



Business Plan for Conservation of the Reddish Egret in the United States

Reddish Egret International Working Group

December 18, 2020

Purpose of a Business Plan

The purpose of a business plan is to provide a concise blueprint of the strategies and resources required to achieve the desired conservation outcomes. The strategies discussed in this plan do not represent solely the authors' view of the actions necessary to achieve the identified conservation goals, but instead reflect the majority view of the many federal, state, academic, and organizational experts that consulted during plan development. This plan is not meant to duplicate ongoing efforts but rather to invest in areas where gaps might exist so as to support the efforts of the larger conservation community.

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About REIWG

The Reddish Egret International Working Group was established in 2005, with six members. The group met to discuss the status of Reddish Egret populations in Texas, Mexico, and Florida. Over the past 15 years the REIWG has grown to ~100 members, including biologists from federal and state governmental agencies, NGOs, universities, and joint ventures throughout North, Central and South America and the Caribbean. The working group seeks to develop and implement science-based conservation and management strategies for Reddish Egrets throughout their range. This is accomplished by working together to develop monitoring protocols, set population and habitat management goals, and protect nesting and foraging habitat. Further, we aim to continually increase our knowledge of Reddish Egret ecology. The working group meets annually to discuss ongoing research and conservation efforts for Reddish Egrets, priorities for future research and management, and possibilities for collaboration among members. We strive to increase membership and involvement, with the goal of having members that represent the species' entire range.

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Glossary

ADCNR	Alabama Department of Conservation and Natural Resources
BMP	best management practice
focal area	subunit of a management unit based on state and ecoregion borders
FWC	Florida Fish and Wildlife Conservation Commission
management unit	major section of Reddish Egret global range
NABCI	North American Bird Conservation Initiative
NAWCA	North American Wetlands Conservation Act
NMBCA	Neotropical Migratory Bird Conservation Act
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
NFWF	National Fish and Wildlife Foundation
NGO	non-governmental organization
NWR	national wildlife refuge
priority area	important habitat at the scale of a bay, island complex or NWR, which includes multiple nesting and/or foraging sites
priority site	important habitat at the scale of a single nesting colony or foraging wetland; primarily used for nesting colonies
REIWG	Reddish Egret International Working Group
SLAMM	Sea Level Affecting Marshes Model
TPWD	Texas Parks and Wildlife Department
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

Background

This is the first Business Plan for Conservation of the Reddish Egret (*Egretta rufescens*) in the United States. It builds on conservation planning efforts for the Reddish Egret reaching back to the creation of the [Reddish Egret International Working Group](#) (REIWG) in 2005, and the release of a regional conservation plan for the Reddish Egret in Texas and Louisiana (Vermillion & Wilson 2009). Since then, an international, range wide conservation action plan was published (Wilson et al. 2014) and is currently being revised. The first business plan for the Reddish Egret was recently developed for Mexico (Álvarez et al. 2018). That plan was inspired and partly modeled on the original range wide plan authored by Wilson et al. (2014).

The REIWG has led or facilitated the accomplishment of a variety of objectives outlined in the Reddish Egret Conservation Action Plan (Wilson et al. 2014). The REIWG divided the global population of Reddish Egrets into management units and, since 2014, has recruited members from specific geographic regions (e.g., countries, states) to provide more regional expertise on the threats, opportunities and status of the species. Additionally, as part of the monitoring strategy from Wilson et al. (2014), the REIWG identified focal nesting colonies from across the species' range to serve as the baseline for periodic surveys to estimate population status and trends. Ongoing efforts from the conservation action plan include identification of focal foraging areas, as well as assessment and management of direct threats to the species (e.g., human disturbance and predation). The conservation action plan now under revision will update the status and progress of Reddish Egret conservation efforts within the United States, but is largely aimed at including a more thorough consideration of Reddish Egret populations outside of the United States. The business plan presented here is intended to accelerate the progress of Reddish Egret conservation efforts within the United States by focusing on the regional aspects of Reddish Egret conservation and by clearly delineating a budget and timeline for meeting our goals. While non-breeding Reddish Egrets seasonally occur within the west-southwestern regions of the U.S. (e.g., California, Arizona), this plan is focused primarily on the U.S. breeding populations along the Gulf of Mexico.

Conservation Need

Although rigorous quantitative information on population abundance and trend is lacking, there is concern that Reddish Egret populations may be declining (unpublished data, Texas Colonial Waterbird Society; Selman & Davis 2015; Cox et al. 2019b). Globally, the species is listed as Near Threatened (BirdLife International 2016). Outside of the U.S., the species is listed as Endangered in Mexico and a species of concern in the Bahamas. The Reddish Egret was identified as a high priority species in need of “immediate management” in the Southeast United States Waterbird Conservation Plan (Hunter et al. 2006), and is recognized by the U.S. Fish and Wildlife Service (USFWS) as a Bird of Conservation Concern (USFWS 2008). The species is also included as a Watch List species in the U.S. State of the Birds (NABCI 2014). Four of five U.S. states that border the Gulf of Mexico include Reddish Egret as a species of greatest conservation need in their State Wildlife Action Plans (TPWD 2012; Holcomb et al. 2015; ADCNR 2016) and Florida has listed the Reddish Egret as threatened, providing the species the greatest possible protection under state law (FWC 2019).

The relatively specific physical and hydrologic conditions required for foraging habitat may make foraging habitat availability an important limiting factor for Reddish Egret populations. For example, high nesting success in Texas colonies (Holderby et al. 2012), juxtaposed with low post-breeding survival (Geary et al. 2015), indicate that a lack of quality and/or quantity of foraging habitat during the non-breeding season could affect population dynamics (Bates et al. 2016). However, the current understanding of the extent and distribution of available foraging habitat throughout the range of the Reddish Egret is generally poor. Similarly, many facets of Reddish Egret demography, populations, life history, and habitat needs remain poorly understood, yet are essential for a thorough characterization and assessment of status. Furthermore, the effects of climate change represent a severe and largely irreversible threat to most Reddish Egret nesting and foraging habitat throughout the United States. In sum, the species’ limited distribution, specific habitat needs, and potentially declining population trend, combined with key knowledge gaps, and the imminent threat of climate change, suggest that Reddish Egrets are in need of immediate and substantial conservation efforts.

Reddish Egrets are also representative of other colonial shrub nesting birds as well as a variety of species dependent on wind-driven tidal flats. While this document is focused on conserving Reddish Egret populations and their associated breeding, wintering and foraging habitats, we recognize that conservation initiatives are often multi-species and/or ecosystem focused as an attempt to apply more broad scale actions to conserve a suite of species and/or habitats. We propose that Reddish Egrets be regarded as a sentinel species for the health of tidal flat and coastal island ecosystems. Conservation actions oriented towards Reddish Egrets would likely benefit many other plant and animal species that are also dependent on these threatened habitats. As such, the strategies and objectives for Reddish Egret conservation identified herein can be integrated into the efforts of organizations and partnerships whose interests lie more broadly in the conservation of coastal obligate birds and other species (Appendix A).

Species Distribution

The Reddish Egret is the rarest heron species in the United States. It is a habitat specialist, with a breeding distribution limited to a narrow fringe of coastal habitats along the Gulf of Mexico, and to a lesser extent the south Atlantic coast. Its non-breeding distribution covers much of the same territory, but also expands to the mid-Atlantic coast, as well as the southern coast of California and some parts of Arizona. The Reddish Egret has a small, and stable to declining, global population, of which nearly 40% breeds within the United States (Wilson et al. 2014). Beyond the United States, Reddish Egrets occur along the Pacific, Gulf and Caribbean coasts of Mexico, as well as the Caribbean and Pacific coasts of Central America, Caribbean islands (e.g., Cuba, Great Inagua), and to a lesser extent the Caribbean coast of Colombia and Venezuela. This plan focuses strictly on Reddish Egret populations and habitats along the Gulf and Atlantic coasts of the United States.

Habitat Requirements

The unique habitat requirements of the Reddish Egret are central to its conservation status. Reddish Egrets forage exclusively in shallow coastal flats, ponds and lagoons. Specifically, these habitats include wind-tidal flats and alluvial overwash zones of barrier islands; open banks and ponds inside keys; intertidal flats, salterns, open beaches and reefs; and hypersaline flats and solar salt ponds. Microhabitat requirements are shallow water, generally 5-15 cm deep, and rarely to about 25 cm deep (Koczur et al. 2019). Reddish Egrets appear to largely prey upon small, non-commercial fish; primarily sheepshead minnow (*Cyprinodon variegatus*) in Texas and Florida, and other species of pupfish (*Cyprinodon sp.*) and goby (*Quietula sp.*) outside of the U.S. (Holderby et al. 2014). Reddish Egrets typically select nesting sites relatively free from human disturbance and mammalian predators. The species typically nests in shrubs but will use a variety of substrates in coastal habitats across the range (Koczur et al. 2018a). Breeding habitat in Florida includes offshore natural mangrove (*Avicennia germinans*, *Laguncularia racemosa*, *Rhizophora mangle*) islands and shrubby dredged material islands in impoundments or bays. Breeding habitat in southern Texas generally consists of low lying barrier or dredged material islands where the vegetation can be short shrubs or prickly pear cactus (*Opuntia spp.*), although several large colonies are in taller Tamaulipan thorn scrub along the coast (Holderby et al. 2012, Koczur et al. 2018b).

Threats

The primary threats to Reddish Egrets have shifted over time. According to early naturalists' accounts, Reddish Egrets were a common and resident species along the Gulf coast of the United States from Florida to Texas (Koczur et al. 2018a), but their populations were decimated by the actions of plume hunters in the late 19th and early 20th centuries. Since the cessation of plume hunting, the primary threat faced by Reddish Egrets has been habitat loss and degradation, caused by a combination of human activities. It is estimated that U.S. Atlantic and Gulf of Mexico coastal watersheds lost ~65,000 acres of saltwater wetlands between 1998 and 2004 (Stedman & Dahl 2008) because of subsidence, sea level rise, land conversion, and shipping channel and waterway dredging. Greater than half of U.S. residents live in coastal communities (Crossett et al. 2004), and the infrastructure required to support them is proximate to Reddish Egret habitat throughout its range. In the near future, changes to foraging and nesting habitat caused by climate change are likely to be the predominant threat to Reddish Egrets (Powell et al. 2017). Direct threats to the persistence of Reddish Egrets are summarized below. For more detailed descriptions of the threats Reddish Egrets face, please refer to the international conservation action plan (Wilson et al. 2014).

Climate Change Related Threats: Globally, sea levels are predicted to rise between 0.3 and 2.5 m by 2100, and likely more so throughout the U.S. range of Reddish Egrets (Sweet et al. 2017). Even under less severe scenarios, sea level rise will inundate most currently available nesting and foraging habitat, altering it beyond use (Powell et al. 2017).

Coastal Development: Most colonies within the U.S. are in locations not suitable for development or are already protected. However, coastal development also threatens foraging habitat by filling or channeling shallow waters to increase surface area for building or to improve access to developed areas. Furthermore, coastal residential and commercial development is a contributing factor to a number of other threats.

Coastal Engineering: Coastal engineering includes ecosystem manipulation such as shoreline armoring, water flow management (e.g., channelization, dams), and dredging and placement of dredged material from ship channels. Hydrologic changes from these activities (e.g., increase in water depth, damage to tidal flats) and secondary impacts such as decreased water quality may render foraging habitat suboptimal to unsuitable. These activities can degrade nesting habitat, as well, by creating land bridges or larger islands that are less manageable. However, with proper guidance coastal engineering can create or restore nesting and foraging habitat.

Coastal Energy Development: Coastal energy development includes the legacy from oil and gas exploration and production (as well as any new development), wind development (including facilities and transmission lines), increased barge traffic, seismic activity, abandoned infrastructure, canal dredging, and increased saltwater intrusion, releases from vessels, and other accidental spills.

Elevated Predation Rates: Human activities have artificially boosted the abundance of mesopredators (e.g., raccoons, crows) by providing attractive food sources and suppressing top-level predators. Non-native predators (e.g., fire ants, pythons, iguanas) also create novel pressures on Reddish Egret populations.

Human Disturbance from Recreational & Commercial Activities: The coastal areas used by Reddish Egrets, even those in protected areas, are often frequented by humans fishing, crabbing, boating, birdwatching, bird monitoring, or otherwise recreating (e.g., nature photography).

Marine Transportation: Wakes created by marine vessels can cause erosion of islands and shorelines, especially near shipping channels.

Impaired Water Quality: Water quality can be degraded by industrial pollutants, solid waste, agrochemicals, and sedimentation caused by changes in land use. While the effects of industrial and agricultural pollutants on Reddish Egrets are not well understood (Spalding et al. 1997), the potential risk is high. Water quality indirectly impacts Reddish Egrets by degrading foraging habitat, and can contribute to red tide events, which have killed Reddish Egrets in Florida.

Invasive Species Impacts on Habitat: Exotic grasses such as guineagrass (*Urochloa maxima*) and buffelgrass (*Pennisetum ciliare*) have degraded the quality of nesting habitat at some sites in Texas. The invasive moth, *Cactoblastis cactorum*, threatens populations of *Opuntia* cacti that appear to be selected preferentially by some Reddish Egrets as a guard against predation. Introduced fish may have negative impacts on foraging habitat by reducing the fish populations that Reddish Egrets depend on (Harrison et al. 2013).

