Rookery Island Bird Abundance: A 40 Year Study

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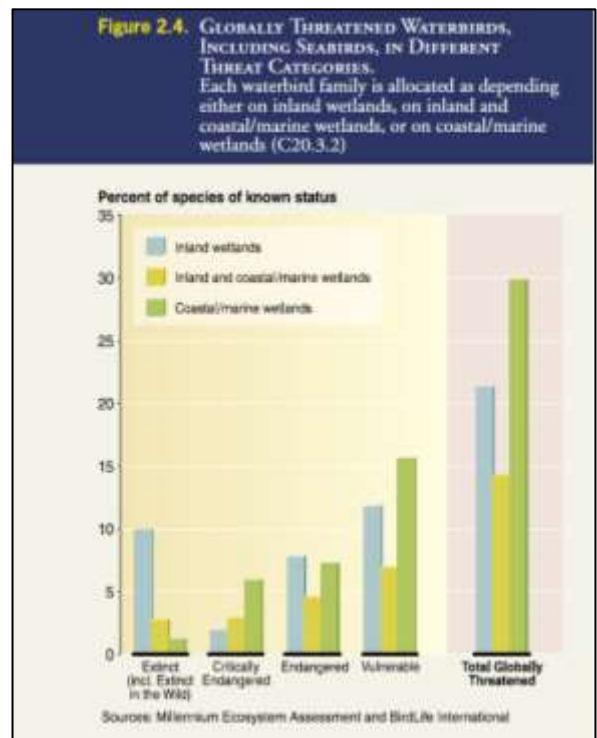

(Photo Credit: Newstead et al. 2013)

Background

The state of Texas ranks second in the United States on its birding list of 650 species (White 2016). During the summer months at the Texas coast, the general public and conservationists can find large groups of birds gathered in colonies. These colonies, or rookeries, primarily congregate to increase the odds of their chicks' survival through predation watch and sharing of parental responsibilities during nesting season (http://tx.audubon.org/colonial-waterbirds). The variety of coastal ecosystems, federally and privately protected areas, such as the Mission Aransas National Estuarine Research Reserve (NERR), and location as a stopover for migrating and wintering species, make the coast a particularly unique and productive environment for waterbirds (http://www.cbbep.org/coastal-waterbirds/). These migratory, wintering, and resident colonial waterbird species attract ecotourists, hunters, and curious visitors to the rookery islands of the Texas coast as many are fascinated with the birds' existence and aesthetic values (Carney and Sydeman 1999; Kushlan 1993). While the Texas coastal economy

benefits from waterbird-related ecotourism activities, waterbirds face several threats to their survival. These island-nesters face challenges such as predation, human disturbance, habitat loss and degradation, and an increase of marine debris in their environment (TPWD).

Coastal seabirds that depend on wetland habitats, such as those that nest on rookery islands in Texas, are particularly vulnerable to anthropogenic and natural threats. These wetland-dependent coastal

Figure 2.4. GLOBALLY THREATENED WATERBIRDS, INCLUDING SEABIRDS, IN DIFFERENT THREAT CATEGORIES. Each waterbird family is allocated as depending either on inland wetlands, on inland and coastal/marine wetlands, or on coastal/marine wetlands (C20.3.2)

species' numbers are declining more quickly than their inland wetland- and terrestrial habitat-dependent counterparts (Millennium Ecosystem Assessment 2005: Figure 2.4 image). Given coastal waterbirds' importance to a diverse group of people, conservation organizations on the coast, including citizen science groups, are taking responsibility for documenting observations of the birds and using this observational data to make management decisions to protect and conserve the rookery islands for future generations to enjoy.

Objective

The objective of this study is to investigate the spatiotemporal nesting dynamics on the Texas Coastal Bend rookery islands over a 40 year observation period. Different colonial waterbirds prefer different habitat types for nesting, foraging, overwintering, and more (Darnell and Smith 2004; Curtiss and Pierce 2016). According to their habitat requirements, the birds select vegetation or substrate on rookery islands to build their nests. This study follows the Audubon Texas' grouping of colonial waterbirds into two main groups of ground and shrub/tree nesters (http://tx.audubon.org/colonial-waterbirds). Investigating the spatiotemporal trends of ground and shrub nesting waterbirds serves as a proxy for understanding habitat changes during the same time frame. Therefore, this study has the potential to inform policy-makers and conservationists how to manage habitat to protect these important coastal bird species.

Methodology

I. *Data Acquisition:* GIS and Excel files were received and downloaded from three sources. The Mission Aransas National Estuarine Research Reserve (MANERR) boundary shapefile was downloaded from the NERRS Centralized Data Management Office website as the area of interest (http://cdmo.baruch.sc.edu/). Communication with Coastal

Bend Bays and Estuaries Program (CBBEP) directed the focus of this study. A shapefile and point file of CBBEP restoration islands in the Texas Gulf Coast were received by email. The Texas Colonial Waterbird Survey (TCWS), collected by the Texas Colonial Waterbird Society, was also received by email from CBBEP.

II. *Texas Colonial Waterbird Survey:* The United States has a long and involved history of monitoring abundance of colonial waterbirds. Kushlan (2012) states the Texas Waterbird Survey is most likely the "longest standing and most comprehensive for a state." Beginning in 1973, the Texas Colonial Waterbird Society, began conducting annual surveys of waterbird species along the Texas Coast. Over the 40 years, the society has identified 35 bird species at the rookery islands and observed them as adults, nests, and pairs. Colonial waterbirds were first categorized as ground or shrub nester (Table 1 after References). Colonial waterbirds were then filtered by active status (supported nests) and colonies of interest (refer to Methodology III.). Finally, pair observation counts were selected as a nesting indicator, excluding nest and adult observation counts.

