sack including dead oyster shell
- Size limits
  - 3 inches
  - Oysters 0.75-2.99 inches are considered undersized and may not make up more than 5% of the catch
  - No more than 6 sacks of un-culled oysters permitted on deck
- Means and methods
  - One dredge
    - Cannot exceed 48 inches width or two-barrel capacity
  - No fishing in 9 Environmentally sensitive minor bays
  - No fishing 300 feet from shore
- During the public season COL holders must follow these rules.
- After the public season:
  - These rules do not apply
  - No more than 2 dredges
  - Sunrise to sunset
- Report landings via Trip Ticket Program

TPWD Oyster Dredge Sampling

- Routine Monitoring
  - Monthly random sampling
  - 10-30 per bay system
  - Not enough to manage by harvest area
  - Targets both productive and degraded areas

- Targeted Oyster Sampling
  - Targets more productive areas that could be fished
  - Up to ~180 per bay system
  - More intensive sampling per harvest area
  - Pre-season and as needed
  - Triggered by:
    - Industry reports
    - Undersized oyster citations
    - Routine samples
    - Heavy harvest pressure
    - Samples nearing threshold


Photo Credit: Christine Jensen, TPWD


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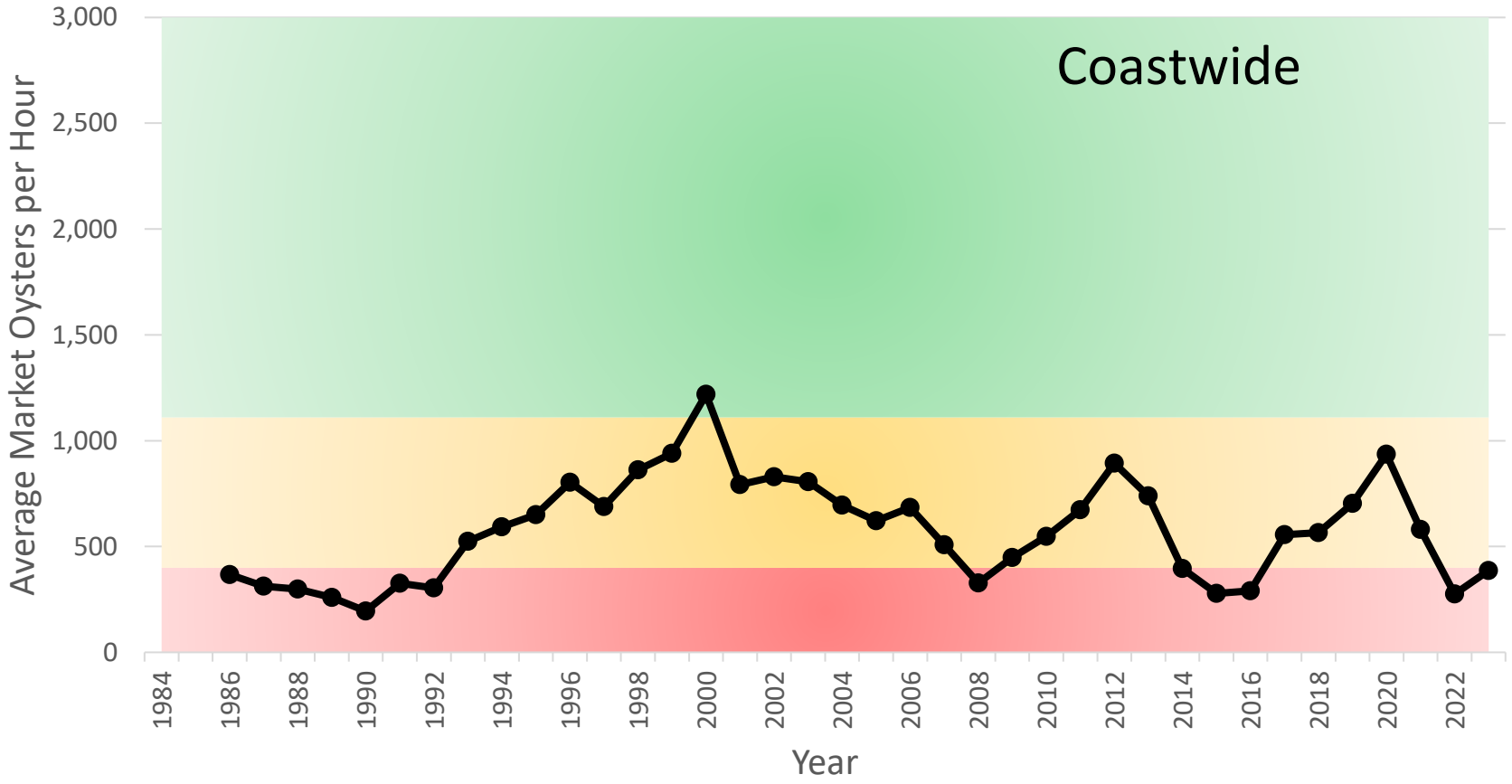
Photo Credit: Christine Jensen, TPWD

Market Oyster Abundance ≥ 76 mm (3 in)



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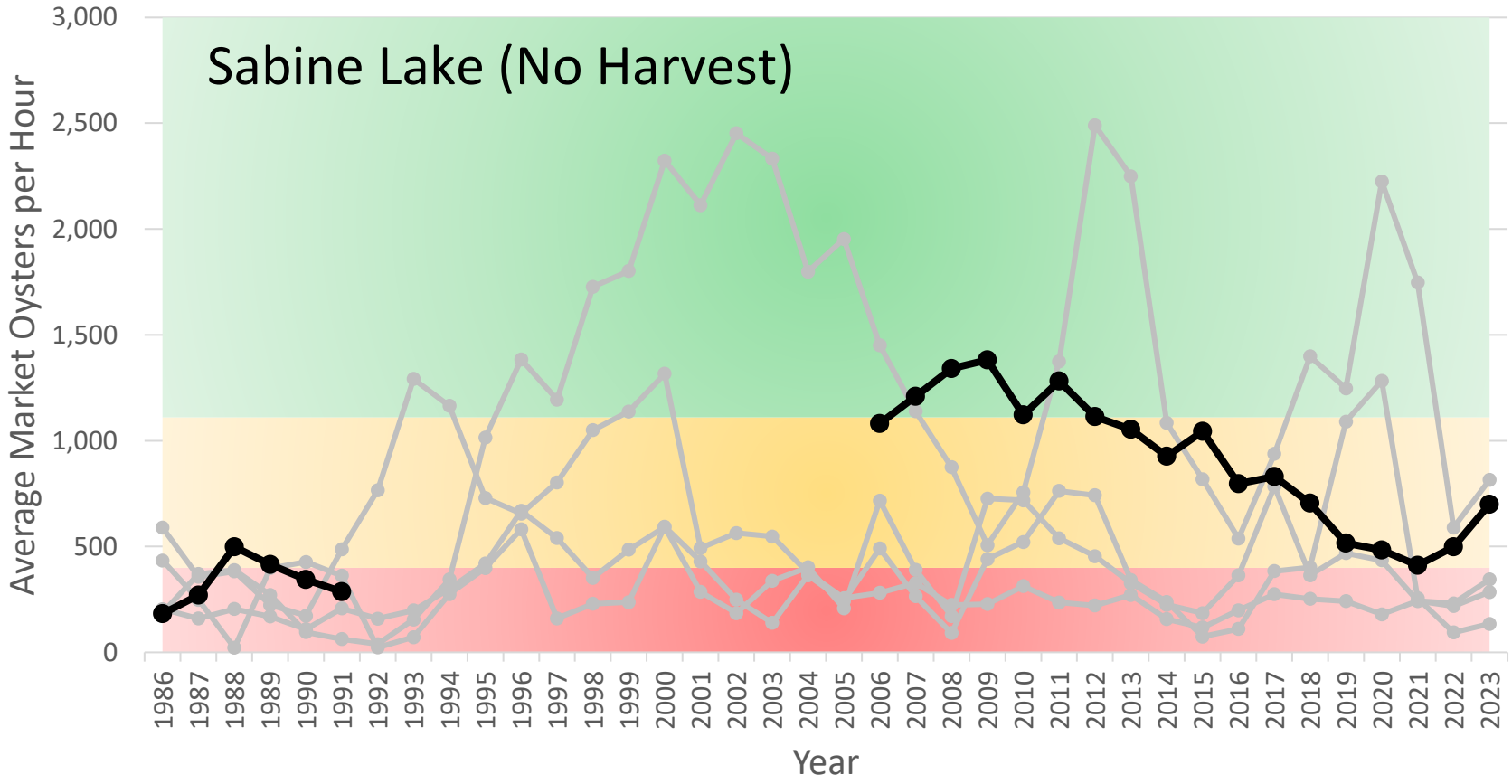

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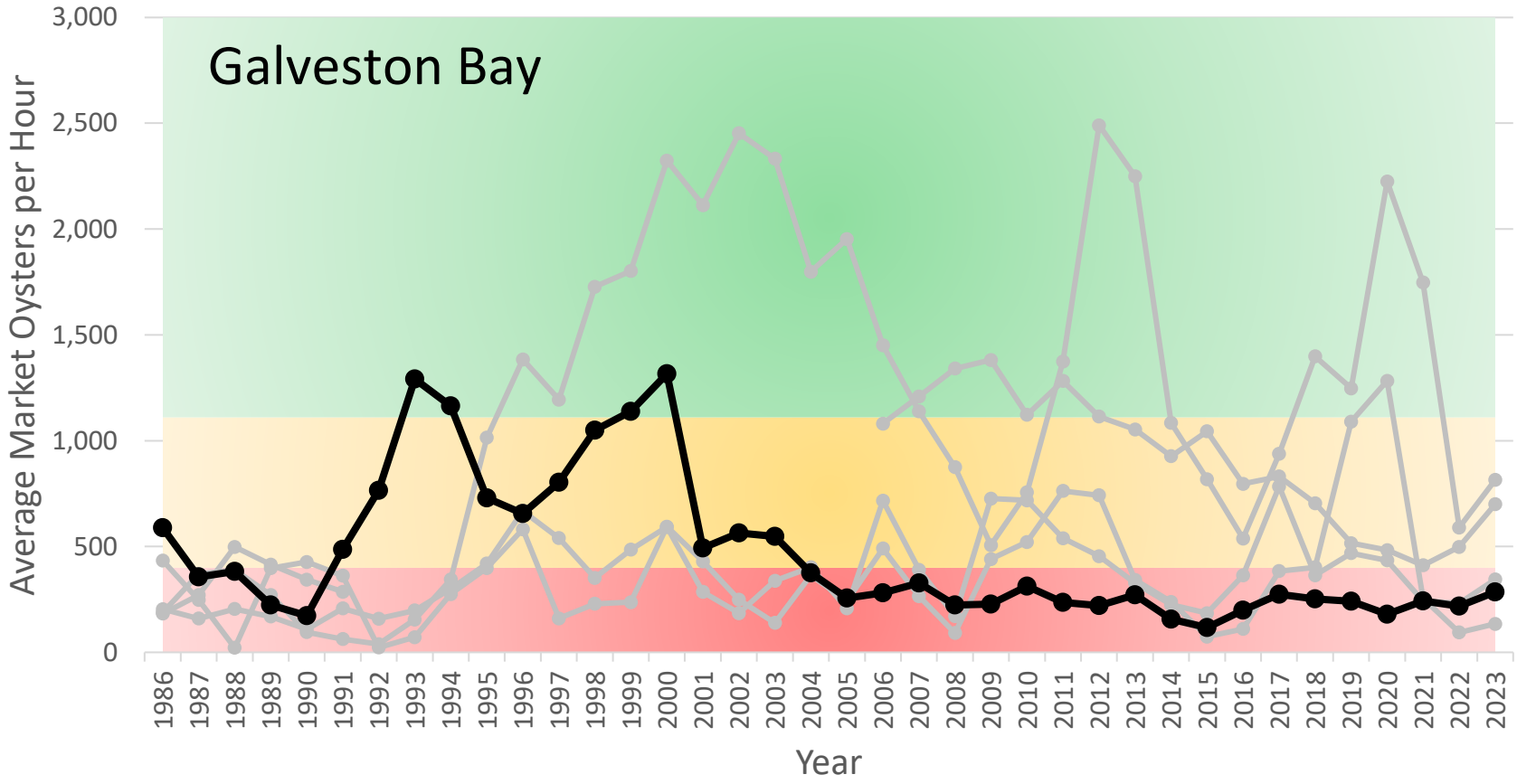

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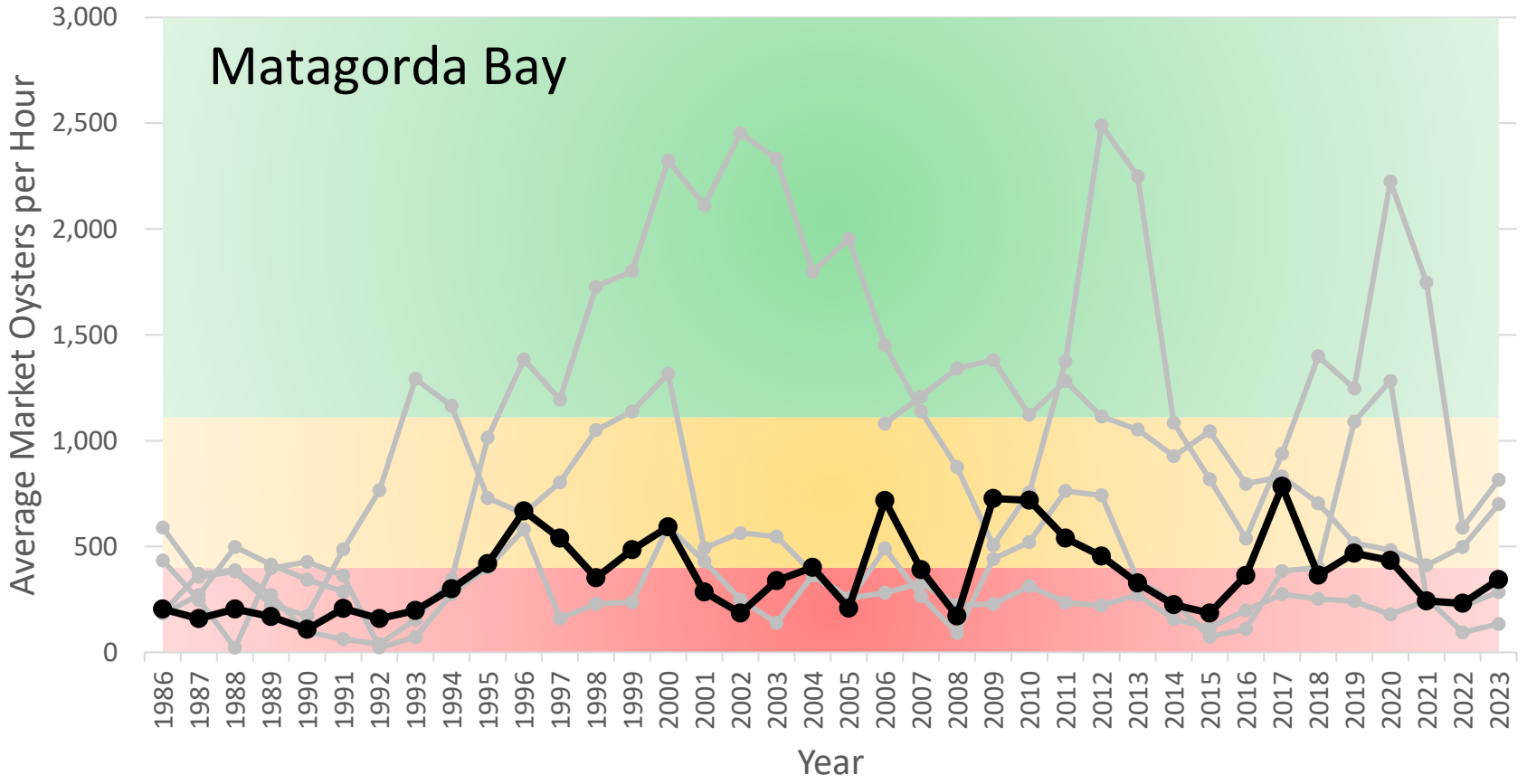

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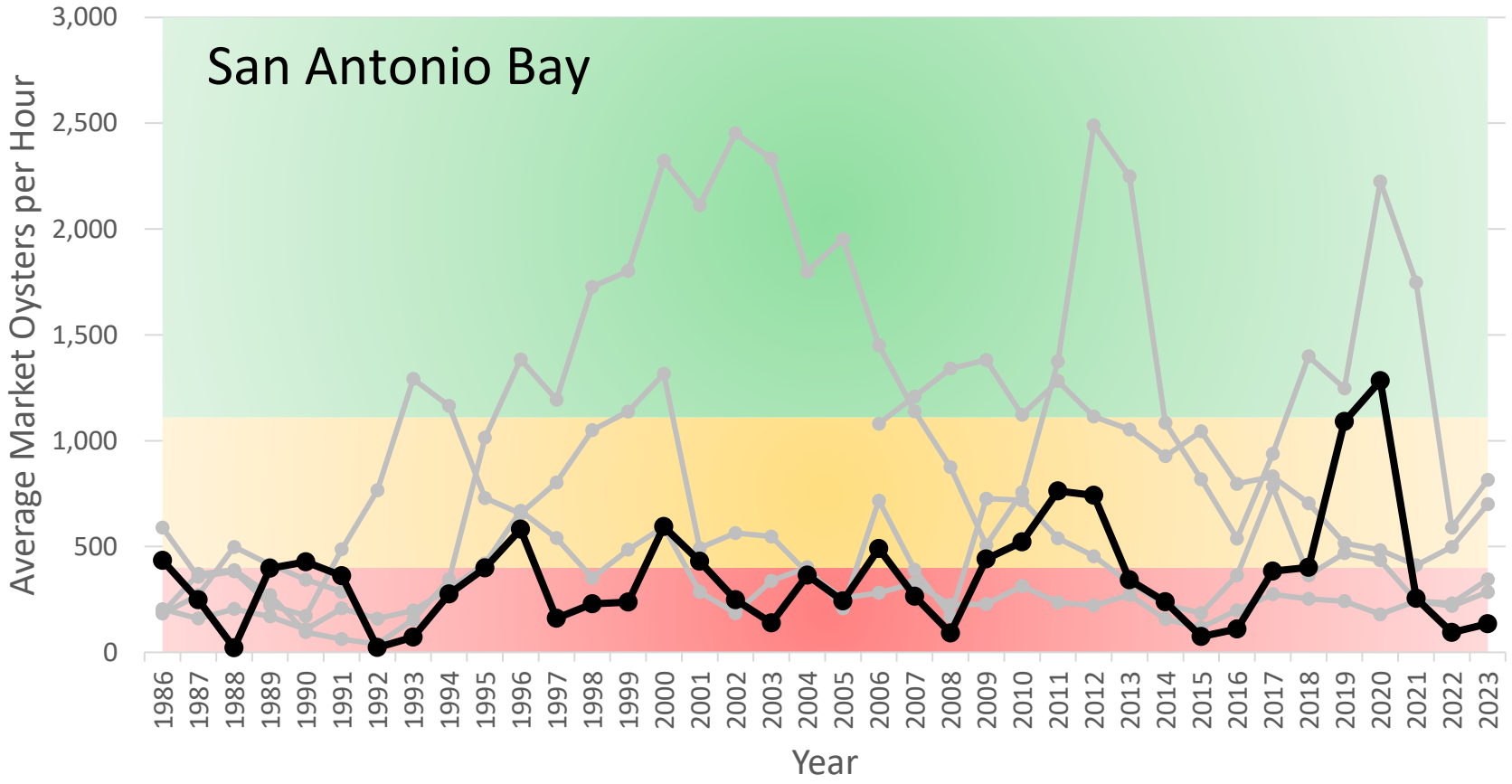

