Reddish Egret (*Egretta rufuscens*)

Conservation Action Plan

November 2014


COASTAL BEND
BAYS & ESTUARIES PROGRAM


pro
natura
asociación civil


U.S.
FISH & WILDLIFE
SERVICE
DEPARTMENT OF THE INTERIOR


FOUNDATIONS
OF SUCCESS


TEXAS
STATE
UNIVERSITY
SAN MARCOS


Audubon
TEXAS


TEXAS A&M
UNIVERSITY
KINGSVILLE


TEXAS
PARKS &
WILDLIFE


GULF COAST
BIRD OBSERVATORY


Gulf Coast Joint Venture


Audubon
FLORIDA


FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION


ARCI
AVIAN
RESEARCH and
CONSERVATION
INSTITUTE


LOUISIANA
DEPARTMENT
OF
WILDLIFE & FISHERIES


Terra
Peninsular


CAESAR KLEBERG
WILDLIFE
RESEARCH INSTITUTE


Audubon


CICESE

TABLE OF CONTENTS

Reddish Egret. Jim Gray

ACKNOWLEDGEMENTS

This plan is dedicated to the memory of Rich Paul. Nancy Douglass

Plan Dedication

The Reddish Egret Conservation Plan is dedicated in memory of Rich Paul (1946 – 2005), an outstanding field ornithologist, who conducted extensive research on the Reddish Egret during his career with National Audubon Society. He was the manager of the Coastal Islands Sanctuaries and in his younger days worked at Audubon's research station in the Florida Keys. He wrote the first status assessment for the Reddish Egret in 1991 and coauthored the Birds of North America species account in 2002. In 1994 he was named Wildlife Conservationist of the Year by the Florida Wildlife Federation; a year later he received the Golden Egret Award, Audubon's highest career service award. In 2001, the National Fish and Wildlife Foundation honored him with the Chuck Yeager Award for action and achievement.

Acknowledgements

Thanks go to many individuals from universities, private conservation organizations, state conservation agencies, and U.S. Fish and Wildlife Service offices (USFWS) that provided information used in developing this plan. We especially thank those who attended the Reddish Egret Workshop held in Corpus Christi, TX in October 2012 (see Appendix B for a list of participants). Completion of the plan would not have been possible without their guidance, support, and input. Jennifer Wheeler (USFWS), Clay Green (Texas State Univeristy), and Eduardo Palacios (Pronatura Noreste) provided day to day guidance and consultation during the completion of this project. Special thanks go to Stefani Melvin who established the Reddish Egret Working Group in 2005 and did much of the preliminary work for this plan. Funding for this product was provided by Focal Species funds through the Division of Migratory Bird Management, USFWS. Cover photo courtesy of William Majoros. Plan design by Debra Reynolds, USFWS

Reddish Egret. Tom Grey

EXECUTIVE SUMMARY

There is nothing in which the birds differ more from man than the way in which they can build and yet leave a landscape as it was before.

~Robert Lynd

Despite its large range, the Reddish Egret occupies a restricted belt of coastal habitat, is patchily distributed and has a relatively small and declining global population. Accordingly there is broad agreement that the Reddish Egret is in need of our conservation effort. Using the "Open Standards Approach for Conservation Measures" the Reddish Egret Working Group presents a range-wide conceptual conservation model for this species that highlights and ranks the greatest threats to maintaining population stability and expanding the population, explores the underlying causes of those threats, and identifies key strategies to address them. This document serves as a guide for conserving the Reddish Egret as a species throughout its range, proposing processes to identify focal colony sites and foraging areas, defined as the locations that should be priorities for collective conservation effort. This plan also provides the context to support management action for locally important locations.

We recommend four over arching strategies:

1. Actively manage factors directly affecting Reddish Egret populations
2. Ensure that long-term stewardship and management of habitat is effectively implemented in focal colony sites and foraging areas
3. Develop and implement long-term monitoring of populations to support better decision-making at the local, regional and global scale.
4. Identify mechanisms for conserving unprotected focal areas.

This plan emphasizes consideration of the way interventions will influence indirect and direct threats, and promotes activities to ultimately achieve the stated goals. Central to this process was compilation of current species information to identify focal nesting sites (Note: a colony implies nesting; a site is the physical space that can be occupied or not; a colony is always occupied, i.e., site + birds nesting) and foraging areas.

Although this plan lists activities to address threats and proposes a list to calculate necessary investments, it is not a business strategy—yet. Next steps include further articulating activities, formulating metrics to measure success, assessing capacity and risk, and making this plan operational. It should be viewed as a milestone in an ongoing and evolving campaign by the Reddish Egret Working Group to restore and maintain viable Reddish Egret populations throughout the species' range.

Recommended Citation

Wilson, T. E., J. Wheeler, M. C. Green, and E. Palacios. (eds.). Reddish Egret Conservation Action Plan. Reddish Egret Conservation Planning Workshop, October 2012. Corpus Christi, TX.

INTRODUCTION

The Reddish Egret is the rarest and least known of the egrets and herons of North America. It is a habitat specialist, patchily distributed in a narrow fringe of coastal habitats in the Nearctic and Neotropical ecozones for all aspects of its life cycle. Specifically, the population lays within a narrow latitudinal range extending east from the Baja California peninsula, including the Gulf of California, the Yucatan Peninsula, the northern coast of Gulf of Mexico to peninsular Florida and islands in the Caribbean basin, namely Bahamas and Cuba. The global population of Reddish Egrets is estimated to be 5,000 – 7,000 individuals, with 3,500 to 4,250 breeding pairs (see Table 6).

According to early naturalist' accounts, Reddish Egrets were a common and resident species along the Gulf Coast of the United States from Florida to Texas. The Reddish Egret population was decimated by the actions of plume hunters in the late 1880s. Although breeding populations have significantly recovered, they are still reduced from pre-hunting levels. In addition, the species is thought to be currently declining again in nesting areas such as the Florida Keys and Florida Bay.

Beginning in 2005, the United States Fish and Wildlife Service (USFWS) adopted a Focal Species Strategy[1] to provide a process for better measuring its success in achieving bird conservation priorities. The purpose of this strategy is to provide explicit, strategic, and adaptive sets of conservation actions necessary for restoring species of concern to viable and sustainable population levels. Reddish Egret was selected as a Focal Species to receive increased conservation attention by USFWS over the short term.