III. *Rookery Islands Selection:* CBBEP studies and works on 117 islands while the Waterbird Society conducts surveys on 426 islands along the Texas coast. Three parameters were determined to narrow the scope of the study area. Rookery island polygons had to be completely within the MANERR boundaries—select by location on GIS—be a CBBEP restoration island, and be a TCWS island. Twenty-five rookery islands met all three conditions. The aforementioned parameters were selected because of this study's objective to inform local management habitat decisions. Moreover, the research priorities of MANERR to protect key habitats from anthropogenic and natural influences supported the use of MANERR boundaries for location selection in GIS. A basemap showing the

rookery islands of interest are displayed; twenty-five rookery islands gave way to five unique colony names (Figure 1; Figure 2; Figure 3). All files were set to the same projected and geographic coordinate systems as the MANERR Boundary layer: North America Albers Equal Area Conic and GCS North American 1983.
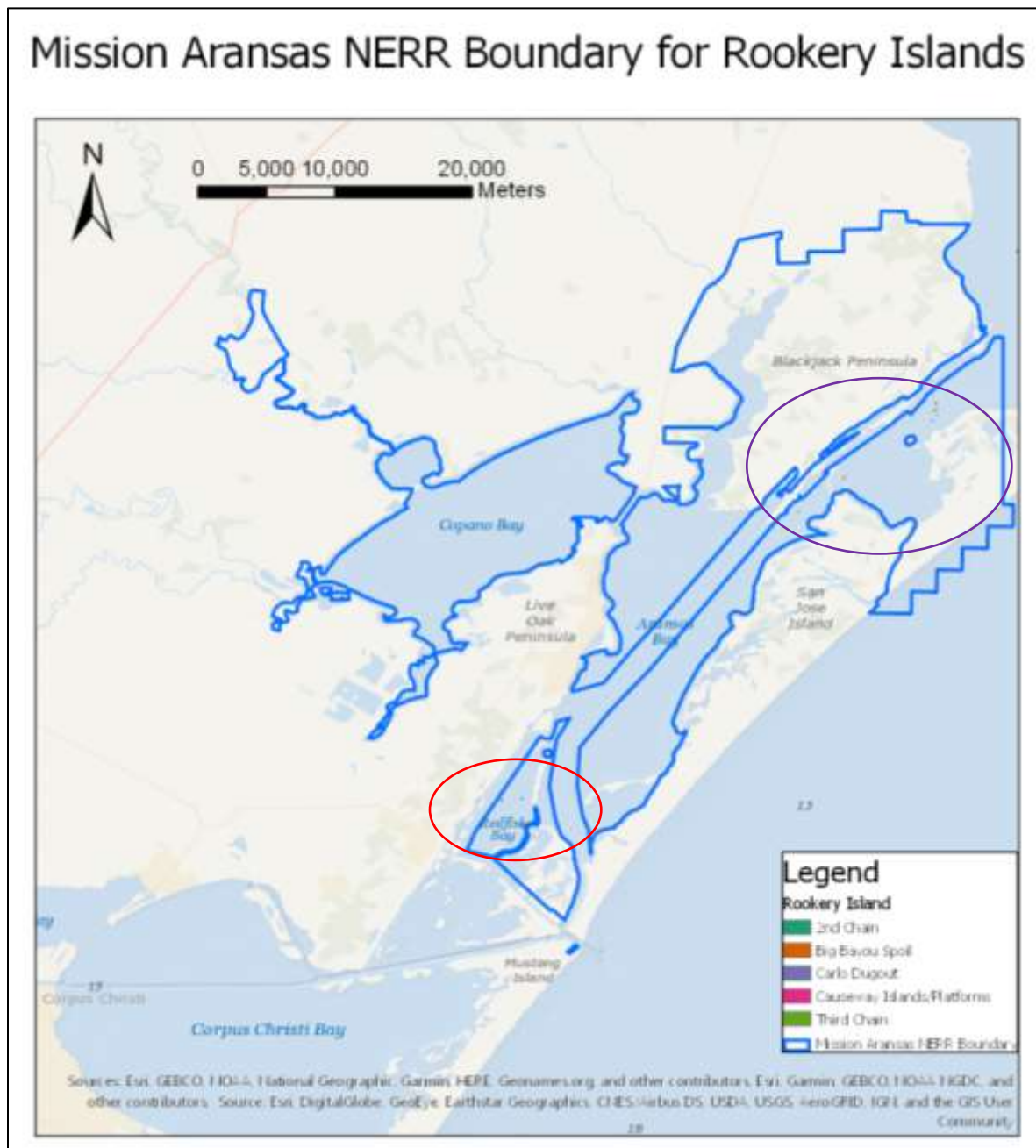

Figure 1. Basemap of rookery island colonies within the Mission Aransas NERR Boundary. The purple circle highlights the three rookeries in Mesquite Bay, and the red circle highlights the two rookeries in Redfish Bay.