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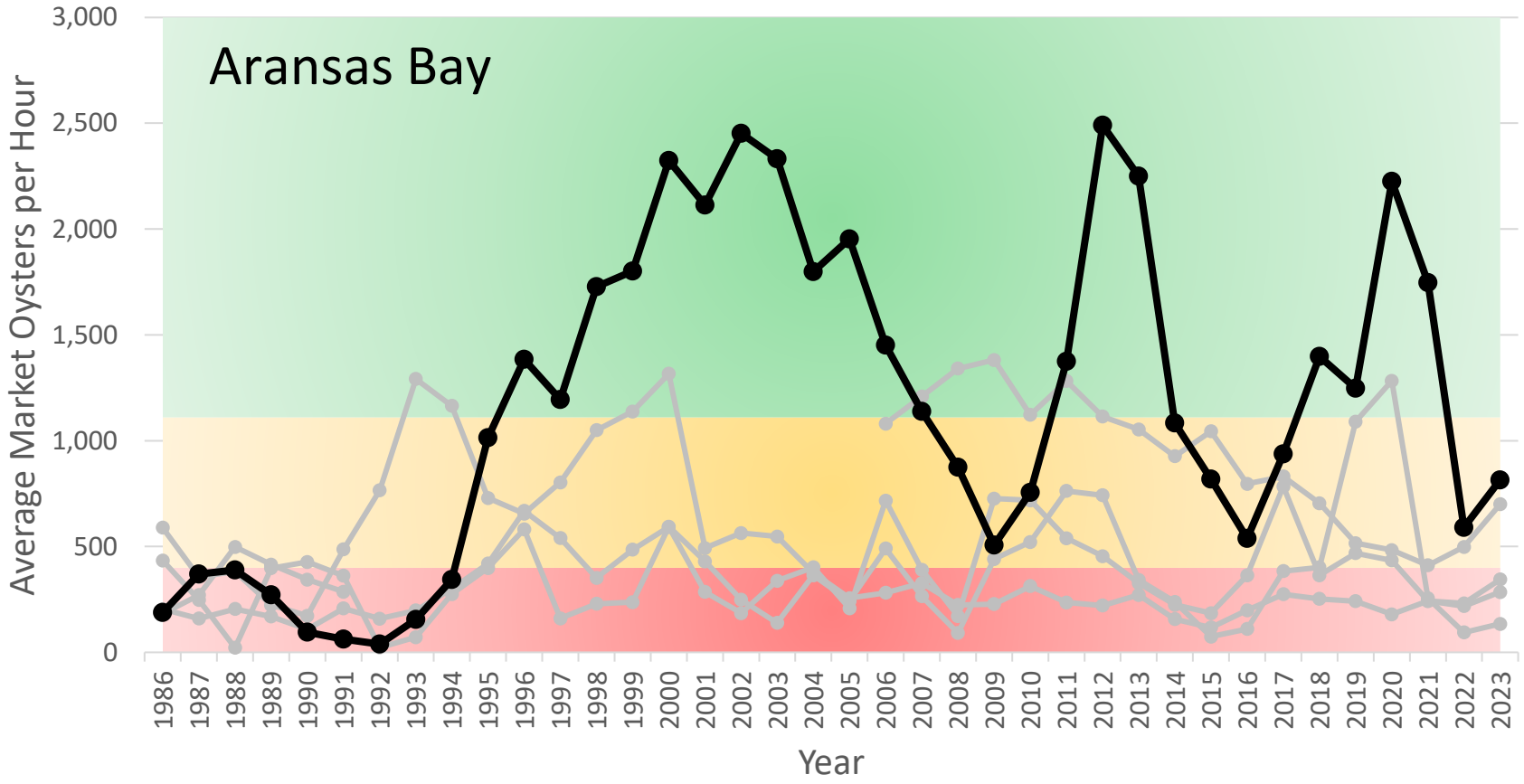


Why the decline?

Fishing

Reduced freshwater inflow

Drought

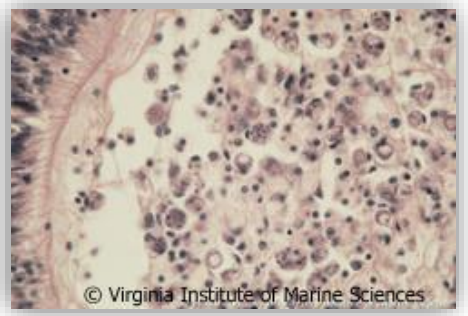
Flooding

Predators

Habitat Destruction

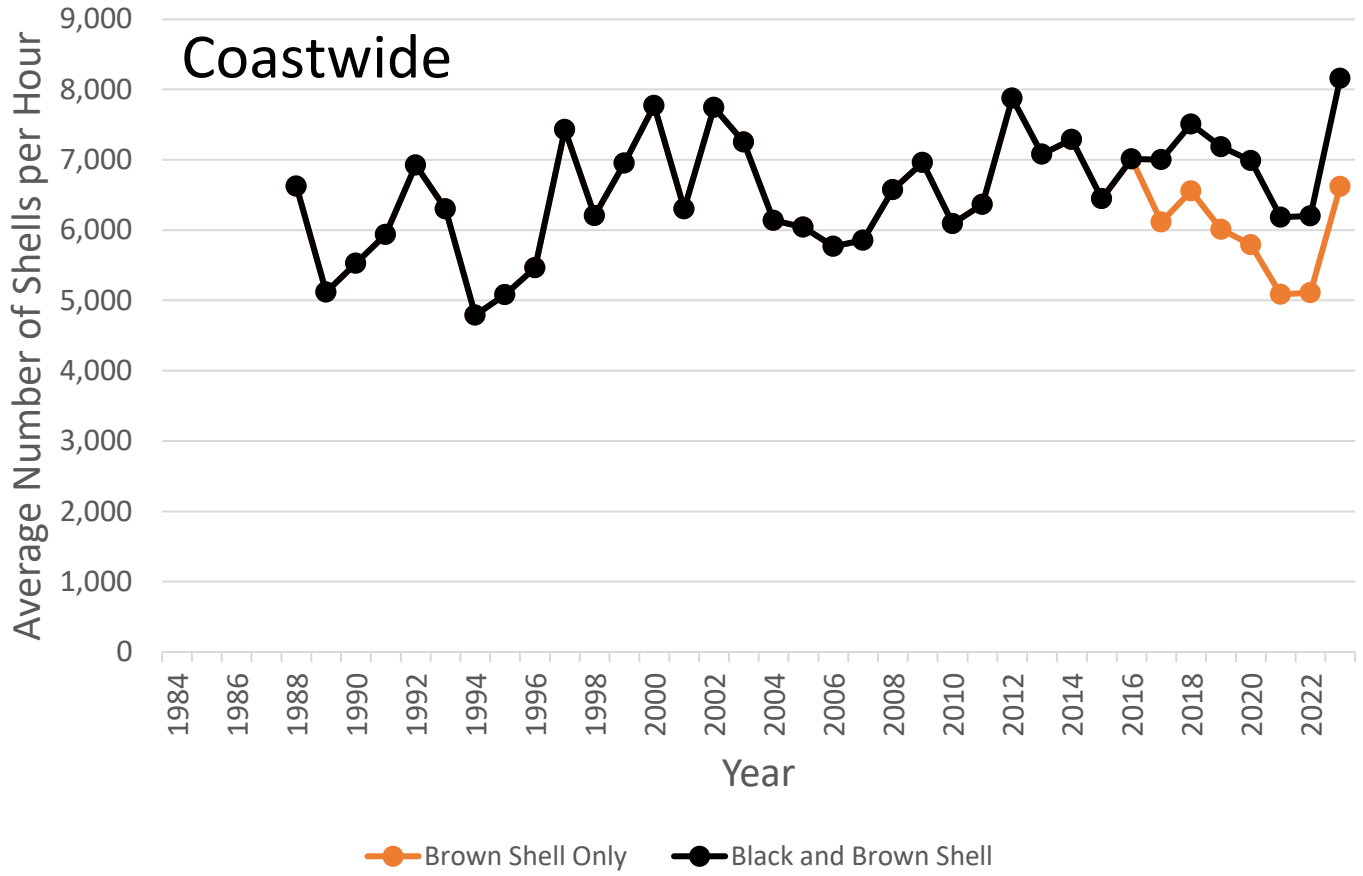
High Demand

Sedimentation



Disease

Available Substrate on Public Reefs



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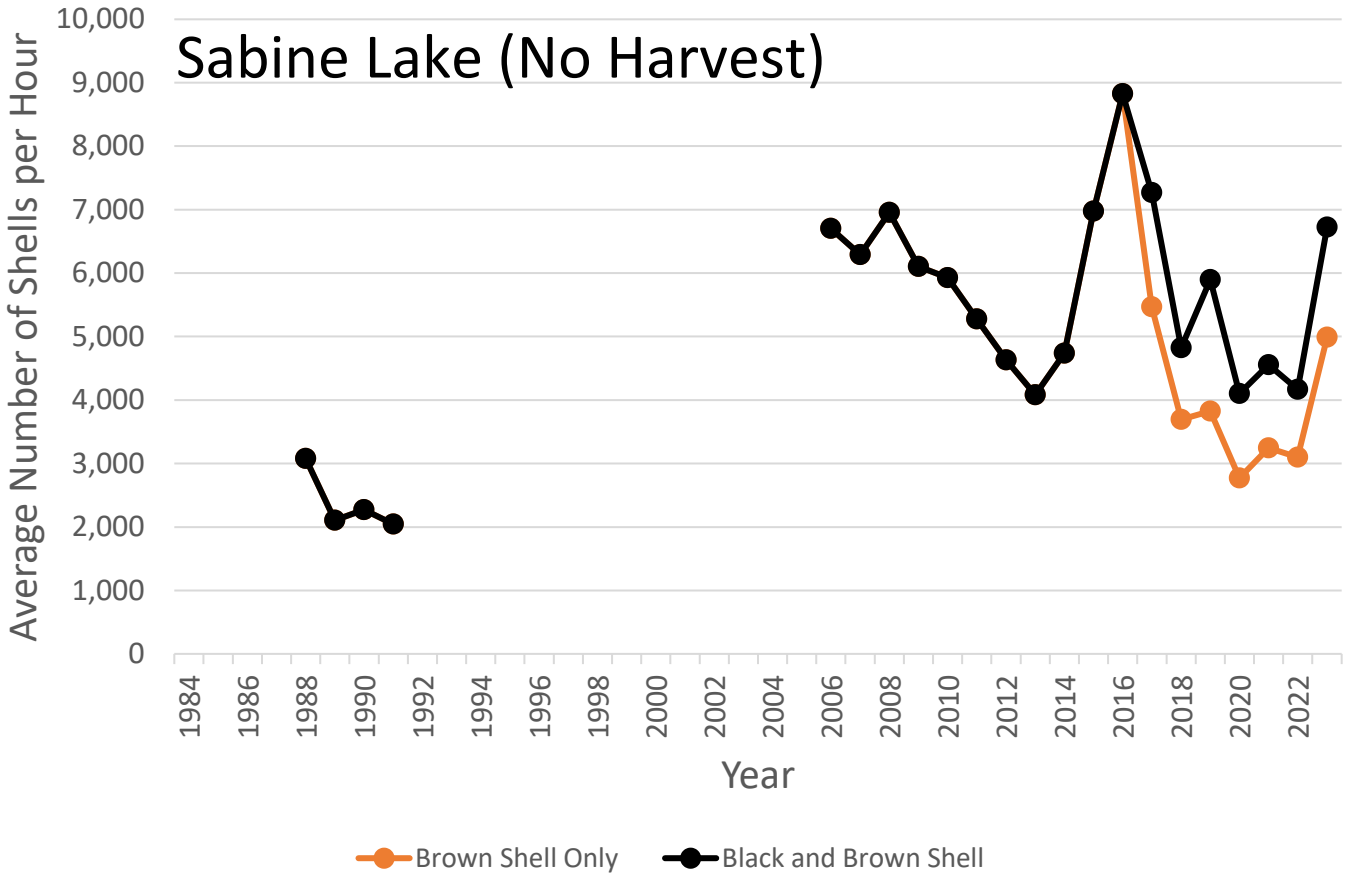

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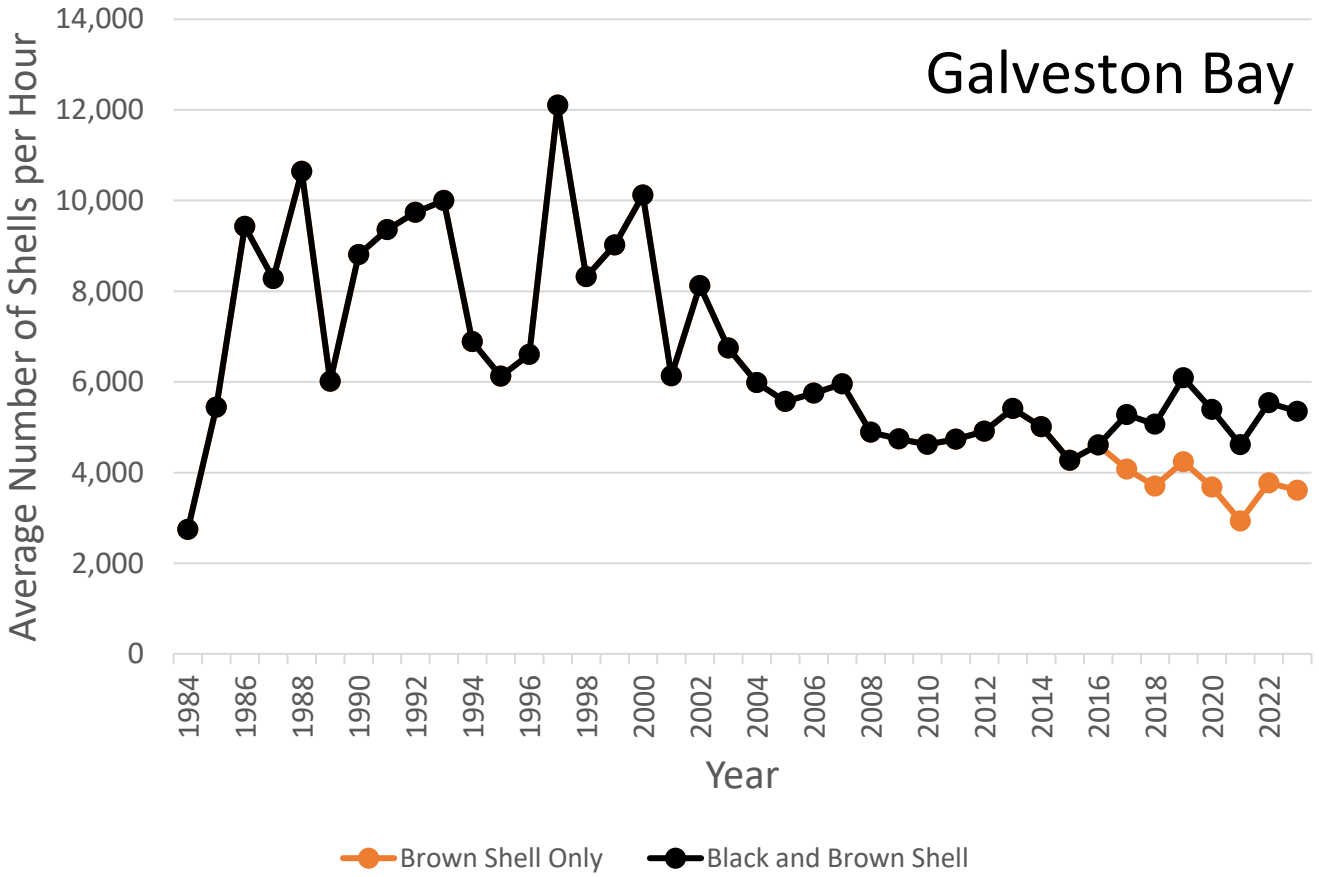

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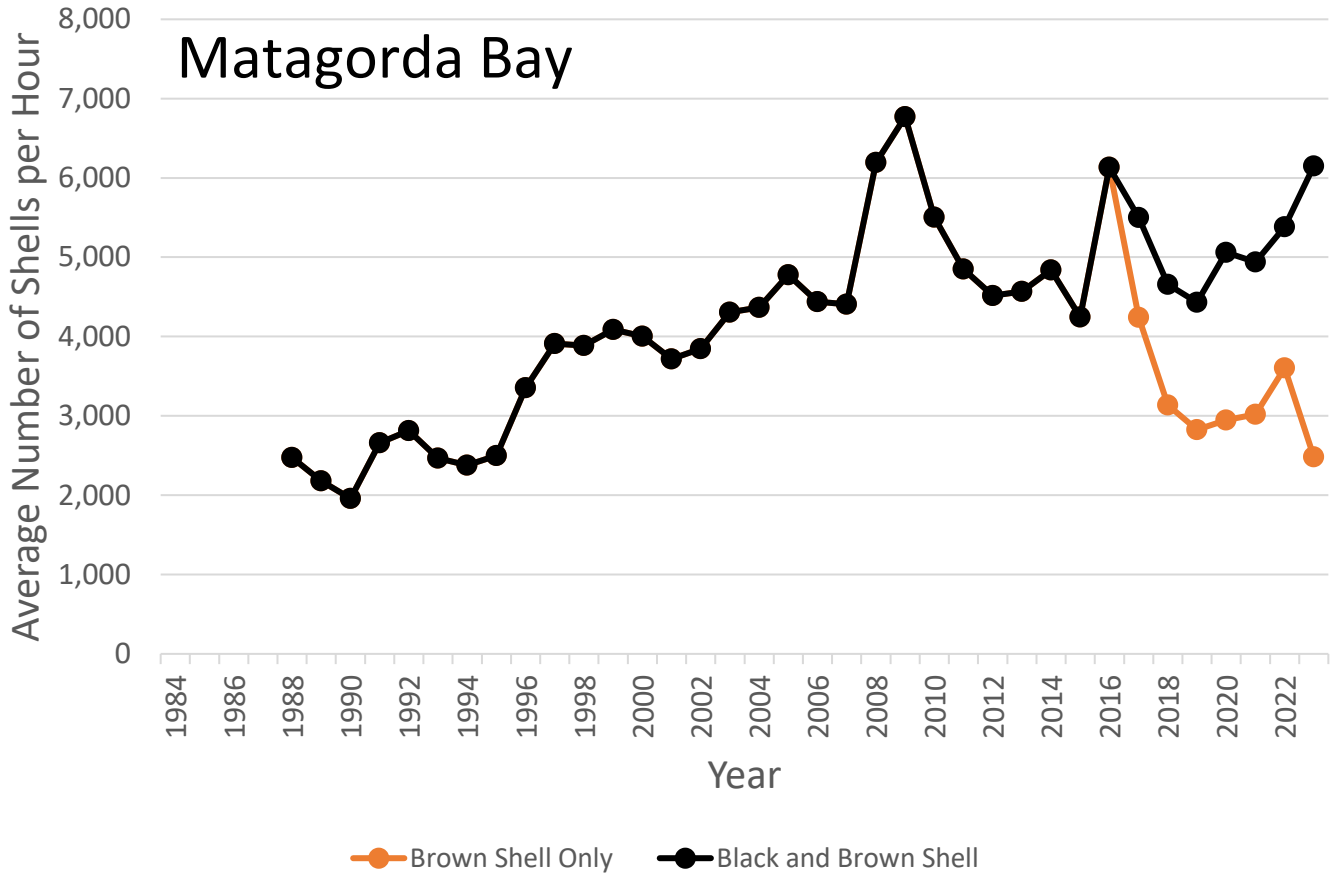