To advance the conservation of this species, the Reddish Egret Working Group, a multi-organization partnership with scientists and managers from U.S., Bahamas and Mexico was formed. The Working Group first met in October 2005 to discuss the status of Reddish Egret populations in Texas, Mexico, and Florida. From there, it was decided a status assessment was necessary as the majority of information was at least a decade old (Paul 1991, Lowther and Paul 2002). The Status Assessment was completed in 2006 (Green 2006) and formed the basis for subsequent investments in research and information collection.

[1] For more information on the focal species program visit the website at

http://www.fws.gov/migratorybirds/

Survey in the Bahamas. Matt Jeffrey

Reddish Egret pair. Emily Whittman

Several projects to fill information gaps identified in the Status Assessment were undertaken in subsequent years (Bates et al. 2009, Palacios and Green. 2010, Green et al. 2011, Hill and Green 2011, Fidorra et al. 2011, Holderby et al. 2012, Hill et al. 2012). Additionally the many organizations represented in the Reddish Egret Working Group continued to undertake management activities to survey, protect, and foster local Reddish Egret populations and habitats. Conservation plans were developed to guide local and regional action [e.g., the Texas Gulf Coast (Vermillion and Wilson 2009)] yet a range-wide plan was needed.

This Conservation Action Plan was conceived as a means to ensure that further investments in Reddish Egret conservation were guided by a shared set of range-wide goals and prioritized to most effectively reach those goals. Moreover, this comprehensive framework will allow each stakeholder to understand the contributions and intended outcomes of each local activity. The methodology for creating this plan drew on the "Open Standards for the Practice of Conservation" framework (CMP 2007). The goal of this adaptive management framework is to bring together common concepts, approaches, and terminology in project design, management, and monitoring to improve the practice of conservation (Figure 1). This process was aided by the use of the Miradi software (www.miradi.org).

Figure 1: The Open Standards Process (CMP 2007)

CONCEPTUAL MODEL FOR REDDISH EGRET CONSERVATION

A conceptual model portrays the overall situation surrounding conservation efforts for the Reddish Egret and its habitats (conservation targets), the main direct threats, and the social, cultural, political and economic factors (also known as contributing factors and opportunities) that are contributing to those threats. The conceptual model is a graphic summary of how the Reddish Egret Working Group envisions the context within which they are working and it is used to brainstorm potential conservation strategies. Using the conceptual model, and prioritizing factors most in need of influence, the working group seeks to understand where intervention is necessary and/or effective – and also where it is not.

SCOPE

This conservation plan is intended to address the needs of the species, Reddish Egret (*Egretta rufuscens*), throughout its full range (see Figure 2). The Reddish Egret is an international resource, with Mexico and the U.S. appearing to support about equally the bulk of the global breeding population, complemented by a number of Central American and Caribbean nations.

Nonbreeding birds range further to the north and south of the breeding range?.

Currently, two subspecies are recognized (Payne 1979) although the physical differences are minor. *Egretta rufescens rufescens* (Gmelin 1789) is found along the coast in Florida, along the Gulf of Mexico coast of the United States and eastern Mexico including the Yucatan Peninsula, and the Caribbean. The plumage of this subspecies has been described as lighter and it is smaller in size than the western subspecies *Egretta rufescens dickeyi* (VanRossem 1926); the subspecies status of *E. r. dickeyi* is further supported by genetic studies (Hill et al. 2012). *E. r. dickeyi* is distributed on the coasts of the Baja California Peninsula, Sonora, and Sinaloa. The subspecific taxonomic status of Reddish Egrets found breeding south of Sinaloa (Oaxaca/Chiapas) and the western coast of Central America is as yet undetermined.

Information Need: Gene flow between Texas/ Tamaulipas, Western Mexico and Bahamas has been examined recently, and work is underway to examine samples collected in Florida, Oaxaca and Yucatan. Genetic studies, supplemented by research on juvenile dispersal, will help clarify the appropriate scope for conservation planning to ensure genetic diversity within the species.

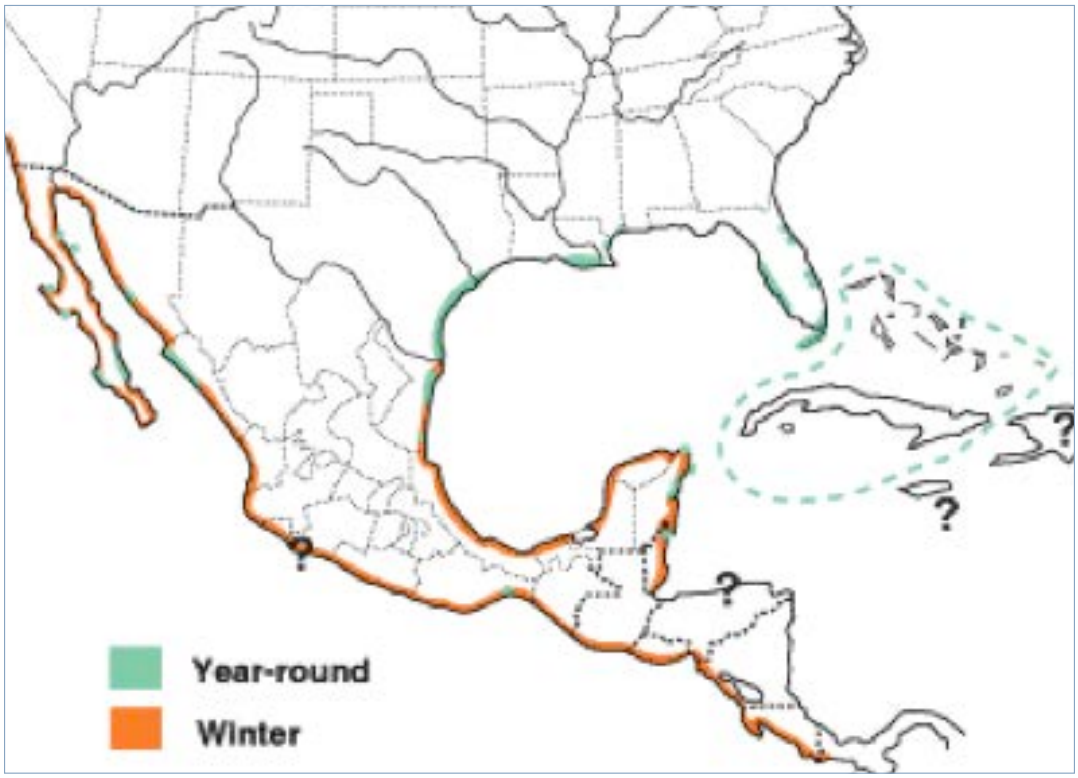


Figure 2. Reddish Egret range map retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/633

VISION

A vision is a description of the desired state or ultimate condition that a group is trying to achieve (CMP 2007). The vision established for the Reddish Egret Conservation Action Plan is that the distribution, diversity, and abundance of populations and habitats of breeding, migratory, and nonbreeding Reddish Egrets are sustained or restored in appropriate current, transitional and future habitats of the Americas. This vision draws from the North American Waterbird Conservation Plan (Kushlan et al. 2002) and is updated to recognize ongoing and emerging threats.