Rookery Islands in Mesquite Bay
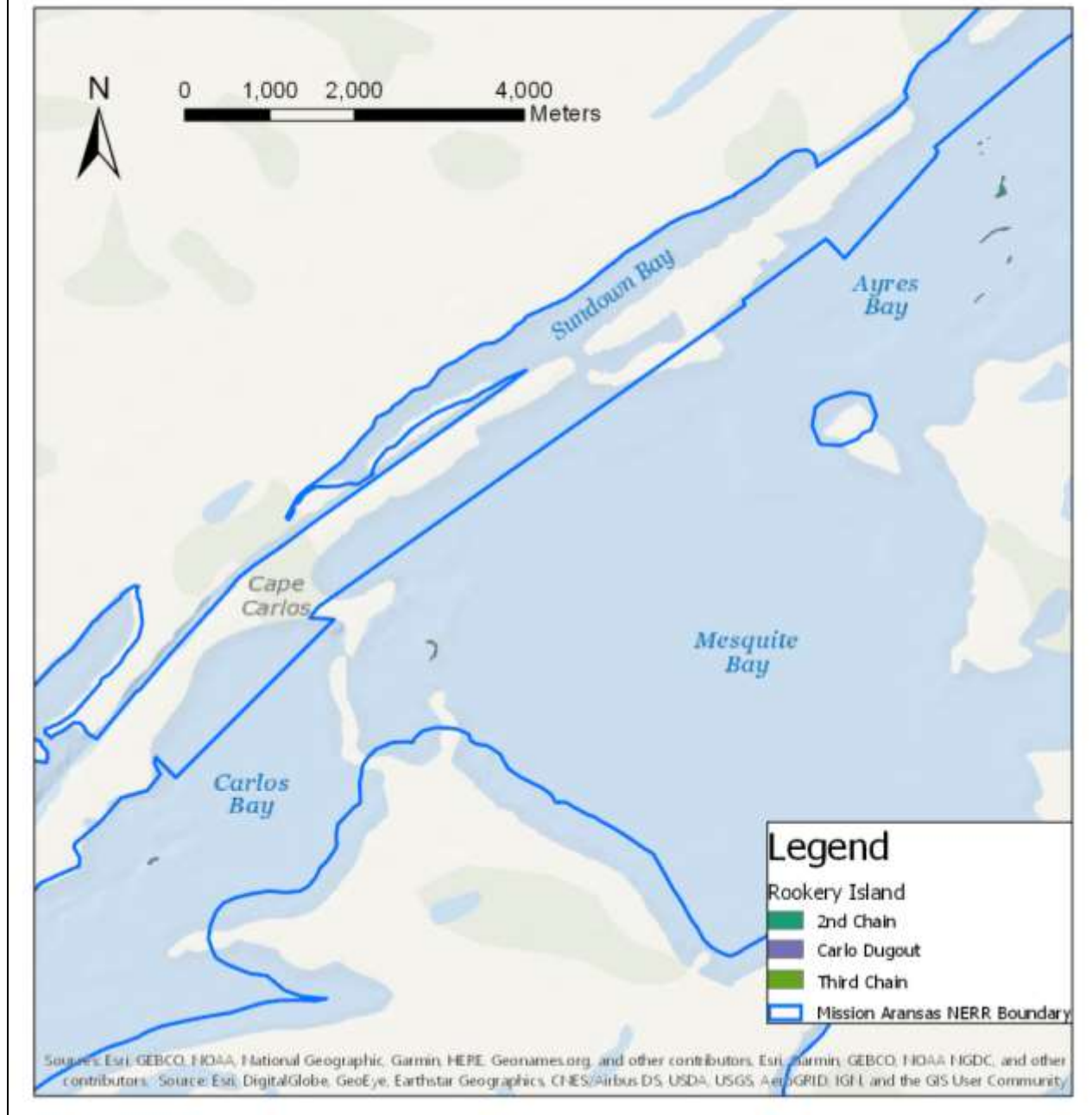
Figure 2. Three rookery islands in Mesquite Bay. From North to South, islands are Second Chain, Third Chain, and Carlos Dugout Islands.

Rookery Islands in Redfish Bay
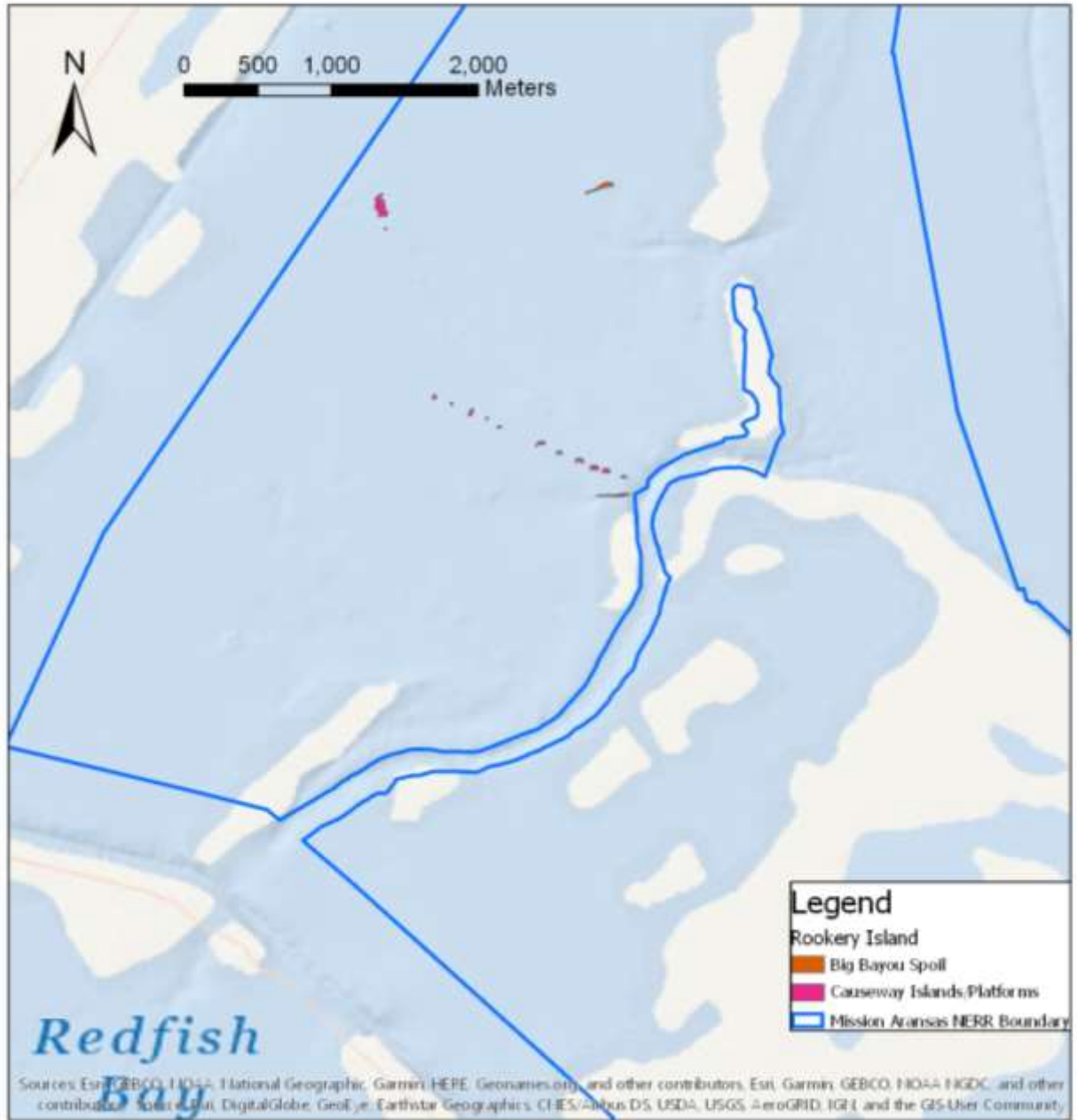
Figure 3. Two rookery islands in Redfish Bay. The northern most island is Big Bayou Spoil and the south island complex is Causeway Islands/Platforms.