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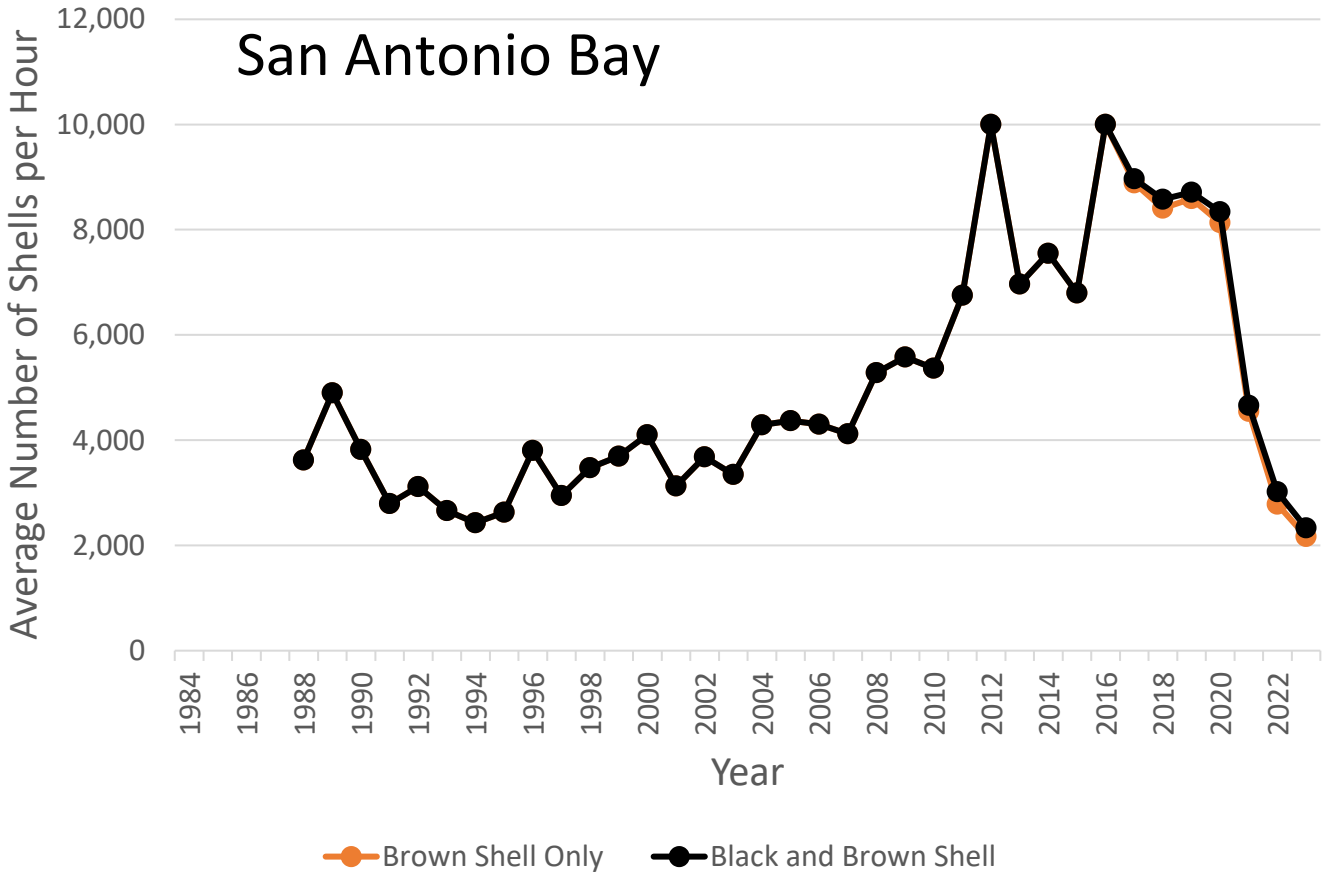

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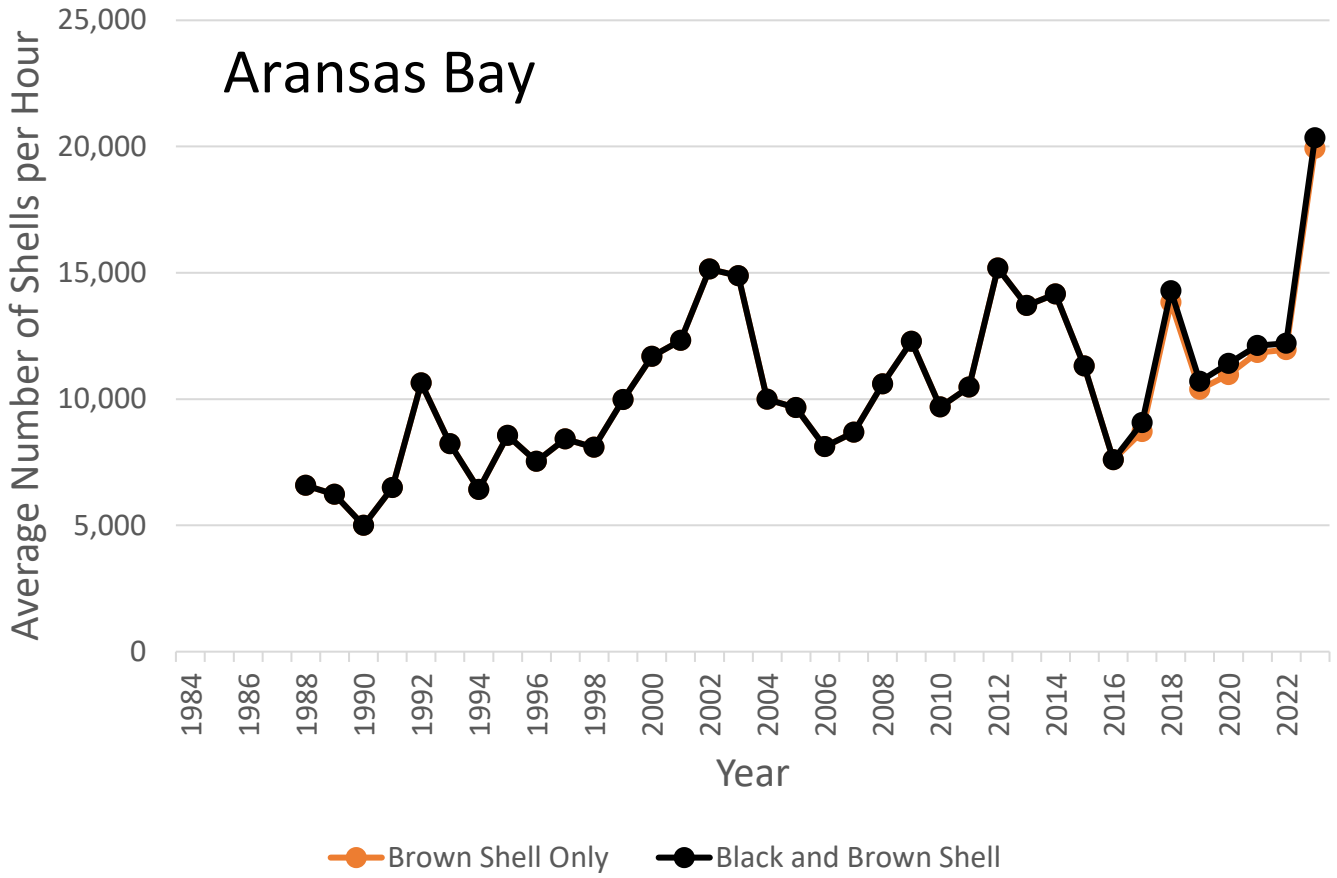


Restoration

- Previously no regular funding source for cultch planting
- Relied on donations, grants, and disaster relief
- 2017 – Regular contributions from oyster dealers
  - Dealers must plant cultch = 30% of volume of oysters purchased or pay a fee

Photo Credit: Christine Jensen, TPWD

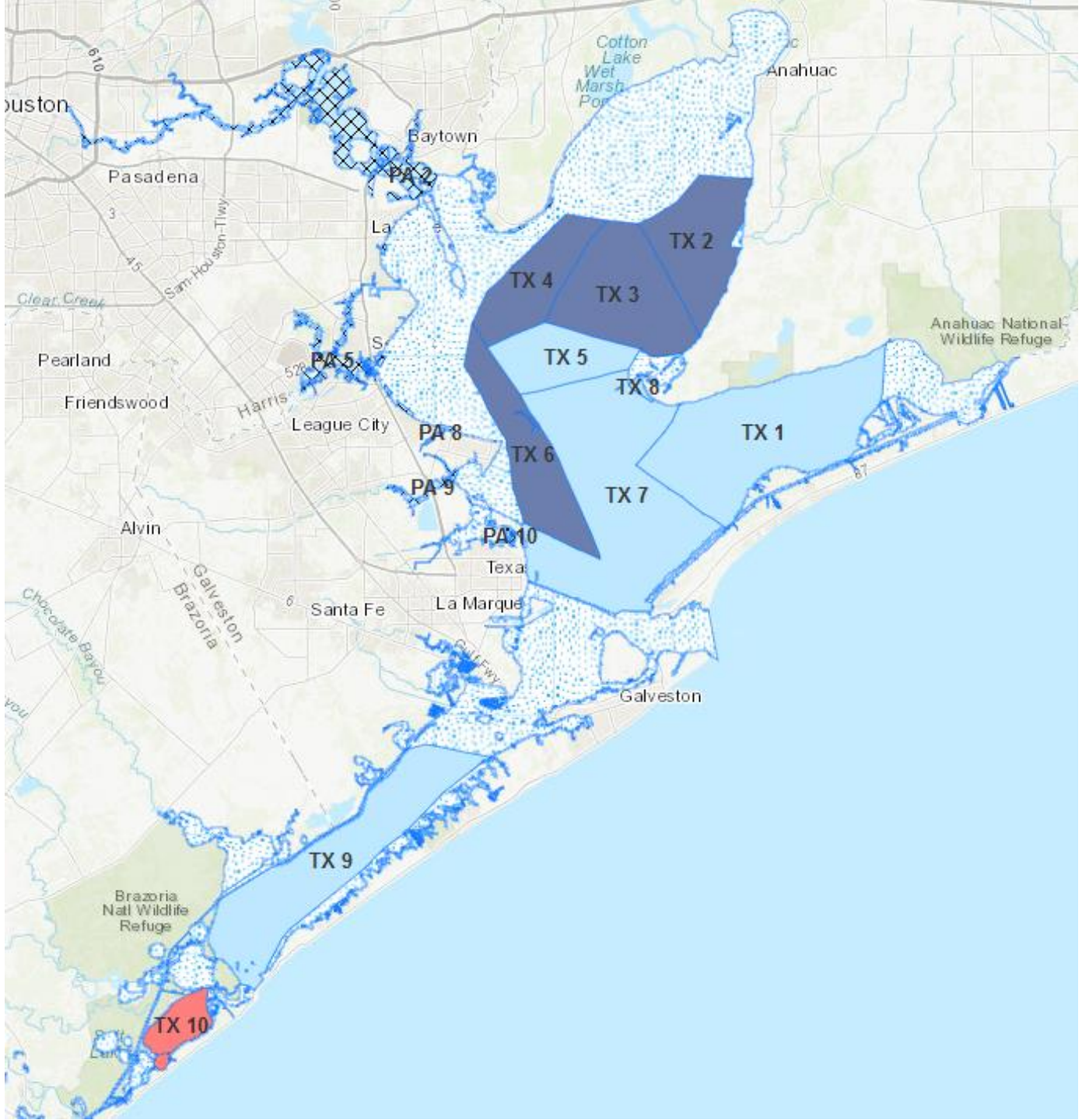
Restoration

- Previously no regular funding source for cultch planting (Except for 20¢ shell recovery fee)
- Relied on donations, grants, and disaster relief
- 2017 – Regular contributions from oyster dealers
  - Dealers must plant cultch = 30% of volume of oysters purchased or pay a fee

	Cultch (Yards^3)			Acres		
Year	Galveston	Matagorda	Total Cultch	Galveston	Matagorda	Total Acres
2018	1,985.2	4,605.3	**6,590.5**	2.5	5.7	**8.2**
2019	7,413.3	2,292.0	**9,705.3**	9.2	2.8	**12.0**
2020	3,220.0	-	**3,220.0**	4.0	-	**4.0**
2021	14,673.8	1,476.0	**16,149.8**	18.2	1.8	**20.0**
2022	7,084.4	640.5	**7,724.9**	8.8	0.8	**9.6**
Totals:	**34,376.7**	**9,013.8**	**43,390.4**	**42.7**	**11.2**	**53.8**

Area Management

- TDSHS shellfish harvest areas
  - Closures based on public health
- TPWD started implementing area closures in 2014
  - Closures based on percent undersized oysters



Area Management

- TDSHS shellfish harvest areas
  - Closures based on public health
- TPWD started implementing area closures in 2014
  - Closures based on percent undersized oysters
- Traffic Light Precautionary Approach in 2015
  - Closures based on abundance and percent undersized

Lights		Rules	
Abundance	% Undersize	Initial Closure	Reopen
		Open	Open
		Open	Open
		Open	Open
		Open	Closed
		Open	Closed
		Closed	Closed
		Closed	Closed
		Closed	Closed
		Closed	Closed

Current Management

- 2020 simplified to looking at just abundance of market-size oysters

Lights	Rules	
Abundance	**Initial Closure**	**Reopen**
	Open	Open
	Open	Closed
	Closed	Closed

Current Management

- 2020 simplified to looking at just abundance of market-size oysters
- In last two years, not many areas opened, and boats are forced into small areas

TEXAS Health and Human Services | Texas Department of State Health Services

Status of Shellfish Harvesting Areas on January 29, 2023

Harvest Area	Public Harvest Area Status	Private Oyster Area Status	Reason for Status
TX 1	Closed	Open	TPWD Action
TX 2	Closed	n/a	TPWD Action; Rainfall
TX 3	Closed	n/a	TPWD Action; Rainfall
TX 4	Closed	n/a	TPWD Action; Rainfall
TX 5	Closed	n/a	TPWD Action
TX 6	Closed	Closed	TPWD Action; Rainfall
TX 7	Closed	Open	TPWD Action
TX 8	Closed	Closed	Sample Results
TX 9	Closed	n/a	TPWD Action
TX 11	Open	n/a	n/a
TX 12	Closed	n/a	TPWD Action
TX 13	Closed	n/a	TPWD Action
TX 14	Closed	Open	TPWD Action
TX 15	Closed	n/a	TPWD Action
TX 16	Closed	n/a	TPWD Action
TX 18	Closed	n/a	TPWD Action
TX 19	Closed	n/a	Water Release
TX 20	Closed	n/a	Water Release
TX 21	Closed	n/a	TPWD Action
TX 24	Closed	n/a	TPWD Action
TX 25	Closed	n/a	TPWD Action
TX 26	Closed	n/a	TPWD Action
TX 27	Closed	n/a	TPWD Action
TX 28	Closed	n/a	TPWD Action
TX 29	Open	n/a	n/a
TX 29 Carlos Bay	Closed	n/a	TPWD Action
TX 30	Closed	n/a	TPWD Action
TX 32	Closed	Open	TPWD Action
TX 33	Open	n/a	n/a
TX 34	Open	n/a	n/a

n/a = not applicable

Photo Credit: Laurie Lyng


Photo Credit: Christine Jensen, TPWD

Summary of Recent Regulations

- Closed several environmentally sensitive bays (including Christmas Bay)
- Closed 300 ft from shore
- No fishing on Saturday or Sunday
- Reduce sack limit to 30
- Additional license requirements for deckhands and those harvesting by hand
- Authority to implement a Vessel Monitoring System


Photo Credit: Frank Tilley, The Victoria Advocate

Summary of Recent Regulations (cont'd)

- 15 → 5% undersized tolerance
- Increased penalties for undersized oysters including the shell
  - Fines, license suspensions, and jail time
  - For both fishermen and dealers
  - Those who posses a cargo of undersized oysters to return oysters to the bed from which they were taken
- Dealers must plant cultch = 30% of volume of oysters purchased or pay a fee
- Established license buyback

Too Much Fishing Pressure

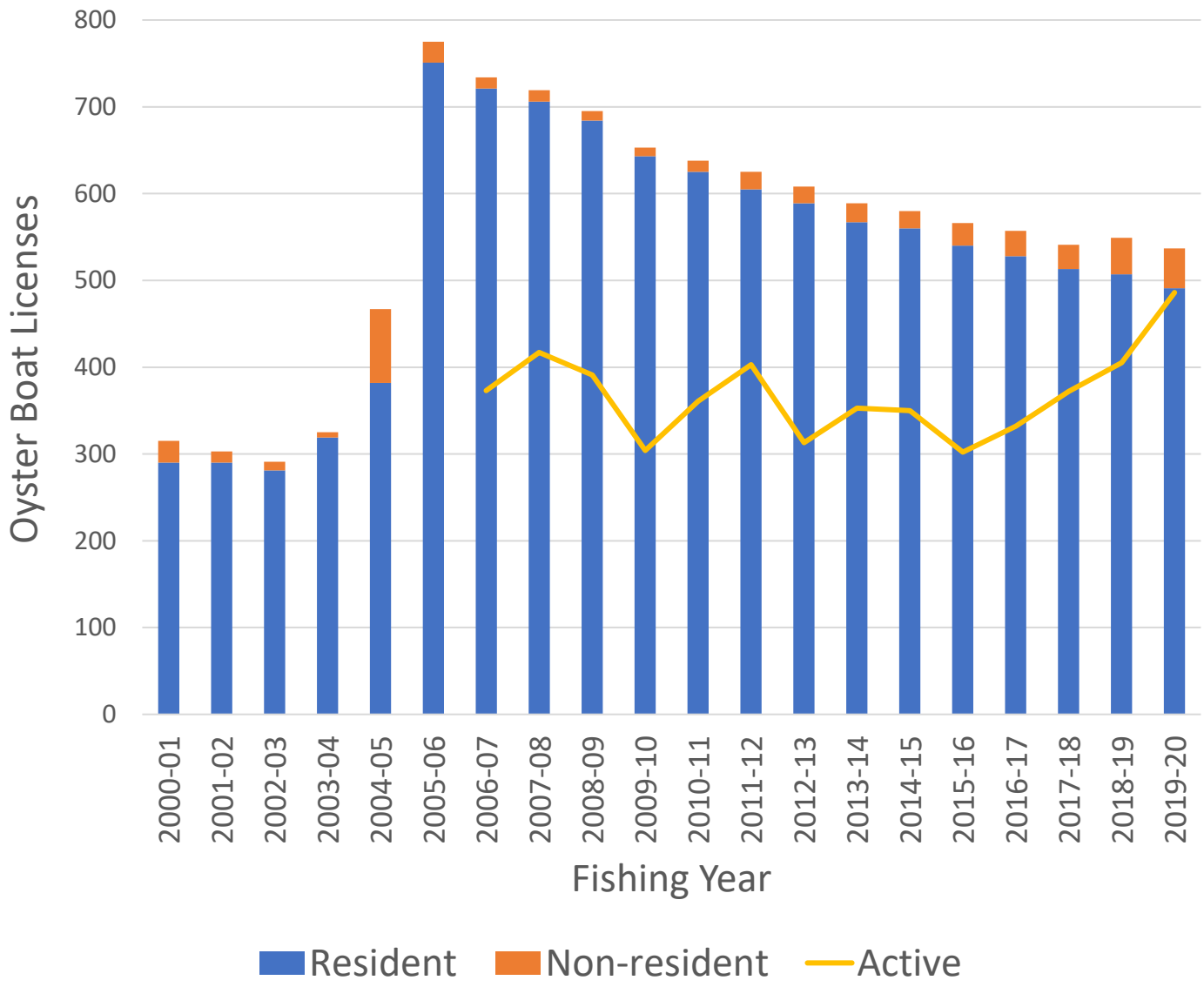


Photo Credit: Jennifer Reynolds, The Daily News

Photo Credit: Jennifer Reynolds, The Daily News

Photo Credit; Save Texas Oysters

Engaging Stakeholders

- Oyster Regulatory Workgroup and Oyster Restoration Workgroup
  - Industry
    - Fishermen
    - Dealers
    - COL holders
  - Academia
  - NGOs
  - Recreational fishermen

- Participate in regional groups as well
  - Examples:
    - Galveston Bay Oyster Workgroup
    - Galveston Bay Estuary Program
- Work with industry to restore reefs
- Participate in research projects with nearby NGOs and Universities

Mariculture

- Separate from Certificate of Location
- Off-bottom operations
  - Examples:
    - Adjustable Long lines
    - Floating cages
    - Upwellers
- First farms in 2021
- Started harvesting 2022
- Currently permitted:
  - 5 Grow-out facilities (2 in Galveston Bay)
  - 2 Nursery-Hatchery facilities
  - 8 Grow-out facilities in progress


Photo Credit: Bill Walton


Photo Credit: Univ of Maryland


Photo Credit: The Star Democrat

Mariculture

- Separate from Certificate of Location
- Off-bottom operations
  - Examples:
    - Adjustable Long lines
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- First farms in 2021
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  - 6 Grow-out facilities
  - 2 Nursery-Hatchery facilities
  - 7 Grow-out facilities in progress


