Building resilience for rookery islands: long-term waterbird population trends on North Deer Island

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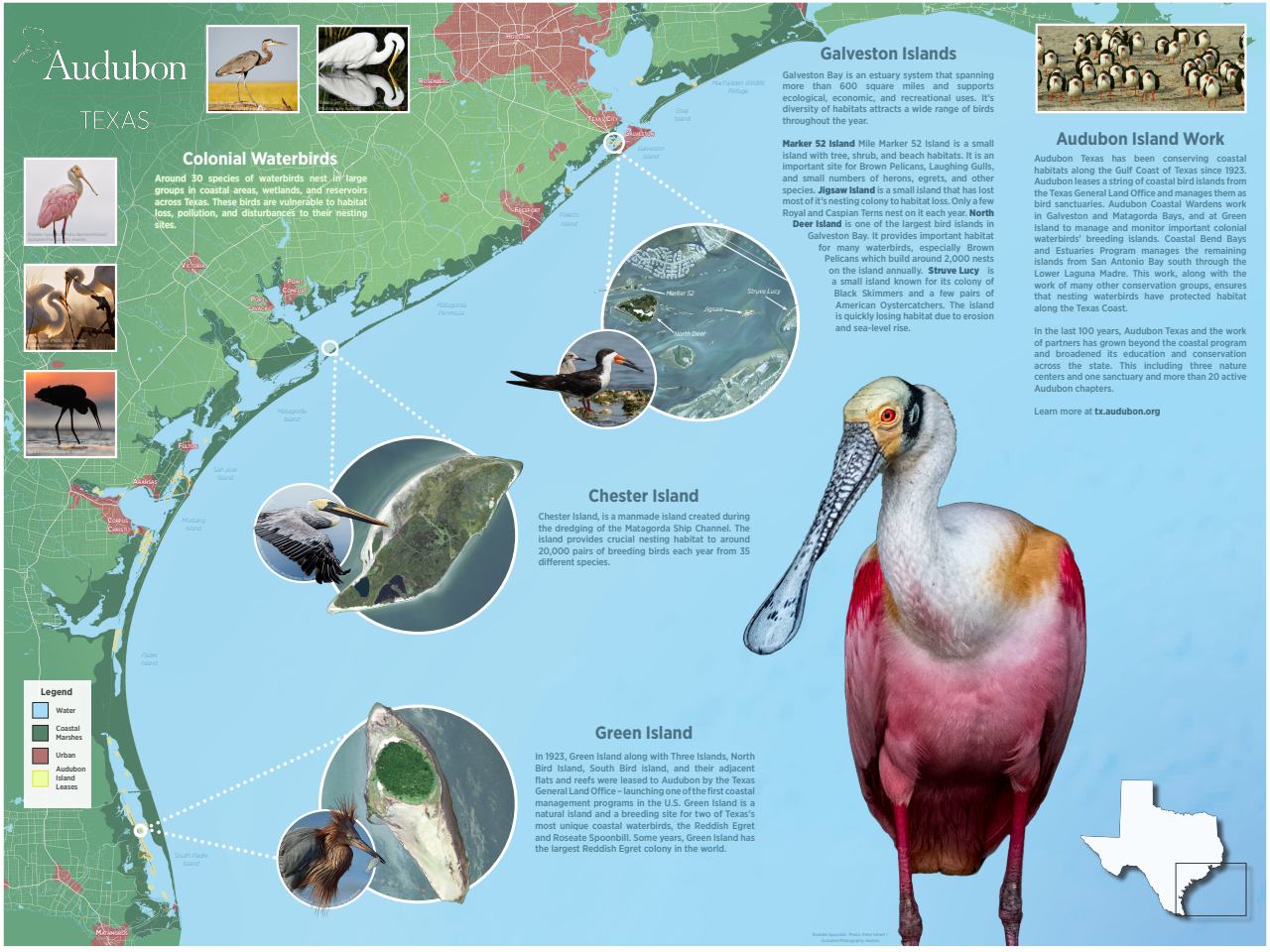
Audubon
TEXAS

HOUSTON AUDUBON

Photo: Tim Forrester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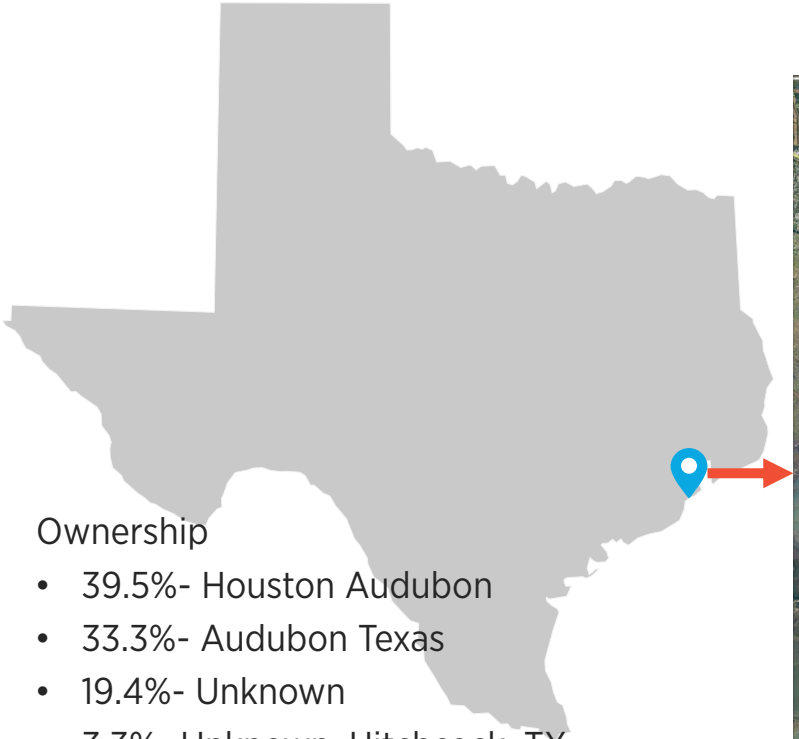
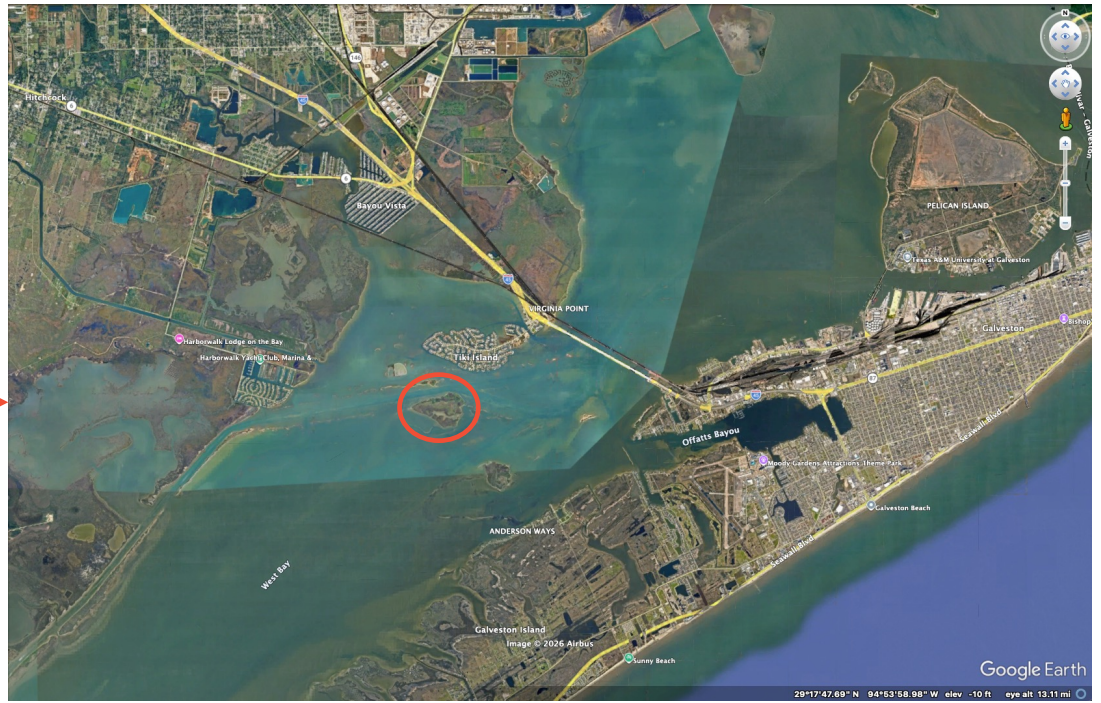
TEXAS
Colonial Waterbirds
Around 30 species of waterbirds nest in large groups in coastal areas, wetlands, and reservoirs across Texas. These birds are vulnerable to habitat loss, pollution, and disturbances to their nesting sites.
Galveston Islands
Galveston Bay is an estuary system that spanning more than 600 square miles and supports ecological, economic, and recreational uses. It's diversity of habitats attracts a wide range of birds throughout the year.
Marker 52 Island Mile Marker 52 Island is a small island with tree, shrub, and beach habitats. It is an important site for Brown Pelicans, Laughing Gulls, and small numbers of herons, egrets, and other species. Jigsaw Island is a small island that has lost most of it's nesting colony to habitat loss. Only a few Royal and Caspian Terns nest on it each year. North Deer Island is one of the largest bird islands in Galveston Bay. It provides important habitat for many waterbirds, especially Brown Pelicans which build around 2,000 nests on the island annually. Struve Lucy is a small island known for its colony of Black Skimmers and a few pairs of American Oystercatchers. The island is quickly losing habitat due to erosion and sea-level rise.
Marker 52
Struve Lucy
Jigsaw
North Deer
Audubon Island Work
Audubon Texas has been conserving coastal habitats along the Gulf Coast of Texas since 1923. Audubon leases a string of coastal bird islands from the Texas General Land Office and manages them as bird sanctuaries. Audubon Coastal Wardens work in Galveston and Matagorda Bays, and at Green Island to manage and monitor important colonial waterbirds' breeding islands. Coastal Bend Bays and Estuaries Program manages the remaining islands from San Antonio Bay south through the Lower Laguna Madre. This work, along with the work of many other conservation groups, ensures that nesting waterbirds have protected habitat along the Texas Coast.
In the last 100 years, Audubon Texas and the work of partners has grown beyond the coastal program and broadened its education and conservation across the state. This including three nature centers and one sanctuary and more than 20 active Audubon chapters.
Learn more at tx.audubon.org
Chester Island
Chester Island, is a manmade island created during the dredging of the Matagorda Ship Channel. The island provides crucial nesting habitat to around 20,000 pairs of breeding birds each year from 35 different species.
Green Island
In 1923, Green Island along with Three Islands, North Bird Island, South Bird island, and their adjacent flats and reefs were leased to Audubon by the Texas General Land Office – launching one of the first coastal management programs in the U.S. Green Island is a natural island and a breeding site for two of Texas's most unique coastal waterbirds, the Reddish Egret and Roseate Spoonbill. Some years, Green Island has the largest Reddish Egret colony in the world.
Legend
Water
Coastal Marshes
Urban
Audubon Island Leases
Houston
Galveston
Texas City
Port Lavaca
Port Aransas
Corpus Christi
Matagorda Peninsula
Matagorda Island
San Jose Island
Mustang Island
Padre Island
South Padre Island
Brownsville

North Deer Island





Ownership

- 39.5%- Houston Audubon
- 33.3%- Audubon Texas
- 19.4%- Unknown
- 3.3%- Unknown, Hitchcock, TX
- 3.1%- Joseph Charles III
- 1.4%- Janice Mcbride Frey

The impact of North Deer Island

- Average 10,180 nesting pairs/year (Peak year 2004 = ~29,000 pairs) of up to 19 species
- Average 21.3% of all birds nesting on the upper coast

Species	Average # nesting pairs (2021 – 2025)
Laughing Gull	4976
Brown Pelican	2263
Royal Tern	830
Tricolored Heron	114
Neotropic Cormorant	49
Great Blue Heron	40
Great Egret	38

The History of North Deer Island

- Natural in origin
- Used for dredged material placement 1930 – 1958
- Moved to conservation focus with partial acquisition by Houston Audubon in 1975
- By the 1990s, faced severe erosion crisis.