IV.   *Remaining GIS Workflow:* To create maps displaying the pair abundance by island,

observation data was joined to locality data in GIS. Observation data from four years was

joined as either observations of ground nesters or observations as tree/shrub nesters.
Graduated symbology was used as the best method to visualize waterbird pair abundance
over the study period.

Spatiotemporal Results

Both nesting groups suffered declines from 1973-2013 although there was great decadal
variation in decline and growth. This focused spatial scale demonstrates interesting trends, but
the trends should not be extrapolated to the regional level based on the high variability present.
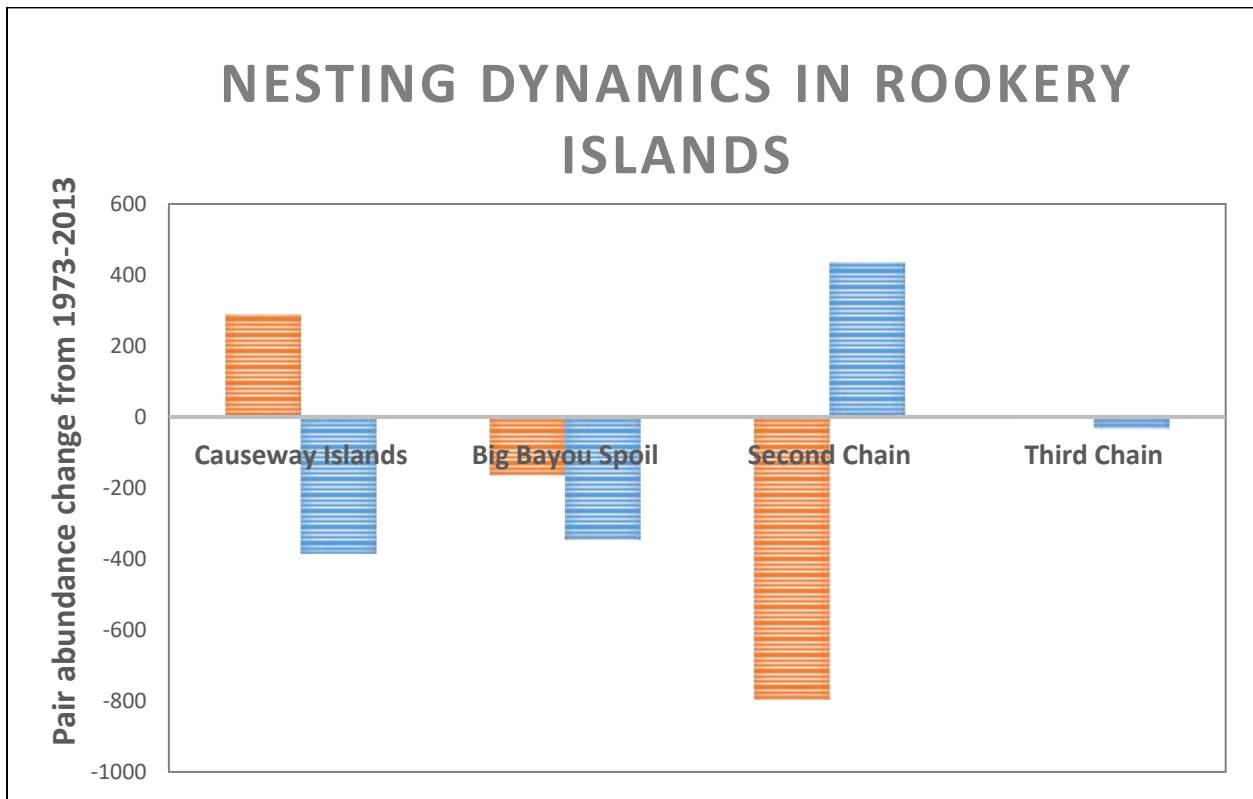
Figure 4. Net pair abundance changes during the 40 year study period. Blue represents ground nesters and orange represents tree nesters. Causeway Islands and Second Chain Islands show different nesting preferences gaining in abundance during the study period while Big Bayou and Third Chain only show abundance decreases. Carlos Dugout is not shown due to incomplete data over the entire 40 year period.
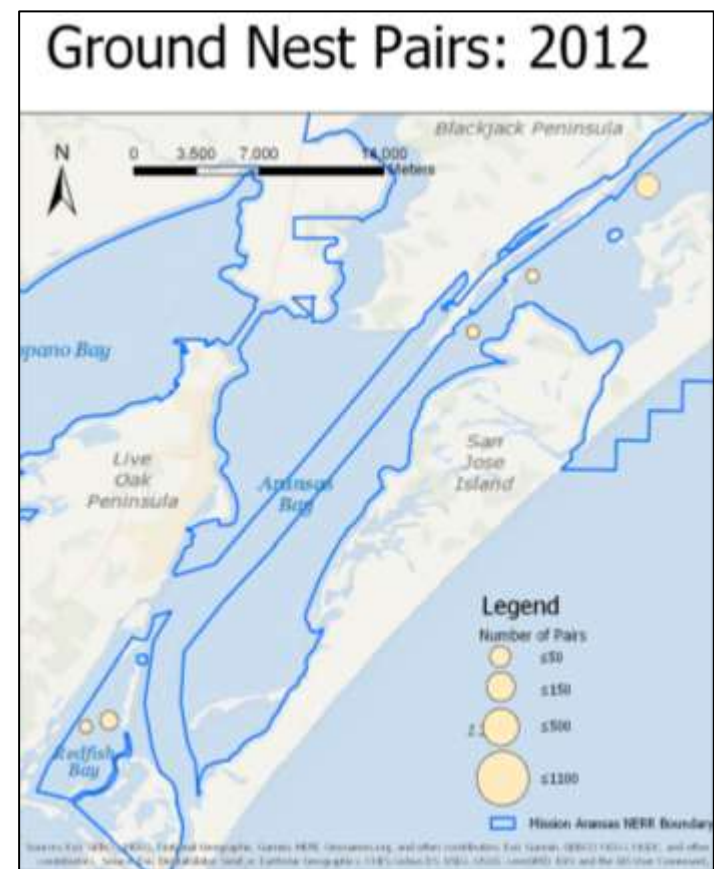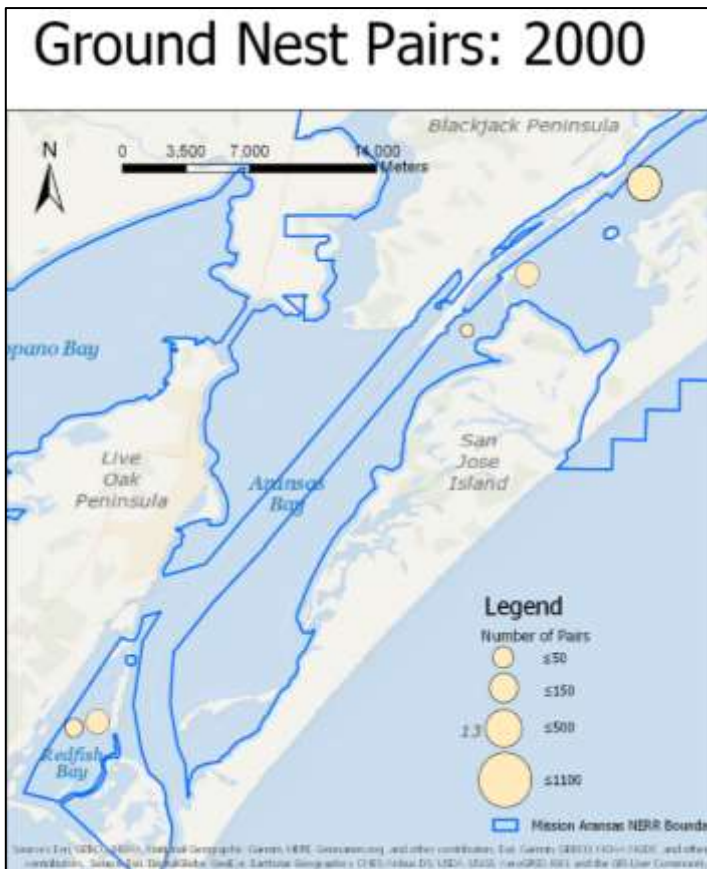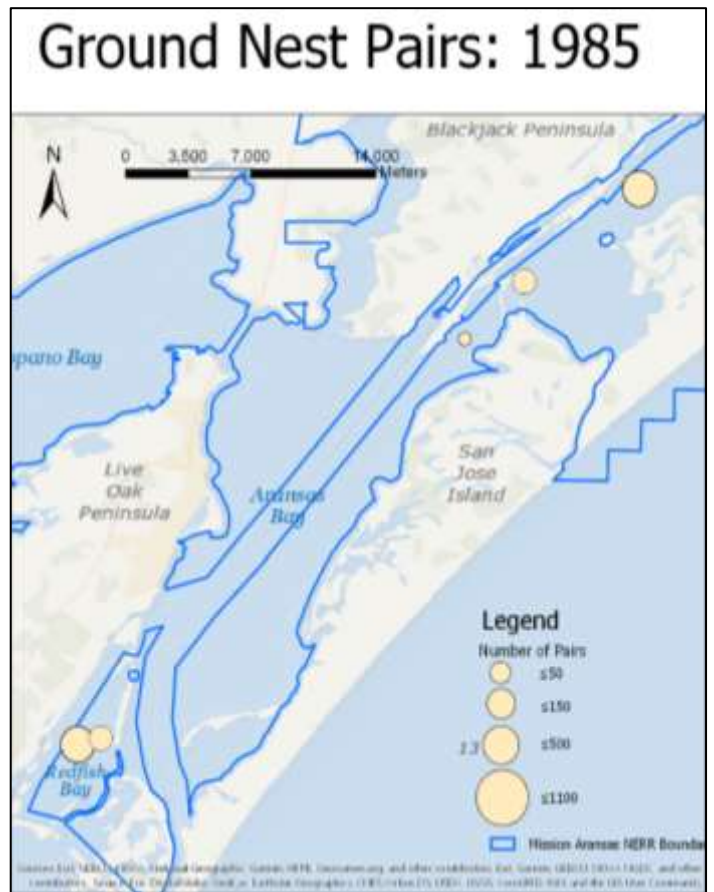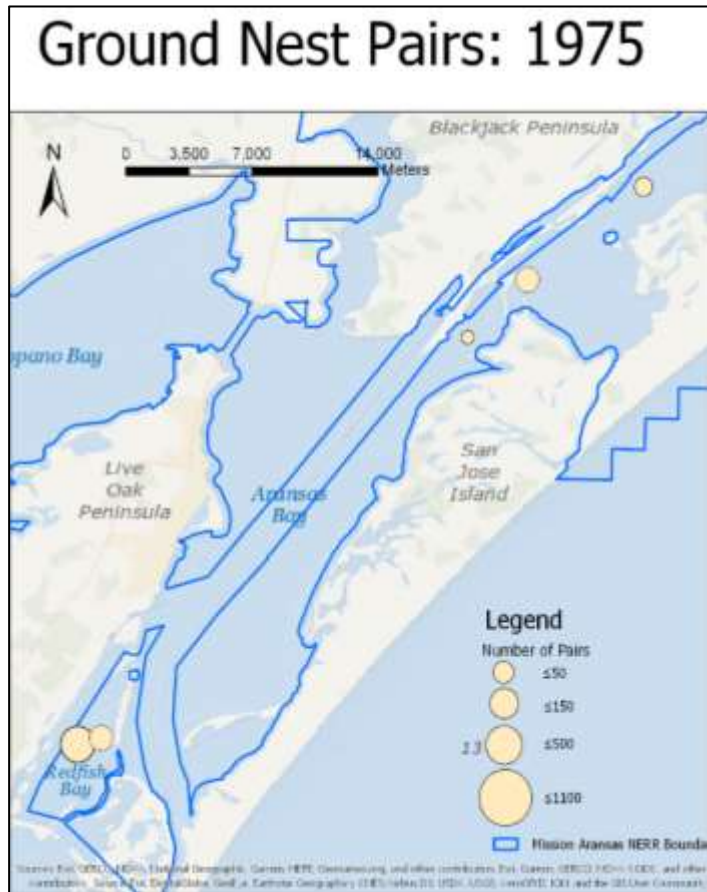
Figure 5. Ground nest pair abundances at four years of observation period.