Photo Credit: Texas Parks and Wildlife Department

Achieving Sustainable Harvest

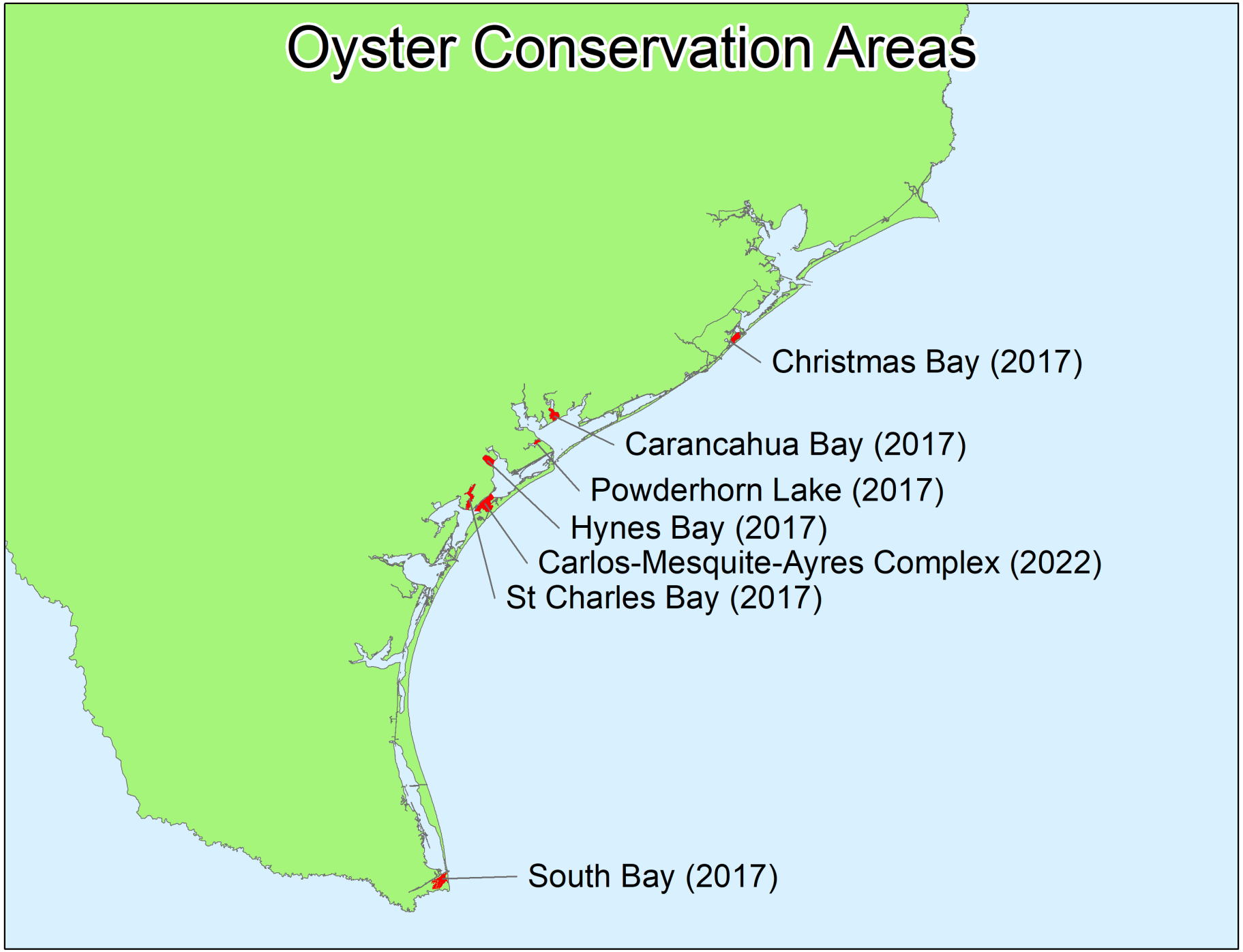
- Mapping Reefs
- Restoration
- Encourage private harvest (mariculture and Certificate of Location)
- Currently open/close areas based on market abundance from dredge surveys
- Alternate monitoring gears (patent tongs)?
- Shell budget model?
  - Provides estimate of sustainable harvest based on cultch availability
  - Data needs:
    - Density estimates (Oysters/m^2)
    - Mapping data
  - Implementation needs:
    - Way of projecting when an area reaches quota
    - More frequent reporting
- Other?

Questions?

Photo Credit: Christine Jensen, TPWD

Oyster Conservation Areas

- **7 minor bay complexes closed to harvest**
  - → **Area characteristics:**
    - **Shallow bays**
    - **Intertidal/shallow reefs adjacent to sensitive habitats (e.g. seagrass)**
    - **Historically low harvest pressure**
    - **Function as de facto spawning reserves**
  - → **Increased harvest pressure observed as primary fishing grounds became depleted**


Oyster Conservation Areas
Christmas Bay (2017)
Carancahua Bay (2017)
Powderhorn Lake (2017)
Hynes Bay (2017)
Carlos-Mesquite-Ayres Complex (2022)
St Charles Bay (2017)
South Bay (2017)

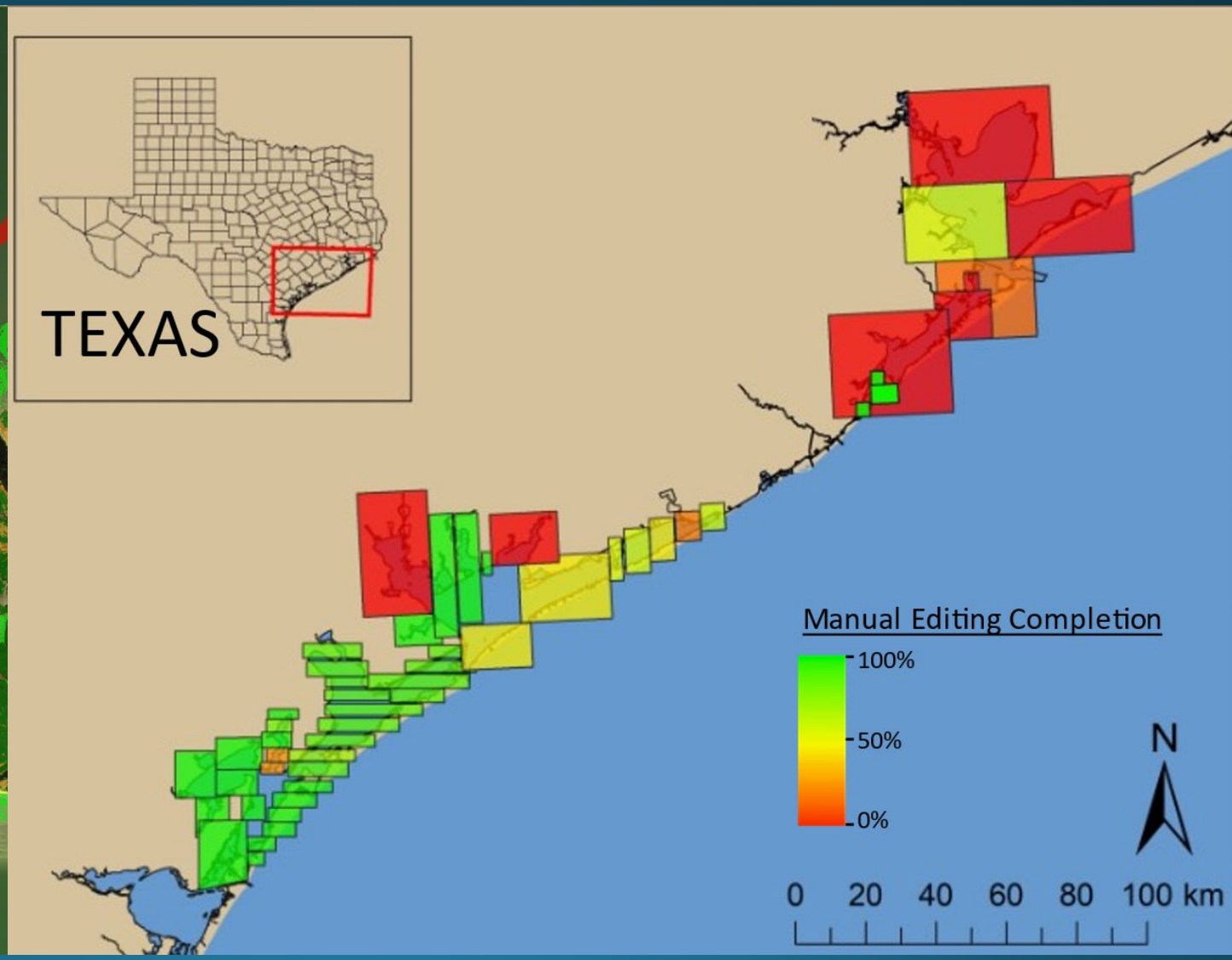
Habitat Monitoring in Oyster Conservation Areas

Oyster Mapping Efforts

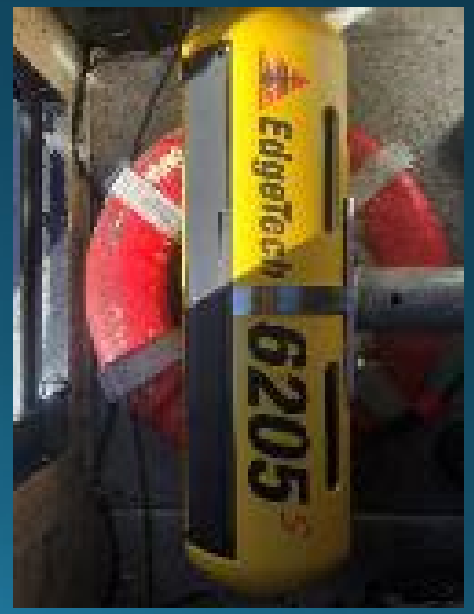
- Aerial imagery assessments
  - → Shallow reefs

- Sonar surveys
  - → Bay-wide (large-scale) surveys of deep reefs
  - → Targeted (small-scale) surveys
    - Restoration planning, design, verification, and monitoring