Erosion crisis for North Deer Island.

- Erosion crisis driven by…
  - Vessel traffic along intracoastal
  - Storm impacts
  - Land subsidence

- Shoreline erosion rates reached 5 – 10 feet per year

Restoration efforts – Phase I (2000 – 2003)

- Emergency shoreline stabilization
- Breakwaters and armored shorelines installed
- Collaborative effort: TPDW, GLO, Houston Audubon, Audubon Texsa

Restoration efforts – Phase 2 (2006 – 2008)

- More comprehensive erosion protection and marsh restoration ($3.2 million)
- 6,450 feet of breakwaters, revetments and groins.
- 1.7 miles of shoreline protected
- 8 acres of salt marsh restored using dredged material and volunteer planting

Restoration efforts – Phase 2 (2006 – 2008)

Audubon

Partners

- Houston Audubon members and friends.
- Audubon Texas
- EcoNRG
- EPA Gulf of Mexico Program
- Harris & Eliza Kempner Fund
- Meadows Foundation
- Reliant Energy
- National Fish and Wildlife Foundation Shell Marine Habitat Program
- Texas Commission on Environmental Quality - Galveston Bay Estuary Program
- Texas General Land Office
- Texas Parks and Wildlife Department U.S. Fish and Wildlife Service

Photo: Alexis Baldera

So… how did this all influence bird populations?

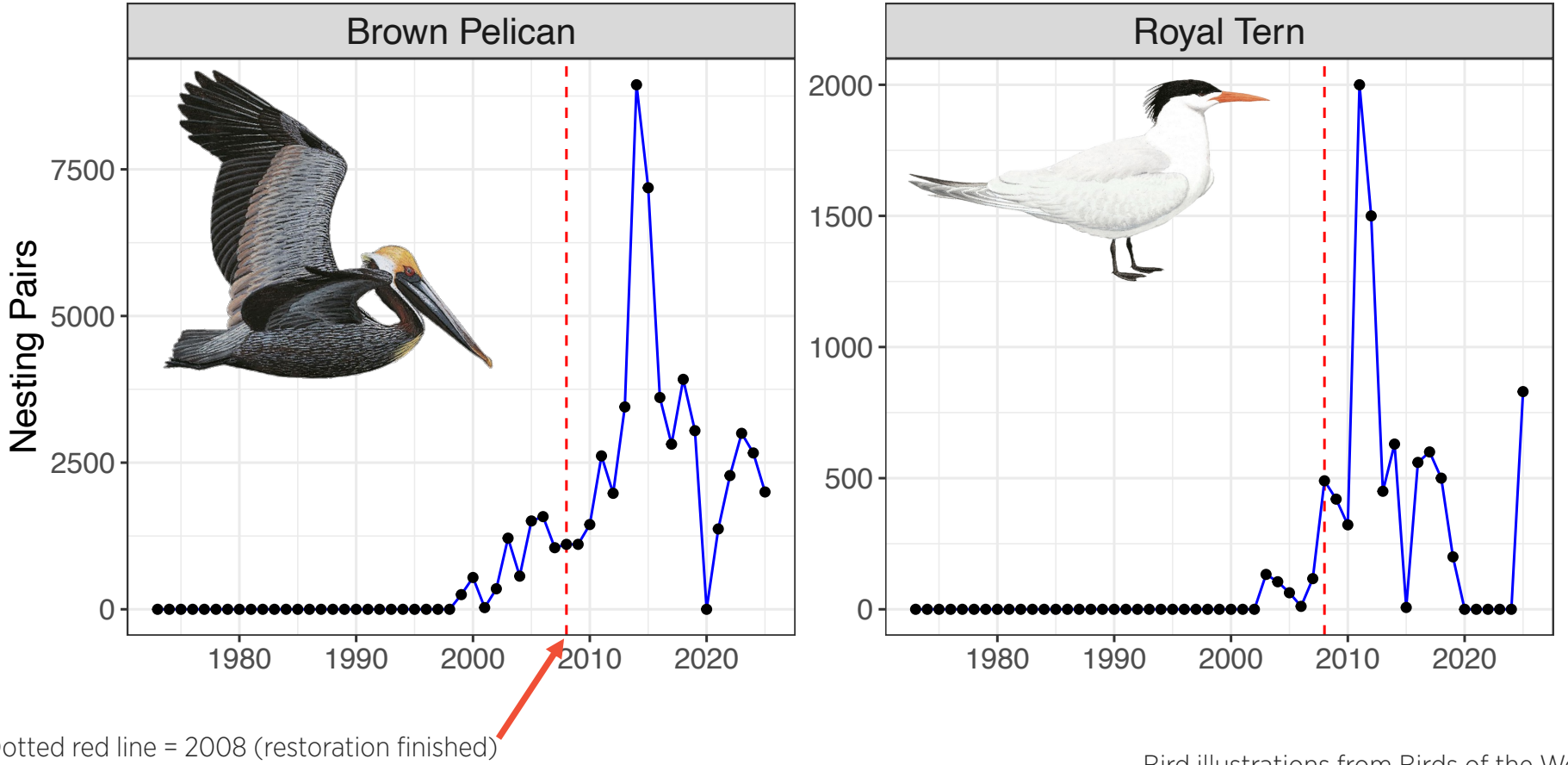
Audubon

TEXAS WATERBIRD SOCIETY

Thanks to the Texas Waterbird Society and the many volunteers who collected data.