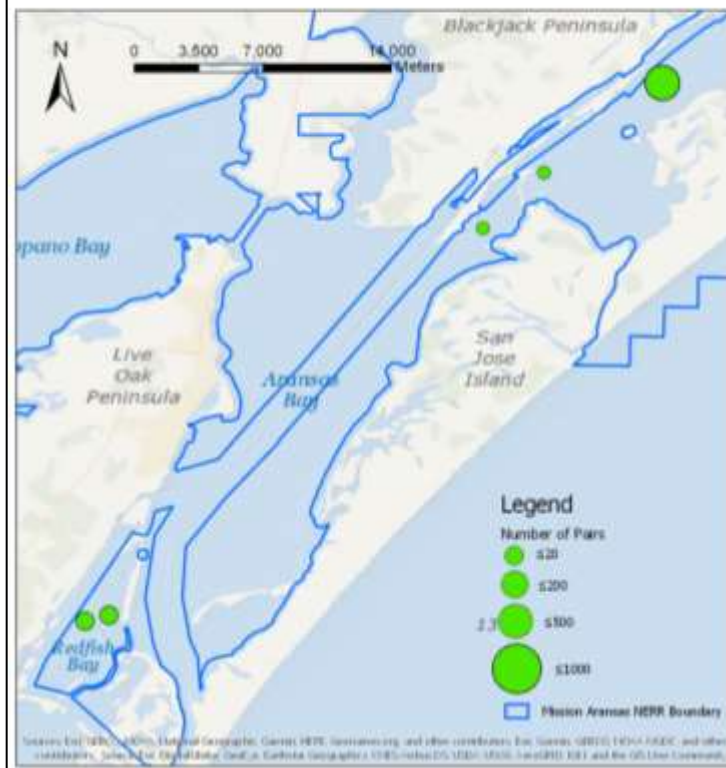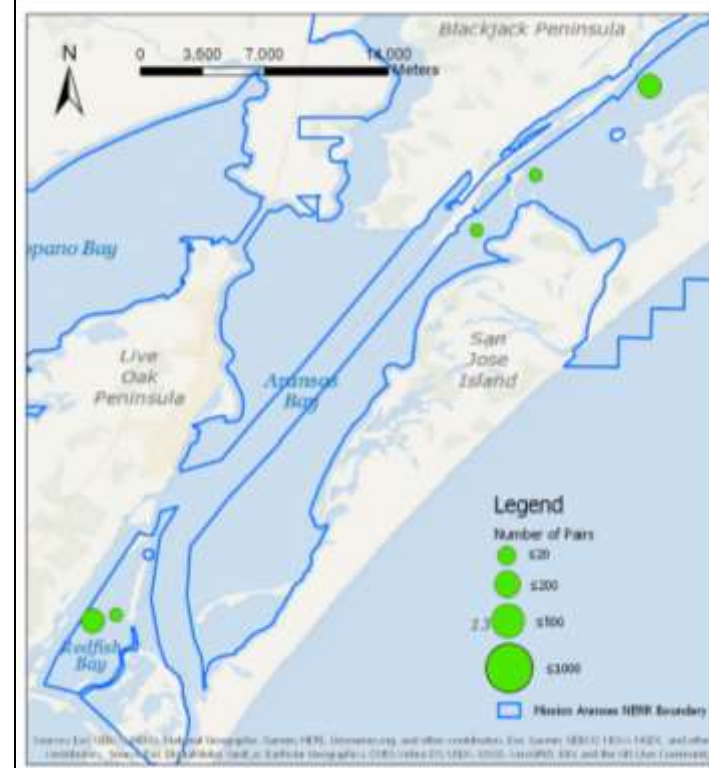*Figure 6. Shrub/Tree nest pair abundances at four years of observation period*

Rookery Colony	Total Island Area (m sq.)	Average Annual Pair Abundance	Pair per m sq. of Island
Second Chain	17357.05353	1866.58	0.107540142
Big Bayou Spoil	3209.221847	286.48	0.089267746
Carlo Dugout	2949.371488	37.58	0.012741698
Third Chain	5118.355124	247.89	0.048431575
Causeway Islands/Platforms	17405.8547	517.36	0.029723332