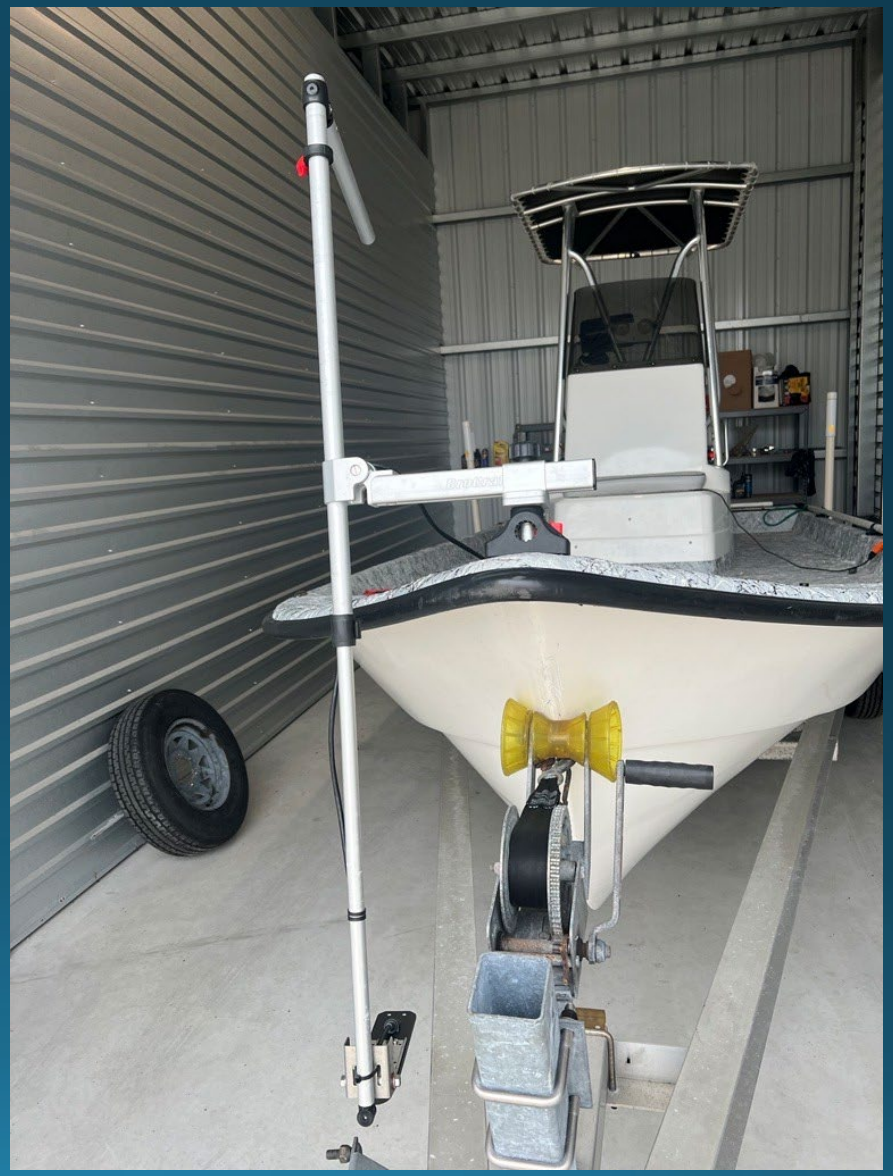
Aerial Imagery



Scientific-Grade Sonar Surveys



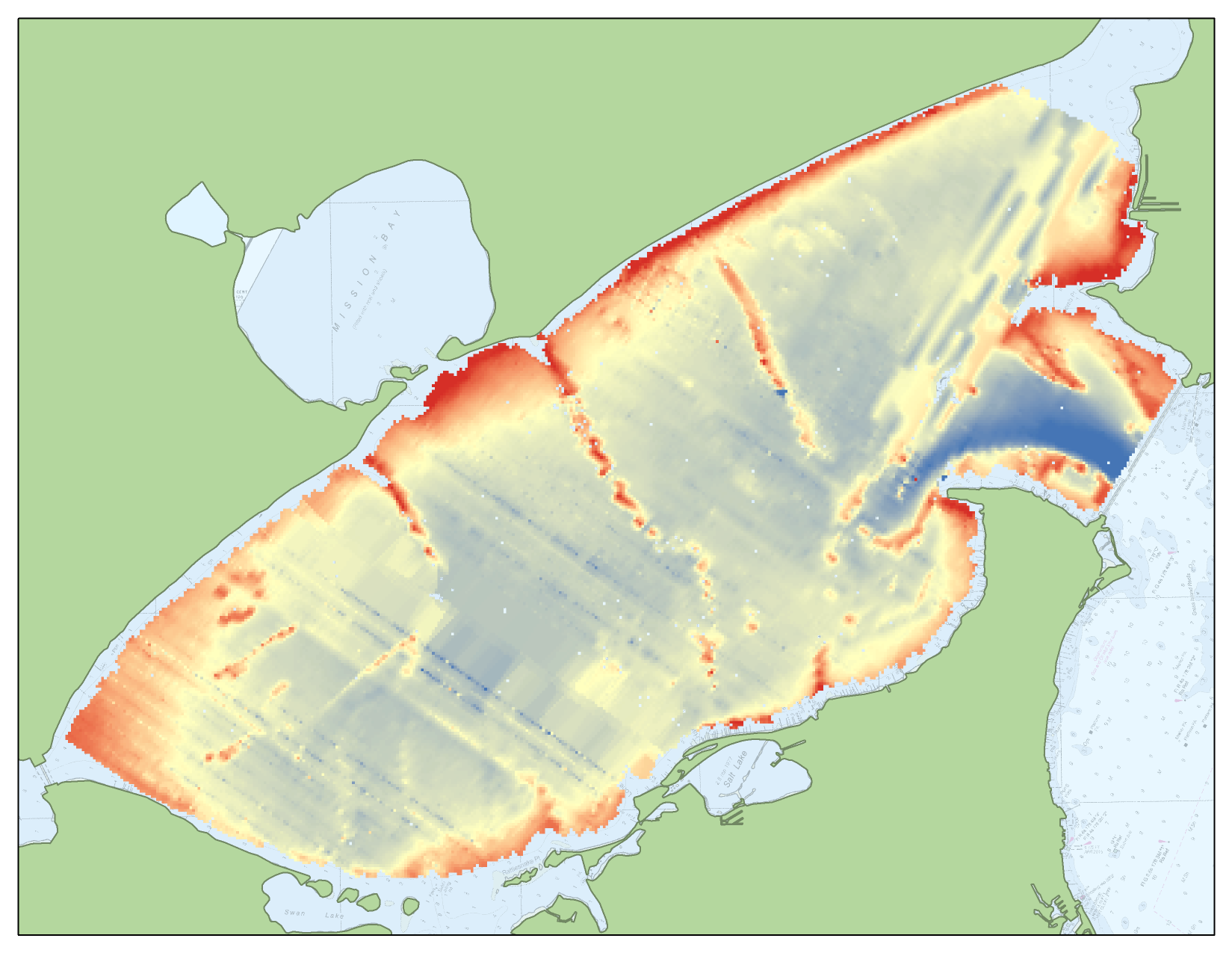
Recreational-Grade Sonar Surveys



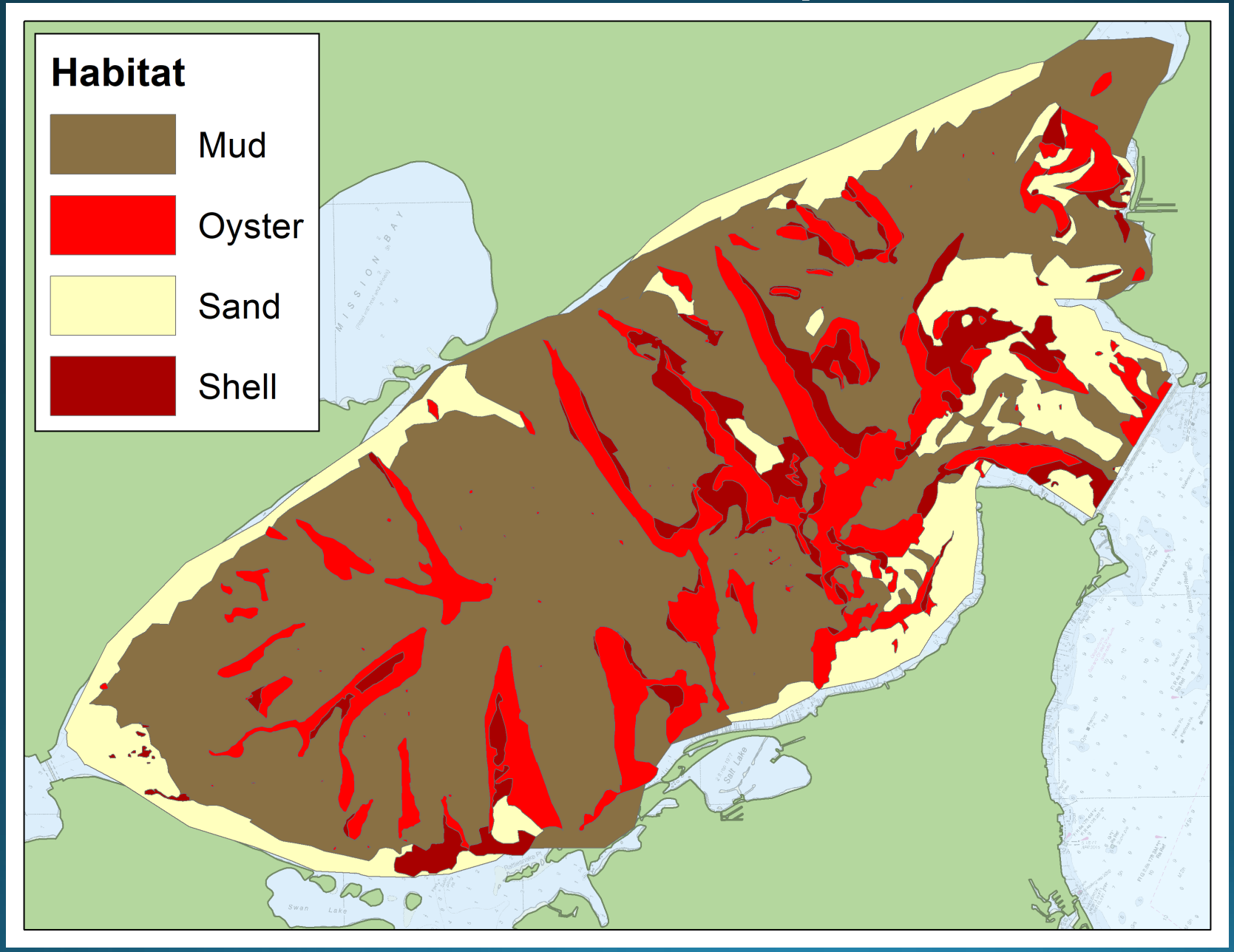
Side Scan Sonar

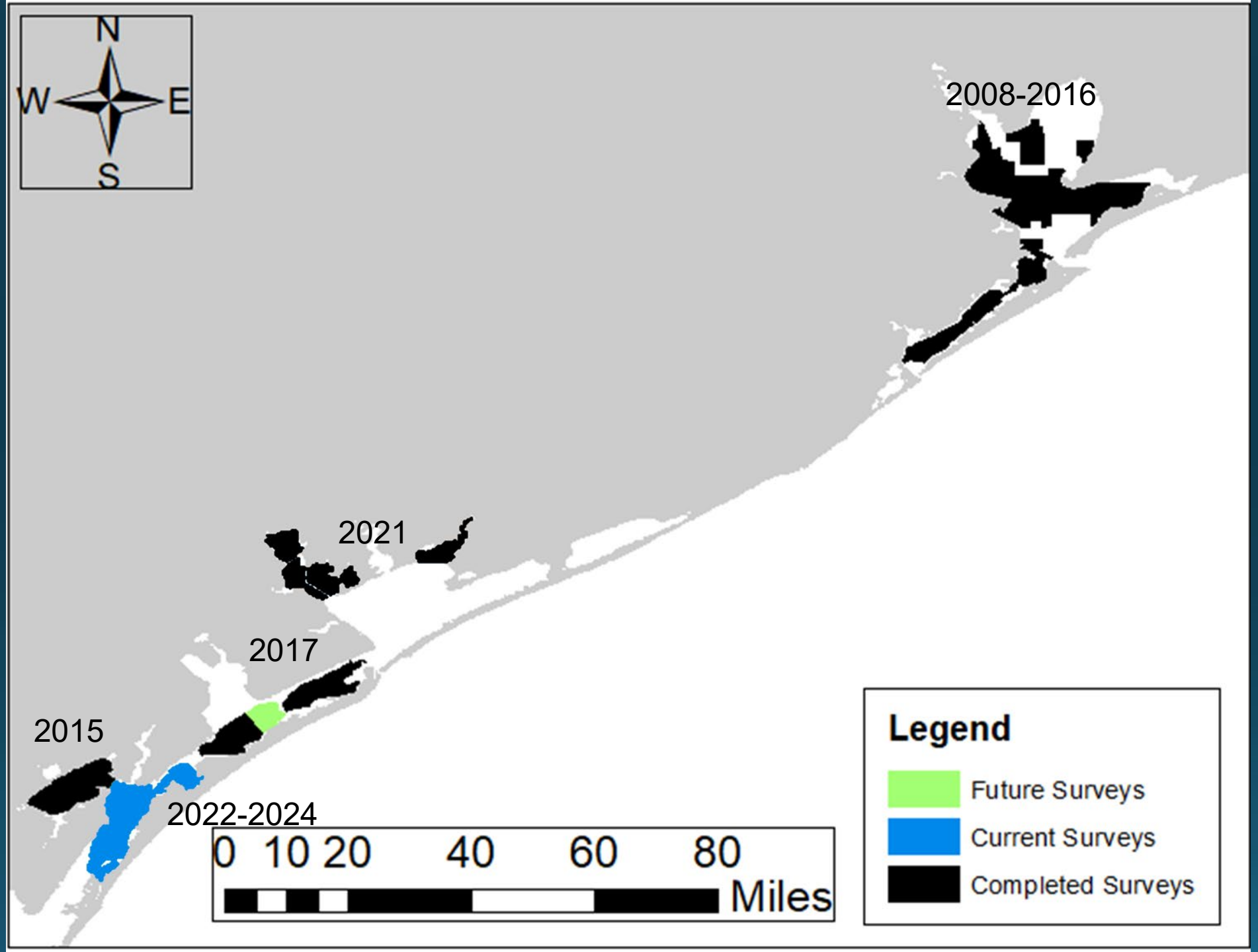
Bathymetry/Substrate Characteristics

Bathymetry (DEM)



Habitat Maps




N
W
E
S
2008-2016
2021
2017
2015
2022-2024
0 10 20 40 60 80
Miles
Legend
Future Surveys
Current Surveys
Completed Surveys

Pairing acoustic data and dredge sample metrics

Objectives

1. Determine if current sampling metric is related to reef structure.

2. Assess if other oyster metrics are better related to reef structure.

Study Design

- Study sites represent a range of reef types/condition
- Early- and post-season sampling
- Dredges (n=10) at each site/sampling event (N=120)
- Acoustic data at each site/sampling event:
  - Side-scan SONAR
    - Reef footprint
  - Single beam echosounder
    - Characteristics (roughness, etc.)
  - Multibeam echosounder
    - Bathymetry—not yet complete

Preliminary Results: Alt. Oyster Metrics

Oyster Metrics		R^2	Rough.	Hard.	First Bot.	Sec. Bot.	Rise.	Max. Sv	Kurt.	Skew.	Depth
Live Oyster	Market ≥(3")	0.53									
	Medium (2-3")	0.32									
	Small (1-2")	0.36									
Box Oyster	Market (≥3")	0.40									
	Medium (2-3")	0.40									
	Small (1-2")	0.42									
Oyster Shell	Large (≥2")	0.27									
	Small (1-2")	0.23									
	Black Shell (≥1")	0.16									

$p < 0.05$

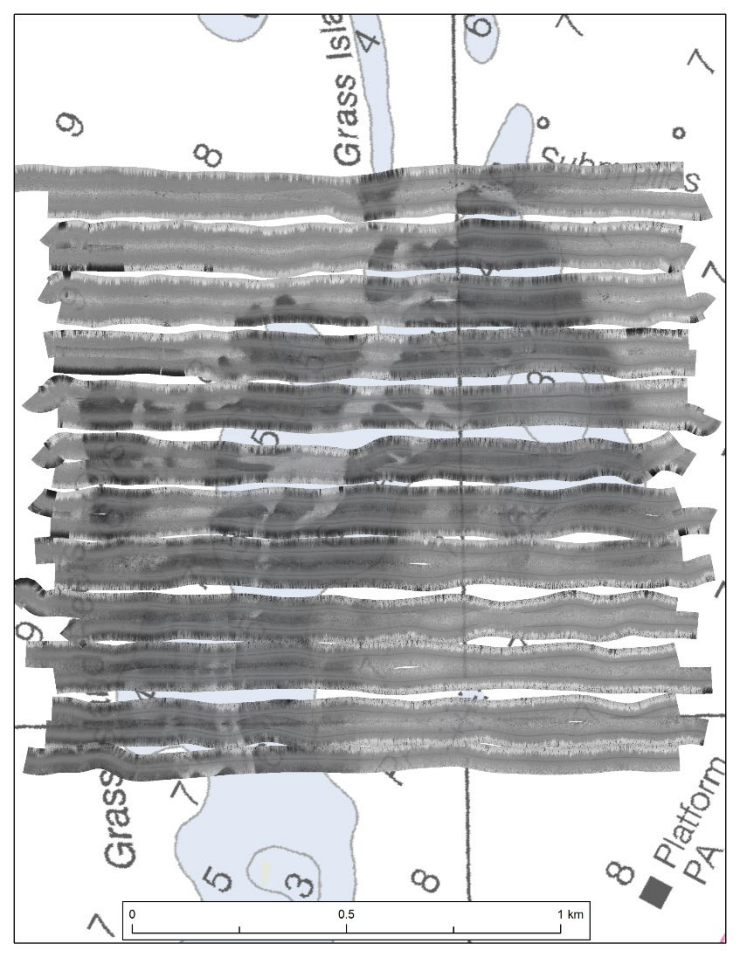
$p < 0.1$

- Market Oyster CPUE metric does relate to reef structure

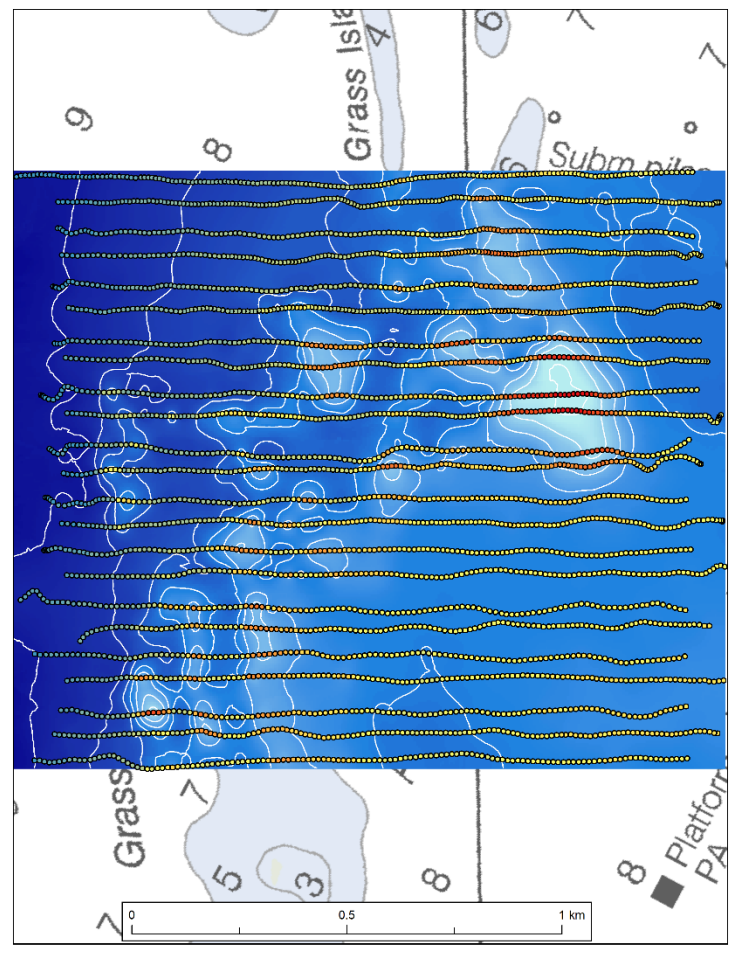
- Other alt. metrics also relate to reef structure
  - Different “aspects” of structure covered by other metrics
  - Use of multiple metrics may better represent structure

Oyster Restoration Planning

Side Scan Survey



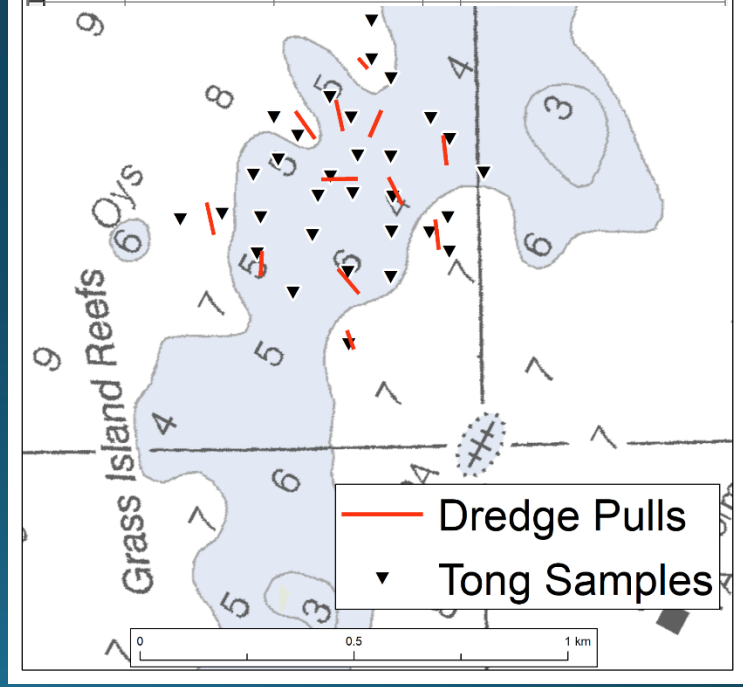
Bathymetry Survey

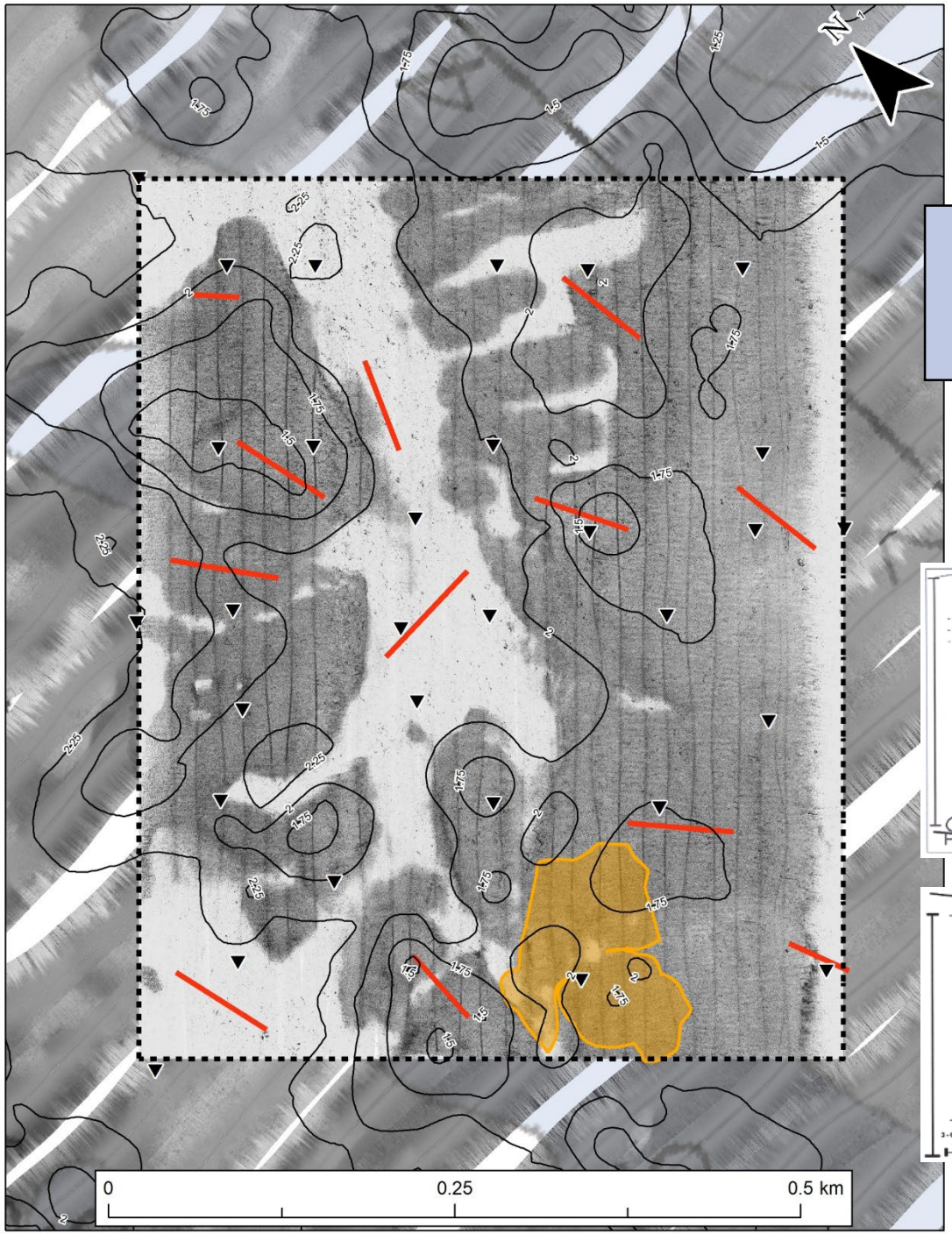


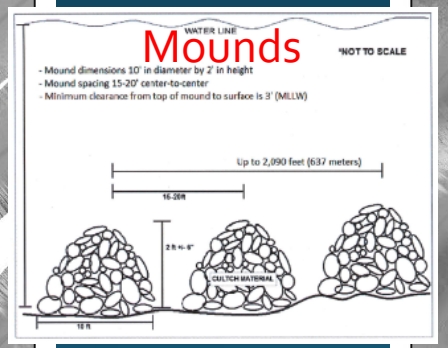
Pre-Restoration Sampling

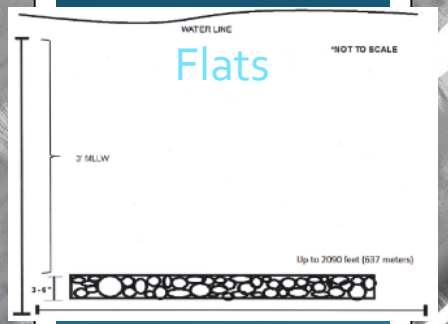
Id	Depth	PercMud	PercHash	PercShell	PercLive	Notes	Assessment
1	5.4	50	5	5	85		Good
2	4.7	0	0	5	90		Good
3	6.5	0	0	100	0	Buried shell	Very Poor
4	5.6	0	0	0	100		Good
5	6	35	10	10	45		Medium

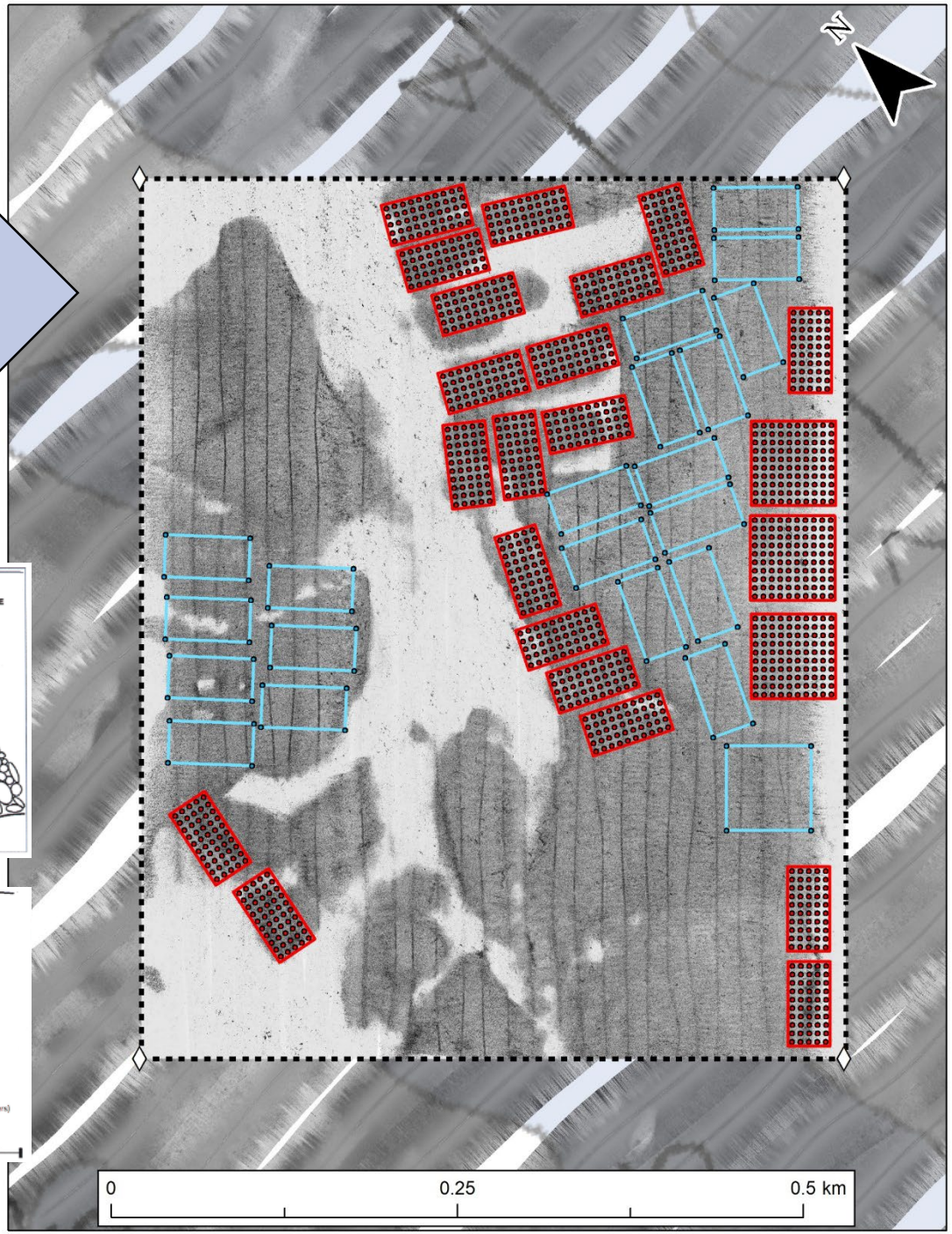
Waypoint	BottomType	Assessment	Dept	Notes
WP006	Firmer Mud/Shell Hash	Tongs	6.4	
WP007	Mostly Mud	Tongs	6.5	
WP008	Shell Hash/Whole Shell	Tongs	4.5	Missed target 7; Depth corrected
WP009	Shell Hash/Whole Shell	Tongs	4.4	Missed target 7; Depth corrected
WP010	Shell Hash/Whole Shell	Tongs	5.9	Missed target 7; Depth corrected
WP011	Firmer Mud/Shell Hash	Tongs/GoPro/Push Pole	5.9	