Information Need: Roost-habitat requirements need to be examined to determine if they differ from those for breeding and foraging.

CONSERVATION TARGETS

Conservation targets are the ecosystems/habitats, ecological processes, or species on which a project is focusing (CMP 2007). The primary targets for the Reddish Egret Conservation Plan are the Reddish Egret population itself, and the habitats that support the birds' essential activities of nesting and foraging (Figure 3).

Although roosting is also an essential activity, roosting habitat was not assumed as distinct from nesting or foraging habitat.

Given that there are two subspecies of Reddish Egret, and that threats and management situations vary greatly across the hemispheric range of the species, three management units – Eastern, Central, and Western – were identified for purposes of conservation planning. These are shown spatially in Figure 4. Therefore, in total, nine targets were identified: populations, breeding habitat, and foraging habitat in each of three management units. Each of these targets is described in greater detail below.

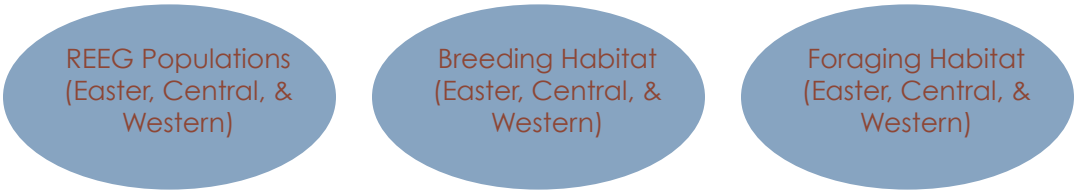


Figure 3. Project targets

Eggs. Clay Green

Information Need: Neither post-breeding dispersal nor migratory movements are well understood for this species but are critical for refining the biologically appropriate management units. Such information is best gained through long term banding programs coupled with satellite telemetry studies. Specific gaps include:

- *Oaxaca/Chiapas region and El Salvador: Banding and telemetry work has indicated that this area brings together birds from Western Mexico and Texas during the winter.*

It is unknown if birds are actually mixing there.

- *Yucatan: Recent surveys there indicate a breeding population that is larger than expected and very little is known about gene flow, connectivity, and migratory status of birds there. Interestingly, a hatch-year bird from that area showed up in Florida (St. Joseph's Island).*

- *Caribbean: Exchange between Florida and islands: Limited satellite telemetry in the lower Florida Keys shows strong year-round fidelity to the local region (n=8 birds tracked for <3 years).*

POPULATION TARGETS

Delineation of the three management units identified for Reddish Egret was established based on the location of population aggregations, emerging information on genetic variation and flow, data on individual movements from banding and telemetry, and occurrences of color morphs. However, there is some evidence that nomadism may influence genetic interchange throughout the range. Year-round residents exist in each of the breeding locations, but birds also are known to disperse and migrate great distances. Further, juvenile dispersal seems to be multi-directional; e.g., banded birds from the Laguna Madre have been observed in the upper Texas coast, coastal Louisiana, Florida panhandle, in southern Mexico, and even in Colombia (Geary 2012).

As with many egrets, the species became the target of the feather trade which pushed the birds near extinction. Jim Gray

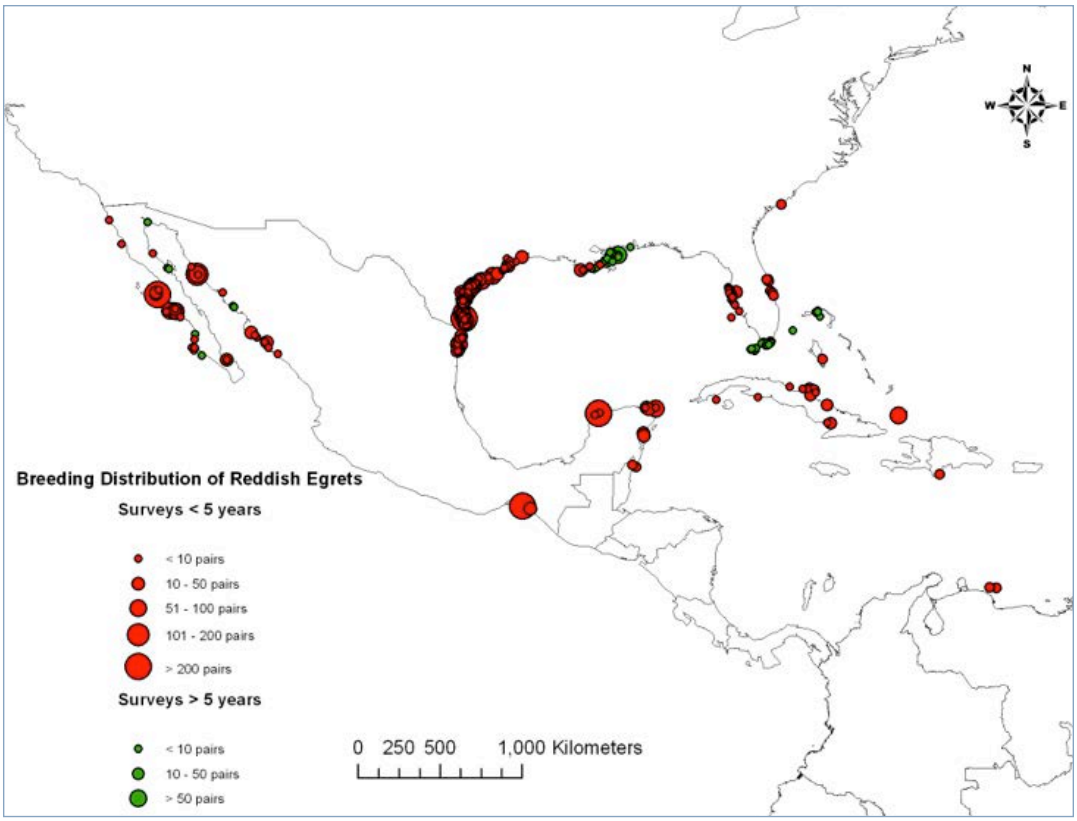


Figure 4. Range-wide distribution of Reddish Egrets colonies and approximate numbers of pairs per area, with delineated management units.