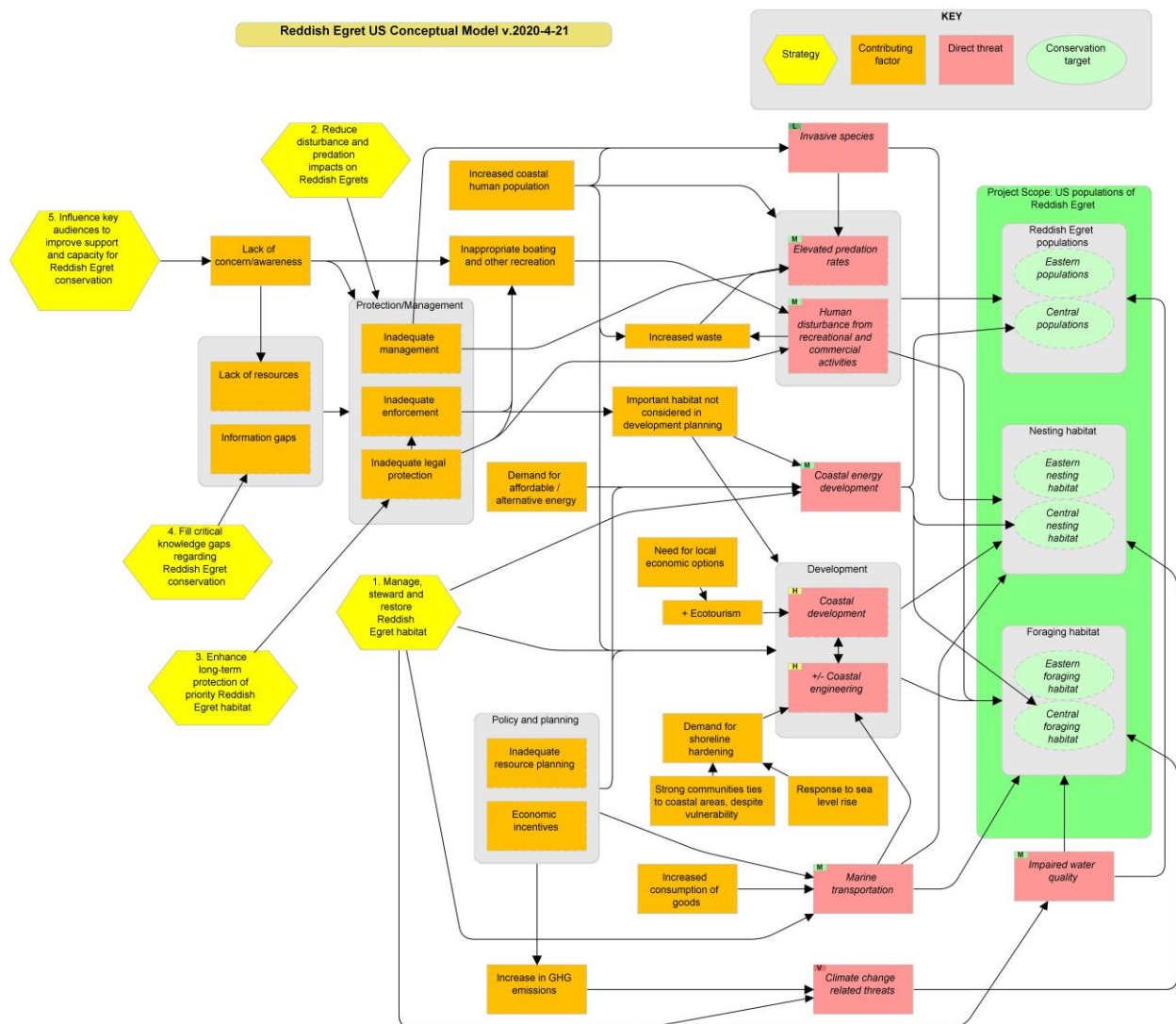


Figure 1. Conceptual model of Reddish Egret populations and habitats, illustrating the threats they face, their contributing factors, and where the strategies of this plan can intervene.

Current Conservation Context

The Reddish Egret International Working Group consists of many organizations, agencies, entities and individuals that are engaged in Reddish Egret conservation. In the United States, Reddish Egrets are protected under the Migratory Bird Treaty Act and as such, a responsibility of the USFWS. Within the states along the Gulf of Mexico, Reddish Egrets are included in state wildlife action plans and receive priority for state funding (primarily in Florida, Louisiana). Across the states, conservation planning (e.g., Vermillion & Wilson 2009) and North American Wetlands Conservation Act (NAWCA) funding have been coordinated by Joint Ventures (e.g., Gulf Coast Joint Venture, Rio Grande Joint Venture). Within each state, habitat conservation and education-outreach has been done through the state wildlife offices, as well as work with various NGOs including Florida Audubon, Texas Audubon, Coastal Bend Bays and Estuaries Program (CBBEP), and American Bird Conservancy. The sustainability of the REIWG itself is critical for implementation of this business plan as the working group relies on volunteerism to chair the working group and working group committees. As such, progress forward can vary due to competing demands of the working group chair and steering committee.

Across the Gulf Coast, the National Fish and Wildlife Foundation (NFWF) has been instrumental in the funding of projects on species and habitat conservation. NFWF has already funded Reddish Egret research in the past, focusing on the movement and spatial ecology of Reddish Egrets in Texas (Geary et al. 2015, Koczur et al. 2018b), as well as funding this current working group initiative to develop and draft the range-wide conservation plan (Green et al. 2020) and this Business Plan for the U.S. Gulf Coast. In 2013, as a result of a U.S. District Court decision stemming from the Deepwater Horizon Oil Spill, over \$2.5 billion was directed towards NFWF to fund projects benefitting natural resources of the Gulf Coast affected by the spill. Additionally, the Deepwater Horizon oil spill Natural Resource Damage Assessment (NRDA) Trustees have awarded numerous grants to various states to restore and/or protect nesting habitat which includes Reddish Egrets. In response to the Deepwater Horizon oil spill, the Gulf of Mexico Avian Monitoring Network was formed, and Reddish Egret is listed as a priority species (Wilson et al. 2019). Potential funders can play a critical role in the future of Reddish Egret conservation through the implementation of this Plan's action items via coordinated cross-state conservation strategies. This includes funding key information gaps and protecting or restoring habitat at the most important sites that lack funding from other sources.

Conservation Outcomes

The goal of this program is to increase the total number of Reddish Egret breeding pairs within the United States by 10% by the end of 2030. A modest increase in the size of the breeding population of Reddish Egrets would represent a considerable achievement, given the currently stable to declining population trend, and the myriad threats the species faces, including the grave and increasing risk posed by climate change. Furthermore, even a small population increase presents a challenge, given the long lifespans and small clutch sizes of the species (Koczur et al. 2019). However, (re)colonization of breeding sites along the Florida panhandle, Atlantic coast, or elsewhere could facilitate achieving our goal. Moreover, while it is beyond our capacity to reduce the impacts of climate change at the source (e.g., reducing the global release of carbon), we can mitigate many of the effects of climate change (e.g., land loss due to sea level rise), as well as focus attention on other threats that constrain population growth. In this manner, we expect the outcomes of each conservation strategy (Table 1) to cumulatively achieve the program goal by increasing the species' resiliency and redundancy and maximizing the species' distribution across the range.

Due to incongruent efforts to survey Reddish Egret populations across the United States, our current estimates of breeding pairs (Table 2) may be inadequate for assessing progress towards our goal. If current breeding pair estimates were used as the baseline, it is possible that our goal could be inadvertently achieved by an increase in monitoring effort leading to higher estimates due to accounting for unknown or under sampled sites. Thus, a critical step of this plan is the implementation of a thorough range wide survey that sets a reliable baseline for measuring a 10% increase in breeding pairs.

Similarly, incomplete and outdated data on nesting habitat and greater uncertainties about foraging habitat impede our capacity to identify priority nesting and foraging habitat, which is central to implementing the strategies within this plan and achieving our goal. Despite these barriers, we developed a preliminary list of priority sites and areas (Appendix B). A site refers to a specific nesting colony or patch of foraging habitat (e.g., tidal flats or other wetlands). An area refers to a bay, island complex or other geographic feature that includes multiple sites. We designated priority sites and areas based on high concentrations of Reddish Egrets, the existence of moderate to severe threats, historic use, and restoration potential. We also stratified sites geographically. For example, Reddish Egrets nest in much smaller congregations in Louisiana and Florida than in Texas, so the threshold for a high concentration of Reddish Egrets is lower for those states than in Texas. These prioritizations were made based on expert opinion, but this list should be refined in the future once higher quality data exists and a more rigorous set of criteria can be established and applied systematically across the U.S. range.

Table 1. Goals for each strategy are intended to cumulatively achieve the program goal of increasing the number of breeding pairs by 10% by 2030.

Strategy	Program Outcome	Metric	Program Goal (2030)
Manage, steward and restore Reddish Egret habitat	Increased quantity and quality of Reddish Egret foraging and nesting habitat facilitates population increase	# of priority sites with improved habitat quality	15 sites
Reduce disturbance and predation impacts on Reddish Egrets	Increased Reddish Egret productivity at priority sites facilitates population increase	# of priority sites with improved management and/or signage	30 sites
Enhance long-term protection of priority Reddish Egret habitat	Enough habitat is protected to ensure long-term stability of Reddish Egret populations	# of new sites under long-term protection	5 sites
Fill critical knowledge gaps regarding Reddish Egret conservation	Knowledge gaps no longer substantially limit Reddish Egret conservation efforts	# of priority information needs addressed	5 information needs
Influence key audiences to improve support and capacity for Reddish Egret conservation	Public and stakeholder support facilitates success of other strategies	# of priority areas with outreach programs	10 priority areas

Geographic Focus

At the range wide level, conservation planning for the Reddish Egret is compartmentalized into three management units based on a combination of regionally specific threats and opportunities, and to a lesser extent genetic separation (Wilson et al. 2014). This plan adopts the Central and Eastern Management Units, which are well represented by Reddish Egret populations centered in Texas and Florida, but excludes the Western Management Unit because it is located entirely outside the United States. However, to facilitate the successful implementation of this plan, we also break those management units down to the state level because the funds, personnel and institutions involved in conservation delivery are often delineated by state boundaries. Focal areas are based on organizational units utilized by major actors within each region, and generally align with level IV ecoregions (Table 2).

Table 2. Management units, states, and focal areas, including most recent estimates of breeding pairs for each state.

Management Unit	State	Focal Areas	Population Estimate	References
Central	Alabama/Mississippi	Coastal Mississippi-Alabama	5-10 pairs	Green 2006
	Louisiana	Chenier Plain, Mississippi River Coastal Wetlands	65-80 pairs	Collins 2017, unpublished data; Remsen et al. 2019
	Texas	Chenier Plain, Laguna Madre, Texas Mid-coast	1320 pairs	2020 Texas Colonial Waterbird Survey, unpublished data
Eastern	Florida	Atlantic Coast, Florida Keys and Florida Bay, Gulf Coast	480 pairs	Cox et al. 2019b
	Georgia/South Carolina	Coastal Georgia-South Carolina	<5 pairs	Green 2006

In the United States, the majority of Reddish Egrets within the Central Management Unit nest in Texas (Figure 2). Within Texas, the bulk of the population nests along the middle (Texas Mid-coast) and lower (Laguna Madre) coast. This species has been documented using more than 100 coastal nesting sites in Texas, but the majority of the population nests in a few large colonies. Seven colonies represent 50-80% of the state's annual breeding population (unpublished data, Texas Colonial Waterbird Society). The largest documented colony of Reddish Egrets is Green Island in the lower Laguna Madre which historically supported over 1,000 pairs, with recent estimates numbering <600 pairs. Louisiana hosts approximately 4% of the U.S. breeding population. This population is distributed across numerous small nearshore islands in the southeastern Deltaic Plain region of Louisiana, as well as a recently described population in the southwestern Chenier Plain region of the state that breeds on a natural marsh island (Selman and Davis 2015, Collins et al. in review). Since the 1980's, at least 43 sites have supported nesting birds at some time, but 13 of those sites have disappeared due to coastal land loss factors. Alabama currently has nesting birds at

one site. There are no known nesting records from Mississippi, but non-breeding individuals are considered regular, though uncommon there (Turcotte & Watts 1999). During the winter, some of the Texas and Louisiana populations migrate to Mexico (Hill et al. 2012; Wilson et al. 2014; Koczur et al 2018b). However, most of the Louisiana population appears non-migratory, while some birds have been tracked to wintering sites in Texas and Central America (P. Vasseur, unpublished data).

The United States portion of the Eastern Management Unit consists predominately of Florida. Currently, Reddish Egrets nest in Florida along the Gulf coast from Tampa Bay south to Florida Bay and the Keys, where there are scattered colonies of a few pairs on small mangrove-dominated islands. On Florida's east coast, Reddish Egrets nest mainly at Merritt Island National Wildlife Refuge and on a few other islands in the Indian River Lagoon. The remainder of peninsular Florida does not support breeding Reddish Egrets. In winter, some Reddish Egrets fledged in Florida appear to disperse north into the Florida panhandle (National Audubon Society 2018), with increased observations of post-breeding juveniles in Georgia (National Audubon Society 2018). Small numbers of non-breeding Reddish Egrets occur annually north to South Carolina, with the most northern breeding record on the U.S. Atlantic occurring at Cape Romain National Wildlife Refuge in South Carolina in 2004 (Ferguson et al. 2005).

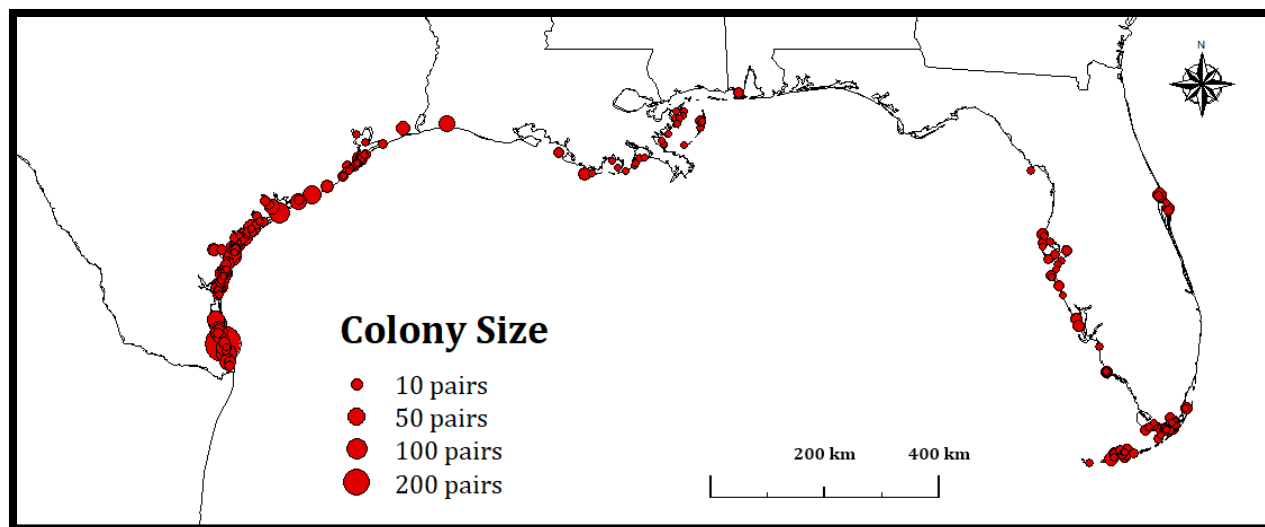


Figure 2. Map of Reddish Egret breeding colonies within the United States as of December 2019.

Implementation Plan

Our implementation plan consists of five strategies that will collectively promote Reddish Egret population growth, leading to an increase in the number of breeding pairs in the United States by at least 10% by the end of 2030.

1. Manage, steward and restore Reddish Egret habitat
2. Reduce disturbance and predation impacts on Reddish Egrets
3. Enhance long-term protection of priority Reddish Egret habitat
4. Fill critical knowledge gaps regarding Reddish Egret conservation
5. Influence key audiences to improve support and capacity for Reddish Egret conservation

The first three strategies are aimed at addressing direct threats to Reddish Egret habitat and populations (or their contributing factors). The first strategy addresses some of the greatest threats to Reddish Egrets: climate change, coastal development, and coastal engineering. While no strategy in this plan directly addresses the drivers of climate change (e.g., fossil fuel emissions), elements of this strategy can mitigate some of its effects (e.g., dredged material deposition counteracting the effects of rising sea levels). The second strategy is aimed at threats directly affecting Reddish Egret populations (e.g., human disturbance and elevated predation rates). These threats are rated lower than the previous threats, but are less costly to manage and produce measurable benefits, in terms of reproductive success, that can assist the species in overcoming more intractable threats. The third strategy addresses habitat-related threats (e.g., by preventing development), and population-related threats (e.g., by increasing the area in which management of predation and human disturbance can be implemented). The last two strategies are aimed at building the conservation community's capacity to implement the strategies that more directly benefit Reddish Egrets. One accomplishes this via research, while the other employs outreach and education. While these latter two strategies may not directly influence Reddish Egret populations, they are critical to ensuring that the other strategies can be executed successfully (see Table 4 for further details).