N
0
0.25
0.5 km

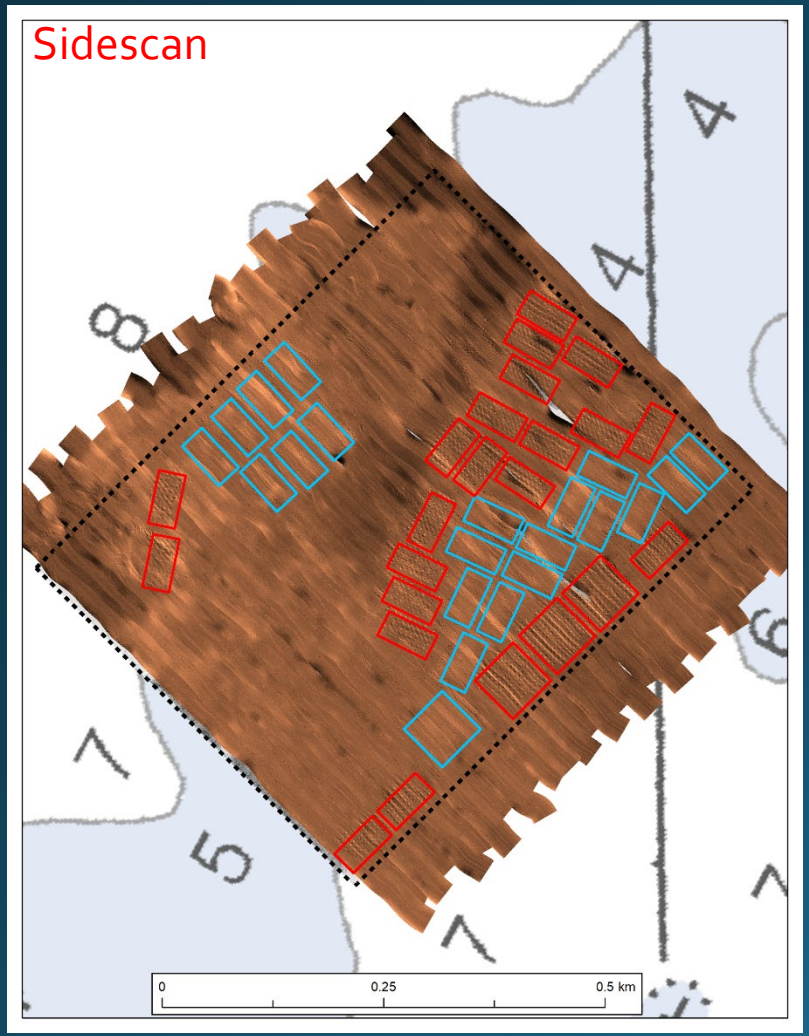

Mounds
WATER LINE
*NOT TO SCALE
- Mound dimensions 10' in diameter by 2' in height
- Mound spacing 15-20' center-to-center
- Minimum clearance from top of mound to surface is 3' (MLLW)
Up to 2,090 feet (637 meters)
16-20ft
2 ft +/- 6"
CULTCH MATERIAL
10 ft


WATER LINE
*NOT TO SCALE
Flats
3' MLLW
Up to 2090 feet (637 meters)
3-6"

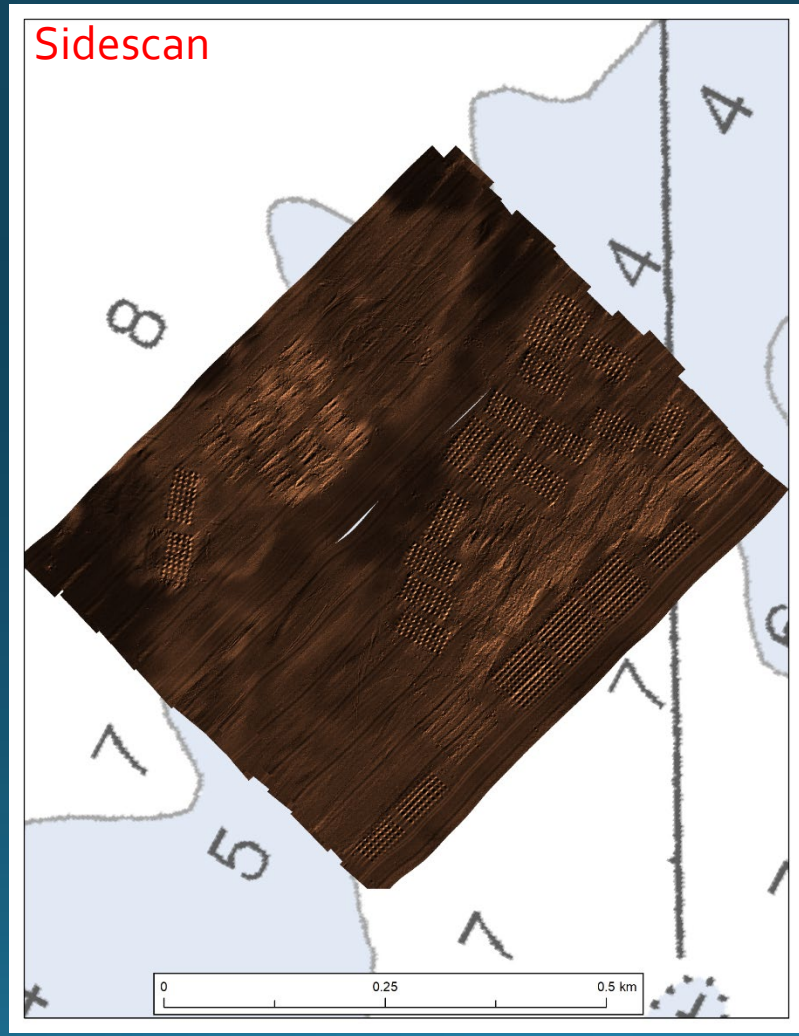

N
0
0.25
0.5 km

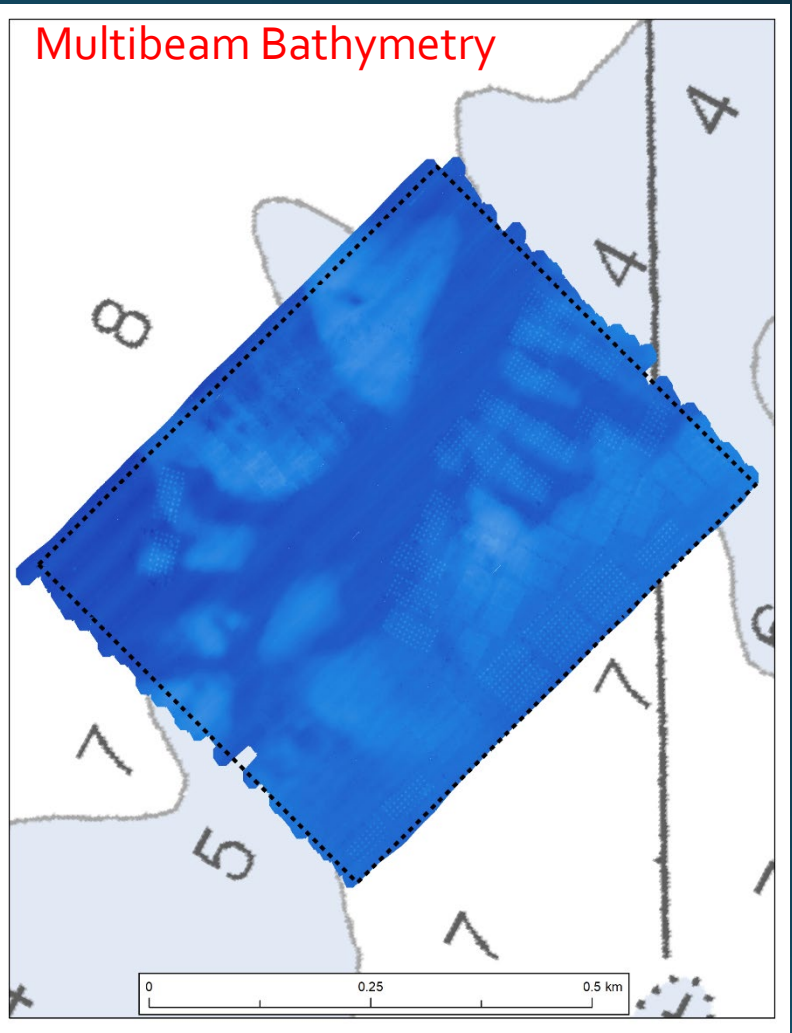
Post-Restoration Placement Verification & Monitoring

Rapid/Periodic Verification
Humminbird SS and Echosounder

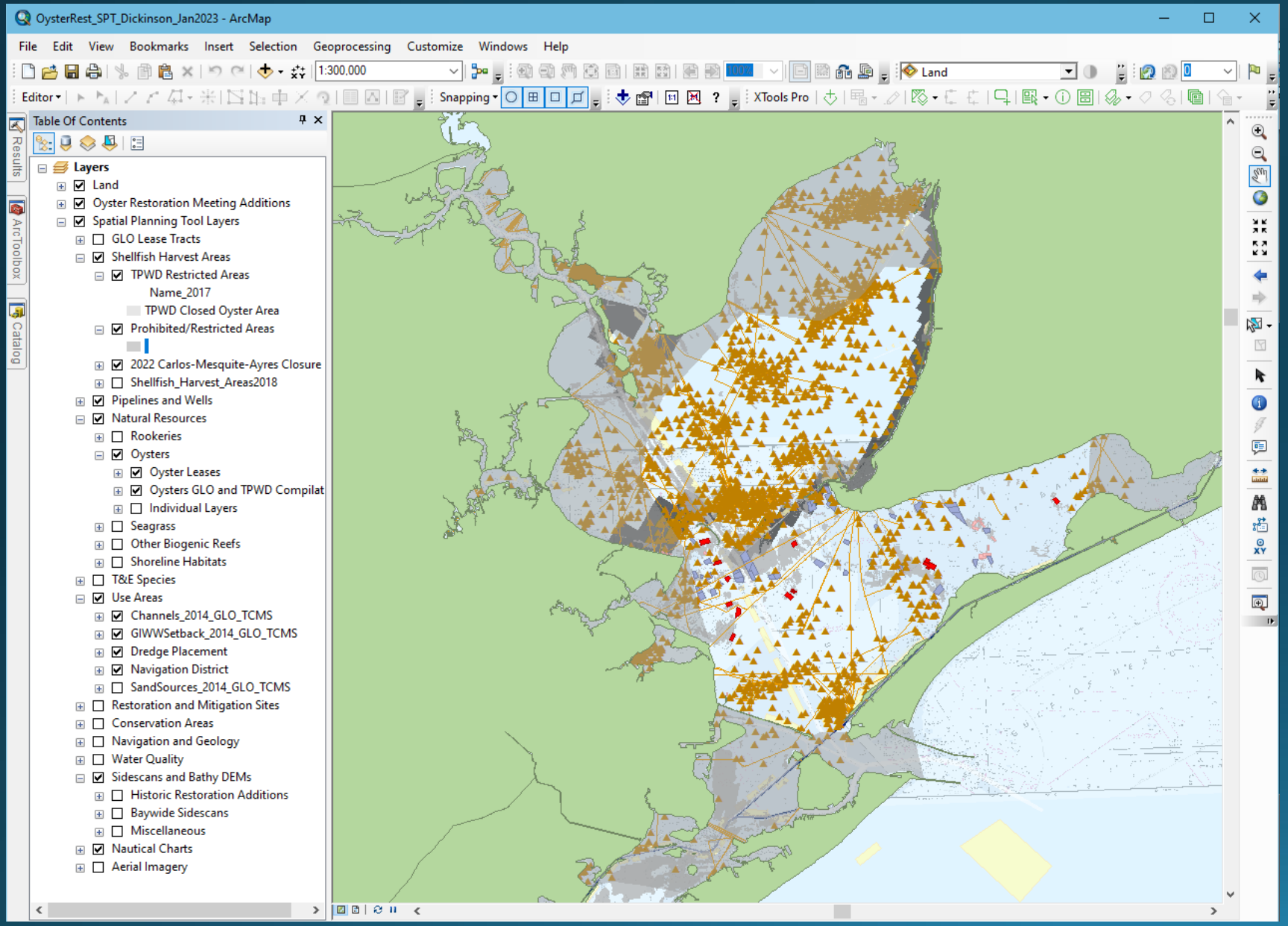


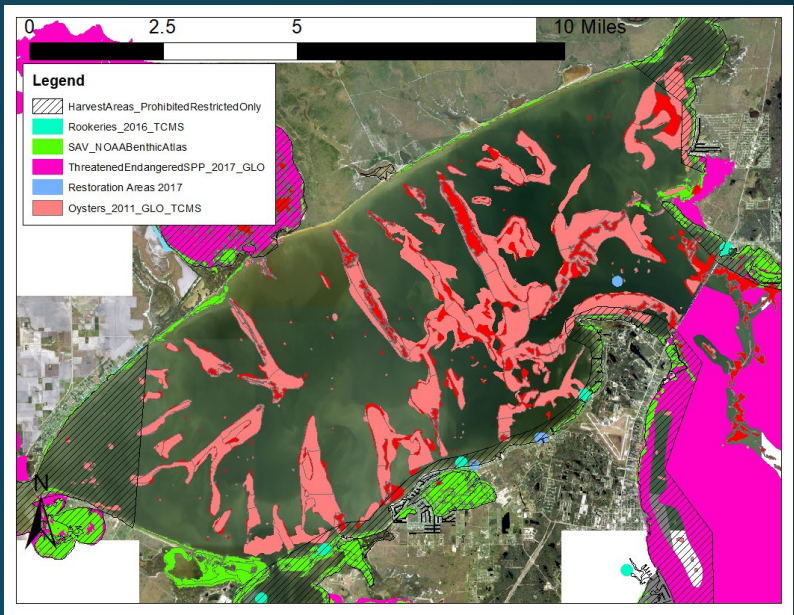
High-Resolution Verification
Edgetech SS and Multibeam

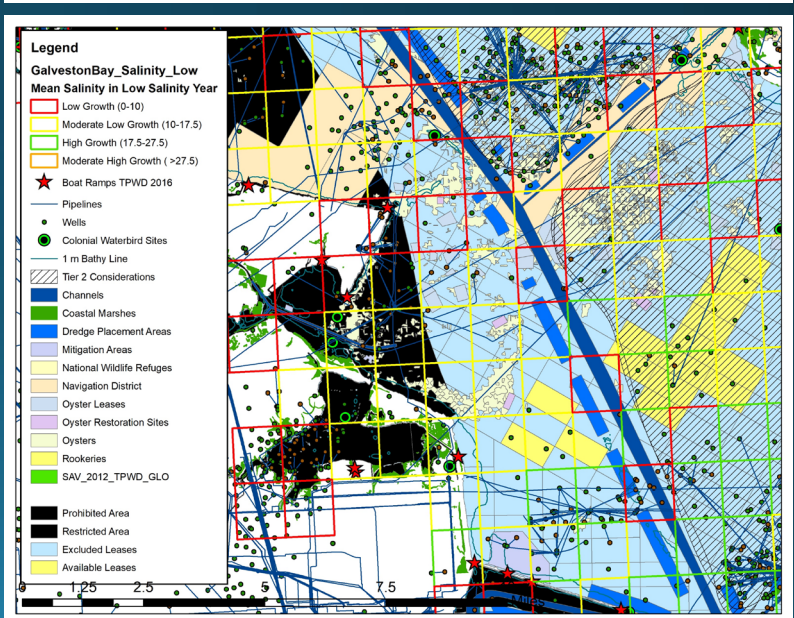




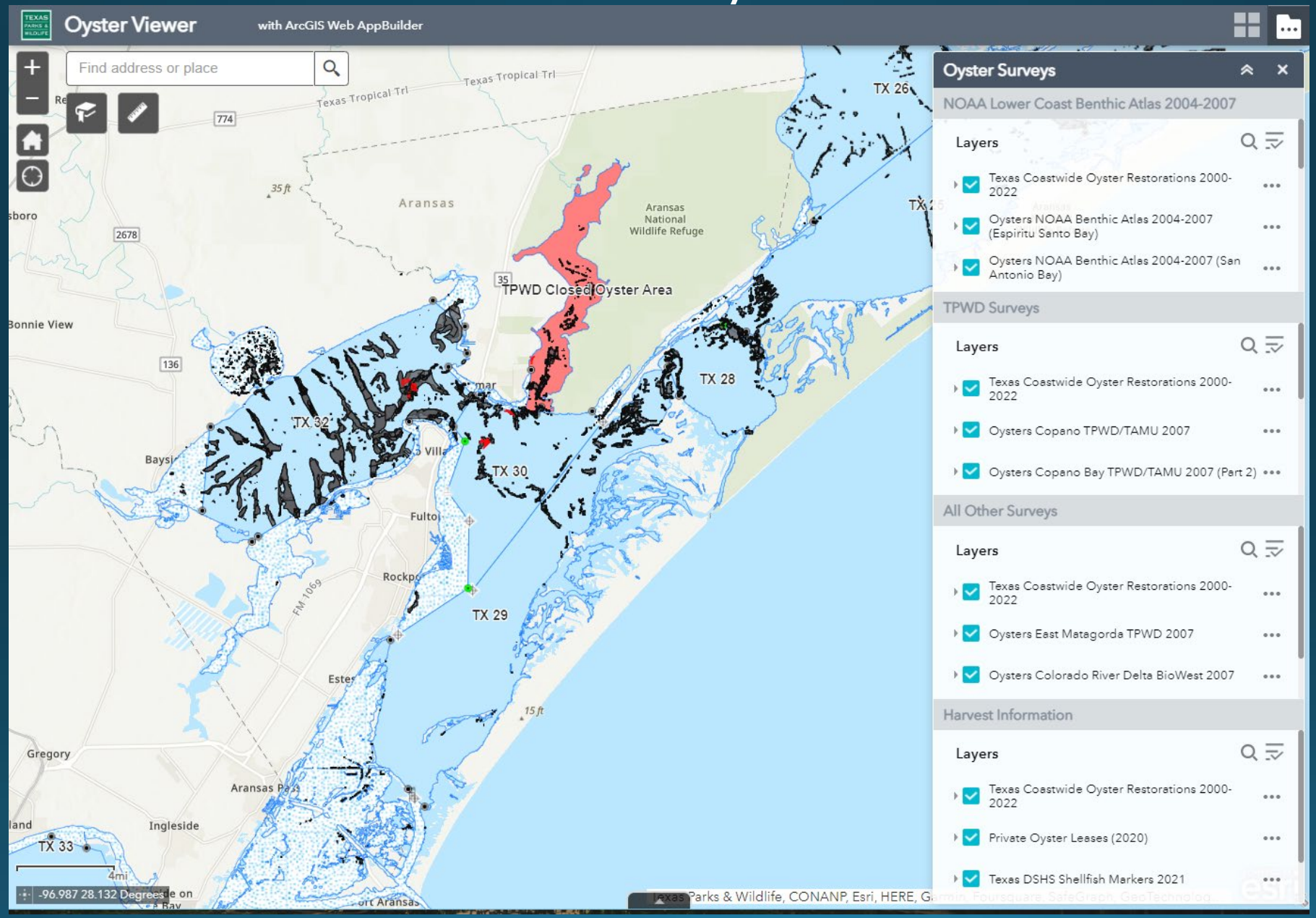
Marine Spatial Planning Tool







ArcGIS Online: Oyster Viewer

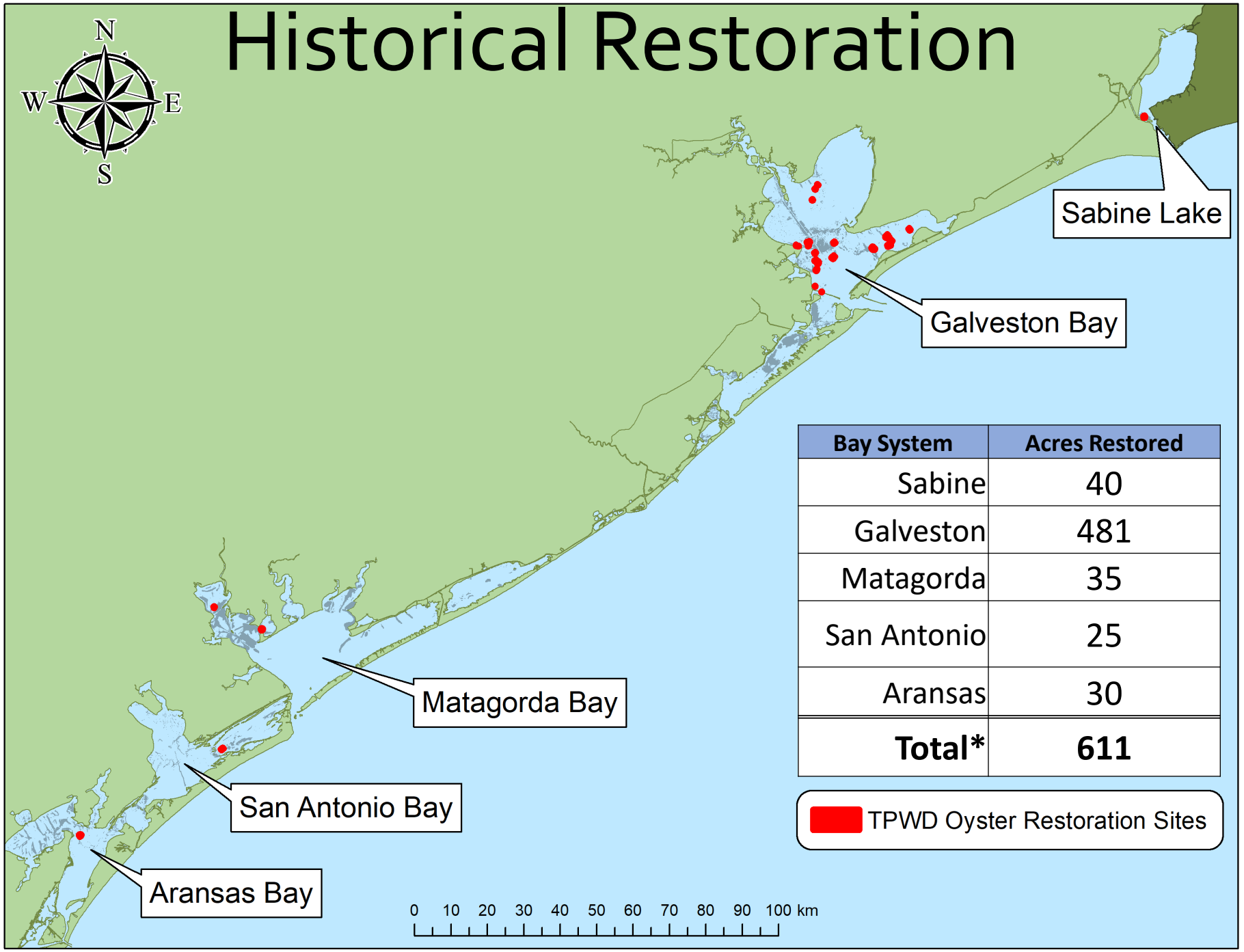


HAT Oyster Viewer: https://tpwd.maps.arcgis.com/apps/webappviewer/index.html?id=fc67b547652c4ee0b23bdf59f67b6d99