Eastern Management Unit

This unit includes peninsular Florida, the Caribbean, and the northern coast of South America (Figure 4). 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 per mangrove island. 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. The northernmost breeding record along the North American Atlantic was on Marsh Island, a barrier island located within Cape Romain National Wildlife Refuge in South Carolina in 2004 (Ferguson et al. 2005).

In winter, some Reddish Egrets fledged in Florida appear to disperse north into the Florida panhandle (Christmas Bird Count), with increased observations of post-breeding juveniles in Georgia. Wintering Reddish Egrets have also been observed on multiple Caribbean islands and on the northern coast of South America, but the source of these birds is unknown.

In the Caribbean, Reddish Egrets breed in the Bahamas on at least four islands, Great Inagua, Grand Bahama, Bimimi Islands and New Providence, with the majority of birds nesting on Great Inagua. There are historical accounts of Reddish Egrets on Andros Island, and it may currently support breeding pairs (Jeffery, pers. comm.), but this has not yet been confirmed (Pearson 1923). This species is known to breed in Cuba, although the number and specific locations of colonies are unknown (Figure. 4). Historically Reddish Egrets also bred on Jamaica and Hispaniola.

Central Management Unit

This unit includes the Gulf coasts of Mexico and the U.S. east to Florida as well as the Yucatan Peninsula and south into Central America (Figure 4). It also includes the colonies on the Pacific coast of Mexico in the Gulf of Tehuantepec in the states of Chiapas and Oaxaca.

Louisiana hosts a relatively small number of nesting Reddish Egrets, distributed across numerous small islands in the southeastern part of the state. 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 and Watts 1999).

In Texas, Reddish Egrets nest along much of the entire coast, with the majority of the breeding population on the middle and lower Texas 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. Based on Texas Colonial Waterbird Society data, seven colonies represent between 50 and 80 percent of the state's breeding population each year. The largest documented colony of Reddish Egrets is Green Island in the lower Laguna Madre (managed by Texas Audubon) which has historically supported over 1,000 pairs although recent estimates are < 600 pairs.

In Mexico Reddish Egrets are distributed throughout the coastal areas of the Gulf of Mexico with reported breeding colonies along the northwest coast of the Gulf of Mexico and Yucatan Peninsula. Reddish Egrets also breed in Belize, but apparently in small numbers.

There is good evidence for connectivity between Texas and Mexico birds. Banded birds from Tamaulipas have been re-sighted in Texas and recent genetic analyses show a strong relationship between these areas (Hill et al 2012). About one-half the birds marked in Texas migrate to wintering areas in Mexico (Ballard and Green, unpubl. data). In particular, Laguna Madre de Tamaulipas, a wetland complex north of Tampico, and the Pacific coast of Oaxaca appear to be critical areas for birds migrating south from Texas. Therefore, Mexico supports half the Central unit's breeding population, and part of Texas' breeding population during the winter.

Laguna Madre, Texas. Creative Commons

Laguna Madre de Tamaulipas. Creative Commons

Western Management Unit

This management unit includes Reddish Egret breeding sites in the states of northwest Mexico, specifically, along both coasts of the Baja California peninsula and along the coasts of Sonora and Sinaloa (Figure 4). The Reddish Egret possibly breeds in Nayarit and Colima but no colonies have been recorded there.

Little is known about the post-breeding dispersal and migration of Reddish Egret in the western management unit, but a northern movement of individuals up the Baja California Peninsula as far as southern California and Arizona has been documented. Nonbreeding Reddish Egret have been seen all along central Mexico's Pacific Coast into Central America; specifically, hatch year birds from Baja California Sur and Sinaloa have been re-sighted in Nayarit and El Salvador, respectively.

As noted earlier, the northwest Mexican breeding population is thought to be a valid subspecies (*E. r. dickeyii*) (Van Rossem 1926; Payne 1979), genetically separated from populations to the east (Hill et al 2012). The extent of mixing with the populations nesting in south Mexico (the colonies in Oaxaca and Chiapas, which are grouped into the central management unit) has yet to be determined.

In Texas, nests are built mostly on the ground near a bush or prickly pear cactus or on an oyster shell beach. Clay Green

HABITAT TARGETS

The Reddish Egret is the only Ardeid to be restricted to coastal saline habitats. The critical need for this species appears to be proximity to shallow open waters suitable for its unique foraging technique.

Breeding Habitat

Reddish Egrets typically select nesting sites relatively free from human disturbance and mammalian predators. The species will use a variety of substrates in coastal habitats across the range. Breeding habitat in Florida includes offshore natural mangrove islands and shrubby dredge spoil islands in impoundments or bays. In the Caribbean, Reddish Egrets nest in colonies or singly on mangrove islands.

Breeding habitat on the northwest coast of the Gulf of Mexico (Texas, Tamaulipas) generally consists of low-lying barrier or dredge-spoil islands where the vegetation can be short shrubs or prickly pear cactus although several large colonies are in Tamaulipan thorn scrub. The primary nesting islands are located in southern Texas and Tamaulipas in the Laguna Madre. Nesting habitat in the Yucatan region and further south into Belize appears to be largely in mangroves, as is the case for the Oaxaca and Chiapas colonies. Nesting habitat in northwest Mexico is variable, including mangrove and various types of scrub habitat (coastal sage, thorn, Sonoran desert), on halophytes, and even rocky ground where little vegetation exists and boulders are used as protection and shading for the nest.

Foraging Habitat

Reddish Egrets forage exclusively in shallow coastal flats, ponds and lagoons including wind-tidal flats and alluvial overwash zones of barrier islands, open banks and ponds inside keys, intertidal flats, salterns, occasionally open beaches and reefs and in hypersaline flats and solar salt ponds. Microhabitat requirements are shallow water, generally 5-15 cm deep, rarely to about 25 cm deep. Primary prey has been shown to be small fish, primarily sheepshead minnow (*Cyprinodon variegatus*) in Texas, Florida, and Bahamas; Yucatan pupfish (*Cyprinodon artifrons*) in Yucatan; and American shadow goby (*Quietula y-cauda*) in Baja California Sur.