Each strategy consists of activities that target steps in a results chain (Figures 3 through 7) that are essential to achieving the goal of that strategy. Most, but not all, activities include a specific objective that will be used to monitor progress towards achieving the goals of this plan (Table 5). Some activities must be completed before other activities, while other activities are relatively temporally independent and can be conducted at any time. Table 3 illustrates the timeline by which we envision the activities of this plan being carried out. We also include an expanded version of this figure in Appendix C that is meant as a reference for members of the REIWG. Due to the novel coronavirus pandemic, activities slated for the first two years of this plan have already been impacted and are likely to be further delayed. Moreover, lack of funds to support a coordinator of the REIWG could delay anticipated progress across the implementation plan.

Table 3. This timeline represents which activities should be implemented within the first five years of the plan (initial) and the second five years of the plan (successive). Lighter shades indicate the need for preliminary or follow-up work. Bold activities indicate high priority activities. For a year-by-year breakdown of anticipated implementation see Appendix C.

	Initial	Successive
Strategy 1. Manage, steward, and restore Reddish Egret habitat		
<i>Substrategy 1a: Minimize impacts of new development in priority areas</i>		
Improve communication with permitting agencies to mitigate development impacts in or near priority habitat		
<i>Substrategy 1b: Minimize impacts of marine transportation in priority areas</i>		
Assess priority areas for erosion control needs		
Implement erosion control at selected sites		
Monitoring conducted to facilitate adaptive management		
<i>Substrategy 1c: Increase beneficial use / reduce negative impacts of coastal engineering (placement of dredged material)</i>		
Increase capacity of conservation organizations and agencies to establish stronger relationships with USACE		
Identify high-level officials to improve communications with USACE		
Assess priority areas for dredged material deposition needs		
Implement dredged material deposition at selected sites		
Monitoring conducted to facilitate adaptive management		
<i>Substrategy 1d: Restore habitat</i>		
Assess priority areas for vegetation management needs		
Implement vegetation management at selected sites		
Assess potential for hydrologic restoration of foraging and nesting sites		
Implement hydrologic restoration at one experimental site		
Monitoring conducted to facilitate adaptive management		
Identify and share best management practices for restoration		
Strategy 2. Reduce disturbance and predation impacts on Reddish Egrets		
<i>Substrategy 2a: Reduce human disturbance impacts on Reddish Egrets</i>		
Survey managers to determine when and where human disturbance is most significant		
Improve interaction with law enforcement by focusing on high-level officials		
Conduct 'inreach' to state employees to increase enforcement		
Increase/establish signage		
Put messages on Hummingbird and other GPS devices		
<i>Substrategy 2b: Reduce predation impacts on Reddish Egrets</i>		
Investigate cooperation with USDA Wildlife Services		
Increase surveillance (trail cams, tracks) and proactively assess priority colonies for risk of predation		
Implement predation management to restore historic or open new nesting sites		
Develop predation management guidelines		
REIWG encourages National Park Service to allow predation management		

	Initial	Successive
Strategy 3. Enhance long-term protection of priority Reddish Egret habitat		
3.1 Assess protected status / ownership of priority sites and areas		
3.2 Use relevant mechanisms to add priority habitat to the conservation estate for Reddish Egrets		
Strategy 4. Fill critical knowledge gaps regarding Reddish Egret conservation		
4.1 Standardize protocols for monitoring breeding colonies		
4.2 Standardize protocols for monitoring wintering sites		
4.3 Standardize protocol for banding and DNA sampling		
4.4 Complete initial list of breeding colonies		
4.5 Map known foraging areas		
4.6 Conduct standardized baseline survey		
4.7 Develop database of breeding colonies and foraging areas		
4.8 Fund or conduct studies to fill key knowledge gaps		
4.9 Investigate opportunities for climate-resilient design of habitat		
Strategy 5. Influence key audiences to improve support and capacity for Reddish Egret conservation		
<i>Substrategy 5a: Influence donors and conservation professionals to improve support and capacity for Reddish Egret conservation</i>		
Document benefits of Reddish Egret habitat to humans and other species		
Identify priority donors and conservation professionals		
Secure funding to sustain REIWG capacity to guide conservation efforts		
Organize inspirational meetings (and excursions) for conservation professionals		
<i>Substrategy 5b: Influence community members and general public to improve support and capacity for Reddish Egret conservation</i>		
Identify complementary educational efforts and advocate inclusion of messages about Reddish Egrets (e.g., Whooping Cranes)		
Develop general outreach materials (disturbance video, infographic, pamphlet, webcam, story maps, social media)		
Make a short presentation available for use in schools and with decision-makers		
Work with Scouts / Master Naturalists / other groups to produce messages		
Develop outreach materials about predators (possibly with animal control offices)		
<i>Substrategy 5c: Influence boaters, fishers and other recreational users to improve support and capacity for Reddish Egret conservation</i>		
Identify barriers to reducing disturbance		
Include colonial waterbird messages in boater and fishing education / licensing programs		
Give talks, materials to fishing cooperatives / groups		
Work with boat owners and give them information to provide to renters		
Develop outreach materials for birdwatching and youth groups, birding festivals, etc.		
Promote Audubon's colony watch ('adopt' a colony)		
Educate fishing/photo guides, fishermen, etc. about resighting/monitoring efforts		

Strategy 1: Manage, steward and restore Reddish Egret habitat

This strategy focuses on addressing threats to Reddish Egret nesting and foraging habitat, such as climate change, coastal development, coastal engineering, coastal energy development, marine transportation, and invasive species. It is separated into four substrategies: 1a) minimize impacts of new development in priority areas, 1b) minimize impacts of marine transportation in priority areas, 1c) increase beneficial use / reduce negative impacts of coastal engineering (placement of dredged material), and 1d) restore habitat (Figure 3). In many cases, it is beyond the REIWG's capacity to address the drivers of these threats or prevent their impacts. Instead, this strategy focuses on reducing impacts where drivers cannot be addressed, mitigating for negative impacts when they cannot be avoided, and restoring habitat after damage has been done.

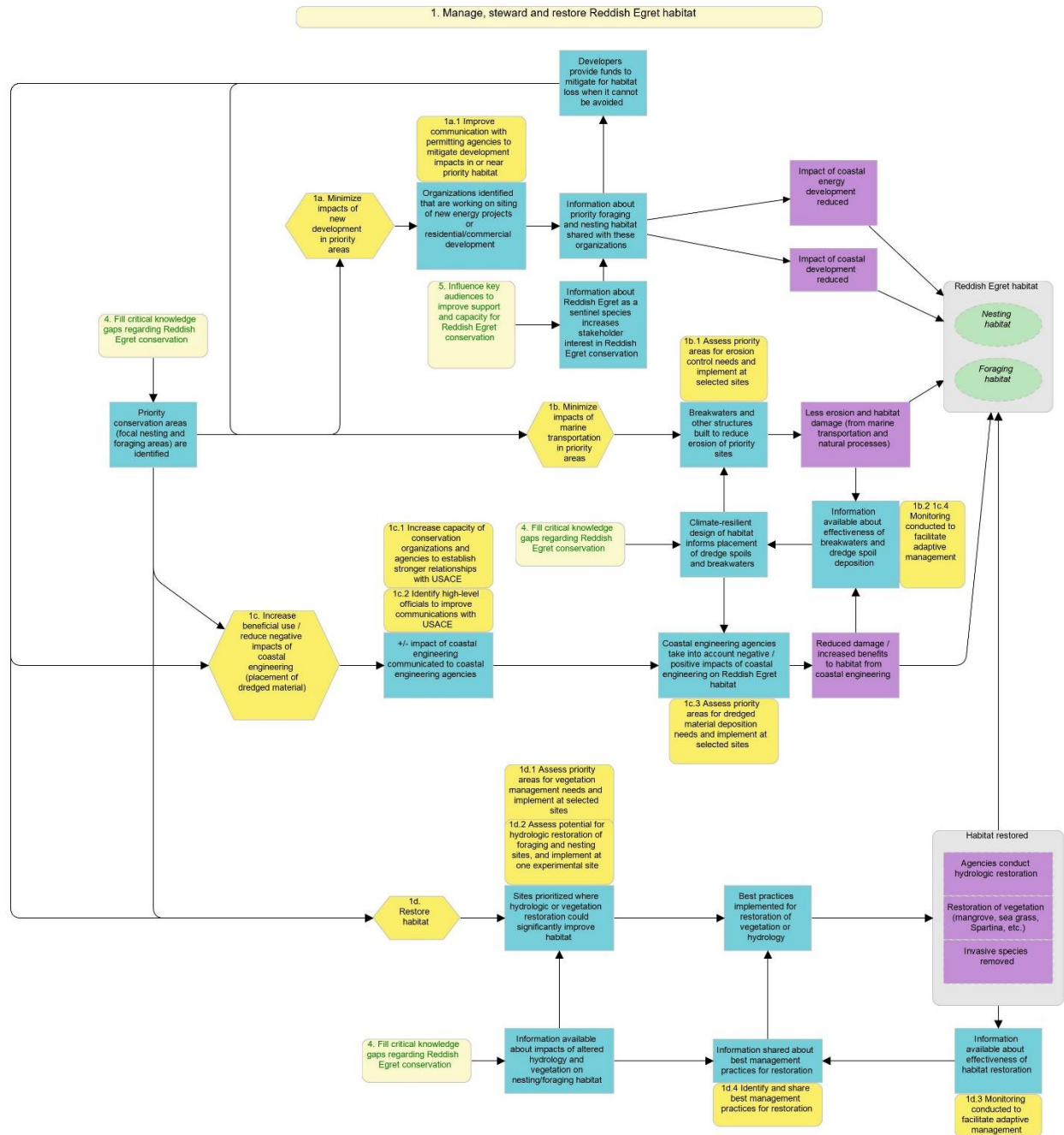


Figure 3. Results chain illustrating the necessary steps to effectively manage, steward and restore Reddish Egret habitat.

Strategy 1a: Minimize impacts of new development in priority areas

Continuing development in coastal areas seems inevitable, so this substrategy seeks to minimize and mitigate impacts from residential, tourism and energy development near or in priority Reddish Egret habitats. This relies on the authorities, conservation groups and land managers that control or influence siting and construction being provided with appropriate technical information. Access to information on nesting sites and suitable foraging habitats will allow for more informed permitting of land use changes.

1a.1 Improve communication with permitting agencies to mitigate development impacts in or near priority habitat

Conservation agencies and organizations already work to guide decision-making processes on siting of various types of development in or near priority Reddish Egret habitat. However, the efficacy of these efforts could be improved. In particular, it is important to identify core foraging areas (i.e., foraging habitat within 15 miles of nesting sites) to improve coastal zoning or permitting. Audiences for this information include both agencies for public works as well as private parties (e.g., a landholder pursuing shoreline armoring). Key agencies include U.S. Army Corps of Engineers (USACE), USFWS, Ecological Services Program, and state natural resource permitting agencies. Furthermore, efforts could be focused on identifying an avenue or mechanism to accrue mitigation funds through a third party (e.g., a mitigation bank) when development cannot be prevented in or near priority Reddish Egret habitat and making recommendations for how to use these funds. This could provide critical funds for mitigating the damage done by development by enabling habitat restoration, management or protection in other priority areas. These mitigation funds could be used to benefit other species, as well, adding weight to the proposed sentinel species status of Reddish Egrets.

Strategy 1b: Minimize impacts of marine transportation in priority areas

Marine transportation from large commercial tankers to small fishing skiffs will always be a reality for coastal areas used by Reddish Egret. This substrategy seeks to minimize negative effects (e.g., erosion, foraging habitat damage) from marine transportation.

1b.1 Assess priority areas for erosion control needs and implement at selected sites

Priority areas should be assessed across the U.S. range to identify nesting and foraging sites most in need of protection from erosion. Sites should then be selected for deployment of breakwaters and other erosion control measures based on most immediate need over the next 10 years. Some preliminary work along these lines has already been conducted along the Texas coast (CBBEP 2018). *Objective: By 2025, at least 15 priority areas are assessed for erosion control needs. Objective: By 2030, six sites needing erosion control measures have erosion control measures.*

1b.2 Monitoring conducted to facilitate adaptive management

Breakwaters have been established throughout the southeastern U.S. to protect the habitat of Reddish Egrets and other species from erosion, and continue to be built. These efforts should be monitored to improve efficacy and reduce costs of future breakwaters, as they are among the most expensive tools in the Reddish Egret conservation toolkit.

Strategy 1c: Increase beneficial use / reduce negative impacts of coastal engineering (placement of dredged material)

Coastal engineering projects can have adverse or positive effects for Reddish Egret habitat. This substrategy seeks to minimize habitat damage from projects, and increase beneficial use (i.e., habitat creation and maintenance, reduction of erosion). Although the beneficial use of dredged material for habitat creation and maintenance is recognized, the location of dredged material deposition is often influenced by funding and competing interests (e.g., marsh restoration vs. island creation), as well as limitations on how far the USACE can transport dredged material (Golder et al. 2008).

1c.1 Increase capacity of conservation organizations and agencies to establish stronger relationships with USACE

Additional funds could allow conservation organizations and agencies to increase their capacity to build stronger relationships with the USACE by hiring additional employees. While these employees would work on a variety of other issues, they could specifically dedicate a portion of their time to coordinating this effort.

1c.2 Identify high-level officials to improve communications with USACE

Past efforts to coordinate coastal engineering to the benefit of Reddish Egrets and other species have been impeded by inconsistency in communication and follow-through. Opportunities to improve Reddish Egret habitat have been missed, despite seemingly win-win scenarios where dredged material deposition in priority Reddish Egret sites should be less expensive than where dredged material was actually deposited (i.e., at greater distances). Identification of relevant high-level officials within the USACE should facilitate clearer lines of communication and more consistent follow-through on proposed plans of action. *Objective: By 2024, a relationship has been forged with high level officials within the USACE to facilitate coordination of dredged material deposition.*

1c.3 Assess priority areas for dredged material deposition needs and implement at selected sites

Priority areas should be assessed across the U.S. range to identify nesting and foraging sites most in need of dredged material deposition to maintain or create habitat. Sites should then be selected for deposition of dredged material based on most immediate need over the next 10 years. *Objective: By 2025, at least 15 priority areas are assessed for dredged material deposition needs. Objective: By 2030, seven sites needing dredged material have material deposited.*

1c.4 Monitoring conducted to facilitate adaptive management

To date, beneficial use of dredged material is a largely opportunistic endeavor, due to a variety of factors (e.g., the complexity of inter-agency coordination, lack of communication, potentially high costs, etc.). While monitoring may not produce insights relative to addressing many of these factors, critical information about the application of dredged material could be gleaned to ensure that future efforts make use of this resource in a manner most conducive to creating high quality Reddish Egret habitat.