Oyster Restoration

- Contracted placement
  - →Experimental designs
- Dealer placement
- Shell recovery

Historical Restoration



Bay System	Acres Restored
Sabine	40
Galveston	481
Matagorda	35
San Antonio	25
Aransas	30
Total*	**611**

TPWD Oyster Restoration Sites

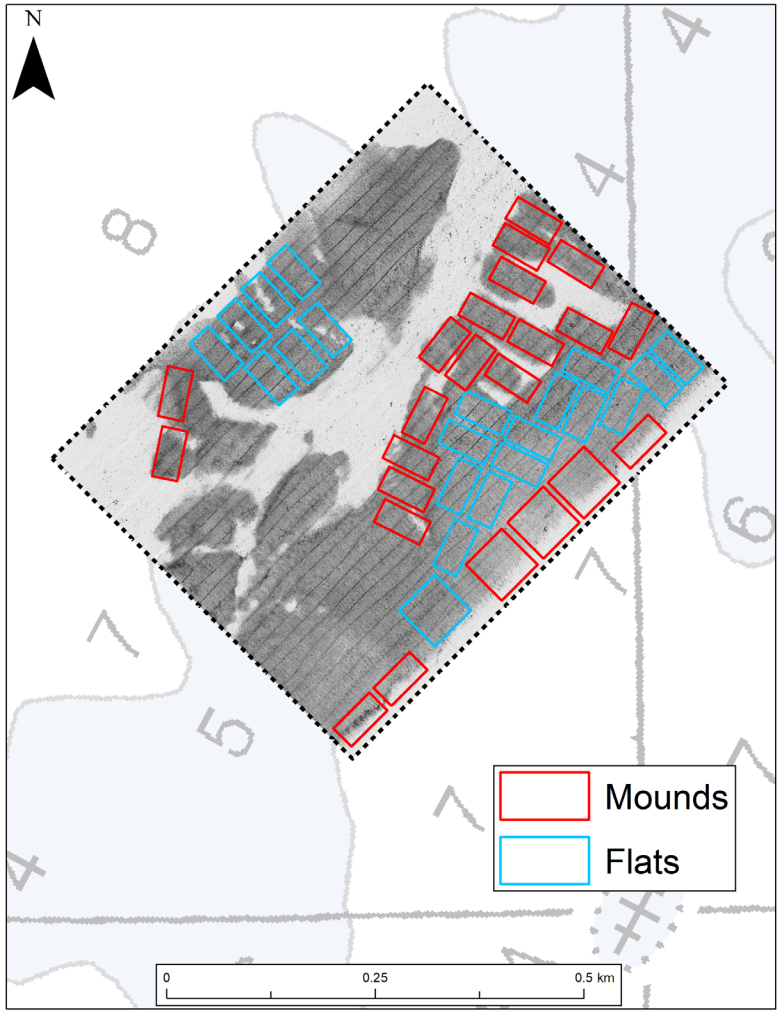
Historical Restoration

Bay System	Year	Location	Acreage	# Cubic Yards	Cost per Cubic Yard	Project Cost
Galveston	2009	EDRP Middle Reef	20	12857	$56	$719,992
Galveston	2009	San Leon Phase 1	2.5	1300	$70	$92,081
Galveston	2011	Ike Restoration	175	70355	$38	$2,674,197
Galveston	2011	San Leon Phase 2	2.75	2200	$58	$156,990
Galveston	2013	South Dollar	30	14070	$69	$976,458
Galveston	2014	CIAP East Bay (lumped)	185	71581	$56	$4,163,166
Sabine	2014	Sabine	25	7142	$76	$539,435
Galveston	2017	Pasadena 2016/2017	10.8	2069	$76	$157,244
Galveston	2017	Texas City Dike	5	1099	$91	$100,009
Galveston	2017	Todds Dump	11	6502	$76	$494,152
Galveston	2019	Pepper Grove 2019	4.5	1800	$68	$122,400
Aransas	2020	Grass Island	30	9237	$167	$1,545,667
Sabine	2020	Sabine II	15	3706	$210	$779,932
Galveston	2021	Dollar	36	4320	$215	$1,212,432
Galveston	2021	Pepper Grove Middle	1.8	756	$215	
Galveston	2021	Resignation	1.3	569	$215	
Matagorda	2021	Keller Bay Reef	25	6500	$206	$1,339,000
San Antonio	2022	Josephine's Reef	24.7	4640	$227	$1,051,764