The largest colony in the Bahamas (Lake Rosa) is located on an inland salt lake on Great Inagua where nesting and foraging habitats are in close proximity to each other. Territorial behavior, presumably unique to this region, exists at Lake Rosa where Reddish Egrets defend a nesting island and surrounding foraging habitat.

There is some belief that foraging habitat might be limiting due to the relatively specific physical and hydrologic conditions required by the Reddish Egret to forage. For example, there is evidence that nesting success is high in Texas colonies (Holderby et al. 2011) but post-breeding survival seems to be low (Geary 2012), suggesting that lack of sufficient foraging habitat, in quality and/or quantity, during the nonbreeding season might be an issue.

Finding a nest location close to open shallow water is critical for foraging. Clay Green

Reddish Egret on the Bahama breeding grounds. Matt Jeffrey

STATUS OF CONSERVATION TARGETS

The status of Reddish Egret populations and habitats is discussed to the degree known below. A formal Population Viability Analysis (PVA) relies on knowledge of basic ecology, demographic, and life history parameters, such as productivity, juvenile survival, age of first breeding, post-breeding dispersal, site fidelity, adult survival, etc., and this information is only just emerging.

Conservation Need: Revisit designation of Reddish Egret by Mexico's federal authority.

Population Status

A recent survey of the literature and local experts indicates the population is likely less than 7,000 individuals range-wide. Although breeding populations at some locations are apparently stable, the overall population currently seems to be in decline. Thus, although quantitative information on population abundance and status is lacking, Reddish Egrets have been designated as a species of concern by many organizations.

The IUCN Red List classifies the Reddish Egret as Near Threatened because despite its large range it occupies a restricted habitat, is patchily distributed, and is assumed to have a moderately small and declining global population. The North American Waterbird Conservation Plan listed this species as only a moderate priority (Kushlan et al. 2002) based on optimistic breeding pair numbers and apparently stable population. 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).

In all areas of the U.S. and Mexico, the Reddish Egret is legally protected under the domestic laws enacting the Migratory Bird Treaty between the two nations, which prohibit direct take by humans unless authorized by permit. The species is not federally listed as endangered or threatened in the United States, but it is federally listed in Mexico (NOM-059-SEMARNAT-2010, SEMARNAT 2010), with its legal designation of special protection status (i.e., species of special concern). Reddish Egrets regularly occur in eight U.S. states: California, Texas, Louisiana, Mississippi, Alabama, Georgia, Florida, South Carolina, and North Carolina. Four of these states have identified Reddish Egrets as a species of greatest conservation need in their Comprehensive State Wildlife Conservation Strategy (Texas, Louisiana, Alabama, and Florida).

Information Need: The Reddish Egret Working Group recommends that a tentative PVA, based on all available information, be conducted for the species in the coming year. In addition to robust estimates of critical demographic rates, additional field research is needed to determine causes of direct mortality of juveniles and adults. The apparent low survivorship in the non-breeding season cannot be addressed unless the threats/causes are known.

Habitat Status

Certainly human activities have greatly altered the landscape in the geographic range of the Reddish Egret. Coastal development has decreased the quantity and quality of suitable habitat. It is estimated that Atlantic (NC, SC, GA, & eastern FL) and Gulf of Mexico (western FL, AL, MS, LA, & TX) coastal watersheds lost ~65,000 acres of saltwater wetlands between 1998 and 2004 (Stedman and Dahl 2008). Some of this lost is from processes of subsidence and sea level rise (get percent from Steadman and Dahl); the remainder from land conversion and canal/waterway dredging. It was estimated that in 2003, 53% of the US population (153 million people) lived in 673 coastal counties, an increase of more than 33 million since 1980 (Crossett et. al. 2004). Much of this high density population is located in counties that are the core habitat for Reddish Egrets along the Gulf of Mexico and southern Florida coasts.

The compilation of colony locations (See Appendix A, to be posted on Reddish Egret Working Group Website) includes information on the ownership/protected status of nesting sites. While this has yet to be determined for many of the sites, it appears that several have protected status and public ownership. If so, then development is unlikely there, although this status does not ensure habitat quality or management of direct threats to populations.

While better identified in some parts of the range than others, in general the current understanding of the extent and distribution of available foraging habitat throughout the range of the Reddish Egret is poor. Recent research in the Laguna Madre, Texas measured attributes of foraging habitat from over 400 foraging individuals and flocks throughout the annual cycle. These attributes were then used in a geographic information system to spatially analyze and map the distribution of foraging habitat throughout the Laguna Madre as well as its temporal dynamics throughout the year (Bates 2011). The Working Group plans to build upon this recent effort to inventory and map foraging areas across the range of the species. This effort will use a combination of local observations, digitized spatial data, and recent data from satellite-tagged Reddish Egrets to identify historic, presently known, and potential foraging areas. This will provide a search image for survey work to fill information gaps on status. It will also guide preliminary identification of the critical foraging areas within each management unit – areas that should be the focus of protection and management efforts.

The reddish egret is one of the most active herons, and is often seen on the move. It stalks its prey visually, frequently running energetically and using the shadow of its wings to reduce glare on the water once it is in position to spear a fish—the result is a fascinating dance. Jim Gray

DIRECT THREATS

By definition (CMP 2007), direct threats are anthropogenic in nature and negatively affect bird populations (i.e., increased mortality, reduced reproduction) or their habitats (i.e., decreased quality or quantity). Natural processes are included if they have been altered or exacerbated due to human influence.

Identification and Rating of Threats

The following threats are identified as being significant to one or more of the nine conservation targets (Reddish Egret populations and habitats in the three management units):

- Habitat shifting and alteration from sea-level rise and subsidence
- Tourism and residential development
- Coastal engineering
- Increased frequency and intensity of storms and flooding
- Marine transportation
- Energy development
- Predators—problematic native species
- Human disturbance due to recreational and commercial activities
- Invasive species
- Local ranching and other land use activities
- Shrimp aquaculture

Threat rating is a method for making an implicit assessment of threats more explicit and more objective. It involves determining and defining a set of criteria and then applying those criteria systematically to the direct threats to conservation targets so that conservation actions can be directed where they are most needed (FOS 2009). The Reddish Egret Working Group rated each threat -target combination on a four-point scale (very high, high, medium, or low) pertaining to the scope, severity and irreversibility of the threat. The ratings for scope, severity and irreversibility are then combined using established rule sets (an automated process in Miradi) to give an overall rating for each threat-target combination, which are then summarized across all threats and across all targets.