Strategy 1d: Restore habitat

While the previous substrategies focus on preventing the destruction of habitat or creating new habitat altogether, there are also opportunities to improve the quality of existing nesting and foraging habitat. Invasive plants can degrade the suitability of nesting habitat (e.g., guineagrass in south Texas). Foraging habitat could be degraded by agricultural pollutants, invasive species that compete with Reddish Egrets for prey, or hydrologic changes induced by various factors. Efforts should be focused on better understanding these alterations of habitat quality and how to effectively restore sites degraded by them.

1d.1 Assess priority areas for vegetation management needs and implement at selected sites

Priority areas should be assessed across the U.S. range to identify nesting sites most in need of vegetation management, whether via removal of invasive species or planting of native species. Sites should then be selected for vegetation management based on most immediate need over the next 10 years. *Objective: By 2025, at least 15 priority areas are assessed for vegetation management needs. Objective: By 2030, vegetation management has been implemented at ten nesting sites.*

1d.2 Assess potential for hydrologic restoration of foraging and nesting sites, and implement at one experimental site

Restoration of the Bahia Grande estuary in south Texas provides an example of the type of hydrologic restoration project that could benefit Reddish Egrets. Bahia Grande was cut off from tidal exchange, so three channels were created to restore flow, creating Reddish Egret foraging and nesting habitat. The potential for another hydrologic restoration project should be explored and implemented for at least one site. While this is likely to predominately restore foraging habitat, nesting habitat could also be created if the hydrologic restoration results in new islands for rookeries (as was the case at Bahia Grande). *Objective: By 2027, restoration potential of Reddish Egret habitat through reintroduction of natural flooding regimes is assessed. Objective: By 2030, one hydrologic restoration project is conducted.*

1d.3 Monitoring conducted to facilitate adaptive management

Restoration projects provide ideal opportunities to improve our understanding of nesting and foraging habitat quality, and improve future restoration efforts. To the extent feasible, restoration projects should be designed to enable rigorous analyses of their effects (e.g., by including controls, replicates, etc.).

1d.4 Identify and share best management practices for restoration

The REIWG should synthesize a suite of best management practices to guide restoration of Reddish Egret nesting and foraging habitat. The synthesis of these practices could be derived from insights gained both through direct scientific research and monitoring of restoration projects within an adaptive management framework. *Objective: By 2030, best management practices are shared to the REIWG through publications and/or presentations (e.g., at a management meeting).*

Strategy 2: Reduce disturbance and predation impacts on Reddish Egrets

This strategy directly affects Reddish Egret populations (rather than habitats) by addressing the threats of elevated predation rates and human disturbance. This strategy is split into two substrategies: 2a) reduce human disturbance impacts on Reddish Egrets, and 2b) reduce predation impacts on Reddish Egrets (Figure 4). While human disturbance and elevated predation rates are not the greatest threats Reddish Egrets face, they are threats that the conservation community has greater capacity to manage. These type of management activities are critical components of efforts to conserve Reddish Egrets because they help maximize population growth and minimize the risk of extinction in the long-term.

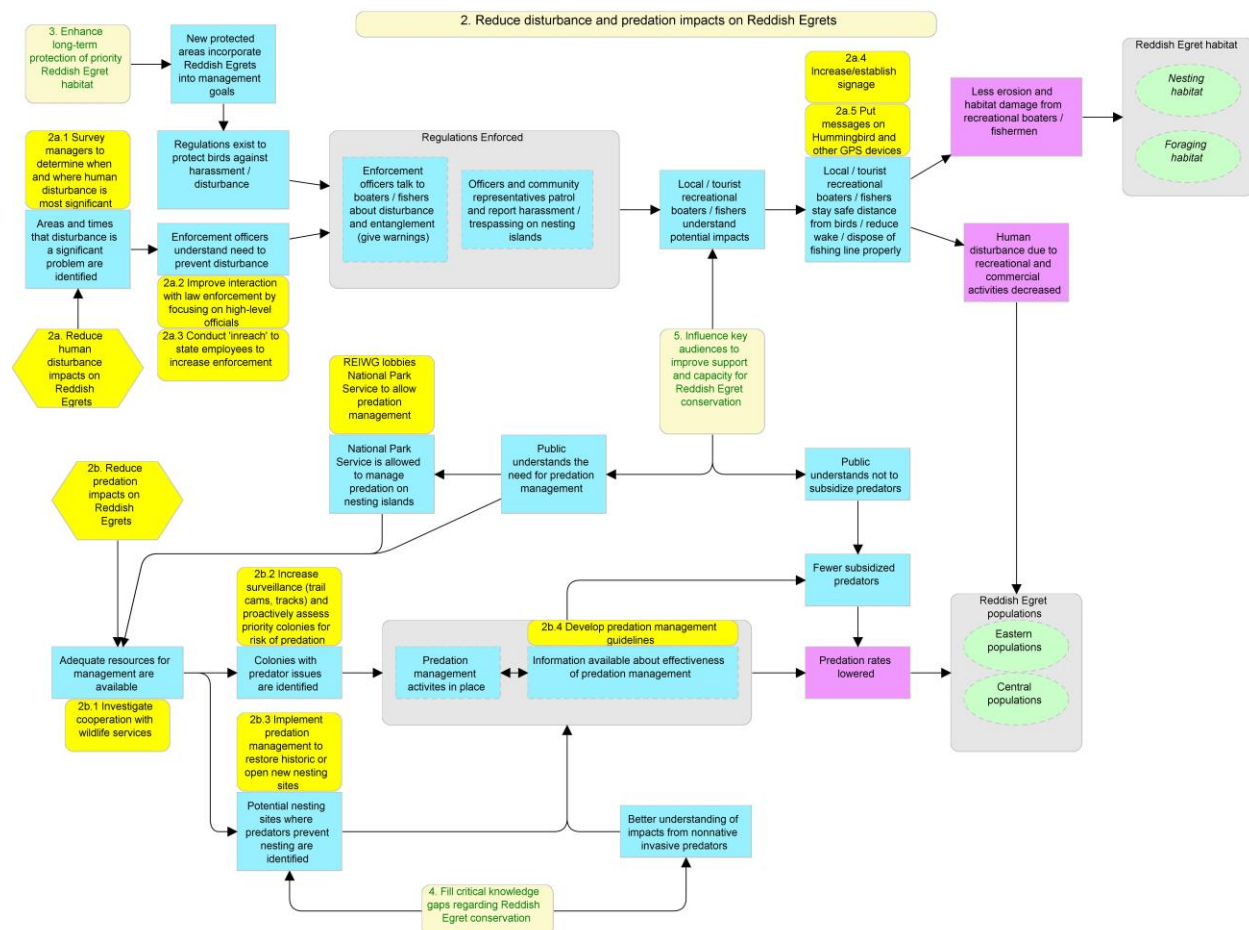


Figure 4. Results chain illustrating the necessary steps to effectively reduce disturbance and predation impacts on Reddish Egrets.

Strategy 2a: Reduce human disturbance impacts on Reddish Egrets

Human activities (e.g., fishing, recreational boating) can disturb Reddish Egret populations, potentially impacting nesting success or causing direct mortality. Disturbance reduction efforts will include actions that directly (e.g., posting signs) and indirectly (e.g., outreach) reduce disturbance.

2a.1 Survey managers to determine when and where human disturbance is most significant

The extent to which human disturbance negatively influences Reddish Egret populations varies substantially by location, season, and day of the week. Identifying 'hotspots' in time and space of potential human disturbance impacts will enable more effective use of limited conservation and law enforcement personnel to prevent significant disturbance. *Objective: By 2022, managers have been surveyed to identify spatial and temporal 'hotspots' of human disturbance.*

2a.2 Improve interaction with law enforcement by focusing on high-level officials

Identifying and interacting with higher level law enforcement personnel should promote consistency and efficacy of efforts to prevent human disturbance of Reddish Egret populations. *Objective: Every 2 years, Federal and State law enforcement is contacted for coordination/reminder of potential disturbance issues.*

2a.3 Conduct 'inreach' to state employees to increase enforcement

Some conservation professionals already engage in efforts to dissuade human disturbance of Reddish Egrets and other species that share their habitat. 'Inreach' to employees of various conservation related state agencies could expand the capacity of the conservation community to manage human disturbance.

2a.4 Increase/establish signage

Signage already exists around some important Reddish Egret nesting sites and foraging areas, but existing signage could be increased, or new signage established, to improve communication with the general public. *Objective: By 2025, all Tier 1 priority sites and 40% of Tier 2 priority sites have signage, with periodic replacement.*

2a.5 Put messages on Hummingbird and other GPS devices

Many recreational boaters and fishers use some sort of navigational system. Working with the manufacturers of this equipment to incorporate messaging to dissuade disturbance of important nesting or foraging habitat could be an effective and innovative avenue for communicating with a large audience. To increase the efficacy of this approach, we will include information on waterbird colonies in general (i.e., not solely Reddish Egrets). *Objective: By 2027, Hummingbird and/or other GPS devices include Reddish Egret and other colonial waterbird information.*

Strategy 2b: Reduce predation impacts on Reddish Egrets

Predation includes native species (e.g., raccoon) and non-native species (e.g., red imported fire ant). Predation management includes lethal and nonlethal removal of predators, as well as a reduction in food subsidies that may attract predators (e.g., trash, offal).

2b.1 Investigate cooperation with USDA Wildlife Services

Wildlife Services (U.S. Department of Agriculture) possesses technical expertise for predation management. Development of interagency cooperative agreements between other federal and state agencies, NGOs, and Wildlife Services should be explored to determine their feasibility and cost. Wildlife Services personnel could assist or lead predation management efforts at nesting sites where needed. Increased funding could help overcome some existing logistical issues.

2b.2 Increase surveillance (trail cams, tracks) and proactively assess priority colonies for risk of predation

Proactively assessing the risk of predation at priority colonies could enable managers to prevent substantial losses before they occur. *Objective: By 2025, 80% of Tier 1 priority nesting sites and 40% of Tier 2 priority nesting sites with predator issues have annual predation monitoring and management.*

2b.3 Implement predation management to restore historic or open new nesting sites

It may be possible to restore historic nesting sites or create new nesting sites by implementing predation management on islands that have predators and are not currently used as nesting sites. Opportunities to create new or restore historic nesting colonies should be investigated and implemented where feasible. *Objective: By 2030, predation management has been implemented at selected sites to create or restore nesting colonies.*

2b.4 Develop predation management guidelines

The REIWG should synthesize lessons learned from past and ongoing predation management efforts to improve the efficacy and acceptability (by the general public and local stakeholders) of future efforts. *Objective: By 2023, predator management guidelines have been established and shared with relevant stakeholders.*

2b.5 REIWG encourages National Park Service to allow predation management

In Texas, the National Park Service owns a number of important nesting sites for Reddish Egrets. Currently, they do not allow predation management at these sites, which poses a threat to their long-term viability as nesting habitat. The REIWG should encourage the National Park Service to allow some limited predation management at these sites. The Coastal Bend Bays and Estuaries Program could be an ideal partner for conducting this management.

Strategy 3: Enhance long-term protection of priority Reddish Egret habitat

This strategy focuses on protecting currently unprotected areas (e.g., nesting colonies, foraging sites). Much of Reddish Egret habitat is already protected. However, the types of protection and degree of enforcement vary substantially. Furthermore, the mapping of important foraging habitat is still a work in progress, thus some key areas may not be protected. This strategy will use the list of priority habitat areas to assess protection status and work with partners and stakeholders to secure protection within a climate resilient framework. Examples of tools to be used here include:

- creation of new natural protected areas and implementing their corresponding management plans,
- conservation easements,
- legal designation of critical aquatic habitat, and
- taking advantage of campaigns focused on unrelated, but complementary causes (e.g., conservation of mangroves to sequester carbon; conservation of tidal areas as Marine Protected Areas; restoration of mangrove and marsh areas to address increased flooding risks).

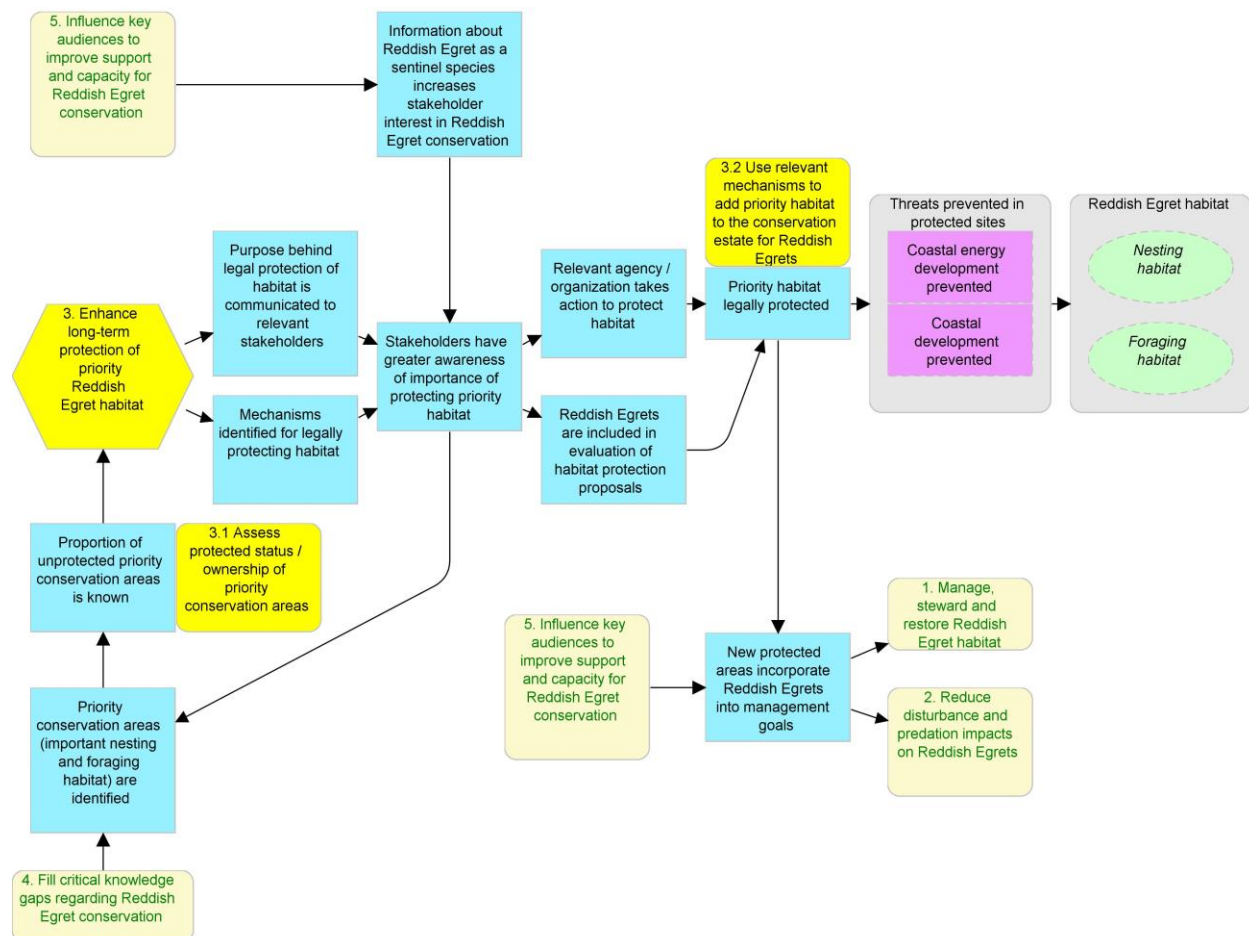


Figure 5. Results chain illustrating the necessary steps to effectively enhance long-term protection of priority Reddish Egret habitat.