Species that increased after restoration on North Deer Island

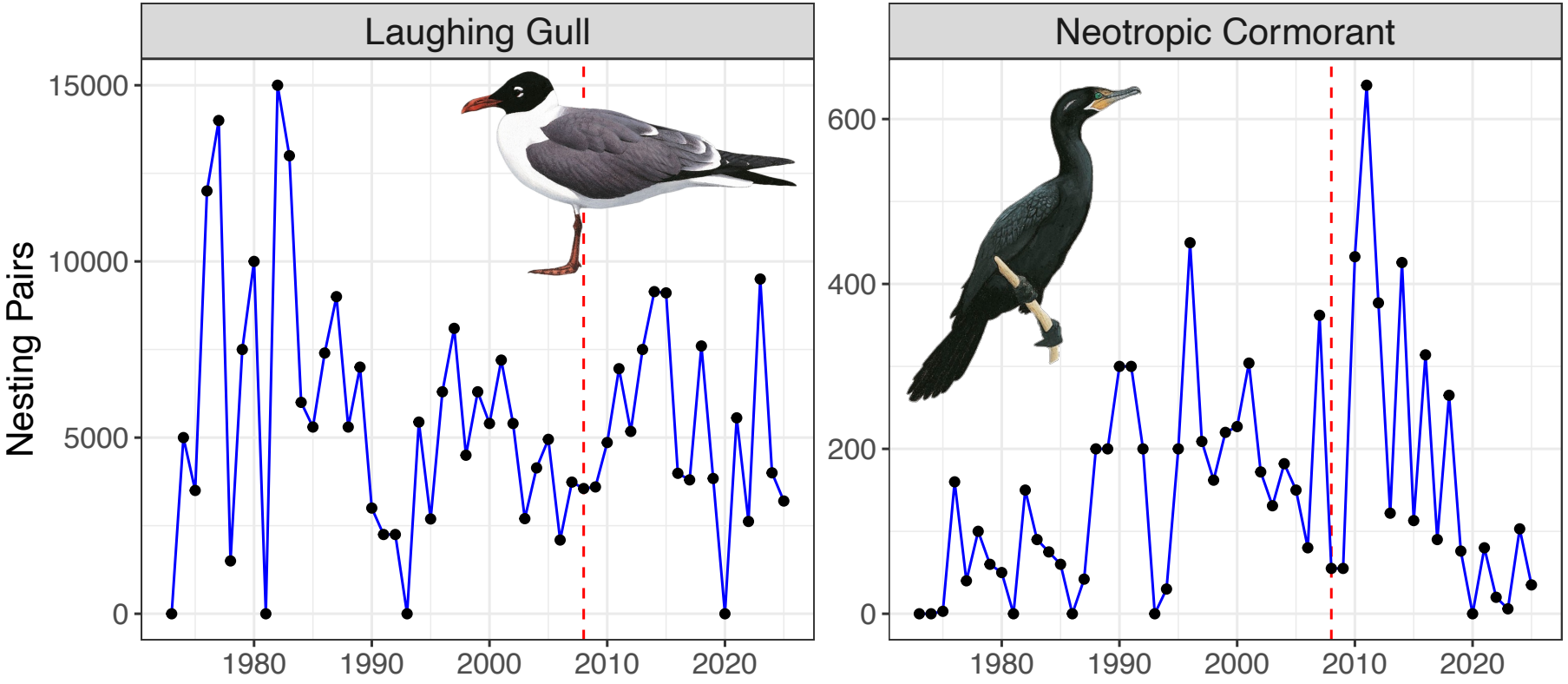
Audubon



Bird illustrations from Birds of the World

Species with long-term increases/stability on NDI , unrelated to restoration

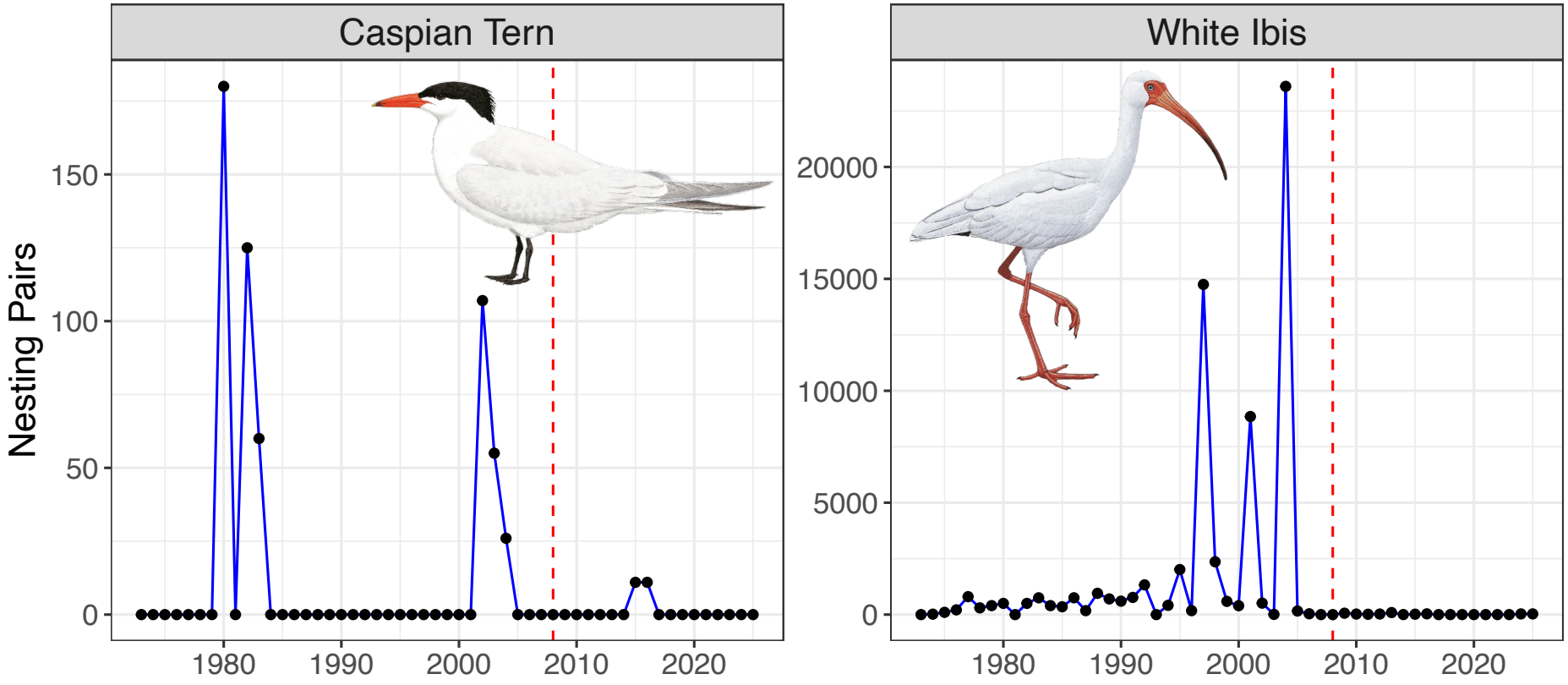
Audubon



Bird illustrations from Birds of the World

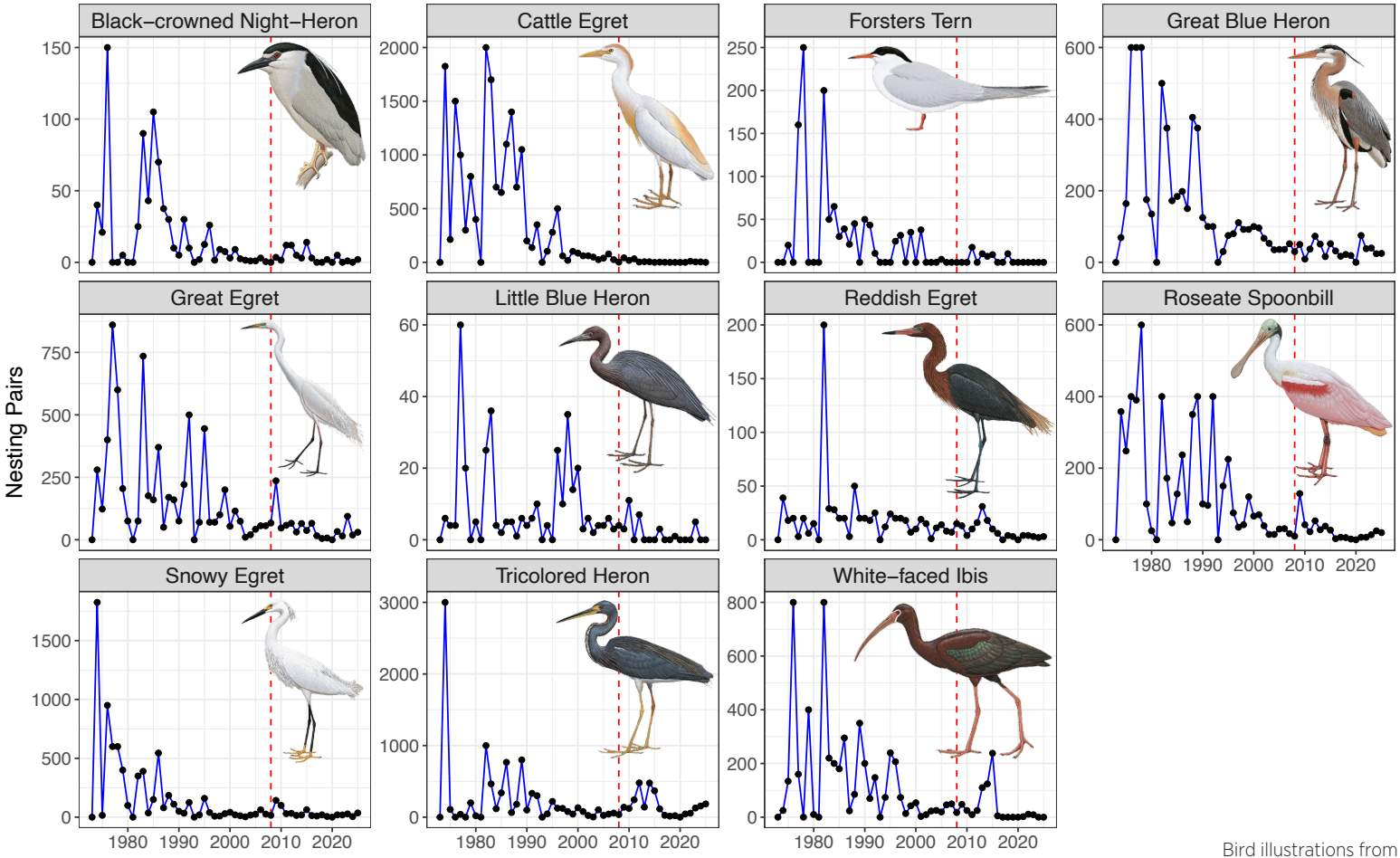
Erratic nesters on North Deer Island

Audubon



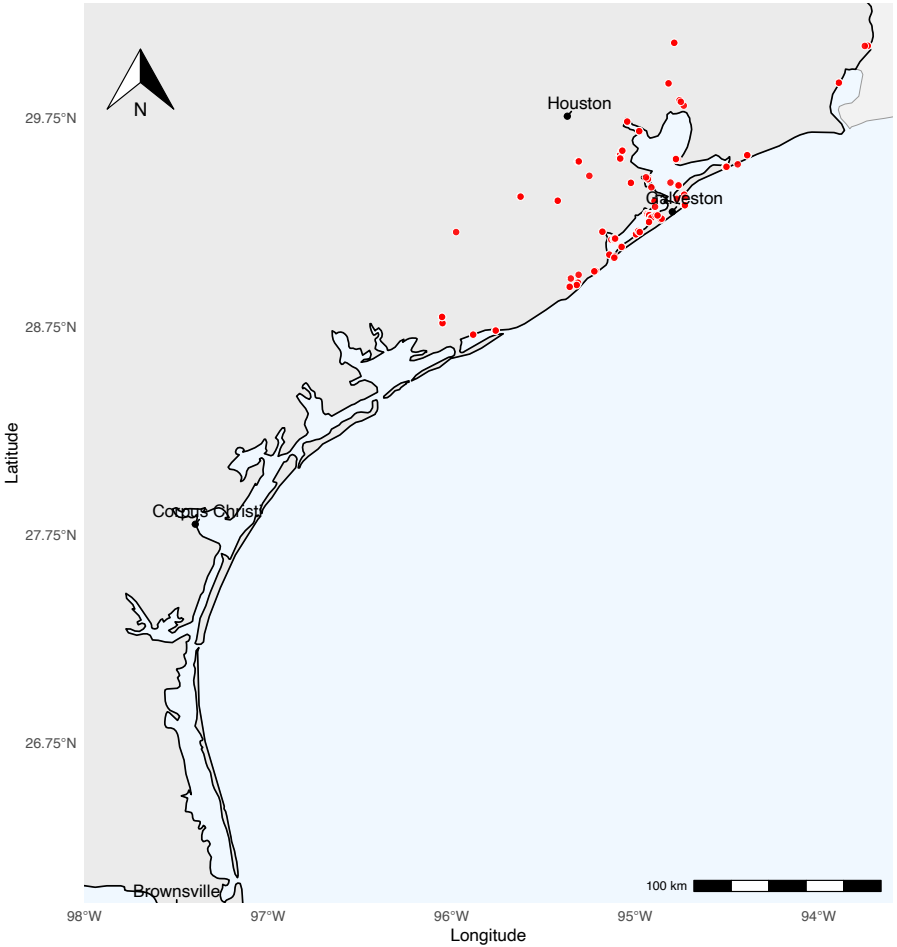
Bird illustrations from Birds of the World