Invasive weeds like Hydrilla, near-shore energy development, and predators are just a few of the threats affecting Reddish Egrets. Northeast Aquatic Nuisance Species Panel, Legal Tides, Jim Fenton

Information Need: Threats to nonbreeding populations and habitats are less well known than those to breeding habitat, likely because of the conservation and management attention paid to the more visible aggregations of birds. If survivorship during the nonbreeding season is limiting, it is crucial to learn more about habitat use and mortality during this period.

Scope

Most commonly defined spatially as the proportion of the target population that can reasonably be expected to be affected by the threat within ten years given the continuation of current circumstances and trends. The criteria for rating scope are as follows: Very High, affecting most or all of the target (71-100%); High, affecting much of the target (31-70%); Medium, affecting some of the target (11-30%); or Low, affecting just a small percent of the target (1-10%).

Severity

Within the scope, the level of damage to the target from the threat that can reasonably be expected given the continuation of current circumstances and trends. For ecosystems and ecological communities, typically measured as the degree of destruction or degradation of the target within the scope. For species, usually measured as the degree of reduction of the target population within the scope. Very High: Within the scope, the threat is likely to destroy or eliminate the target, or reduce its population by 71-100% within ten years or three generations. High: Within the scope, the threat is likely to seriously degrade/reduce the target or reduce its population by 31-70% within ten years or three generations. Medium: Within the scope, the threat is likely to moderately degrade/reduce the target or reduce its population by 11-30% within ten years or three generations. Low: Within the scope, the threat is likely to only slightly degrade/reduce the target or reduce its population by 1-10% within ten years or three generations.

Irreversibility

The degree to which the effects of a threat can be reversed and the target affected by the threat restored, if the threat no longer existed. Very High: The effects of the threat cannot be reversed and it is very unlikely the target can be restored, and/or it would take more than 100 years to achieve this (e.g., wetlands converted to a shopping center). High: The effects of the threat can technically be reversed and the target restored, but it is not practically affordable and/or it would take 21-100 years to achieve this (e.g., wetland converted to agriculture). Medium: The effects of the threat can be reversed and the target restored with a reasonable commitment of resources and/or within 6-20 years (e.g., ditching and draining of wetland). Low: The effects of the threat are easily reversible and the target can be easily restored at a relatively low cost and/or within 0-5 years (e.g., off-road vehicles trespassing in wetland).

Table 1 depicts the overall threat ratings and summaries. Across targets, foraging habitat were ranked as very highly threatened (Eastern Management Unit) or highly threatened (Central and Western management units). Nesting habitat in the Eastern and Central management units are also highly threatened. Across threats, habitat shifting and alteration from sea-level rise ranks as very high, with both the threats of tourism and residential development and coastal engineering ranking as high.

Threats \ Targets	Eastern Pop.s	Central Pop.s	Western Pop.s	Eastern Nesting Habitat	Central Nesting Habitat	Western Nesting Habitat	Eastern Foraging Habitat	Central Foraging Habitat	Western Foraging Habitat	Summary Threat Rating
Habitat shifting and alteration from sea-level rise and subsidence				Very High	Very High	High	Very High	Very High	Very High	Very High
Tourism & Residential Development						High	Medium	High	Medium	High
+/- Coastal Engineering					Low		Very High	High	High	High
Increased frequency and intensity of Storms and Flooding				Me-dium	Medium		Low	Low		Medium
Marine Transportation				Me-dium	High					Medium
Energy Development		Low					Low	Medium	Medium	Medium
Elevated Predation Rates	Me-dium	Medium	Medium							Medium
Human Disturbance due to Recreational and Commercial Activities	Low	Medium	Low							Low
Invasive Species	Low	Low		Low	Medium					Low
Local Ranching & Other Land Use Activities					Low					Low
Shrimp Aquaculture					Low			Low	Medium	Low
Summary Target Ratings:	Low	Medium	Low	High	High	Medium	Very High	High	High	Very High

Table 1. Summary of threat ratings for Reddish Egret population and habitat targets.

DISCUSSION OF DIRECT THREATS

Information Need: Consolidate existing projections of sea level rise relative to Reddish Egret habitat and identify areas where these data are lacking. Models of potential habitat shifts from climate change must be at the level of refinement to specifically address the very particular foraging habitat needs of Reddish Egrets. These models must integrate the complexities of both wind and lunar-driven tidal effects.

Habitat Shifting and Alteration from Sea Level Rise and Subsidence
Overall Rating: Very High

The Reddish Egret is completely dependent on coastal marine habitats for breeding and foraging; habitats which are very vulnerable to loss from sea level rise related to climate change. Even with < 1.5m rise in sea level, most of the current breeding sites used by the species (i.e., islands) would be permanently inundated, especially those in the Eastern and Central Management Units, but also in the Western Management Unit with wetlands with no mangroves. In these management units, these changes are essentially irreversible, although coastal engineering such as the placement of dredge spoil and expensive erosion control projects could slow rate of disappearance (also, artificial elevated nesting structures can be installed on flat nesting islands?) . Additionally, in the Central Management Unit, subsidence (natural and anthropogenic) and reduced freshwater input into bays and estuaries exacerbates the problems associated with sea level rise. Along the Louisiana and upper Texas coasts, increasing subsidence rates are predicted to raise the relative sea level, further reducing the amount of foraging habitat and inundating nesting islands. Mangrove islands on the Pacific Coast could allow for Reddish Egrets to shift their nesting areas to higher elevations, thus mitigating somewhat the severity and irreversibility of this threat to western breeding habitat. However, the largest colony is on a flat island of a wetland with no mangrove islands or other suitable nesting sites in the adjacent wetlands.

Sea level rise is also expected to result in widespread loss of shallow foraging areas throughout the range of the Reddish Egret. The effects are anticipated to be very highly severe and irreversible. Creation of salt ponds that might provide foraging habitat is not expected to offset these losses. The creation of artificial islands within these salt ponds could be alternative nesting sites for Reddish Egrets.

Island and nearshore habitat are of course, subject to natural processes that cause change (e.g., erosion, deposition), but these processes have been largely disrupted by human activities such as dredging, channeling, and shoreline armoring. Moreover, the ability for Reddish Egrets to shift their activities to new areas, if appropriate habitat becomes available, will depend on the current and future use of these areas by humans.