3.1 Assess protected status / ownership of priority sites and areas

Increasing the proportion of priority Reddish Egret habitat under long-term protection first requires that priority unprotected habitat is identified. This step should be conducted by the REIWG and will facilitate efforts to increase protection of priority Reddish Egret habitat. *Objective: By 2025, protected status and ownership of priority sites and areas has been assessed.*

3.2 Use relevant mechanisms to add priority habitat to conservation estate for Reddish Egret

Once protected status and ownership of priority habitat is determined, unprotected sites and areas should be targeted for protection and appropriate mechanisms for implementing protection identified. *Objective: By 2030, five unprotected nesting and/or foraging sites have been protected.*

Strategy 4: Fill critical knowledge gaps regarding Reddish Egret conservation

Monitoring and addressing key information gaps is needed to mitigate threats, assess population status and trends, and provide effective long-term stewardship of Reddish Egret habitat. Information needs are described throughout this plan, with an emphasis on those that are key to setting priorities for conservation delivery and guiding other strategies within this plan. In particular, we strongly emphasize the need to set a rigorous baseline estimate of breeding pairs because this is a critical step to assessing progress of the entire plan.

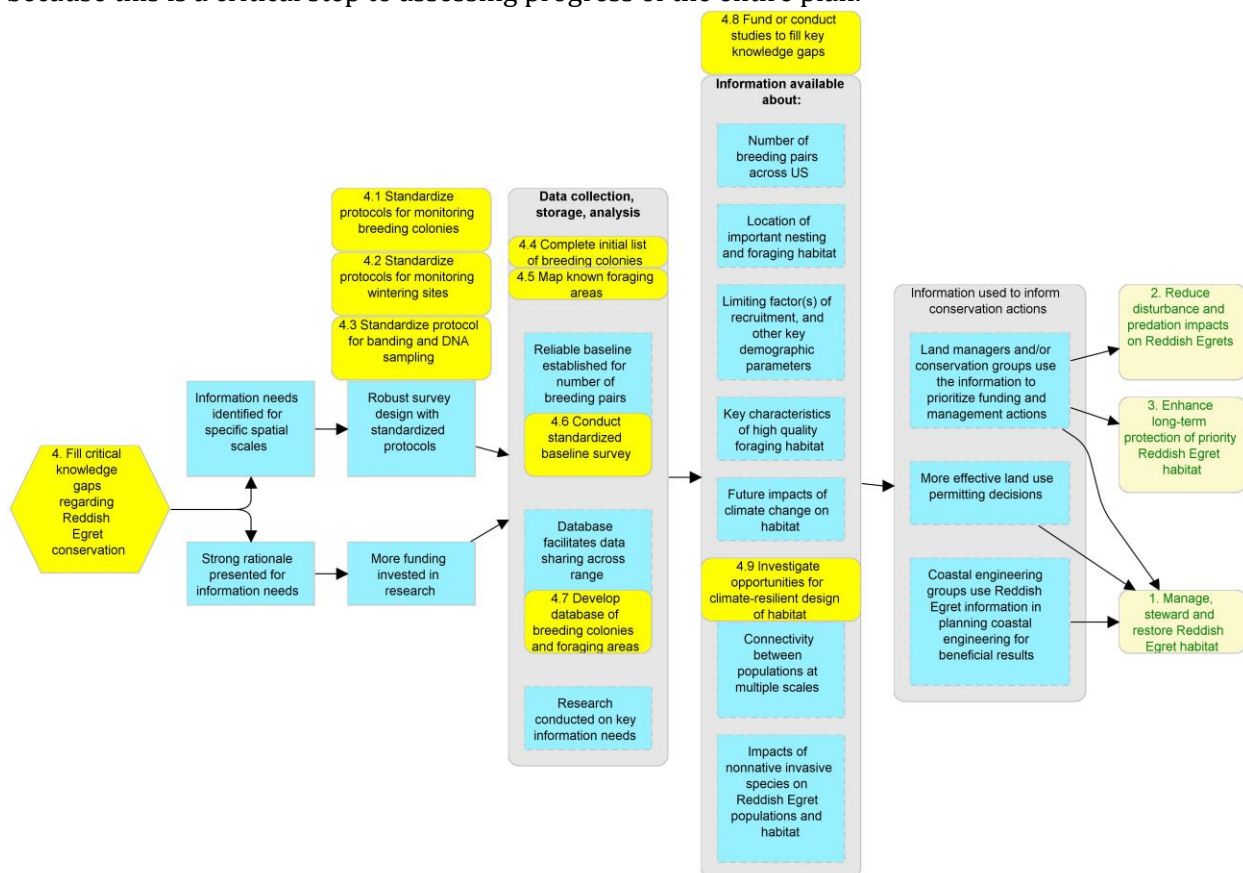


Figure 6. Results chain illustrating the necessary steps to effectively fill critical knowledge gaps regarding Reddish Egret conservation.

4.1 Standardize protocols for monitoring breeding colonies

Standardized protocol(s) for surveying Reddish Egret colonies are necessary to increase precision and minimize bias in our breeding pair estimates to ultimately yield population trends for the species. As an objective from the Wilson et al. (2014) range wide plan, the REIWG formed a committee to discuss and ultimately develop standardized protocol(s) for counting breeding pairs in colonies across the species' range. While a draft standardization of survey protocols was completed in 2019, the REIWG has not finalized the survey protocol(s). *Objective: By December 2021, the REIWG has developed standardized protocols for counting breeding pairs on colonies.*

4.2 Standardize protocols for monitoring wintering sites

Similarly to surveying breeding colonies, a standardized protocol for monitoring non-breeding Reddish Egrets is needed. Very little information is known about Reddish Egrets outside of breeding season and wintering surveys have only been conducted in Mexico as part of a 7-year survey focusing on specific sites (Pronatura Noreste, unpublished data). *Objective: By October 2021, the REIWG has developed standardized protocols for counting Reddish Egrets at wintering sites.*

4.3 Standardize protocol for banding and DNA sampling

The REIWG will continue to encourage the establishment and/or continuation of long-term color banding and subsequent resighting of Reddish Egrets across the range. To be effective and provide robust results, color banding should be done annually at a particular site. The Research and Monitoring Committee has developed a color banding and resighting protocol that establishes color band schemes and identifies priority sites to encourage establishment and sustainment of long-term banding and telemetry studies. *Objective: By January 2021, the REIWG has selected sites for long-term banding and identified collaborators to carry out annual banding and resighting of individuals.*

4.4 Complete initial list of breeding colonies

Since 2014, the working group has created a database and associated map of all known breeding colonies. This database will be maintained and updated through the Research and Monitoring Committee of the working group and housed on the working group website. The database is intended to be a living document that will be periodically updated as new information is obtained on colony locations and breeding pair estimates. Ultimately, the goal is to capture all known locations, retain historical data and maintain latest breeding estimates from across the range. In addition, the Research and Monitoring Committee has developed standardized recommended protocols for monitoring breeding colonies and will have this protocol available in English and Spanish.

4.5 Map known foraging areas

The REIWG is documenting locations where large numbers of Reddish Egrets typically forage and will use this information for potential creation/expansion of protected areas and to minimize and mitigate the impacts of development on important foraging habitat. Using survey data and telemetry studies, the working group has mapped foraging areas in Texas and the Florida Keys, and mapping efforts are under way in Louisiana and the Gulf coast of Florida. Delineation of important foraging areas is needed. The foraging areas database is also intended to be a living document to update as new information becomes available. Recent mapping and analysis of the spatio-temporal

distribution of foraging habitat in the Laguna Madre of Texas (Bates 2011) may provide a basis for expanding an assessment of foraging habitat across the range and identifying potential priority foraging areas within each management unit. *Objective: By 2022, known foraging areas are mapped and available online.*

4.6 Conduct standardized baseline survey

Since Wilson et al. 2014, no standardized range wide monitoring of abundance has been conducted during breeding season or winter periods. While some states conduct multi-species surveys (e.g., Texas Colonial Waterbird Survey), and Florida conducted a Reddish Egret survey (Cox et al. 2019b), a standardized U.S. wide survey needs to be conducted to ensure an accurate baseline estimate of breeding pairs by which to measure progress towards our goal of increasing breeding pairs by 10% by 2030. To date, the piecemeal approach to surveying Reddish Egrets across the U.S. creates the risk that increased survey effort could lead to higher population estimates, artificially achieving the goal of this plan, without actually increasing the number of breeding Reddish Egrets within the U.S. *Objective: Implement standardized, statistically rigorous monitoring protocol (e.g., point count, total count, etc.) that estimates breeding pairs throughout the species' range to the maximum extent possible and at least once every 3 years starting in 2023 at sites believed to support at least 90% of the U.S. population (i.e., 90% of breeding pairs). Conduct a full survey every 6 years starting in 2023 to monitor additional breeding sites or locate new breeding locations to document distribution shifts or range expansions, which may guide future monitoring efforts.*

4.7 Develop database of breeding colonies and foraging areas

This clearinghouse will provide useful and accessible information for a variety of agencies, stakeholders and partners. This information could be used to inform authorities responding to oil spills, decisions on siting of energy development, decision support for funding agencies on habitat protection/restoration, establishment and enforcement of buffer zones, etc. While a standalone database is certainly feasible, the REIWG is exploring options to partner with the USGS Colonial Waterbird Database that has been inactive for over a decade but may be re-initiated in the near future. This database could also tie in to state-specific databases. *Objective: By March 2021, a Reddish Egret database is established, a protocol for data entry is developed, and existing data is entered into the database. Objective: By 2025, the database has been used to revise the preliminary list of priority sites and areas in Appendix B.*

4.8 Fund or conduct studies to fill key knowledge gaps

Beyond a rigorous baseline survey, various other knowledge gaps exist that are key to effectively conserving Reddish Egrets. Foraging habitat availability and quality is likely a limiting factor for Reddish Egret populations, yet the specific characteristics that define high quality foraging habitat are largely unknown. Key demographic parameters are also poorly understood, limiting capacity to assess productivity of specific nesting sites or conduct population viability analyses. Other knowledge gaps include connectivity between populations at multiple scales, impacts of non-native invasive species on Reddish Egret populations and habitat, and those described in specific steps of this strategy. *Objective: By 2025, two of the highest priority information needs that could facilitate Reddish Egret conservation have been addressed. Objective: By 2030, five of the highest priority information needs that could facilitate Reddish Egret conservation have been addressed.*

4.9 Investigate opportunities for climate-resilient design of habitat

Climate change is likely to become the greatest threat to Reddish Egret persistence in the near future. As such, creation (e.g., via dredged material deposition) and restoration of Reddish Egret nesting and foraging habitat should be conducted with future impacts of climate change in mind. Research projects could include efforts to predict future habitat suitability to identify sites that could be protected or managed to provide Reddish Egret habitat as conditions change over time, experimentation with thin-layer sediment placement (Raposa et al. 2020) in foraging areas to counteract sea level rise, and other proactive efforts to meet the challenges posed by climate change. *Objective: Reddish Egret conservation community is thinking about where future habitat may be available (perhaps some rapidly disappearing sites are de-prioritized in favor of others with longer lives according to SLAMM models and other future forecast models) and generates state specific white papers by 2030.*

Strategy 5: Influence key audiences to improve support and capacity for Reddish Egret conservation

This strategy focuses on conducting education and outreach to influence various sectors of the public to build capacity and support for Reddish Egret conservation. It is split into three substrategies: 5a) influence donors and conservation professionals to improve support and capacity for Reddish Egret conservation, 5b) influence community members and general public to improve support and capacity for Reddish Egret conservation, and 5c) influence boaters, fishers and other recreational users to improve support and capacity for Reddish Egret conservation. Each substrategy contributes to the conservation community's capacity to implement the other strategies in this plan (Figure 7). In particular, 5a is important for increasing availability of funding, 5b contributes substantially to efforts to reduce predation, and 5c focuses largely on reducing human disturbance. A key component of this strategy is to secure funding for a dedicated chair of the Reddish Egret International Working Group. The funding provided by NFWF to develop this plan played an important role in driving the progress made by the REIWG over the past few years. The need to ensure consistent leadership of Reddish Egret conservation efforts over the course of this plan makes acquiring funds for such a position critical.

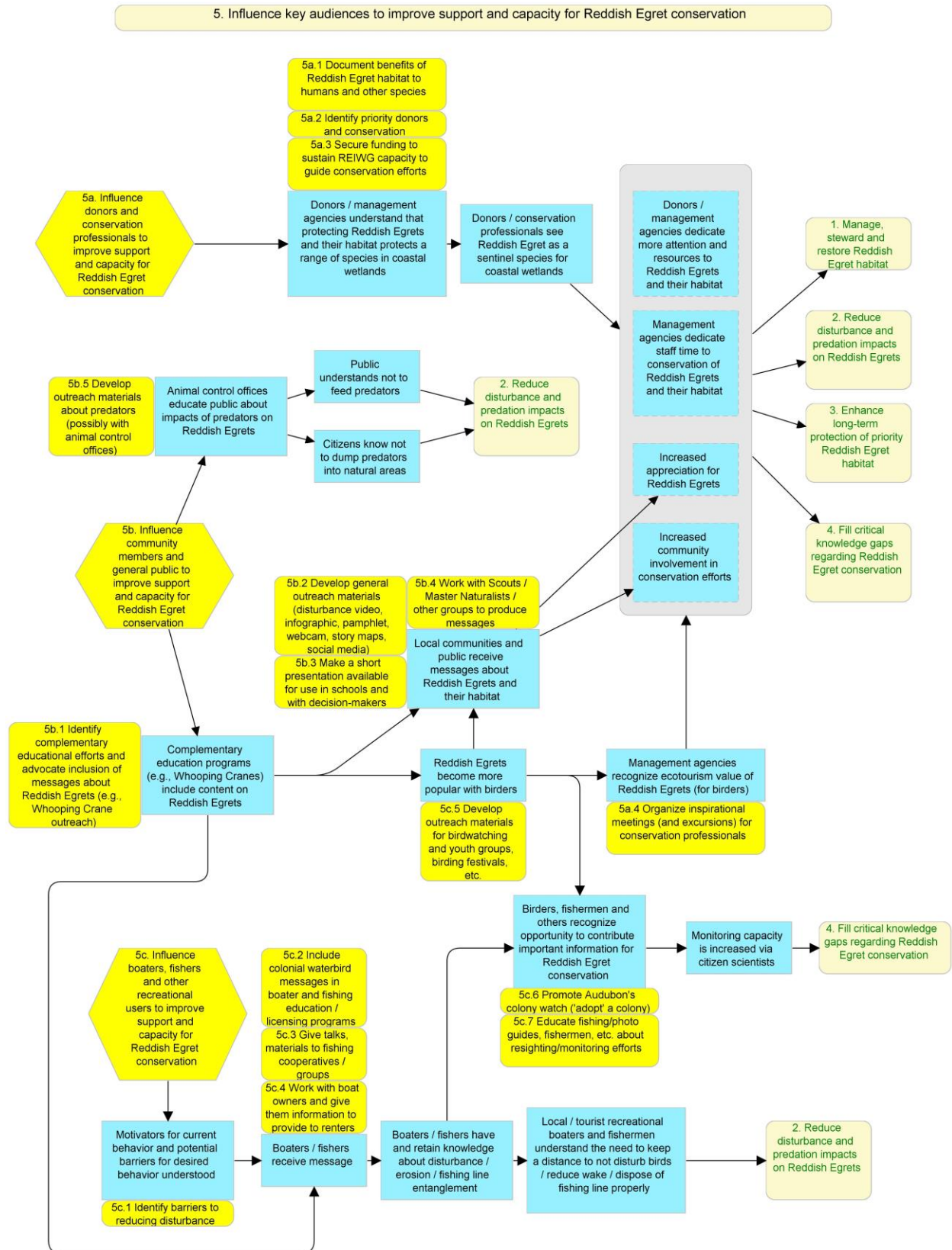


Figure 7. Results chain illustrating the necessary steps to effectively influence key audiences to improve support and capacity for Reddish Egret conservation.