Species with long-term declines on NDI & no response to restoration

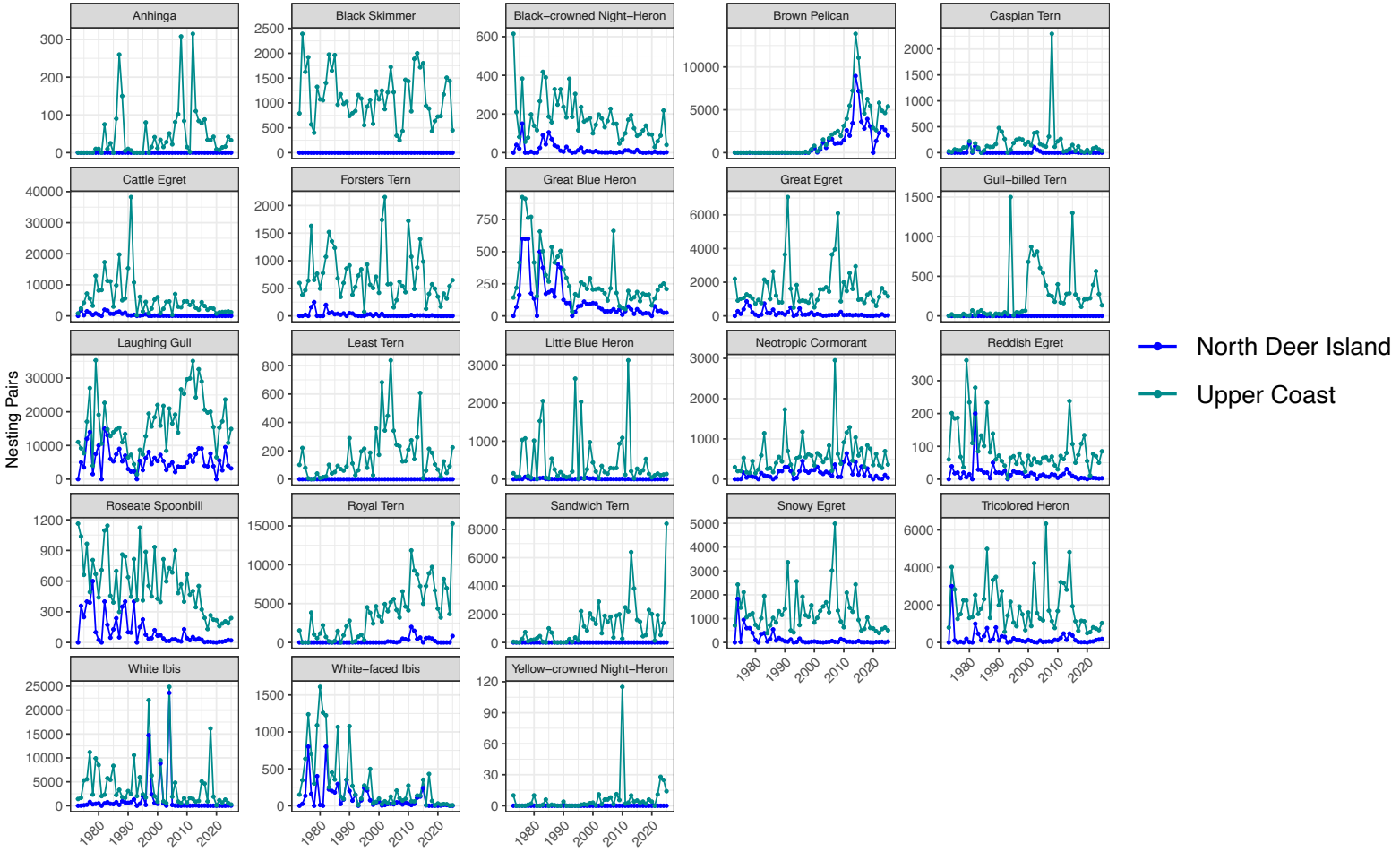


Bird illustrations from Birds of the World

The Texas “Upper Coast”



Comparing population trends from NDI to the whole upper coast



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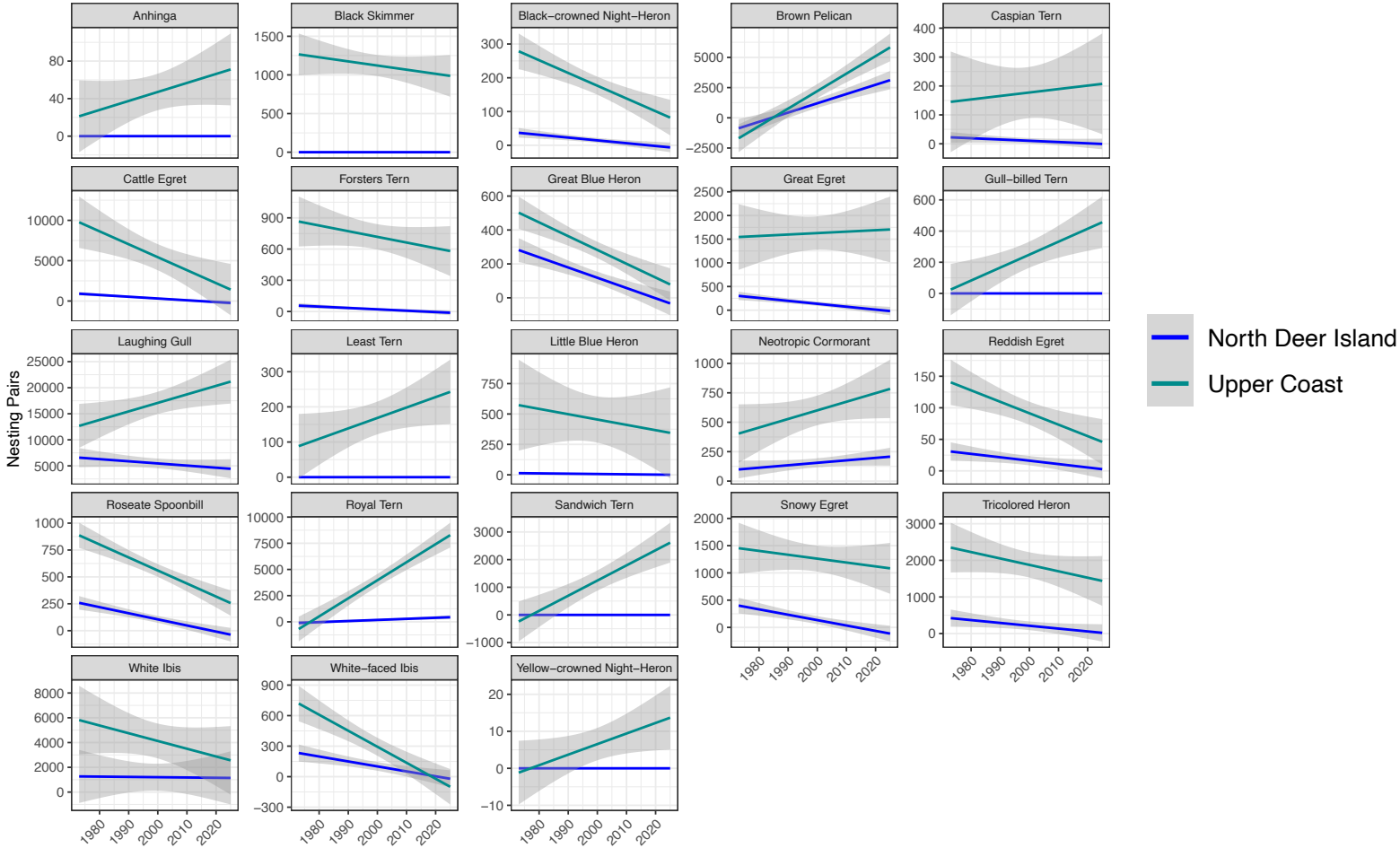
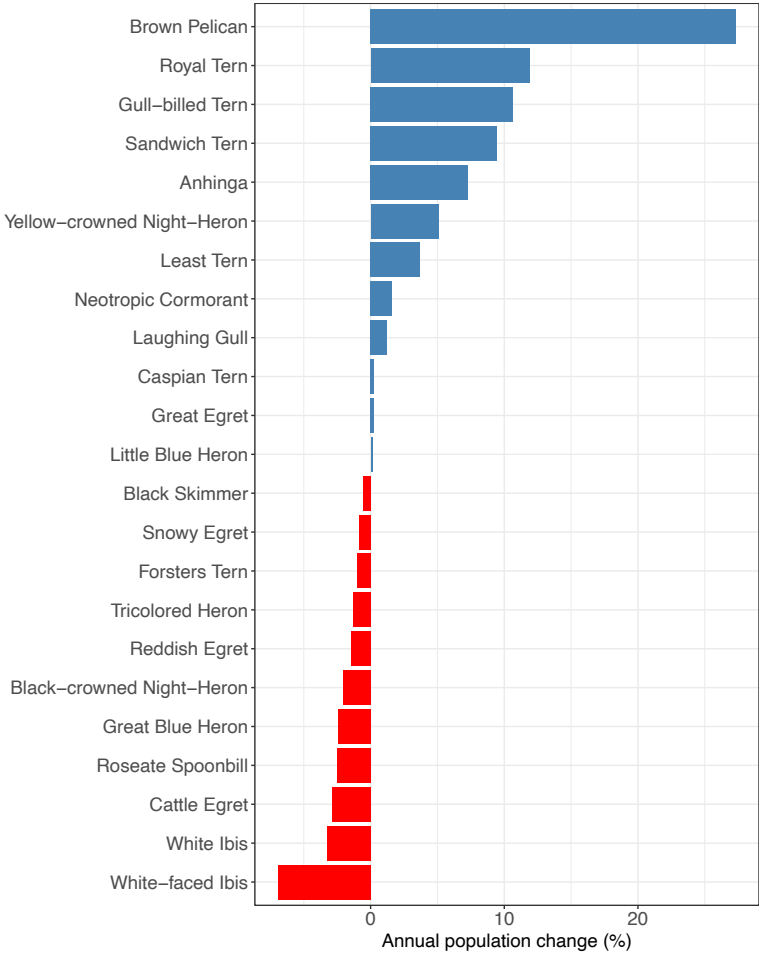


Annual change in population per species on the Upper Coast (1973 – 2025)

Audubon



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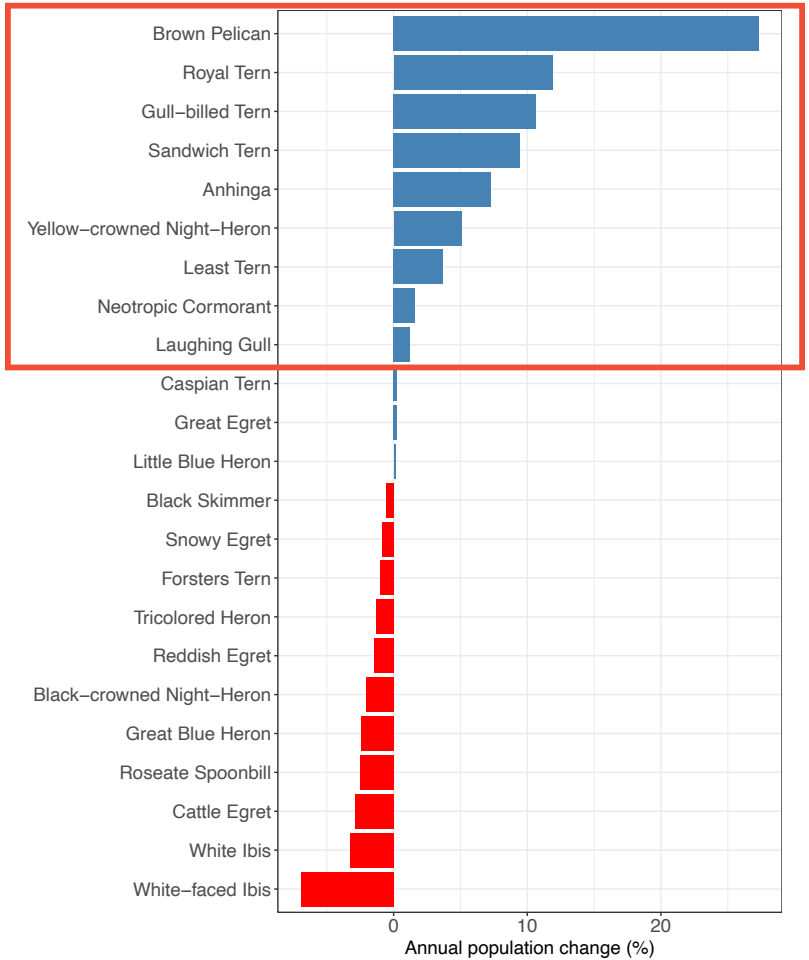
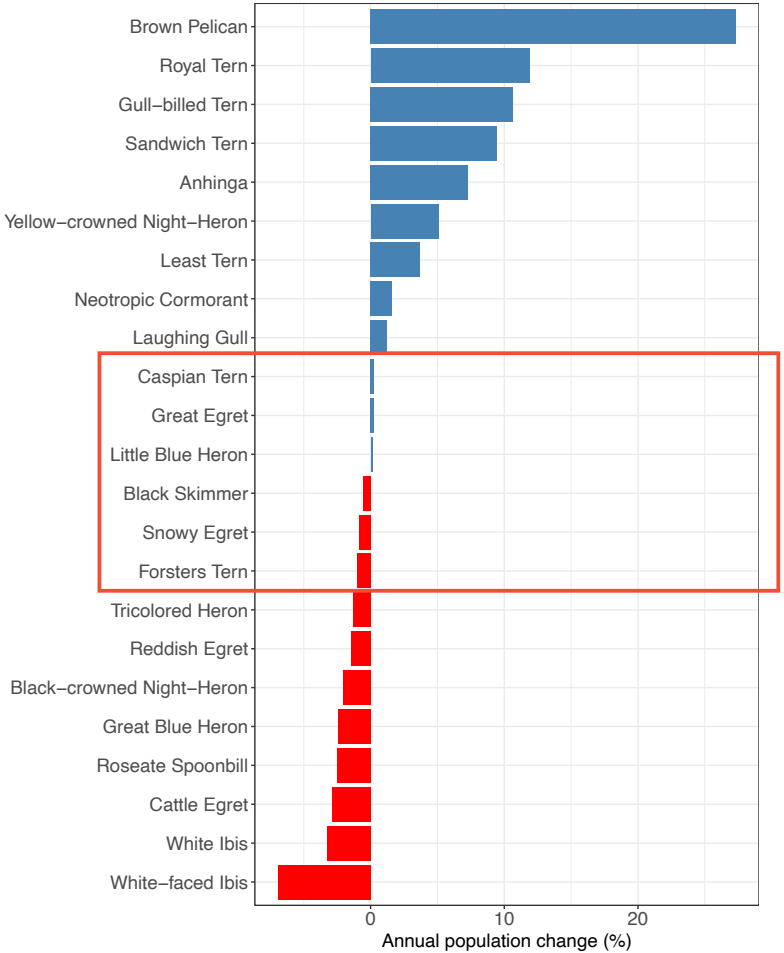