Table 2. Total Island Area was calculated to determine if larger islands have higher abundance of birds (both nesting groups). Island areas were summed if they were a complex of small islands. This is most likely not a true representation of birds on each island. The smallest island had the smallest abundance, but no other island-abundance ratio held true.
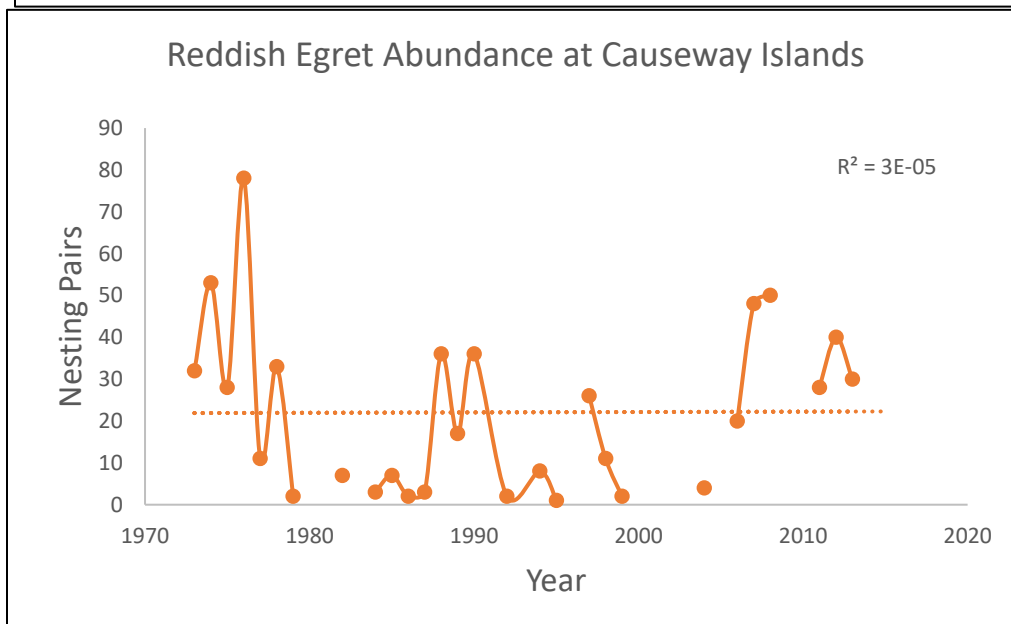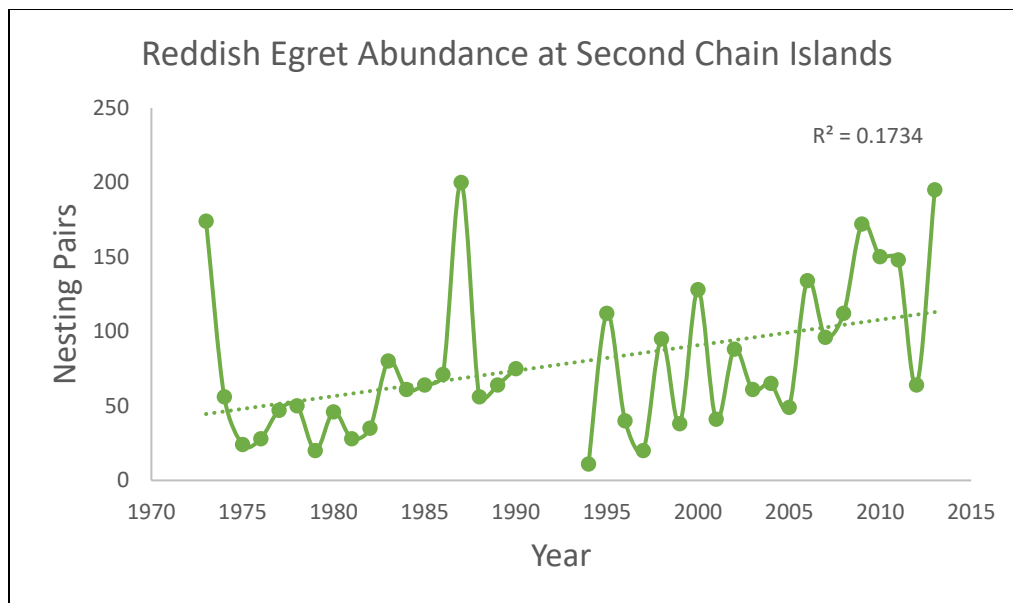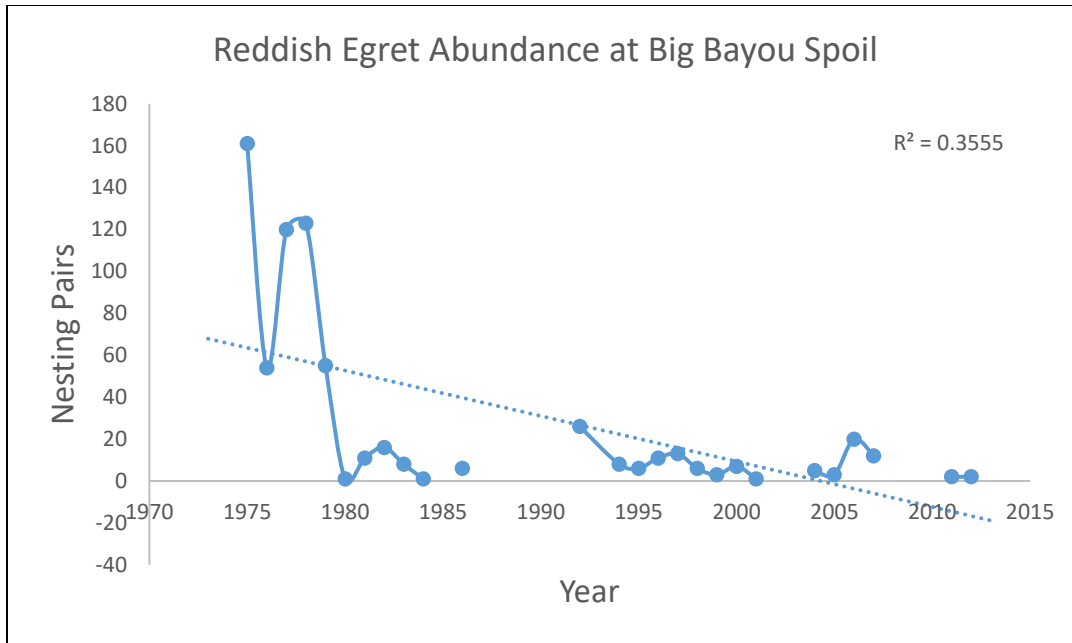
Figure 7. Reddish egret (TPWD Threatened status) pair abundance trends at three islands. The three graphs illustrate the difficulty with determining general trends of rare and endangered species' abundance. All Threatened and Endangered species were included in this study since they were categorized and not analyzed individually.