Strategy 5a: Influence donors and conservation professionals to improve support and capacity for Reddish Egret conservation

This substrategy focuses on influencing donors and conservation professionals to increase availability of critical conservation funds, and to increase understanding among conservation professionals about the sentinel species status of Reddish Egrets and how to manage for them and the species that share their habitats.

5a.1 Document benefits of Reddish Egret habitat to humans and other species

The REIWG is working to document benefits provided by Reddish Egret nesting and foraging habitat to a variety of other species, as well as human well-being. The beginnings of this effort are summarized in Appendix A (pg 40). The results of this effort can then be used to produce a graphic illustrating the benefits of Reddish Egret habitat to other species and human well-being. The REIWG will work with graphic design professionals to produce this graphic, which will be made available online and as a handout. *Objective: By 2022, the REIWG has created outreach/inreach materials to promote the recognition of Reddish Egrets as a sentinel species.*

5a.2 Identify priority donors and conservation professionals

The REIWG will identify donors and conservation professionals who should be targeted by outreach efforts. This activity is partly accomplished by the existence of this plan itself, particularly the Conservation Context subsection (pg 6). *Objective: By 2021, the REIWG has identified key stakeholders that were not already included in Reddish Egret conservation efforts.*

5a.3 Secure funding to sustain REIWG capacity to guide conservation efforts

Many partner agencies and organizations focus on a multitude of species, and increasingly are faced with growing demands for their limited time and resources. Acquiring funds to compensate a dedicated chair of the REIWG would ensure continuity of the working group's efforts and follow-through on the objectives of this plan. While funding a full-time position may be cost-prohibitive, part time funding would likely be enough to compensate the amount of work this position would necessitate. Additionally, outreach funding could be generated by creating a 'broader impacts' section on Reddish Egret focused funding opportunities. *Objective: By 2023, funding is secured to improve capacity of REIWG to guide education and outreach efforts (as well as other strategies).*

5a.4 Organize inspirational meetings (and excursions) for conservation professionals

Most conservation managers are aware of waterbird colonies and include them as management targets. However, they may not appreciate the status of Reddish Egrets in particular, or the value or management needs of their foraging habitat. Meetings and excursions with conservation professionals can be used to improve the understanding and appreciation of the role that Reddish Egrets and their habitats play in the broader estuarine ecosystem. Funds could also be used to enable academics and professionals to present research and status updates at professional meetings and conferences.

Strategy 5b: Influence community members and general public to improve support and capacity for Reddish Egret conservation

This substrategy focuses on influencing the general public more broadly. A key component of this substrategy is to work with existing efforts to educate the public about species that share Reddish Egret habitat (e.g., Whooping Cranes).

5b.1 Identify complementary educational efforts and advocate inclusion of messages about Reddish Egrets (e.g., Whooping Crane outreach)

The REIWG should identify educational efforts regarding species that share habitat with Reddish Egrets by which to maximize efficiency of efforts to increase public education about Reddish Egrets. Including messaging about Reddish Egrets in existing education efforts would be easier to accomplish and avoid redundancy of efforts within a personnel-limited field. Broadening education efforts to include Reddish Egrets could also benefit the existing programs' current target species by potentially expanding audiences and demonstrating the links and interdependence between a multitude of species of interest to the public. Whooping Cranes are an ideal species because they are already relatively well-known among the public and there are existing outreach and education programs for that species. *Objective: By 2023, the REIWG has identified complementary educational efforts through which to promote Reddish Egret conservation.*

5b.2 Develop general outreach materials (disturbance video, infographic, pamphlet, webcam, story maps, social media)

The REIWG has identified a suite of outreach materials that could be produced to promote Reddish Egret outreach and education efforts:

- Short video presentation about Reddish Egrets including basic life history, threats facing the species, etc.
- Infographic (poster/graphic summary) about Reddish Egrets (more visual, less words) that explains the threats facing the species
- Pamphlet about Reddish Egret monitoring and how to report resighted color bands
- Short video presentation or infographic that focuses on specific threat (e.g., human disturbance to nesting colonies)
- Information about how Reddish Egret conservation benefits local communities to include protection of tidal flats, ecotourism, etc.
- Information and examples of potential part-time employment and/or volunteer "citizen science" for monitoring Reddish Egrets. This can engage local communities in conservation and stewardship of local resources. For example, in Mexico there is a program for training community observers with plans to standardize bird count data from community observers.

Objective: By 2021, the REIWG has investigated the successful use of social media by other conservation efforts to adopt for Reddish Egret conservation. Objective: By 2022, the REIWG has created 3 outreach products to promote support for Reddish Egret conservation.

5b.3 Make a short presentation available for use in schools and with decision-makers

Outreach materials described above could be used to develop or compliment a presentation that educators could use in local schools.

5b.4 Work with Scouts / Master Naturalists / other groups to produce messages

The REIWG should engage Master Naturalists, scout groups and other volunteer organizations to produce signage and other outreach materials / messages, to increase community buy-in and support, as well as efficacy of outreach messaging.

5b.5 Develop outreach materials about predators (possibly with animal control offices)

An important aspect of effective predation management is providing educational material in case of public concern. Outreach materials should be developed to educate people about the need for predation management (specifically on nesting islands), the benefits to Reddish Egrets and other species, and an emphasis on the use of humane methods. Outreach materials should also include information about subsidization of predators via improper disposal of waste. *Objective: By 2023, the REIWG has created outreach materials to promote understanding of the need for predation management.*

Strategy 5c: Influence boaters, fishers and other recreational users to improve support and capacity for Reddish Egret conservation

This substrategy focuses on influencing boaters, fishers and other recreational users, with an emphasis on reducing human disturbance to Reddish Egret populations. Simultaneously, efforts could be made to promote opportunities for citizen science. *Objective: By 2025, local partners have developed outreach programs to reach boaters and fishers in at least 8 priority areas.*

5c.1 Identify barriers to reducing disturbance

Understanding the factors that reduce the efficacy of outreach and enforcement aimed at preventing human disturbance of Reddish Egret habitat is critical to the success of these efforts.

5c.2 Include colonial waterbird messages in boater and fishing education / licensing programs

Capitalizing on extant programs meant to educate boaters and fishers as part of the licensing (or other) process would allow the REIWG to amplify its outreach efforts without relying on additional personnel.

5c.3 Give talks, materials to fishing cooperatives / groups

Cooperatives and other organized groups related to fishing and other recreational pursuits are generally interested in conservation of the resources they utilize. As such, they may be particularly open to Reddish Egret outreach and education efforts and could help spread our messages.

5c.4 Work with boat owners and give them information to provide to renters

Many recreational users rent boats, rather than owning a boat. Working with operators that rent boats would allow the REIWG to spread Reddish Egret information to a broad audience via a smaller group of individuals.

5c.5 Develop outreach materials for birdwatching and youth groups, birding festivals, etc.

The birdwatching community is a key recreational group that should be targeted and included in outreach and education efforts. There is already a substantial appreciation for Reddish Egrets within this community, and it would likely be easy to increase this appreciation due to its charismatic nature. Conservation organizations could send personnel to birding festivals to focus on outreach related to Reddish Egrets (and other species that share habitat with them).

5c.6 Promote Audubon's colony watch ('adopt' a colony)

One avenue for incorporating citizen science into Reddish Egret conservation efforts would be to promote the 'adoption' of colonies by interested members of the public. These individuals (or groups) could regularly monitor colonies and provide important data to conservation professionals and academics.

5c.7 Educate fishing/photo guides, fishermen, etc. about resighting/monitoring efforts

Reddish Egret habitat is often remote and difficult to access regularly, particularly with limited funds and personnel of responsible agencies and organizations. Fishing guides, photo tour operators, fishermen and other recreational users that frequently travel to remote locations by boat could be encouraged and trained to contribute to monitoring efforts by reporting banded birds, etc.

Risk Assessment

Risk is an uncertain event or condition which, if it occurs, could negatively affect a plan's outcomes. We assessed seven risk categories to determine the extent to which they could impede progress towards our strategies and goals over the next 10 years. Below, we identify primary risks to success and describe strategies that we will implement to minimize or avoid those risks, where applicable.

Table 4. Results of risk assessment conducted by representatives of key stakeholder organizations.

RISK CATEGORY	RATING	RISK DESCRIPTION	MITIGATING STRATEGIES
Regulatory Risks	Moderate	A small percentage of goals are dependent upon regulatory compliance (e.g., dredging, break water development). Delays or more serious permitting roadblocks could impede implementation of some parts of this plan. Reduction in state protection or listing status is also a possibility, though unlikely.	Ensure permitting delays are built into projects and pre-permitting work occurs.
Financial Risks	High	In Texas, the REIWG is already working on many of the plan's goals, but the financial sustainability of those efforts is unknown. Current funding is insufficient to meet conservation goal.	Fundraising from private donors, lobbying for increased state spending, and development of this business plan.
Environmental Risks	Moderate	The most significant environmental risks are addressed under climate change and water quality. However, the risk of stochastic events such as hurricanes, oil spills or red tides occurring is high, but the impacts would likely be localized.	Stochastic events cannot be prevented, but plans already exist for coordinated responses to events like oil spills. Furthermore, the strategies in this plan include efforts to mitigate and minimize the factors that can exacerbate the risk stochastic events pose.
Scientific Risks	Low	Foundational information needs are not successfully addressed.	Promote and implement rigorous science, and seek cost-sharing partners. Strategy 4 is focused on mitigating this risk.
Social Risks	Low	Limited conservation ethos and/or conflicts in human and wildlife needs could lead to a lack of support for Reddish Egret conservation in coastal communities.	Strategy 5 aims to mitigate this risk through outreach and advocacy with the general public and specific groups of recreational users.
Economic Risks	High	An economic recession could result in reduced environmental spending.	Strategy 5 could generate supplemental support for conservation efforts that could result in new sources of funding or conservation capacity via volunteers.
Institutional Risks	Moderate	The greatest risk is that the REIWG ceases to function effectively due to loss of key members or institutional support. Challenges could also arise when trying to work with USACE or other partner agencies to implement key conservation strategies.	The implementation plan includes activities to address this risk, including funding a coordinator position for the REIWG, continuous influencing and engagement with partners, and increasing capacity of relevant conservation organizations.

Monitoring and Evaluating Performance

Performance of this program will be assessed at both project and program scales. At the project scale, individual grants will be required to track relevant metrics from Table 5 for demonstrating progress on project activities and outcomes and to report out on them in their interim and final programmatic reports.

At the program scale, broader habitat and species outcomes will be monitored through targeted grants, existing external data sources, and/or aggregated data from relevant grant projects, as appropriate. Program scale monitoring will be facilitated by the REIWG, with specific committees focused on reporting and evaluating progress on assigned strategies from the implementation plan. In addition, the REIWG may conduct an internal assessment at a future stage of the program to determine program outcomes and adaptively manage.

The objectives in Table 5 represent the various intermediate steps necessary to achieve success of each strategy, as outlined in the Implementation Plan and summarized in Table 1. Each objective presented in Table 5 is associated with specific activities related to each strategy of the Implementation Plan. When years are designated, we intend that the objective be completed by the end of that year. Below we summarize the rationale for the suite of objectives chosen for each strategy.

Strategy 1. Manage, steward and restore Reddish Egret habitat

To evaluate success towards managing, stewarding, and restoring Reddish Egret habitat, we selected objectives and metrics that primarily focus on assessing the need for various types of management or restoration across 80% of priority areas (by 2024), and then implementing those management or restoration activities at selected sites (by 2030). Additional objectives focus on ensuring that the necessary relationships and organizations have been established to facilitate achieving the previously mentioned objectives (e.g., with high level USACE officials). To facilitate adaptive management, we also include an objective focused on establishing and disseminating BMPs by 2030, based on results of management and restoration projects. The Habitat Management Committee of the REIWG is responsible for overseeing the implementation of this strategy.

Strategy 2. Reduce disturbance and predation impacts on Reddish Egrets

Directly monitoring the success of efforts to reduce disturbance and predation impacts on Reddish Egrets may not be feasible. Instead, the objectives presented here focus on monitoring completion of various activities meant to reduce predation and disturbance. If the completion of these activities effectively reduces the impacts of disturbance and predation, this success should over time contribute to increases in breeding pairs (i.e., the program goal). The Habitat Management Committee and Communications Committee of the REIWG are responsible for overseeing the implementation of this strategy.

Strategy 3. Enhance long-term protection of priority Reddish Egret habitat

Because much Reddish Egret habitat is believed to already be protected within the United States, one of the primary objectives here is to formally assess the ownership and protected status of priority habitat. That assessment will allow us to identify key gaps in protected areas, as well as to ensure protected status of priority sites is not lost over time. The Planning Committee of the REIWG is responsible for overseeing the implementation of this strategy.

Strategy 4. Fill critical knowledge gaps regarding Reddish Egret conservation

Most of the objectives for this strategy focus on what are likely the most critical information gaps of all: a rigorous estimate of the total U.S. breeding population and a map of important foraging areas. Achieving these two objectives is essential for assessing progress towards many other objectives throughout this plan. Beyond that, we include two objectives meant to evaluate progress towards filling other information gaps in the medium- (i.e., 2025) and long-term (i.e., 2030). The Research and Monitoring Committee of the REIWG is responsible for overseeing the implementation of this strategy.