Species seeing statistically significant increases on the Upper Coast…

- Brown Pelican *
- Royal Tern *
- Gull-billed Tern
- Sandwich Tern
- Anhinga
- Yellow-crowned Night-Heron
- Least Tern
- Neotropic Cormorant *
- Laughing Gull

* = NDI playing key role in population trend

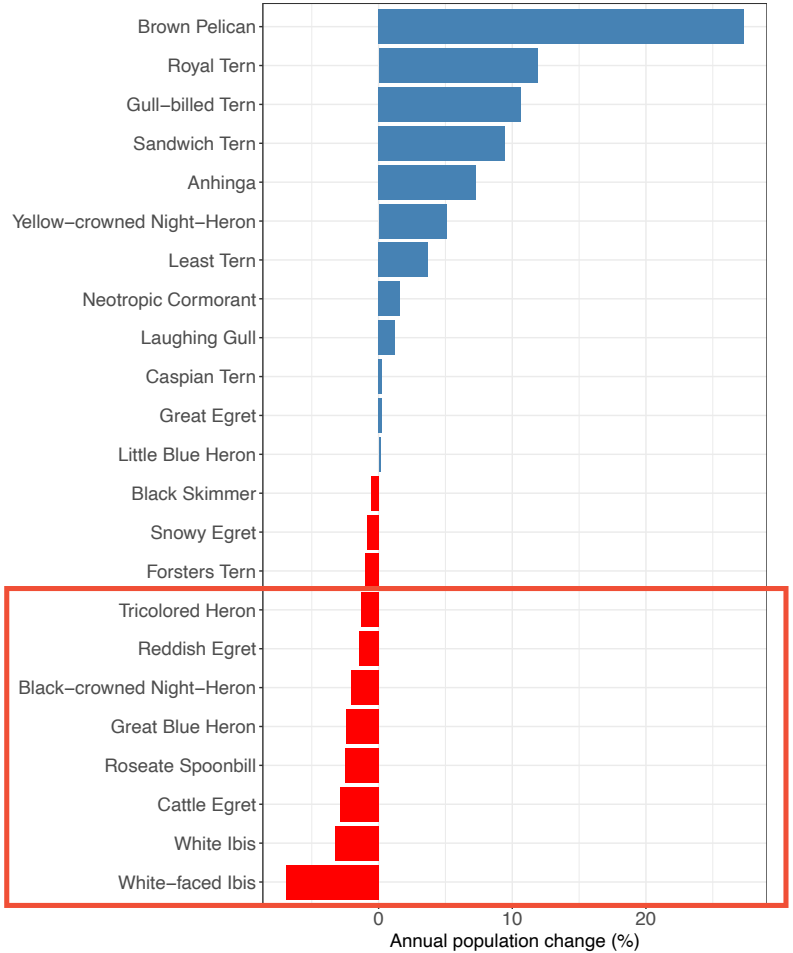
Annual change in population per species on the Upper Coast (1973 – 2025)



Species with stable populations on the Upper Coast…

- Caspian Tern
- Great Egret
- Little Blue Heron
- Black Skimmer
- Snowy Egret
- Forster's Tern

Annual change in population per species on the Upper Coast (1973 – 2025)



Species with statistically significant population decreases on the Upper Coast...

- Tricolored Heron
- Reddish Egret
- Black-crowned Night-Heron
- Great Blue Heron *
- Roseate Spoonbill
- Cattle Egret
- White Ibis
- White-faced Ibis *

* = NDI a key nesting site

Conclusions

- NDI restoration efforts appear to have helped in the dramatic recovery of Brown Pelicans on the upper coast.
- Crowding by recovering pelicans may have limited space for other species to recover on NDI.
- NDI is also currently a key site for Royal Terns, Neotropic Cormorants, Great Blue Herons, and White-faced Ibis

Bird illustrations from Birds of the World

Conclusions

- Species in most urgent need of conservation actions on the upper coast…
  - Black-crowned Night-Heron
  - Tricolored Heron
  - Reddish Egret
  - Great Blue Heron
  - Roseate Spoonbill
  - Cattle Egret
  - White Ibis
  - White-faced Ibis

- Conservation actions needed…
  - Island nesting habitat elevation and shoreline stabilization
  - Vegetation management
  - Predator control
  - Disturbance reduction
  - Protection of foraging areas.

Bird illustrations from Birds of the World

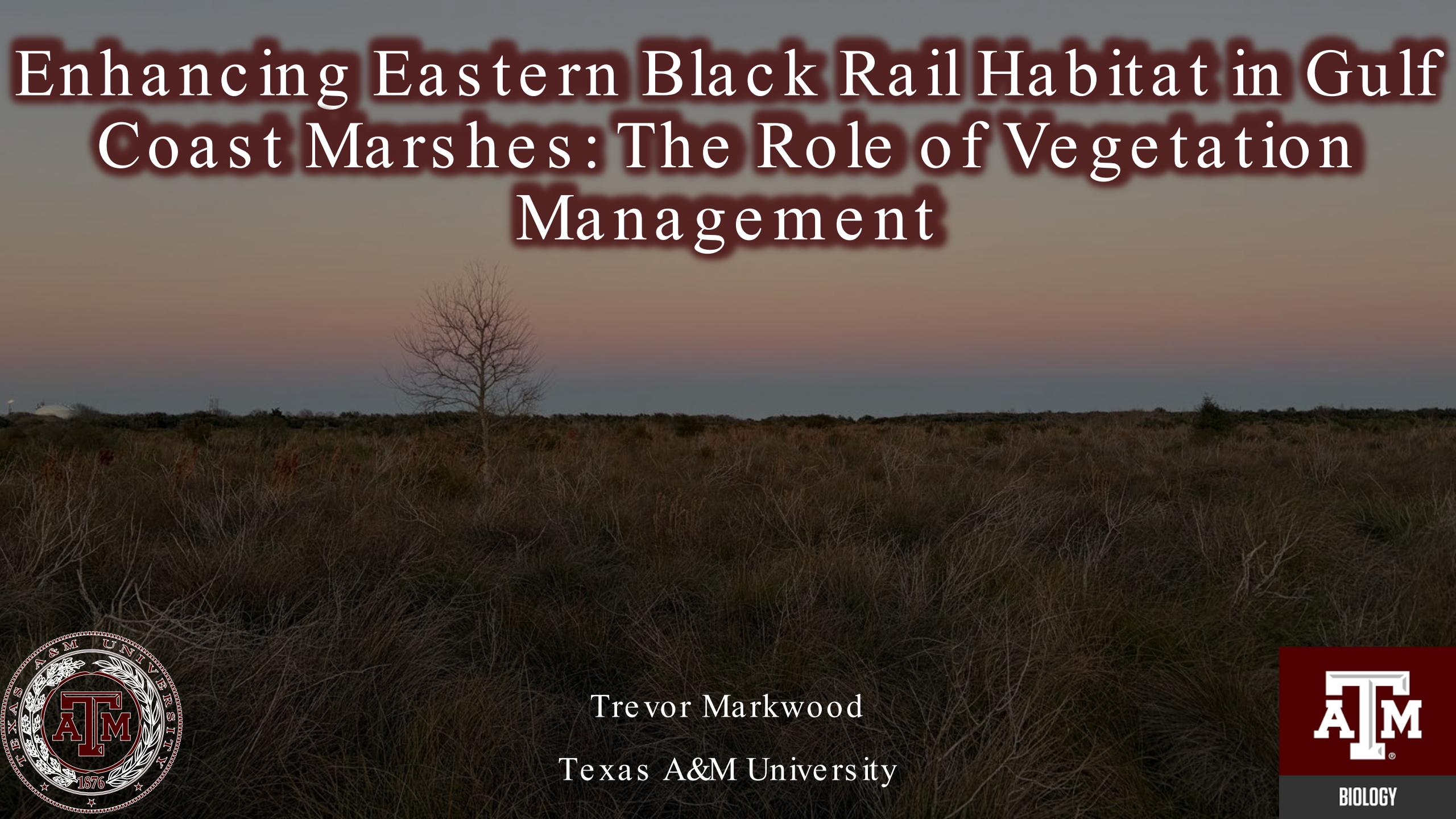
Current work on North Deer Island

- Partners: Audubon Texas, Houston Audubon, Ducks unlimited
- Repairing damaged groins
- Enhancing oyster-based living shorelines
- Creating more bare-ground nesting habitat for beach-nesting birds

Texas Coastal Waterbird data dashboard

https://experience.arcgis.com/experience/d8427a01f1b14adeaa54fdbd63acda45/page/Current-Year-Data

Enhancing Eastern Black Rail Habitat in Gulf Coast Marshes: The Role of Vegetation Management