Texas coastline. USFWS

Tourism and Residential Development Overall Rating: High

Coastal development has certainly been a historic threat to Reddish Egret nesting habitat, resulting in outright loss or altered function. However, in the U.S., much of the damage is already done. Colonies in Florida and along the U.S. Gulf Coast are in locations not suitable for development (small natural or dredged material islands) or are already in protected status (nature reserve, wildlife refuge, private ranches). [Note that these sites may be subject to disturbance; this threat is discussed separately.]

Similarly, the major colonies on the Gulf and Caribbean coasts of Mexico are in protected status, as is the colony on Great Inagua in Bahamas (a National Park). Thus, development for residential or commercial use is not a direct threat to most breeding habitat in Eastern or Central Management Units. There are exceptions: None of the Oaxaca or Chiapas colonies are protected, including the largest colony on Isla Pájaros in Oaxaca. Another is Cuba, which is undergoing or expected to undergo significant development for energy and tourism. Thus, there is some scope in the Central and Eastern Management Unit for development, an activity which severely degrades both nesting and foraging habitats over the long term.

The situation for Western Management Unit breeding habitat is felt to be less secure, with less protection against development (e.g., colonies are vulnerable to destruction for residences or resort construction. Based on protected status of colonies (see Appendix A), this threat is assumed to be medium in scope in the Western unit breeding habitat. Development, when it occurs typically removes breeding substrate, so is highly severe and highly irreversible in nature.

With regards to foraging habitat, residential and commercial development is envisioned as the filling or channeling of shallow waters to increase surface area for building or to improve access into developed areas. This threat is expected at low levels throughout Western and Eastern Management Units, but a bit more widespread in the Central, especially in Mexico. Moreover, because of the importance of tidal mangrove creeks in areas where flats are less extensive (i.e., the Yucatan), loss of any mangroves also signifies more severe loss of important foraging areas. In all cases, loss or degradation of foraging area is assumed to be very highly irreversible.

Note that some development, such as the creation of salt ponds associated with production facilities, provides good foraging habitat (and breeding habitat, if creation of nesting islands is included) and might be viewed as an opportunity for conservation.

Coastal residential and commercial development is a contributing factor to a number of other threats. Population density along coastlines makes Reddish Egrets and their habitats vulnerable to increased predation, human disturbance, and coastal engineering projects. Increasing water pollution is likely to have adverse impacts, although the extent of these effects has not been predicted.

Coastal Engineering Overall Rating: High

Coastal engineering in this document refers to ecosystem manipulation such as shoreline armoring to slow erosion or prevent flooding, water flow management (channelization and dams), and dredging of navigation channels and the resulting deposition of dredged materials.

Some form of coastal engineering exists throughout most of the Reddish Egret's range, but it is currently considered a significant threat only in the U.S. portions of the Central management unit. (In response to sea level rise, coastal engineering projects in other management units may increase, so this threat should

In the absence or shortage of natural nesting islands, man-made dredge-spoil islands provide suitable breeding habitat to Reddish Egrets, and coastal engineering can be an opportunity as well as a threat. The placement of dredge spoil, in appropriate locations, can protect, improve, or expand nesting habitat. Engagement with entities that undertake coastal engineering projects is essential to maximizing the benefits.

be revisited over time.) On the Gulf Coast, particularly Texas, coastal engineering greatly influences availability of nesting habitat; in fact, a majority of the Reddish Egret colonies exist on artificial islands created from dredge-spoil material. The threat stems from the potential adverse effects of dredge spoil placement that creates land bridges or larger islands that are less manageable. Coastal engineering activities can also create new hydrological patterns that erode islands or deprive them of deposition. Severity is low because Reddish Egret populations do not seem to be greatly affected, and irreversibility is high (although moderated somewhat on the Gulf Coast by hurricanes breaching land bridges and reducing island size).

Hydrologic changes from coastal engineering activities (e.g., increase in water depth, substrate damage to tidal flats) and secondary impacts such as decreased water quality may render foraging habitat suboptimal to unsuitable. The adverse effects of coastal engineering on Reddish Egret foraging habitat are expected to be widespread in all management units, but particularly so in Florida, which comprises the bulk of the Eastern Management Unit. The degree of coastal engineering is also viewed as more severe in this unit. Reversing coastal engineering's effects is expensive in all locations, but not impossible especially if natural processes favor formation of tidal flats.

Increased Frequency and Intensity of Storms and Flooding
Overall Rating: Medium

While storm mortality is certainly possible, storms are assumed not to affect Reddish Egret populations directly in any significant way. Storm season is typically after the breeding season, when young would be most vulnerable and when storms potentially make it difficult for adults to forage efficiently. Fledged individuals are assumed not to be particularly vulnerable; tracked individuals in telemetry studies seem to show little response to hurricanes.

However, the increased frequency and intensity of storms related to global climate change will pose direct threats to breeding habitat. Almost all coastal areas are extremely vulnerable to storm surge. Barrier islands and dredge spoil islands may be completely overwashed, and over time, eroded away. Damaged mangroves or other nesting vegetation may take some time to recover, even with active mangrove restoration. For these reasons the threat of storms and flooding is considered high in scope, medium in severity, and of high irreversibility. Note: coastal wetlands on the Pacific coast are not steep, they are the same topography than elsewhere and tropical storms also occur at the same season than in the East, damaging mangroves and flat nesting islands

Storm events may also affect the quality of foraging habitat in that wind from storms increases water turbidity for several days. Reduced water clarity causes foraging difficulties for Reddish Egrets, which are visual feeders. Nest failures of Reddish Egrets in the Florida Keys often occur after storms with heavy or sustained winds which result in more turbid water for several days (Tom Wilmers, pers. comm.). However, without additional data, it is assumed that this threat, though widespread in scope, is low in severity and naturally reverses itself.

Marine Transportation
Overall Rating: Medium

Wakes created by marine vessels can cause erosion of islands and shorelines. Large commercial ships in shipping channels produce larger wakes, but recreational boats also have an effect due to their greater numbers and proximity to nesting habitat. The threat of erosion from marine transportation is widespread in the Eastern and Central management units where severity is medium and high, respectively, and irreversibility is high, given the price of erosion control projects.

Boating traffic also threatens Reddish Egret foraging habitat, through propeller damage and other alterations to the shallow waters required by the species. However, the effects have yet to be quantified.