Experimental Restoration Designs

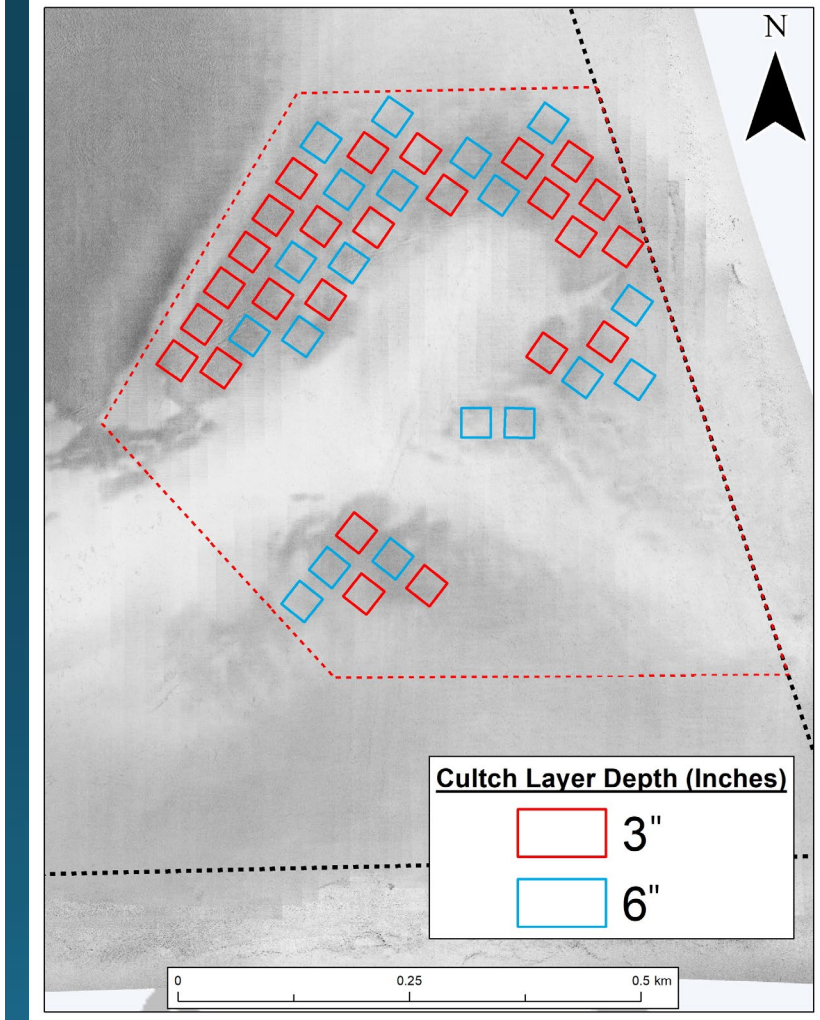
Grass Island

Mounds vs Flats



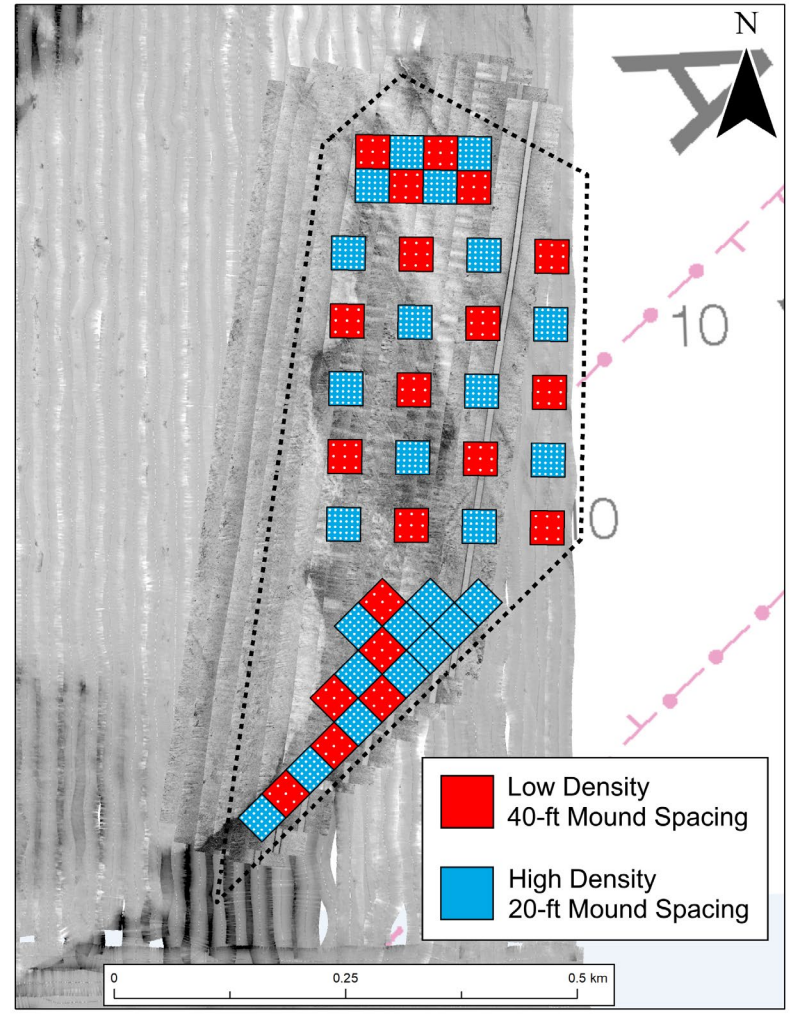
Keller Reef

Alt. Cultch Depths



Dollar Reef

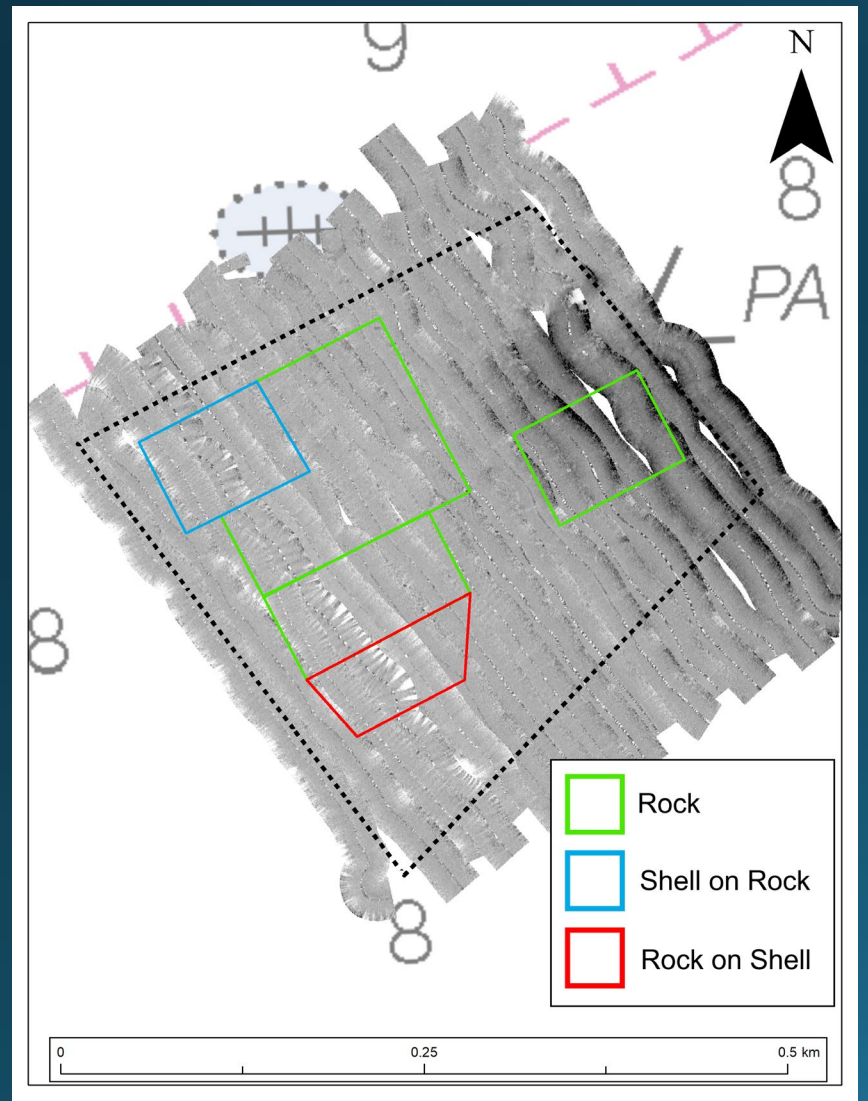
Mound Spacing



Experimental Restoration Designs

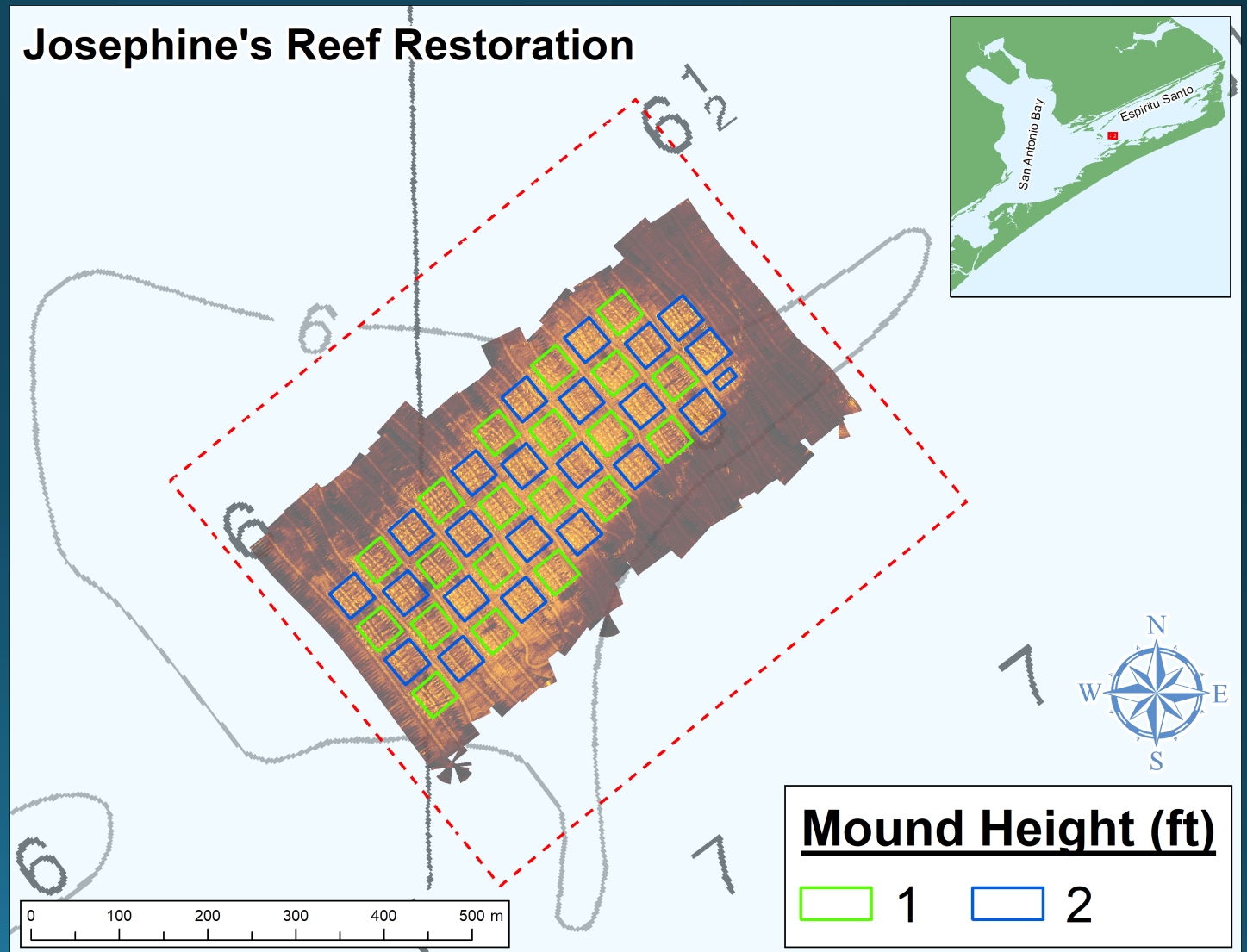
Resignation Reef

Alt. Cultch Materials

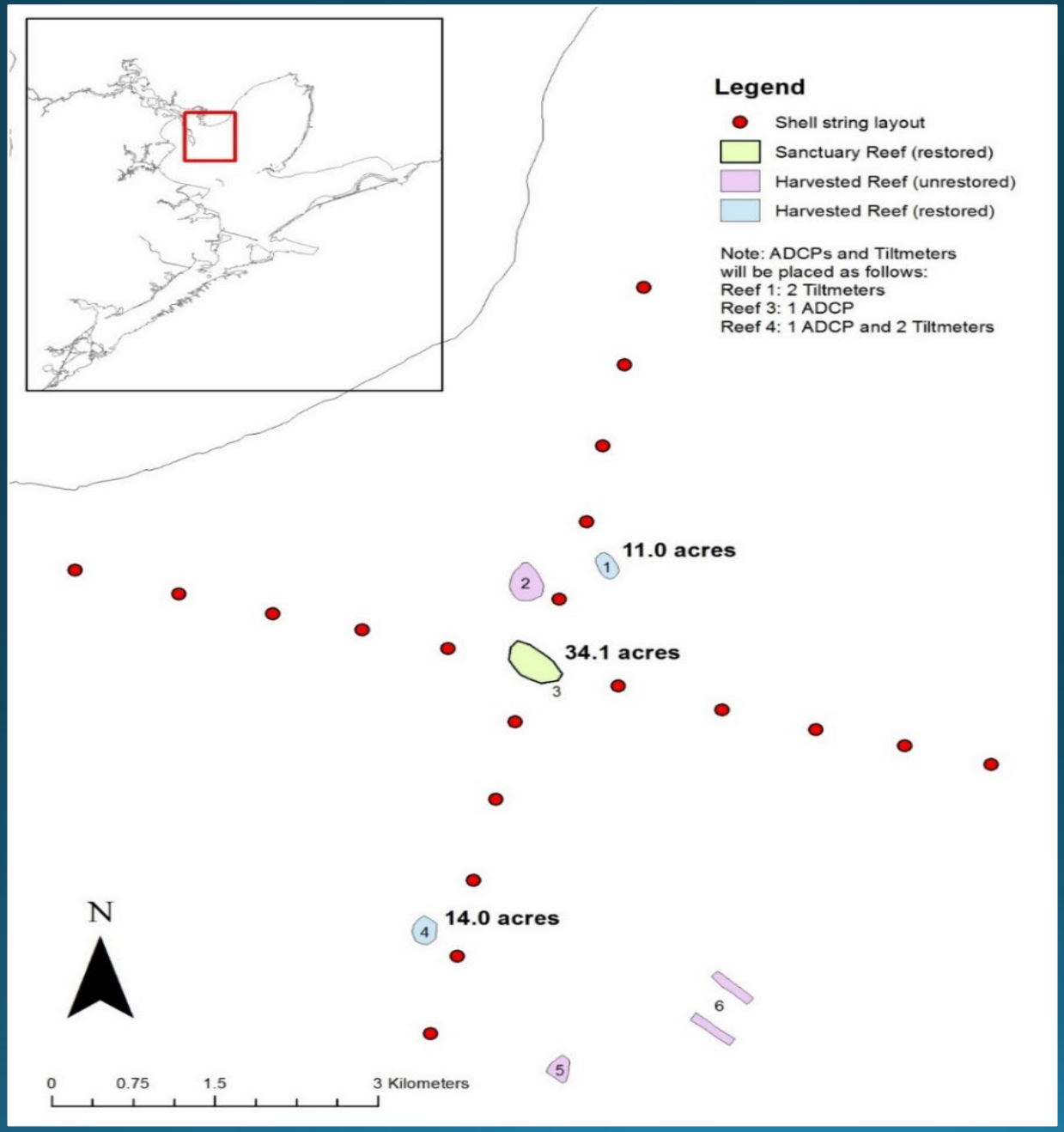


Josephine's Reef

Mound Height

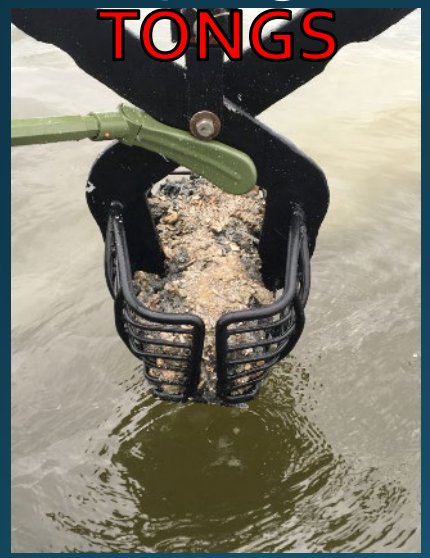


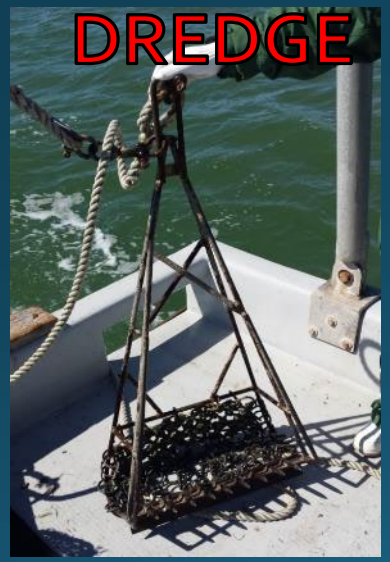
Trinity Bay Reefs: Source/Sink Dynamics



Post-Restoration Monitoring

- Biannual sampling for 3-5 years
  - →Each treatment (if applicable)
  - →Reference site
  - →Pre- and post-harvest closure
- Sample gear





→ Quadrats

- Metrics
  - →Live/dead counts
  - →Recruitment (spat counts)
  - →Growth (lengths)
  - →Infauna

Texas Parks and Wildlife Department
Oyster Shell Recovery Program

- HB51 (2017) includes a requirement for dealers to:
  - Return 30% by volume of the total quantity of oysters harvested the previous license year

  OR
  - Pay a fee to the department to return an equivalent amount of cultch to public reefs

- Currently the fee is $1.32 per sack (no increase)

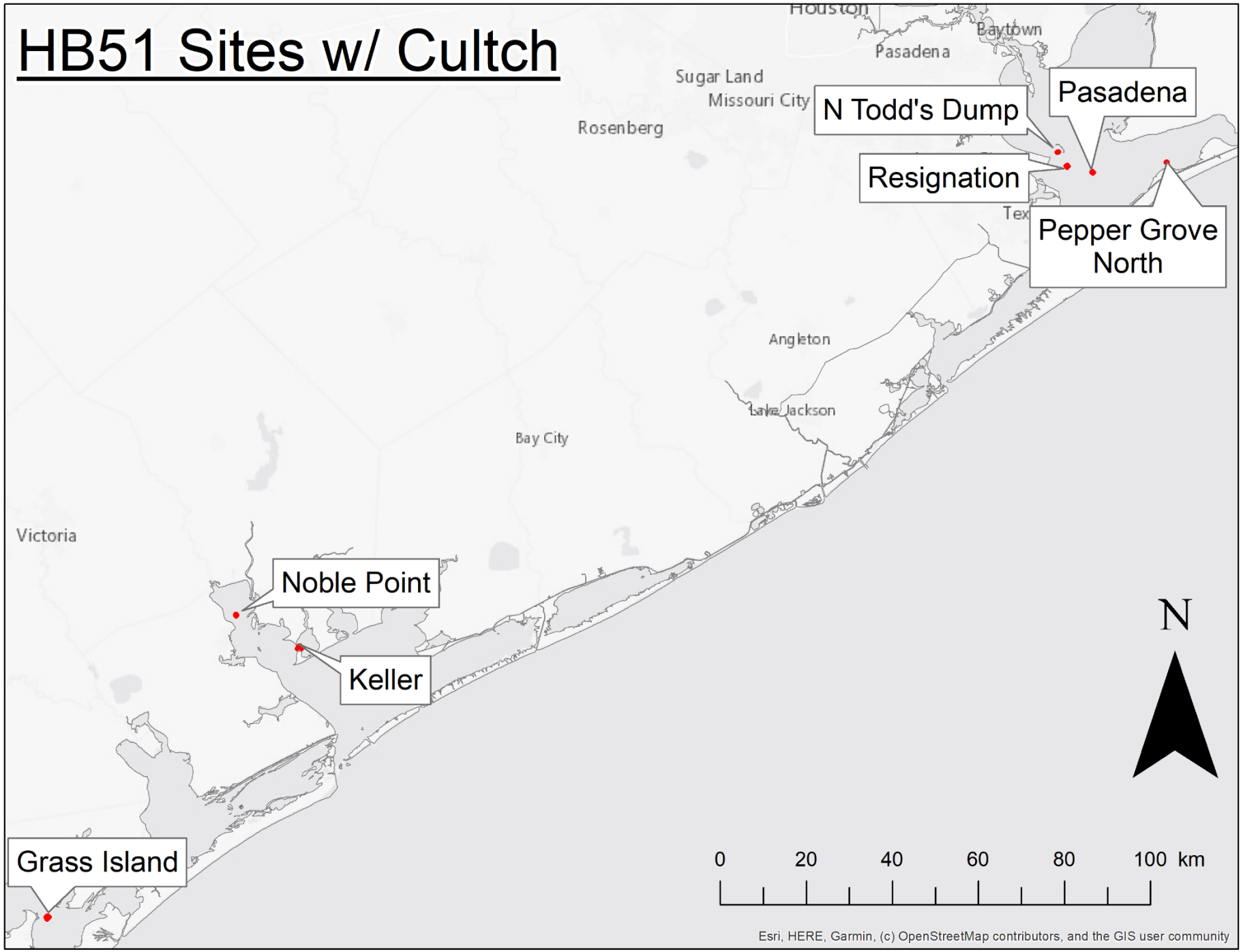
HB51: Dealer Placements & Fees

				Final Disposition (actual)		
LY	Sacks Harvested	Cultch Due (cu yds)	Fee in lieu of cultch	Cultch (cu yds)	Fee ($)	% accounted for
2018	564,787	9,805.30	$745,518	6,590.5	$248,448	100.5
2019	754,565	13,100.00	$996,025	9,705.3	$228,047	97.0
2020	878,503	15,251.70	$1,159,624	3,219.9	$306,294	47.5
2021	861,939	14,964.12	$1,137,759	16,150.2	$242,715	129.3
2022	424,002	7,361.10	$559,683	7,428.4	$135,151	125.1
Total	3,483,796	60,482.22	$4,598,609	43,094.3	$1,160,655	96.5
Balance (as of 8/31/2022)		2,143.3	$162,963	71.3%	25.2%	

HB51: Dealer Placements

	Galveston		Matagorda	
Year	**Cubic Yards**	**Acres**	**Cubic Yards**	**Acres**
2018	1985.2	2.5	4605.3	5.7
2019	7413.3	9.2	2292.0	2.8
2020	3220.0	4.0	0.0	0.0
2021	14673.8	18.2	1476.0	1.8
2022	7084.4	8.8	640.5	0.8
Total	27292.3	42.7	8373.3	11.1

Total Cubic Yards Coastwide	43,390.4
Total Acres Coastwide	~53.8


HB51 Sites w/ Cultch
Houston
Baytown
Pasadena
Sugar Land
Missouri City
Rosenberg
N Todd's Dump
Pasadena
Resignation
Pepper Grove North
Angleton
Lake Jackson
Bay City
Victoria
Noble Point
Keller
Grass Island
N
0 20 40 60 80 100 km
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

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"Sink Your Shucks" Oyster Recycling Program

- Founded by Texas A&M Corpus Christi Harte Research Institute in 2009
  - Dr. Jennifer Pollack and Gail Sutton
- Shells are reclaimed twice a week from partner restaurants, wholesale markets, and festivals around Corpus Christi
- Shells are transferred to a staging area for a 6-month quarantine period
- Shells are then
  (1) Bagged for living shoreline projects
  (2) Used for oyster reef restoration in deeper waters

- Since 2009
  - Have collected over 2 million pounds of oyster shell
  - Restored more than 30 acres of oyster reef in the Coastal Bend of Texas
  - Relies on university students and over 2,000 volunteers

https://www.harte.org/oysterrecycling

Galveston Bay Foundation
Oyster Shell Recycling Program

- Founded by the Galveston Bay Foundation in 2011
- Shells are reclaimed from partner restaurants in the Galveston and Houston area
- Shells are transferred to staging areas for a 6-month quarantine period
- Shells are then used for
  (1) Reef creation and enhancement projects
  (2) Living shoreline projects
  (3) Volunteer oyster gardening

- Since 2011
  - Has recycled 1,140 tons of shell
  - Relies on large network of volunteers

Contact: Haille Leija
https://galvbay.org/work/habitat-restoration/

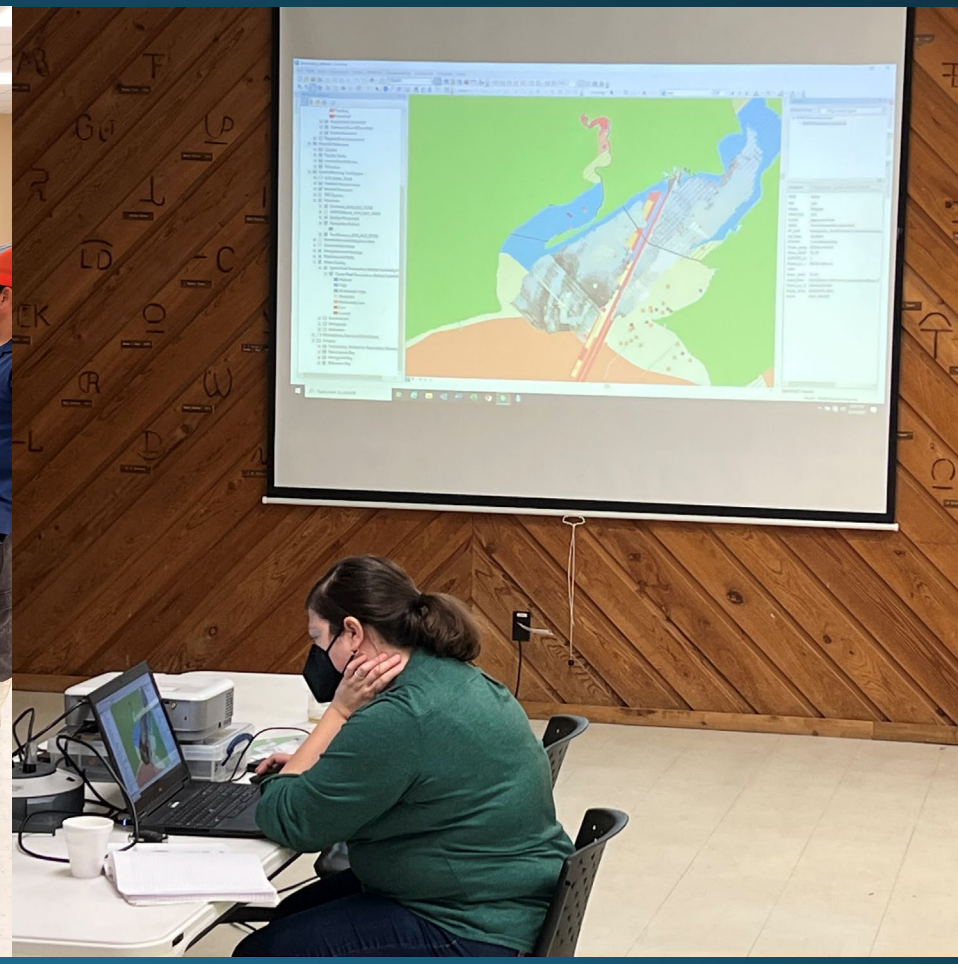
Stakeholder Engagement

- Oyster Regulation Workgroup
- Oyster Restoration Workgroup
- Industry Workshops

Oyster Restoration Workgroups

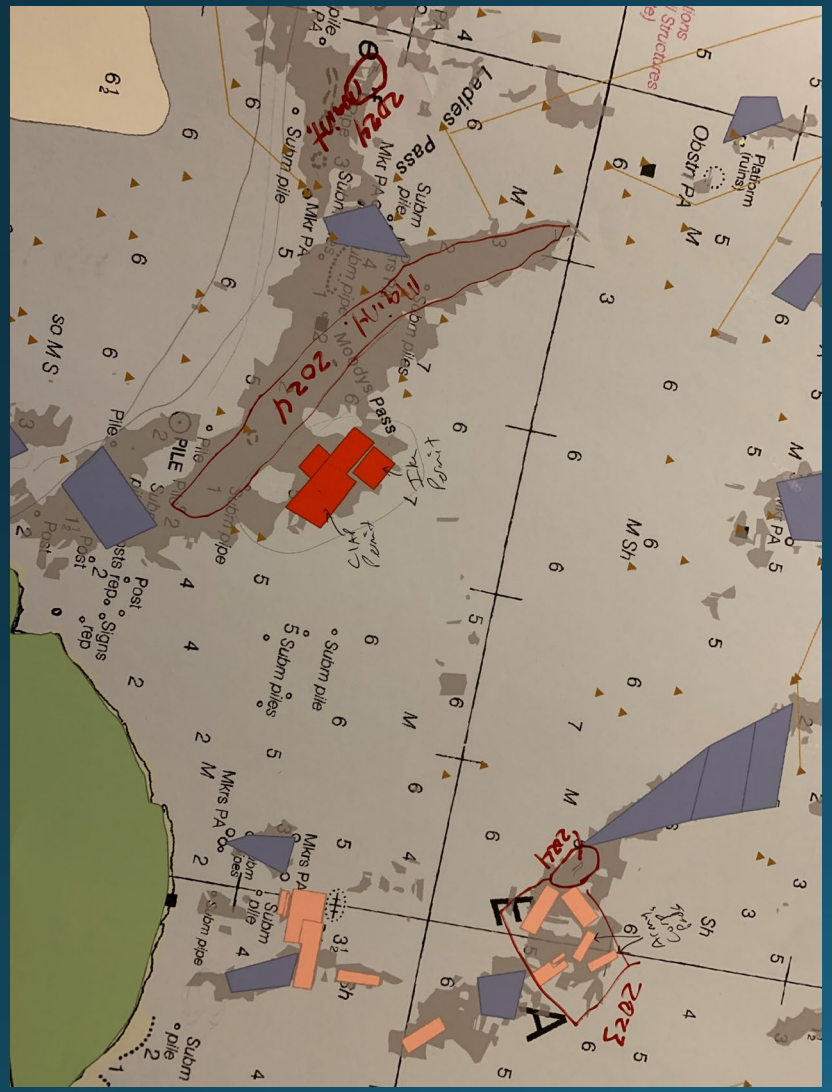
- Industry, NGOs, Research/Academia
- Provide high-level input, brainstorming, and direction for restoration projects
  - → Identify challenges
  - → Collaborate on solutions
  - → Share “lessons learned”
- Engage industry in site selection, project planning, and construction for all types of restoration
- Help facilitate project-specific workshops

Oyster Restoration Workshops



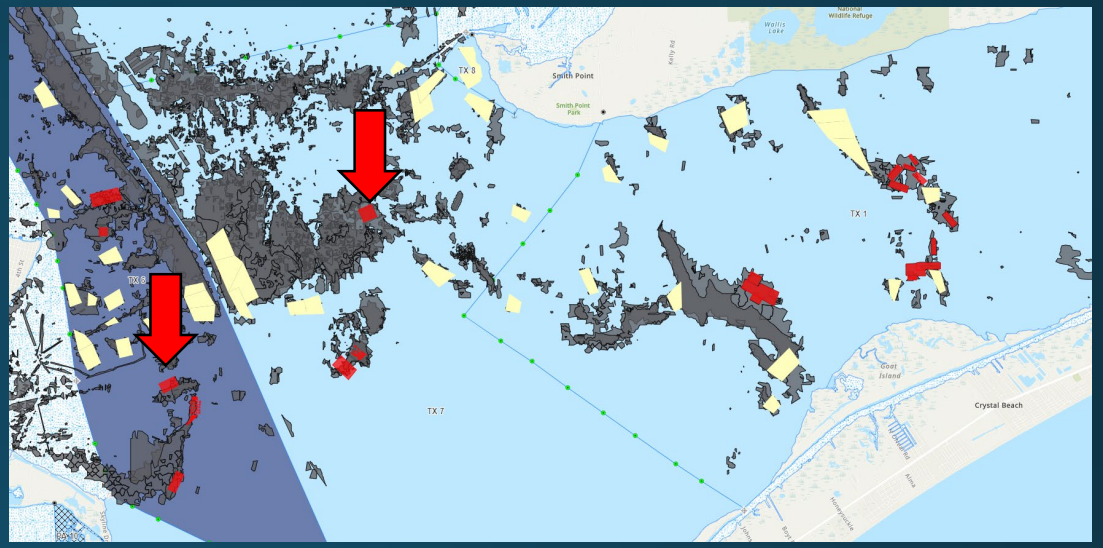
Current focus on “maintenance restorations”

Oyster Restoration Workshops



Upcoming Restoration Projects

- CARES Act (2023)
  - → Galveston Bay System
  - → Previously permitted areas
  - → 3-5” layers of cultch
- Mesquite Bay Complex (2024)
  - → Aransas Bay System
  - → Maintenance approach (1-2” layer)
- Pre-coordination with stakeholders
  - → Site selection
  - → Site visits/sampling
  - → Cultch placement



Questions?