Strategy 5. Influence key audiences to improve support and capacity for Reddish Egret conservation

To evaluate progress towards influencing key audiences to promote Reddish Egret conservation, we primarily focus these objectives on establishing important relationships and identifying key stakeholders. Additionally, we include objectives to measure the amount of outreach materials generated and to assess the percent of priority areas targeted. The Communications Committee of the REIWG is responsible for overseeing the implementation of this strategy.

Table 5. Metrics for monitoring and evaluating the progress and success of the overall program and the strategies that comprise the implementation plan.

Category	Objective	Metrics	Target
Program Goal	By 2030, the total number of Reddish Egret breeding pairs within the United States has increased by 10%.	Annual # of breeding pairs	+10%*
Manage, steward and restore Reddish Egret habitat	By 2025, at least 15 priority areas are assessed for erosion control needs.	# of areas assessed	15
	By 2030, six sites needing erosion control measures have erosion control measures.	# of sites with erosion control measures	6
	By 2024, a relationship has been forged with high level officials within the USACE to facilitate coordination of dredged material deposition.	Relationship(s) established	n/a
	By 2025, at least 15 priority areas are assessed for dredged material deposition needs.	# of areas assessed	15
	By 2030, seven sites needing dredged material have material deposited.	# of sites receiving dredged material deposition	7

	By 2025, at least 15 priority areas are assessed for vegetation management needs.	# of areas assessed	15
	By 2030, vegetation management has been implemented at ten nesting sites.	# of nesting sites receiving vegetation management	10
	By 2027, restoration potential of Reddish Egret habitat through reintroduction of natural flooding regimes is assessed.	Assessment completed	1
	By 2030, one hydrologic restoration project is conducted.	Project completed	1
	By 2030, best management practices are shared to the REIWG through publications and/or presentations (e.g., at a management meeting).	BMPs published or presented	n/a
Reduce disturbance and predation impacts on Reddish Egrets	By 2022, managers have been surveyed to identify spatial and temporal 'hotspots' of human disturbance.	Survey completed	1
	Every 2 years, Federal and State law enforcement is contacted for coordination/reminder of potential disturbance issues.	# of contacts made	n/a
	By 2025, all Tier 1 and 40% of Tier 2 priority sites have signage, with periodic replacement.	% of priority sites with signage	Varies
	By 2027, Hummingbird and/or other GPS devices include Reddish Egret and other colonial waterbird information.	# of GPS platforms with Reddish Egret and other colonial waterbird information	1
	By 2025, 80% of Tier 1 priority nesting sites and 40% of Tier 2 priority nesting sites with predator issues have annual predation monitoring and management.	% of sites with predation management	Varies
	By 2030, predation management has been implemented at selected sites to create or restore nesting colonies.	# of project(s) completed	2
	By 2023, predator management guidelines have been established and shared with relevant stakeholders.	Availability of predator management guidelines	n/a
Enhance long-term protection of priority Reddish Egret habitat	By 2025, protected status and ownership of priority sites and areas has been assessed.	Assessment completed	1
	By 2030, five unprotected nesting and/or foraging sites have been protected.	# of sites protected	5
Fill critical knowledge gaps regarding Reddish Egret conservation	By December 2021, the REIWG has developed standardized protocols for counting breeding pairs on colonies.	Standardized protocols for counting breeding pairs on colonies available and accepted	n/a
	By October 2021, the REIWG has developed standardized protocols for counting Reddish Egrets at wintering sites.	Standardized protocols for counting non-breeding birds available and accepted	n/a
	By January 2021, the REIWG has identified focal sites for long-term banding and identified collaborators to carry out annual banding and resighting of	Sites and collaborators for annual banding and	n/a

	individuals.	resighting established	
	By 2022, known foraging areas are mapped and available online.	Project completed	1
	Implement standardized, statistically rigorous monitoring protocol (e.g., point count, total count) that estimates breeding pairs throughout the species' range to the maximum extent possible and at least once every 3 years starting in 2023 at sites believed to support at least 90% of the U.S. population (i.e., 90% of breeding pairs). Conduct a full survey every 6 years starting in 2023 to monitor additional breeding sites or locate new breeding locations to document distribution shifts or range expansions, which may guide future monitoring efforts.	% of focal areas that have met their survey goals	90%
	By March 2021, a Reddish Egret database is established, a protocol for data entry is developed, and existing data is entered into the database.	Availability of most recent statewide efforts	n/a
	By 2025, the database has been used to revise the preliminary list of priority sites and areas in Appendix B.	Completion of official list of priority sites and areas	n/a
	By 2025, two of the highest priority information needs that could facilitate Reddish Egret conservation have been addressed.	# of knowledge gaps filled	2
	By 2030, five of the highest priority information needs that could facilitate Reddish Egret conservation have been addressed.	# of knowledge gaps filled	5
	Reddish Egret conservation community is thinking about where future habitat may be available (perhaps some rapidly disappearing sites are de-prioritized in favor of others with longer lives according to SLAMM models and other future forecast models) and generates state specific white papers by 2030.	# of states with completed white paper	3
Influence key audiences to improve support and capacity for Reddish Egret conservation	By 2023, funding is secured to improve capacity of REIWG to guide education and outreach efforts (as well as other strategies).	Adequate funding secured for REIWG chair, website, webmaster, meetings, and outreach	n/a
	By 2021, the REIWG has identified key stakeholders that were not already included in Reddish Egret conservation efforts.	# of stakeholders identified (e.g., donors, conservation partners, fishing guides, etc.)	3
	By 2022, the REIWG has created outreach/inreach materials to promote the recognition of Reddish Egrets as a sentinel species.	# of outreach materials created	2
	By 2021, the REIWG has investigated the successful use of social media by other conservation efforts to adopt for Reddish Egret conservation.	Summary report created	1
	By 2023, the REIWG has identified complementary educational efforts through which to promote Reddish Egret conservation	# of complementary educational efforts contacted	1
	By 2023, the REIWG has created outreach materials to promote understanding of the need for predation management	# of outreach materials created	1

	By 2022, the REIWG has created 3 outreach products to promote support for Reddish Egret conservation	# of outreach materials created	3
	By 2025, local partners have developed outreach programs to reach boaters and fishers in at least 8 priority areas	# of priority areas for which local partners have developed outreach programs to reach boaters and fishers	8

* Current estimate of breeding pairs is based on most recent surveys, which have not yet been standardized across the U.S. range (Table 2). Baseline and target will be set by standardized U.S. survey (see Activity 4.6).

Budget

The following budget shows the estimated costs to implement the business plan activities. NFWF will have to raise funds to meet these costs; therefore, this budget reflects NFWF's anticipated engagement over the business plan period of performance and it is *not* an annual or even cumulative commitment by NFWF to invest. This budget assumes that current activities funded by others will, at a minimum, continue.

Current investments come from a variety of sources, including the NAWCA, NFWF, NMBCA, NOAA's RESTORE Science Program, NRDA, USFWS Partners Program, and various state agencies and NGOs. Potential funding sources that could be targeted to increase funding include the Bureau of Ocean Energy Management, county pollution recovery funds, NWR Friends' groups, oil, gas or other development mitigation funds, private donors, and the USFWS Coastal Program.

Table 6. Estimated costs to implement each strategy and substrategy of the business plan in the first five years, second five years, and total 10-year period.

BUDGET CATEGORY	Yrs 1-5	Yrs 6-10	Total
Strategy 1. Manage, steward, and restore Reddish Egret habitat			
1a. Minimize impacts of new development in priority areas	---	---	---
1b. Minimize impacts of marine transportation in priority areas	\$1M	\$4M	\$5M
1c. Increase beneficial use / reduce negative impacts of coastal engineering	\$0.5M	\$3M	\$3.5M
1d. Restore habitat	\$0.37M	\$4.07M	\$4.44M
Strategy 2. Reduce disturbance and predation impacts on Reddish Egrets			
2a. Reduce human disturbance impacts on Reddish Egrets	\$0.58M	\$0.25M	\$0.83M
2b. Reduce predation impacts on Reddish Egrets	\$1.22M	\$1.13M	\$2.35M
Strategy 3. Enhance long-term protection of priority Reddish Egret habitat			
	\$1.16M	\$1.46M	\$2.62M
Strategy 4. Fill critical knowledge gaps regarding Reddish Egret conservation			
	\$2.11M	\$1.58M	\$3.69M
Strategy 5. Influence key audiences to improve support and capacity for Reddish Egret conservation			
5a. Influence donors and conservation professionals to improve support and capacity for Reddish Egret conservation	\$0.09M	\$0.09M	\$0.18M
5b. Influence community members and general public to improve support and capacity for Reddish Egret conservation	\$0.15M	\$0.15M	\$0.30M
5c. Influence boaters, fishers and other recreational users to improve support and capacity for Reddish Egret conservation	\$0.38M	\$0.15M	\$0.53M
TOTAL BUDGET	\$7.56M	\$15.88	\$23.44

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Appendix

Appendix A. Ancillary Benefits

Reddish Egrets utilize unique habitats for foraging and nesting needs. These habitats are utilized by a wide variety of other species, many of which also are of conservation interest (Table A1). Moreover, these habitats provide important services for human communities and economic interests (Table A2). The species itself also provides benefits to people, as it is an iconic species, and highly sought by birdwatchers and nature photographers. Birdwatchers and photographers bring revenue to local communities by traveling to state parks, wildlife refuges and other preserves that host Reddish Egrets and other species. Many coastal cities also host birding festivals that attract many people, who stay in local hotels, visit local restaurants, etc. For example, the [Rio Grande Valley Birding Festival](#) in Harlingen, TX is one of the largest in the country and brings a substantial amount of revenue into the region. Reddish Egrets are an important species in this regard, as evidenced by the logo for the [Florida Birding and Nature Festival](#).

Reddish Egrets typically nest on nearshore islands that provide nesting habitat for other colonially nesting waterbirds (Cox et al. 2019a). These islands also tend to provide structure and bathymetric variation important for fish species, thus conferring recreational and commercial benefits (Ross et al. 1987). Furthermore, islands can play a role in mitigating the impacts of hurricane induced storm surges (Rego & Li 2010). However, the small islands that Reddish Egrets nest on likely provide modest benefit compared to larger barrier islands.

Reddish Egrets forage in shallow waters that are often underappreciated from a conservation standpoint, yet provide important habitat for many species, including migratory shorebirds (Burger et al. 1997), shrimp larvae (Kuipers & Dapper 1984), and prey species for important commercial and recreational fish (Burke 1995). Fish-eating birds also can serve as indicators of water quality or environmental health because they are bio-accumulators that can be used to identify dangerous accumulations of contaminants (Van der Pol et al. 2012).

Table A1. Species that could benefit from implementation of the Business Plan for Conservation of the Reddish Egret in the United States. Habitat refers to nesting (N) or foraging (F) habitat. Status refers to Federally-listed as Endangered (FE), Federally-listed as Threatened (FT), State-listed as Threatened (ST), listed on the Partners in Flight Watch List (WL), common but declining (CD), or recently de-listed (DL).

Common Name	Scientific Name	Habitat	States	Status
Snow Goose	<i>Anser caerulescens</i>	F	LA, MS, TX	---
Blue-winged Teal	<i>Spatula discors</i>	F	all	---
Northern Shoveler	<i>Spatula clypeata</i>	F	all	---
American Wigeon	<i>Mareca americana</i>	F	all	---
Mottled Duck	<i>Anas fulvigula</i>	F	all	WL
Northern Pintail	<i>Anas acuta</i>	F	all	---
Redhead	<i>Aythya americana</i>	F	all	---
Lesser Scaup	<i>Aythya affinis</i>	F	all	---
Bufflehead	<i>Bucephala albeola</i>	F	all	---
Whooping Crane	<i>Grus americana</i>	F	FL, LA, TX	FE
American Oystercatcher	<i>Haematopus palliatus</i>	N	all	ST

Snowy Plover	<i>Charadrius nivosus</i>	F	AL, FL, LA, MS, TX	ST
Piping Plover	<i>Charadrius melodus</i>	F	all	FT
Marbled Godwit	<i>Limosa fedoa</i>	F	FL, GA, LA, SC, TX	WL
Western Sandpiper	<i>Calidris mauri</i>	F	all	---
Black Skimmer	<i>Rynchops niger</i>	N, F	all	ST
Wood Stork	<i>Mycteria americana</i>	N	all	FT
Neotropic Cormorant	<i>Phalacrocorax brasilianus</i>	N, F	LA, TX	---
Double-crested Cormorant	<i>Phalacrocorax auratus</i>	N, F	all	---
Anhinga	<i>Anhinga anhinga</i>	N	all	---
American White Pelican	<i>Pelecanus erythrorhynchos</i>	F	AL, FL, LA, MS, TX	---
Brown Pelican	<i>Pelecanus occidentalis</i>	N, F	all	DL
Great White Heron	<i>Ardea herodias occidentalis</i>	N, F	FL	---
Great Blue Heron	<i>Ardea herodias</i>	N, F	all	---
Great Egret	<i>Ardea alba</i>	N, F	all	---
Snowy Egret	<i>Egretta thula</i>	N, F	all	DL
Little Blue Heron	<i>Egretta caerulea</i>	N, F	all	ST
Tricolored Heron	<i>Egretta tricolor</i>	N, F	all	ST
Green Heron	<i>Butorides virescens</i>	N, F	all	CD
Black-crowned Night- Heron	<i>Nycticorax nycticorax</i>	N, F	all	---
Yellow-crowned Night- Heron	<i>Nyctanassa violacea</i>	N, F	all	---
White Ibis	<i>Eudocimus albus</i>	N, F	all	DL
Glossy Ibis	<i>Plegadis falcinellus</i>	N, F	FL, GA, LA, SC, TX	---
White-faced Ibis	<i>Plegadis chihi</i>	N, F	AL, FL, LA, MS, TX	---
Roseate Spoonbill	<i>Platalea ajaja</i>	N, F	FL, LA, TX	ST
Peregrine Falcon	<i>Falco peregrinus</i>	F	all	ST
Loggerhead sea turtle	<i>Caretta caretta</i>	N, F	all	FT
Green sea turtle	<i>Chelonia mydas</i>	N, F	all	FT
Kemp's Ridley sea turtle	<i>Lepidochelys kempii</i>	N, F	LA, FL, SC, TX	FE
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	N, F	FL, TX	FE
Leatherback sea turtle	<i>Dermochelys coriacea</i>	N, F	all	FE
Spot croaker	<i>Leiostomus xanthurus</i>	F	all	---
Flathead grey mullet	<i>Mugil cephalus</i>	F	all	---
Sheepshead minnow	<i>Cyprinodon variegatus</i>	F	all	---
Gulf killifish	<i>Fundulus grandis</i>	F	AL, FL, LA, MS, TX	---
Pinfish	<i>Lagodon rhomboides</i>	F	all	---
Red drum	<i>Sciaenops ocellatus</i>	F	all	---
Spotted seatrout	<i>Cynoscion nebulosus</i>	F	all	---
Pink shrimp	<i>Penaeus duorarum</i>	F	all	---
Black mangrove	<i>Avicennia germinans</i>	N	FL, LA, MS, TX	---
Buttonwood	<i>Conocarpus erectus</i>	N	FL, TX	---
White mangrove	<i>Laguncularia racemose</i>	N	FL, TX	---
Red mangrove	<i>Rhizophora mangle</i>	N	FL, SC	---
Shoal grass	<i>Halodule wrightii</i>	F	all	---
Widgeon grass	<i>Ruppia maritima</i>	F	all	---
Star grass	<i>Halophila engelmannii</i>	F	FL, LA, MS, TX	ST
Manatee grass	<i>Syringodium filiforme</i>	F	FL, LA, MS, TX	---
Turtle grass	<i>Thalassia testudinum</i>	F	FL, LA, MS, TX	ST

Table A2. Potential benefits to human communities and well-being derived from implementing the Business Plan for Conservation of the Reddish Egret in the United States.