Trevor Markwood

Texas A&M University

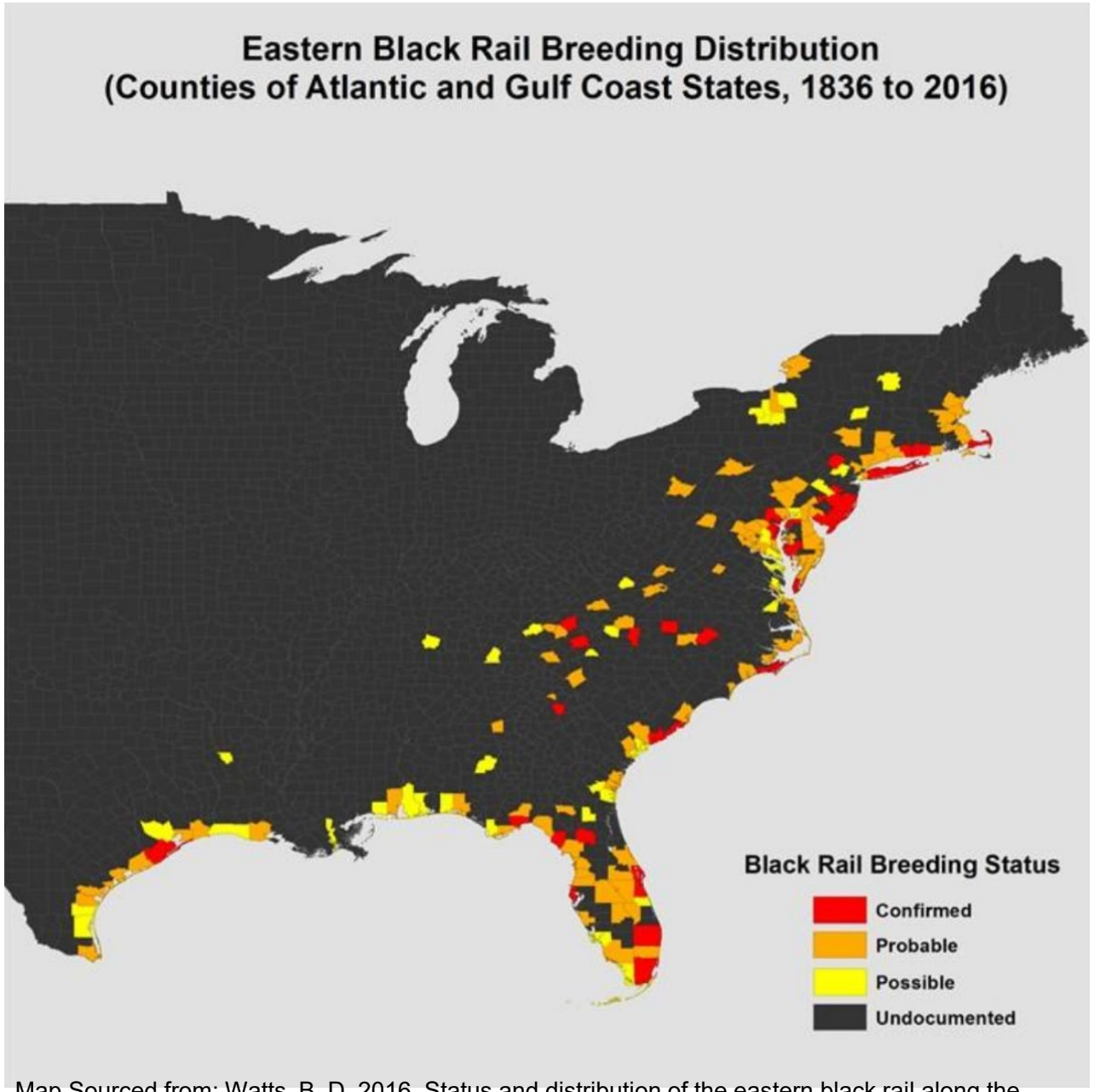
BIOLOGY

Black Rail (BLRA)

- Secretive marsh bird
  - Federally threatened in the US
  - Endangered internationally according to IUCN

- Two of five subspecies breed in United States
  - Eastern Black Rail (*Laterallus jamaicensis jamaicensis*)
  - California Black Rail (*Laterallus jamaicensis coturniculus*)

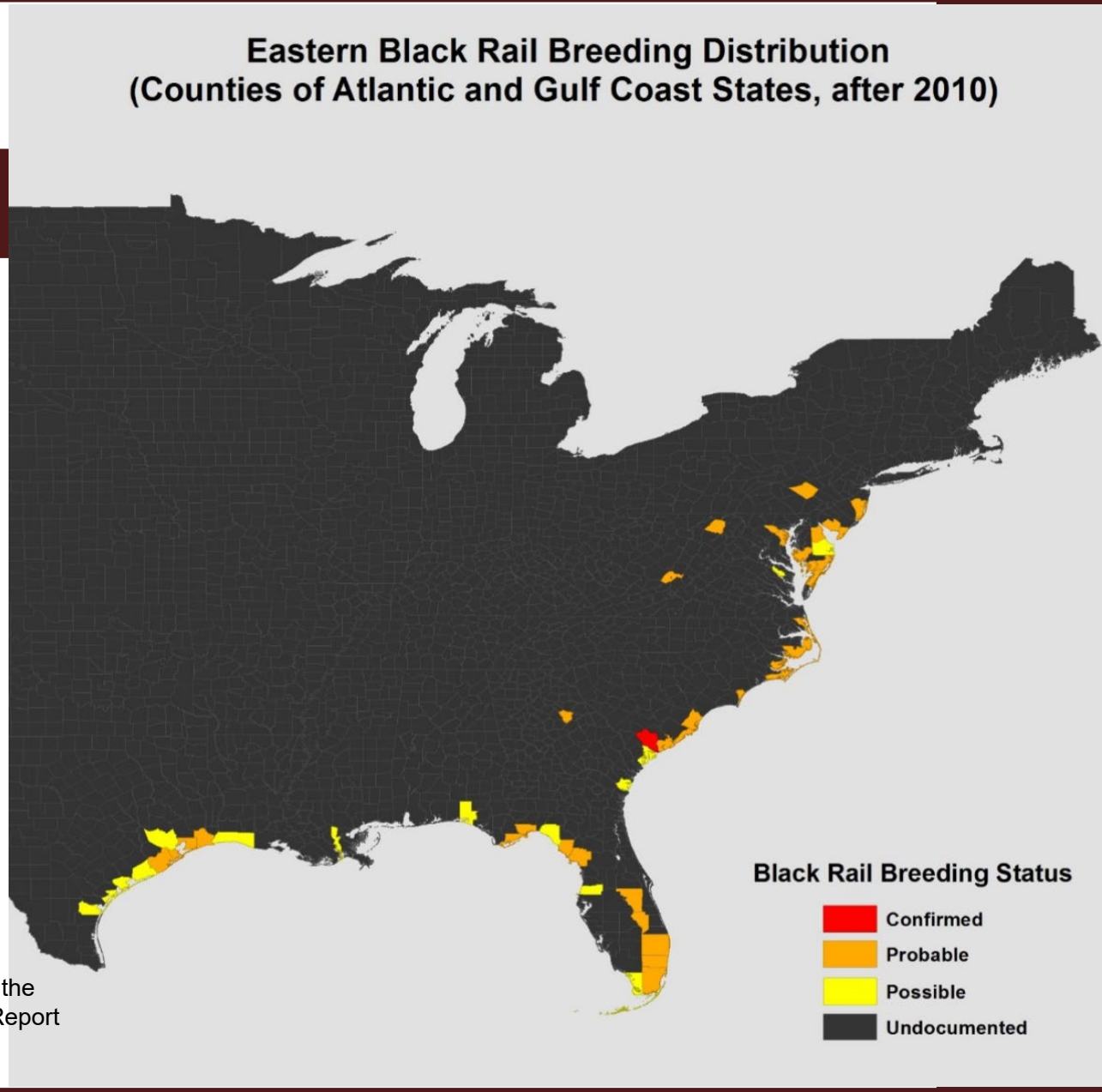
Historic Black Rail Range



Map Sourced from: Watts, B. D. 2016. Status and distribution of the eastern black rail along the Atlantic and Gulf Coasts of North America. The Center for Conservation Biology Technical Report Series, CCBTR-16-09. College of William and Mary/Virginia Commonwealth University, Williamsburg, VA. 148 pp

Modern BLRA Range

- From Watts (2016):
  - Annual population decline 4.7-9.8% since 1980s
  - 455-1,315 breeding pairs in US
  - Not pictured: inland breeding populations in Colorado and Kansas



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Woody Vegetation

- Occupancy associated with high salt marsh habitat and coastal grassy vegetation
  - Colorado population: Cattails
  - Kansas population: Sedges

- Species Status Assessment:
  - Calls for <10% woody vegetation
  - Management needed to reduce woody plant encroachment

Prescribed Burning

- Woody vegetation is typically managed by prescribed fires
- Issues with this:
  - Smoke management
  - Limited burn windows
  - Residential conflicts
- Alternative management methods needed for woody vegetation
  - Mechanical, Chemical, Grazing

Black Rails and the Galveston Bay Plan

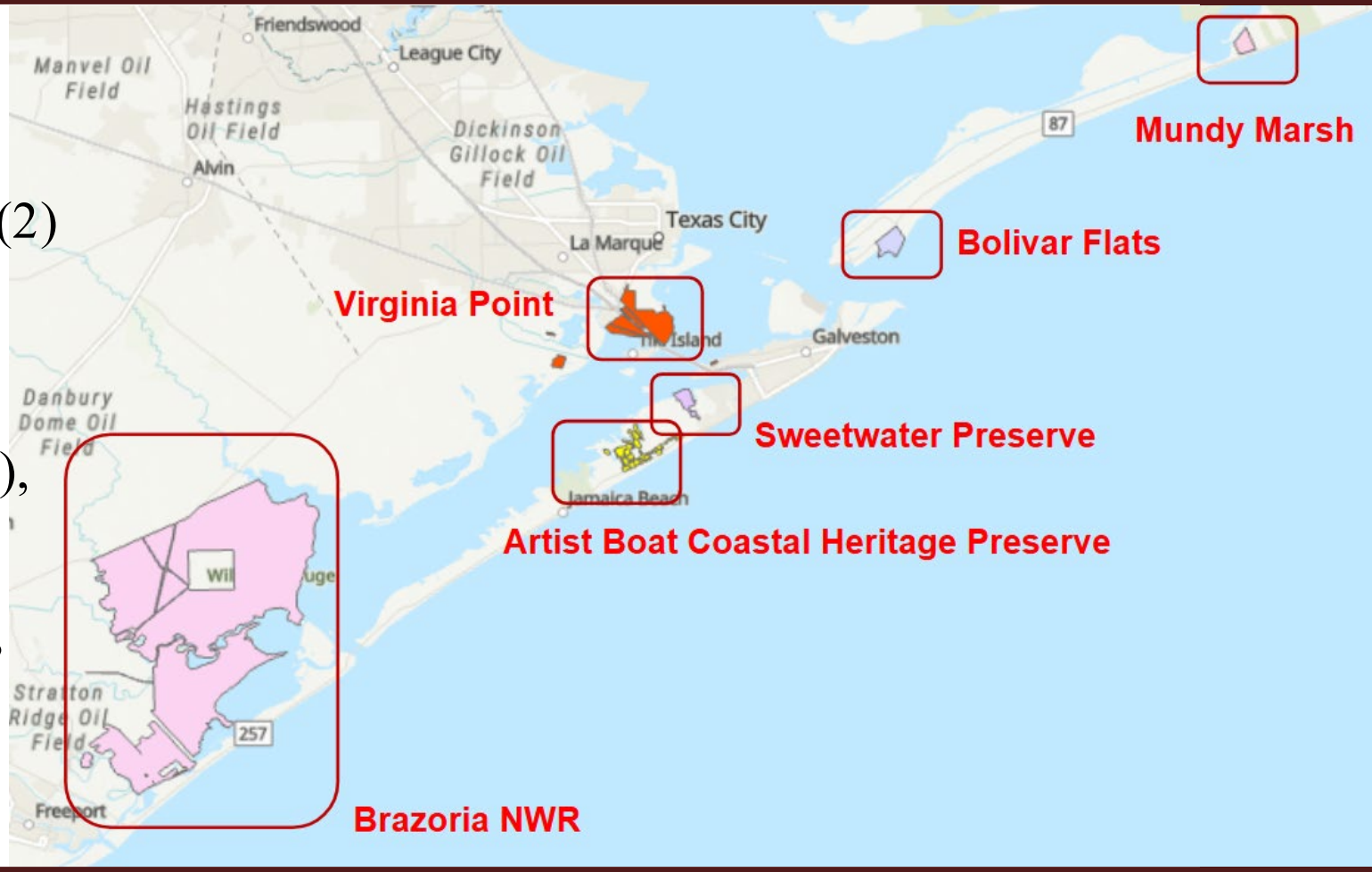
- Plan Priority: Protect and Sustain Living Resources
  - Support Species Conservation:
    - BLRA occupancy is 75% in suitable habitats
    - Texas Mid-Coast has >200 breeding pairs of BLRA, with more pairs residing in Galveston watershed
- Plan Priority: Inform Science-Based Decision Making
  - Understanding which management methods best support BLRA occupancy
  - Can inform land managers how to manage woody vegetation