Considerations and Recommendations

Grouping coastal waterbirds into the two main nesting categories is only one step in understanding the dynamics that influence their livelihood. Moreover, the categorization is a proxy for habitat change and could be validated with vegetation/land cover data over the same time period. Although beyond the scope of this project, future work should balance taking into account the spatial pattern and diversity of habitats of the rookery islands, other environmental stressors, and improved or degraded island conditions beyond the area of interest (Flather and Sauer 1996; Gawlik et al. 1998). Not all potential factors can be taken into account; therefore, studies analyzing observational trends must decide on a local or regional scale analysis—patterns at local studies, like this one, may not translate regionally and may show high variability given the temporal and spatial scales (Flather and Sauer 1996; Gawlik et al. 1998).

The Texas Colonial Waterbird Survey is an extremely useful observational dataset that can be utilized by conservationists, students, and the general public to ask important questions of the waterbirds that have such a recreational and aesthetic value. The 40 year time span is remarkable for its consistency of collection over the years and allows researchers to access historical trends to make projections for the future. However, with any dataset, it is important to consider the limitations that may affect the trends displayed. The Society only observes the waterbirds for one week during the summer once a year. There are also measurements, such as number of nests and presence or absence of subcolonies, which do not exist until the 1980s. These considerations are to stress the importance of early standardization in data collection and the understanding that these observations as one part of a larger story.

GIS mapping has proven useful to conservationists' ability to visualize spatiotemporal trends of their habitats and species of interest. Moreover, GIS maps are an effective tool for communicating the reasoning behind conservation strategies to the public as visual data can be better understood. Colonial waterbird abundance can be a useful bioindicator of environmental conditions along the Texas coast (Kushlan 1993; Kushlan 2012). Monitoring bird abundance will become increasingly important as climate change's effects lead to more frequent, intense storms and sea-level rise which are both set to increase erosion and flood the rookery islands. Conducting studies on the islands and consistently measuring abundance can allow researchers to better understand how nest preference may be impacted under a changing climate (Newstead et al. 2013). Finally, empowering local groups of citizen scientists, students, and the public to get involved with conservation observations serves to benefit all who have a stake in the continued existence of colonial waterbirds.

Acknowledgements

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http://www.cbbep.org/coastal-waterbirds/

Table 1. Observed waterbird species in the Texas Colonial Waterbird Survey categorized as shrub/tree or ground nesters. Colonial waterbirds were assigned a group based on their primary nesting habitat; some waterbirds do not have specific requirements and can nest in various environments. Categories were primarily assigned based on information from Cornell Ornithology Lab. Highlighted species are threatened or endangered.

Bird Name (Local)	Scientific Name	Nesting Group	Conservation Status
American Oystercatcher	Haematopus palliatus	Ground	
American White Pelican	Pelecanus erythrorhynchos	Ground	
Anhinga	Anhinga	Shrub/Tree	
Black Skimmer	Rynchops niger	Ground	
Black-bellied Whistling Duck	Dendrocygna autumnalis	Shrub/Tree	
Black-crowned Night Heron	Nycticorax nycticorax	Shrub/Tree	
Brown Pelican	Pelecanus occidentalis	Shrub/Tree	Delisted due to Recovery (USFWS); Endangered (TPWD)
Caspian Tern	Hydroprogne caspia	Ground	
Cattle Egret	Bubulcus ibis	Shrub/Tree	
Double-crested Cormorant	Phalacrocorax auritus	Ground	
Forster's Tern	Sterna forsteri	Ground	
Fulvous Whistiling-Duck	Dendrocygna bicolor	Ground	
Glossy Ibis	Plegadis falcinellus	Ground	
Great Blue Heron	Ardea herodias	Shrub/Tree	
Great Egret	Ardea alba	Shrub/Tree	
Green Heron	Butorides virescens	Shrub/Tree	
Gull-billed Tern	Gelochelidon nilotica	Ground	
Laughing Gull	Leucophaeus atricilla	Ground	
Least Bittern	Ixobrychus exilis	Ground	
Least Tern	Sternula antillarum	Ground	Endangered (USFWS); Endangered (TPWD)
Little Blue Heron	Egretta caerulea	Shrub/Tree	
Mottled Duck	Anas fulvigula	Ground	
Neotropic Cormorant	Phalacrocorax brasilianus	Shrub/Tree	
Reddish Egret	Egretta rufescens	Ground	Threatened (TPWD)
Reddish Egret-red morph		Ground	
Reddish Egret-white morph		Ground	
Roseate Spoonbill	Platalea ajaja	Shrub/Tree	
Royal Tern	Thalasseus maximus	Ground	
Sandwich Tern	Thalasseus sandvicensis	Ground	
Snowy Egret	Egretta thula	Shrub/Tree	
Sooty Tern	Onychoprion fuscatus	Ground	Threatened (TPWD)
Tricolored Heron	Egretta tricolor	Shrub/Tree	
White Ibis	Eudocimus albus	Shrub/Tree	

White-faced Ibis	*Plegadis chihi*	Shrub/Tree	Threatened (TPWD)
Yellow-crowned Night Heron	*Nyctanassa violacea*	Shrub/Tree	