Human Well-being Benefits	Habitat	Ecosystem Service Class	Example
Aesthetic inspiration / appreciation	N, F	Cultural	Estuary scenes in art, Florida Birding and Nature Festival logo
Food	N, F	Provisioning	Both habitat types provide nursery habitat for important fisheries
Ecotourism	N, F	Cultural	Birding festivals, photography tours
Moderation of extreme events	N	Regulating	Storm surge protection
Recreation and health	F	Cultural	Fishing, birdwatching
Spiritual experience / sense of place	N, F	Cultural	Coastal ecosystems provide a sense of identity for coastal communities

Appendix B. Priority Sites and Areas

Developing a list of priority nesting and foraging sites, as well as larger priority areas (e.g., bays, island complexes) is itself an action item of this plan (Strategy 4.7 Develop database of breeding colonies and foraging areas. Objective 2: By 2025, the database has been used to revise the preliminary list of priority sites and areas in Appendix B). Due to the importance of this action item and value of even an incomplete list of priority sites and areas, we included this initial prioritization set. We wish to emphasize the preliminary nature of this list and to encourage its refinement over the next 5 years into an official list of priority sites and areas by the end of 2025. In lieu of that finalized list, this list may be used as a reference for guiding funds needed to restore or protect habitat, improve management or outreach, or conduct critical research projects.

Priority sites refer to areas of small spatial extent (e.g., a specific island or wetland) that provide important nesting and/or foraging habitat for Reddish Egrets but face moderate to severe threats to their persistence as such. Priority areas refer to larger spatial extents (e.g., bays, wildlife refuges, island complexes) that host numerous sites that may or may not be identified as priority sites but provide otherwise important Reddish Egret habitat. We split priority sites and areas up into two tiers, reflecting their need for conservation action. Tier 1 indicates sites/areas that have supported geographically substantial nesting/foraging populations in the past and are likely to support those populations going into the future if they are managed appropriately. These are the most important sites and areas that should come first when allocating funding. Tier 2 indicates sites/areas that are either less important/threatened than Tier 1 sites, or do not support large populations of Reddish Egret but could in the future if managed appropriately, or that historically supported large populations of Reddish Egret but may not in the future due to changing conditions that are not feasible to counteract. Tier 2 sites/areas are still high priority for funding and management attention, but should come after Tier 1 sites/areas.

Table B1. Tier 1 and 2 priority sites for Reddish Egret nesting and foraging habitat. For management units, C = Central and E = Eastern. Colony size is based on breeding pair counts from most recently available data, but some sites have been surveyed less recently than others. Size categories are as follows: <10 pairs (1), 10-24 (2), 25-49 (3), 50-99 (4), >100 (5). Sites with few or no breeding pairs are in regions with low density breeding sites, provide important foraging habitat, or do not have recent estimates currently available. Sites are ordered geographically from west to east.

Tier 1 Priority Sites	Bay/Estuary	Focal Area	State	Mgmt. Unit	Colony Size
South Land Cut	Lower Laguna Madre	Laguna Madre	TX	C	4
Northeast Mansfield Inlet	Lower Laguna Madre	Laguna Madre	TX	C	4
Green Hill Spoil Island	Lower Laguna Madre	Laguna Madre	TX	C	2
Green Island	Lower Laguna Madre	Laguna Madre	TX	C	5
Bahia Grande Complex	Lower Laguna Madre	Laguna Madre	TX	C	---
South of South Bird Island	Upper Laguna Madre	Laguna Madre	TX	C	4
Three Island Spoil	Lower Laguna Madre	Laguna Madre	TX	C	4
Pita Island / Humble Channel	Upper Laguna Madre	Laguna Madre	TX	C	2
Laguna Vista Spoil	Lower Laguna Madre	Laguna Madre	TX	C	3
Rabbit Island	Upper Laguna Madre	Laguna Madre	TX	C	---
Shamrock Island	Corpus Christi Bay	Texas Mid-coast	TX	C	4
Little Bay	Aransas Bay	Texas Mid-coast	TX	C	2
Sundown (Chester's) Island	Matagorda Bay	Texas Mid-coast	TX	C	4
Dressing Point	East Matagorda Bay	Texas Mid-coast	TX	C	4
West Bay Bird Island	West Bay	Texas Mid-coast	TX	C	1
North Deer Island	West Bay	Texas Mid-coast	TX	C	3
South Deer Island	West Bay	Texas Mid-coast	TX	C	1
Rabbit Island	Calcasieu Lake	Chenier Plain	LA	C	3
Raccoon Island	Caillou Bay	Ms. River Coastal Wetlands	LA	C	2
Queen Bess Island	Barataria Bay	Ms. River Coastal Wetlands	LA	C	1

North Islands Complex	Chandeleur Sound	Ms. River Coastal Wetlands	LA	C	1
Coffee Island (Isle Aux Herbes)	Portersville Bay	Coastal MS-AL	AL	C	1
St. Joseph Sound Marker 26	St. Joseph Sound	Florida Gulf Coast	FL	E	1
Cortez Key Bird Sanctuary	North Sarasota Bay	Florida Gulf Coast	FL	E	1
Rich T. Paul Alafia Bank	Hillsborough Bay	Florida Gulf Coast	FL	E	1
White Pelican Island	Gasparilla Sound	Florida Gulf Coast	FL	E	2
Little Saddlebunch #5	Lower Florida Keys	Florida Keys and Florida Bay	FL	E	2
Bruce Key	Florida Bay	Florida Keys and Florida Bay	FL	E	2
Duck Key	Florida Bay	Florida Keys and Florida Bay	FL	E	1
Mullethead Island	Merritt Island NWR	Florida Atlantic Coast	FL	E	2
Tier 2 Priority Sites	Bay/Estuary	Focal Area	State	Mgmt. Unit	Colony Size
East Flats (Dubb's) Spoil	Lower Laguna Madre	Laguna Madre	TX	C	4
Mansfield Odd Spoil	Lower Laguna Madre	Laguna Madre	TX	C	2
Pelican Island Spoil	Corpus Christi Bay	Texas Mid-coast	TX	C	4
Long Reef - Deadman Islands	Aransas Bay	Texas Mid-coast	TX	C	4
Second Chain of Islands	Aransas Bay	Texas Mid-coast	TX	C	4
Sabine NWR - Unit 1A and Hog Island	Calcasieu Lake	Chenier Plain	LA	C	---
St. John's Island / Oyster Bayou	Calcasieu Lake	Chenier Plain	LA	C	---
Grand Terre Islands	Barataria Bay	Ms. River Coastal Wetlands	LA	C	1
Three Rooker Bar State Park	St. Joseph Sound	Florida Gulf Coast	FL	E	1
Useppa Broken Island North	Pine Island Sound	Florida Gulf Coast	FL	E	2
Marco ABCs "B" Middle	Rookery Bay	Florida Gulf Coast	FL	E	2
Green Heron Mangroves	Lower Florida Keys	Florida Keys and Florida Bay	FL	E	1
Cudjoe Key Mangrove	Lower Florida Keys	Florida Keys and Florida Bay	FL	E	1
Niles Channel Mangrove	Lower Florida Keys	Florida Keys and Florida Bay	FL	E	1

Pine Channel Mangrove Southeast Sandy Key	Lower Florida Keys	Florida Keys and Florida Bay	FL	E	1
	Florida Bay	Florida Keys and Florida Bay	FL	E	1
Palm Key	Florida Bay	Florida Keys and Florida Bay	FL	E	1

Table B2. Tier 1 and 2 priority areas for Reddish Egret habitat complexes. Breeding pairs are aggregated from site estimates, including sites not listed above. Values are from most recently available estimates, but some sites have been surveyed less recently than others. As such, these numbers may not match statewide estimates provided in Table 2. Areas with few or no breeding pairs are in regions with low density breeding sites, provide important foraging habitat, or do not have recent estimates currently available. Areas are ordered geographically from west to east.

Tier 1 Priority Areas	Focal Area	State	Mgmt. Unit	Breeding Pairs
Lower Laguna Madre	Laguna Madre	TX	C	885
Upper Laguna Madre	Laguna Madre	TX	C	247
Corpus Christi Bay	Texas Mid-coast	TX	C	156
Aransas Bay	Texas Mid-coast	TX	C	158
Matagorda Bay	Texas Mid-coast	TX	C	178
Calcasieu Lake	Chenier Plain	LA	C	40
Caillou Bay	Ms. River Coastal Wetlands	LA	C	21
Terrebonne Bay	Ms. River Coastal Wetlands	LA	C	1
Barataria Bay	Ms. River Coastal Wetlands	LA	C	3
Pine Island Sound/Gasparilla Sound	Florida Gulf Coast	FL	E	21
Lower Florida Keys	Florida Keys and Florida Bay	FL	E	86
Florida Bay	Florida Keys and Florida Bay	FL	E	97
Merritt Island NWR	Florida Atlantic Coast	FL	E	43
Tier 2 Priority Areas	Focal Area	State	Mgmt. Unit	Breeding Pairs
Redfish Bay	Texas Mid-coast	TX	C	97
West Bay	Texas Mid-coast	TX	C	92
Atchafalaya Delta	Ms. River Coastal Wetlands	LA	C	5
Chandeleur Sound	Ms. River Coastal Wetlands	LA	C	25
Portersville Bay	Coastal MS-AL	AL	C	5
Pelican Bay	Coastal MS-AL	AL	C	---
Big Bend Seagrasses Aquatic Preserve	Florida Gulf Coast	FL	E	2

Appendix C. Year-by-Year Implementation Plan Gantt Chart

We created a timeline illustrating when we expect each activity to be completed. The condensed form of this chart is presented in Table 3, whereas a year-by-year breakdown is presented here in Table C1. Shaded cells indicate that the work is intended to be completed by that end of that year. Darker cells indicate the major portion of the work involved in any given activity, while lighter shades indicate preliminary or follow-up work (e.g., planning, monitoring). Due to the novel coronavirus pandemic, activities slated for the first two years of this plan have already been impacted and are likely to be further delayed. Moreover, lack of funds to support a coordinator of the REIWG could delay anticipated progress across the implementation plan.

Table C1. Year-by-year breakdown of implementation of each activity. Lighter shades indicate the need for preliminary or follow-up work. Bold activities indicate high priority activities.

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Strategy 1. Manage, steward, and restore Reddish Egret habitat										
<i>Substrategy 1a: Minimize impacts of new development in priority areas</i>										
Improve communication with permitting agencies to mitigate development impacts in or near priority habitat										
<i>Substrategy 1b: Minimize impacts of marine transportation in priority areas</i>										
Assess priority areas for erosion control needs										
Implement erosion control at selected sites										
Monitoring conducted to facilitate adaptive management										
<i>Substrategy 1c: Increase beneficial use / reduce negative impacts of coastal engineering (placement of dredged material)</i>										
Increase capacity of conservation organizations and agencies to establish stronger relationships with USACE										
Identify high-level officials to improve communications with USACE										
Assess priority areas for dredged material deposition needs										
Implement dredged material deposition at selected sites										
Monitoring conducted to facilitate adaptive management										
<i>Substrategy 1d: Restore habitat</i>										
Assess priority areas for vegetation management needs										
Implement vegetation management at selected sites										
Assess potential for hydrologic restoration of foraging and nesting sites										
Implement hydrologic restoration at one experimental site										
Monitoring conducted to facilitate adaptive management										
Identify and share best management practices for restoration										
Strategy 2. Reduce disturbance and predation impacts on Reddish Egrets										
<i>Substrategy 2a: Reduce human disturbance impacts on Reddish Egrets</i>										
Survey managers to determine when and where human disturbance is most significant										
Improve interaction with law enforcement by focusing on high-level officials										
Conduct 'inreach' to state employees to increase enforcement										
Increase/establish signage										
Put messages on Hummingbird and other GPS devices										
<i>Substrategy 2b: Reduce predation impacts on Reddish Egrets</i>										
Investigate cooperation with USDA Wildlife Services										
Increase surveillance (trail cams, tracks) and proactively assess priority colonies for risk of predation										
Implement predation management to restore historic or open new nesting sites										
Develop predation management guidelines										
REIWG encourages National Park Service to allow predation management										

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Strategy 3. Enhance long-term protection of priority Reddish Egret habitat										
3.1 Assess protected status / ownership of priority sites and areas										
3.2 Use relevant mechanisms to add priority habitat to the conservation estate for Reddish Egrets										
Strategy 4. Fill critical knowledge gaps regarding Reddish Egret conservation										
4.1 Standardize protocols for monitoring breeding colonies										
4.2 Standardize protocols for monitoring wintering sites										
4.3 Standardize protocol for banding and DNA sampling										
4.4 Complete initial list of breeding colonies										
4.5 Map known foraging areas										
4.6 Conduct standardized baseline survey										
4.7 Develop database of breeding colonies and foraging areas										
4.8 Fund or conduct studies to fill key knowledge gaps										
4.9 Investigate opportunities for climate-resilient design of habitat										
Strategy 5. Influence key audiences to improve support and capacity for Reddish Egret conservation										
<i>Substrategy 5a: Influence donors and conservation professionals to improve support and capacity for Reddish Egret conservation</i>										
Document benefits of Reddish Egret habitat to humans and other species										
Identify priority donors and conservation professionals										
Secure funding to sustain REIWG capacity to guide conservation efforts										
Organize inspirational meetings (and excursions) for conservation professionals										
<i>Substrategy 5b: Influence community members and general public to improve support and capacity for Reddish Egret conservation</i>										
Identify complementary educational efforts and advocate inclusion of messages about Reddish Egrets (e.g., Whooping Cranes)										
Develop general outreach materials (disturbance video, infographic, pamphlet, webcam, story maps, social media)										
Make a short presentation available for use in schools and with decision-makers										
Work with Scouts / Master Naturalists / other groups to produce messages										
Develop outreach materials about predators (possibly with animal control offices)										
<i>Substrategy 5c: Influence boaters, fishers and other recreational users to improve support and capacity for Reddish Egret conservation</i>										
Identify barriers to reducing disturbance										
Include colonial waterbird messages in boater and fishing education / licensing programs										
Give talks, materials to fishing cooperatives / groups										
Work with boat owners and give them information to provide to renters										
Develop outreach materials for birdwatching and youth groups, birding festivals, etc.										
Promote Audubon's colony watch ('adopt' a colony)										
Educate fishing/photo guides, fishermen, etc. about resighting/monitoring efforts										