Goals of This Project

1. Determine occupancy of Black Rails across a variety of management techniques along the Texas Gulf Coast
2. Determine the vegetation variables that are positively associated with Black Rail occupancy and what management methods are commonly associated with these variables
3. Determine supplemental data methods to further quantify Black Rail occupancy and behavior

Study Sites

- 28 points across 6 different study sites
  - Mechanical: AB(4), SP(3), VP,(2) BRZ (1)
  - Chemical: VP (2), BRZ (6)
  - Control – Woody: VP(2), BF(1), MM (2)
  - Control – Non-Woody: VP (2), SP(1), BF (1)
  - Historic Grazing Site: AB (1)



Methods: Audio Data Capture

- Data collected using Audiomoth Automated Recording Units (ARUs)
- ARUs left out for a week-long period to record every day
  - 3.5 hours at sunrise (1.5 hours before sunrise, 2 hours after)
  - 3.5 hours at sunset (30 minutes before sunset, 3 hours after)
- Analyzed using Kaleidoscope Pro

Methods: Vegetation Sampling

- Six clip plots along three 30m transects
  - Collect biomass >1 inch to ground in a 1m^2 area
- Every 15m collect the following:
  - # stems <10 cm
  - # stems 20-30 cm
  - Water depth
  - Canopy height
  - Vegetation cover (non-woody, woody, total)

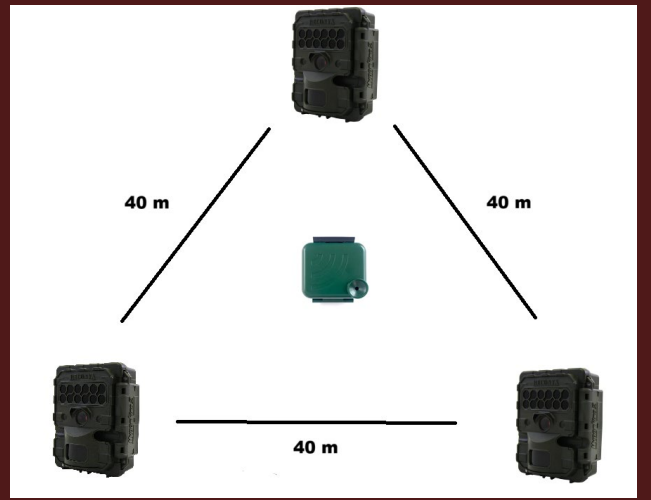
Methods: Supplemental Data

DRONE SURVEYS

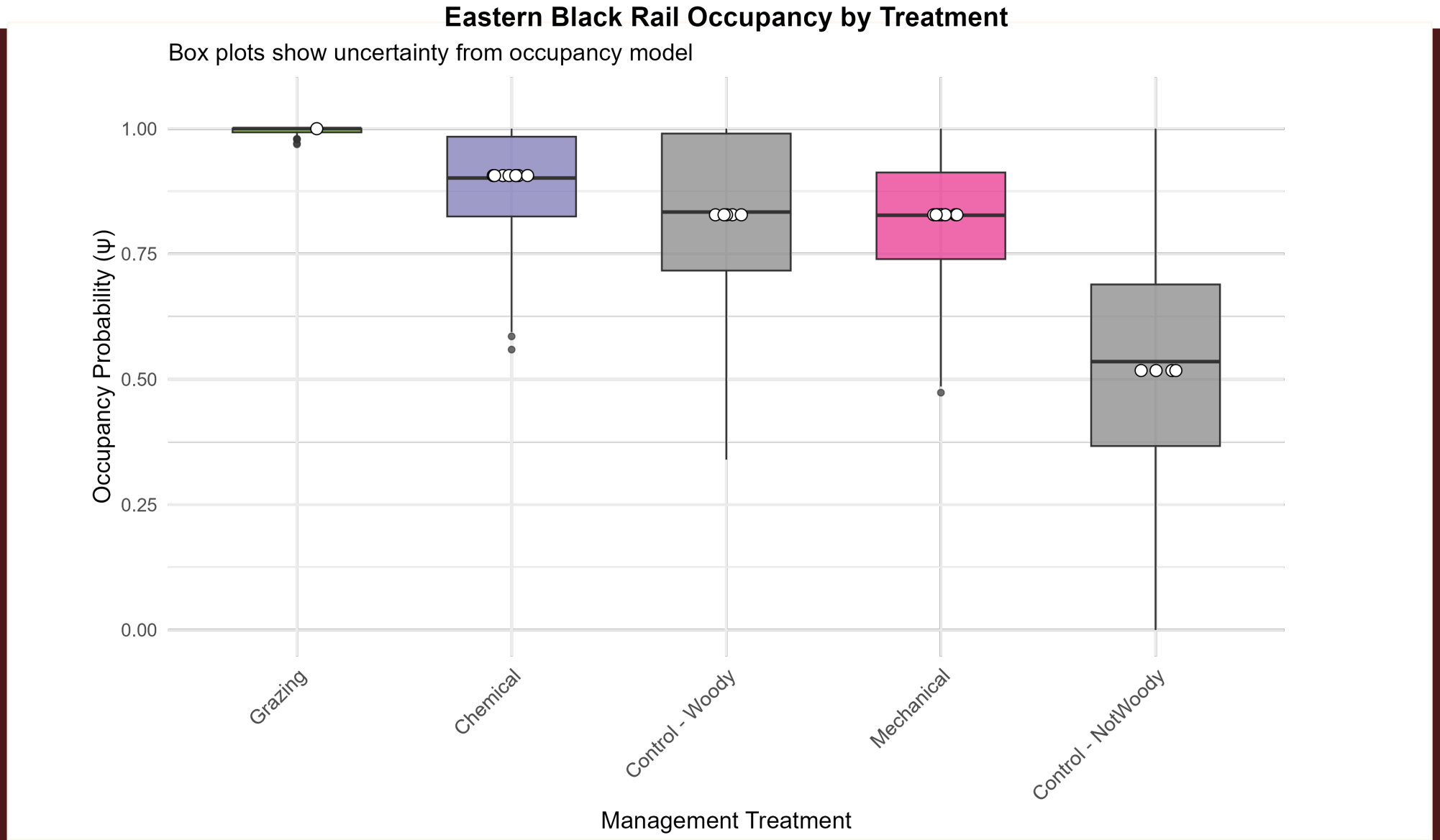
- Drone flights to find BLRA in the field
  - Pilot spots thermal image, observer finds and determines species

CAMERA TRI-TRAP

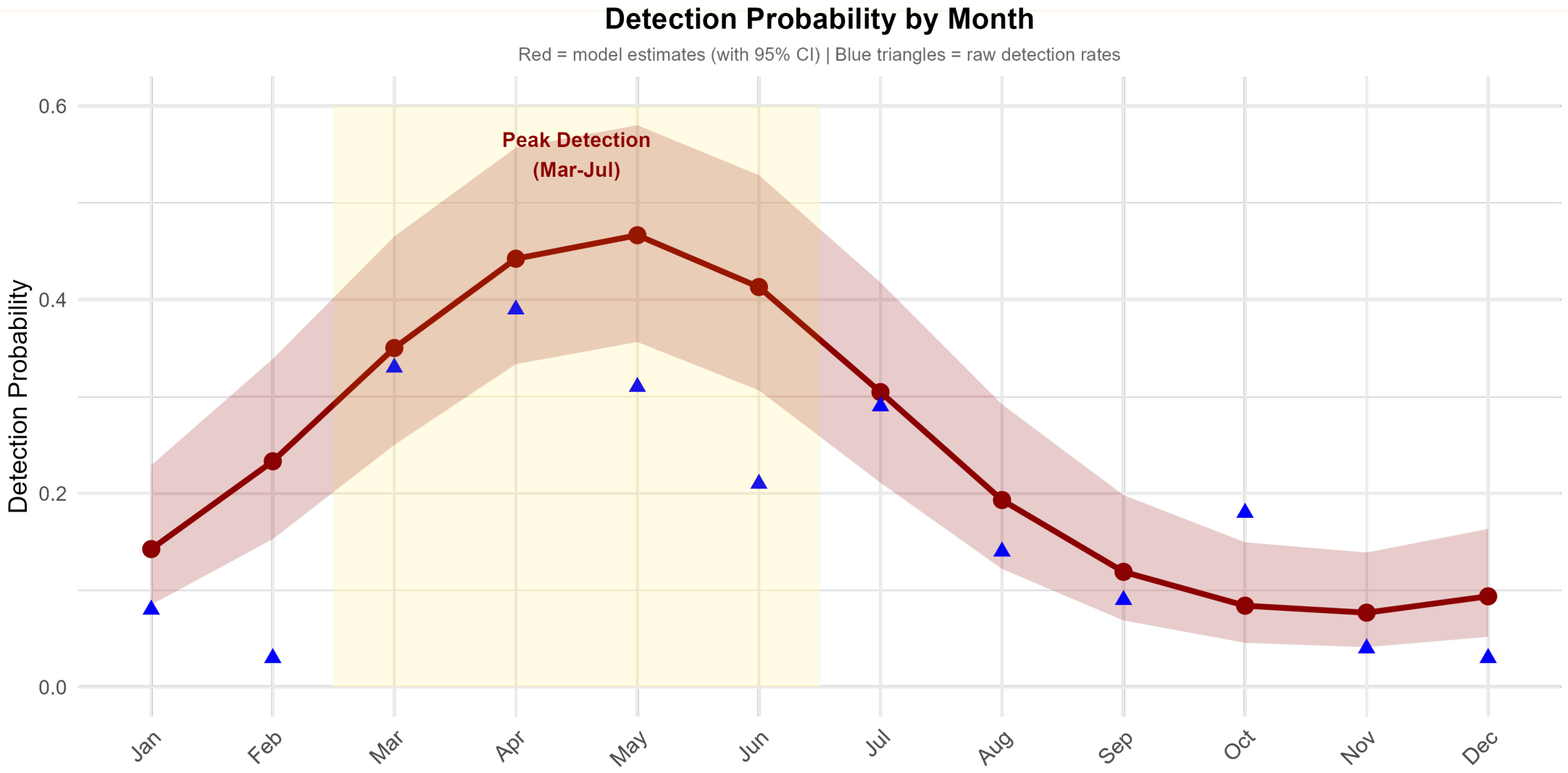
- Cameras placed in triangle around ARUs with confirmed occupancy
  - Triggered by movement, placed in likely rail trails



Results: Occupancy in Galveston



Seasonal Detectability



Drone Supplemental Data

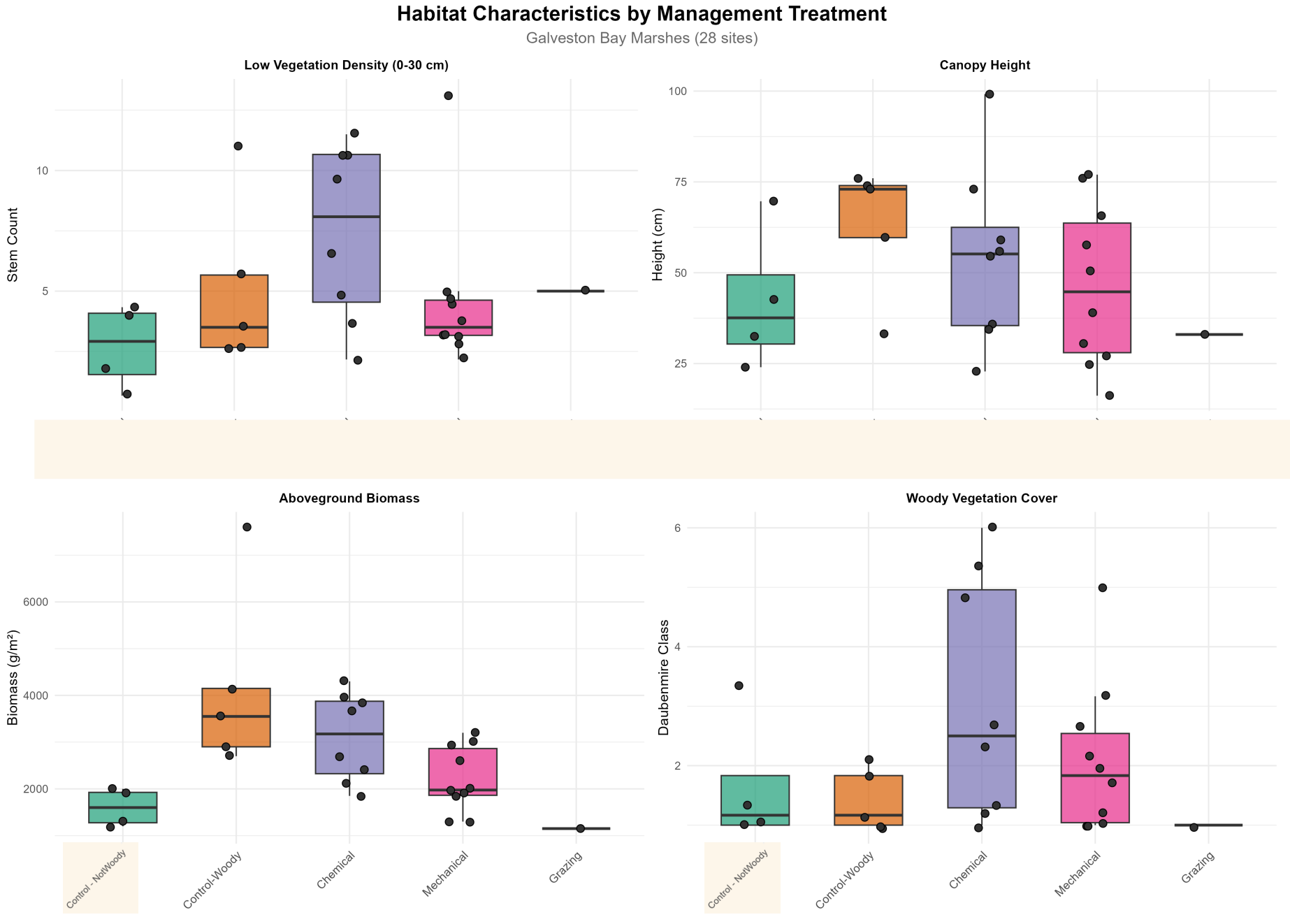
- One BLRA spotted on 20 total Galveston drone surveys
- Other notable species:
  - Virginia Rail (n=1)
  - Yellow Rail (n=1)
  - Sora (n=3)
  - Eastern Meadowlark (n=2)
  - Mice/ Cotton Rat (n = a lot)

Game Camera Supplemental Data

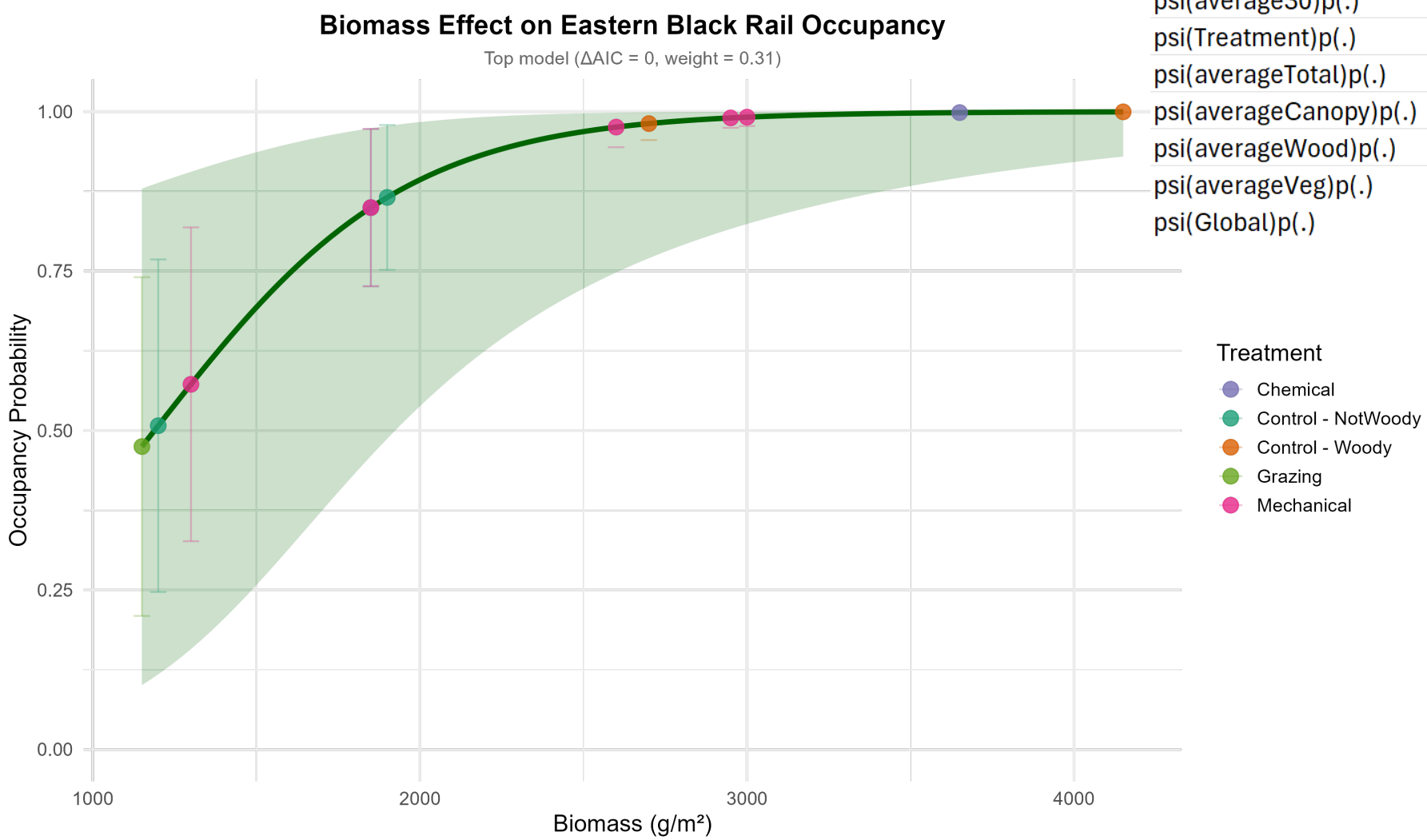
- One BLRA spotted using the tri-trap methods at BF
  - 24 total cameras deployed at 8 sites
- Species analysis currently being conducted on game camera photos

Results: Vegetation Survey Data

- Biomass varied significantly between treatments (ANOVA, p = .0066
- Other variables showed no significant difference



Biomass and Occupancy



Occupancy Models	nPars	AIC	delta	AICwt	cumltvWt
psi(Biomass)p(.)	3	164.3	0	3.10E-01	0.31
psi(.)p(.)	2	164.44	0.13	2.90E-01	0.61
psi(averageWD)p(.)	3	166.08	1.78	1.30E-01	0.74
psi(average10)p(.)	3	166.28	1.98	1.20E-01	0.85
psi(average30)p(.)	3	166.36	2.06	1.10E-01	0.96
psi(Treatment)p(.)	6	169.51	5.21	2.30E-02	0.99
psi(averageTotal)p(.)	3	172.2	7.9	6.00E-03	0.99
psi(averageCanopy)p(.)	3	172.2	7.9	6.00E-03	1
psi(averageWood)p(.)	16	181.84	17.54	4.90E-05	1
psi(averageVeg)p(.)	18	188.59	24.29	1.70E-06	1
psi(Global)p(.)	42	233.84	69.54	2.50E-16	1

Summary and Conclusions

- Occupancy in sites was very high, suggesting management of woody vegetation supports BLRA occupancy
- Biomass had the greatest impact on BLRA occupancy, suggesting that woody vegetation management should focus on aboveground biomass
- Chemical management of woody vegetation seems to have the highest occupancy with 91% of sites occupieid
- Further research into supplemental methods can improve BLRA detections

Future

- Coordinating with Nature Conservancy to further investigate grazing sites
- Rotating of sites after 1 year of collection to expand study sites in Galveston

Acknowledgements

- Scenic Galveston Foundation
- Artist Boat Coastal Heritage Preserve
- Galveston Bay Foundation
- Houston Audubon Society
- Mid-Coast NWR
- Funding from USFWS, GBEP, and TCEQ

Questions? Reach out to me at: tmarkwood@tamu.edu