Energy Development
Overall Rating: Medium

In parts of the Reddish Egret range, habitats exhibit a legacy of oil and gas development, including existing and abandoned structures, canals and well pads, environmental contamination and risk of pollutant releases. There is an expanding effort to develop renewable energy sources including wind power on and off shore, which involves construction of turbines and transmission lines. Such development is most notable in the Central management unit. For example, areas around the large colonies in Oaxaca are under intensive pressure, including on the long sandbar that separates the Lagunas Superior and Inferior.

Energy development poses a threat to individual birds, through collisions and potential poisoning. Tracking studies showed 3 of 21 tracked birds died in areas of wind facilities, although cause of mortality was not determined (Bart Ballard, unpublished data) Considering the evidence of direct mortality, this threat was rated as low in scope, medium severity and high irreversibility (given the difficulty of removing energy structures).

Foraging habitat is also viewed as threatened by wind energy development, specifically the placement of turbines or transmission towers in shallow waters or in what might be future foraging habitats following

Motor boat wakes can cause erosion. Creative Commons

sea level rise. Wind energy development is influenced by the wind potential of a given area, which is low in the eastern range of the Reddish Egret and moderate in the central and western portions. These indicators were used as substitutes for scope. Severity ranks high due to the damage to shallow water hydrology, and the effects are deemed highly irreversible.

Predators
Overall Rating: Medium

Predators are primarily a risk to Reddish Egret eggs and during the nestling and immediate post-fledging stages. Although adult egrets may be taken by many predators (crocodiles, alligators, and potentially large raptors such as bald eagles), the threats are much greater for eggs and flightless young. Eggs and young may be eaten by mammalian, avian, or crab species while unattended in the nest. When nests are over water, alligators, crocodiles, and scavenging fish take young when they fall from the nest. Snakes, raccoons, opossums and rats are efficient climbers and common predators at all wading bird nests, including those in mangrove or other trees.

Historically, human presence has artificially boosted the numbers of mesopredators (e.g., raccoons and crows) by providing attractive food sources and suppressing top-level predators. This threat is widespread throughout the range of Reddish Egret. Its severity is considered medium, as the decreased

productivity of affected colonies will diminish populations over time (i.e., 11 to 30%). Irreversability is high. Rangewide predator control probably is not cost-effective, although in Texas, adequate commitment of resources can reduce predation rates.

Human Disturbance Due to Commercial and Recreational Activities
Overall Rating: Low

The coastal areas used by Reddish Egret, even those in protected areas, are often frequented by humans fishing, crabbing, boating, bird-watching, bird monitoring, or otherwise recreating etc. (e.g. nature photography). For example, many spoil islands are increasingly under pressure for recreation as beach island locations to anchor near or on, and protected sites without timely law enforcement are functionally under-protected. Disturbance by humans causes direct nest loss due to hyperthermia or hypothermia of eggs or chicks, and facilitates predation by exposing nests to gulls, grackles, and crows. For the purposes of this plan, recreational activities are considered to include the take of eggs or nestlings by humans. In Sonora, Oaxaca and Chiapas, there is traditional collection of eggs and nestlings at colonial waterbird colonies for human consumption. Egging also occurs in Tamaulipas and Sinaloa, as does the taking of nestlings for bait in the blue crab fishery.

The Reddish Egret typically forages singly on very shallow, broad unvegetated intertidal flats. It uses various active foraging techniques and therefore requires large expanses of undisturbed foraging habitats. Disturbance by humans may lower the foraging efficiency of Reddish Egrets, although they likely show some habituation.

The scope of human disturbance affecting populations is high, affecting the majority of the population. Severity is considered at a level sufficient to reduce affected populations by as much as 30%. While it is likely that disturbance has caused some colonies to be abandoned, it is possible that some disturbed individuals relocate to alternative locations. Disturbance effects are considered easily reversed (i.e. the Reddish Egret populations can return to normal behavior once disturbance ceases) but the feasibility and cost of controlling disturbance is great (thus, irreversibility is high). This includes areas highly popular for recreation where any signage and education must be supplemented by regulation or law enforcement. This applies to reducing traditional consumptive use in the Oaxaca and Chiapas colonies (Western and Central management units) and would probably require greater investment in the form of wardens, park rangers, or volunteers needed to monitor breeding island colonies.

American Crow predates on exposed eggs. Creative Commons, Linda Tanner

Disturbance by humans may lower the foraging efficiency of Reddish Egrets. USFWS

Invasive Species
Overall Rating: Low

The introduced red imported fire ant (*Solenopsis invicta*) has become a big problem at the breeding sites along the Gulf Coast, and the tawny (or Rasberry) crazy ant (*Nylanderia fulva*) is a looming threat. Once a chick begins pipping, blood and fluid attract ants that overwhelm and kill young birds before they are able to escape the egg. Evidence also exists that red imported fire ants are able to breach apparently intact eggshells (Seymour 2007). In Florida, new threats include exotic reptiles such as Burmese pythons, water monitors, and green iguanas, all of which may prey on adults, eggs, and chicks, as well as introduced fish that may have negative impacts on the prey base fish community where Reddish Egrets are known to forage (Harrison et al. 2013).

Threats to populations of Reddish Egret from invasive predators are of concern in scattered locations in the Eastern management unit, and more so in the Central Management Unit. However, the threat is assumed to be of low severity and reversible with relatively low cost. There are no data on invasive species threats for the Western Management Unit.

Invasive exotic species can also affect breeding habitat. At some sites in Texas, exotic grasses such as guineagrass (*Urochloa maxima*) and buffelgrass (*Pennisetum ciliare*) have encroached in areas of woody vegetation that previously provided substrate for Reddish Egret nesting. The invasive moth, *Cactoblastis cactorum*, which entered Florida in 1989 and is moving quickly along both the Gulf and Atlantic Coasts, threatens populations of *Opuntia cacti* that appear to be selected preferentially by some Reddish Egrets as a guard against predation. Loss of this nesting substrate might adversely affect Reddish Egret populations, especially in Texas if it occurs in large colonies near the mainland where predation is higher. The threat of invasive grasses and potential of the Cactoblastis moth is considered of medium scope and severity in the Central management unit, and low in the Eastern. It is reversible to some extent with modest investment (i.e., with construction of nesting platforms).

Burmese python in Florida. Creative Commons, Todd Pierson

Local Ranching and Other Land Use Activities
Overall Rating: Low

In the Laguna Madre of Tamaulipas, Reddish Egret nesting habitat is increasingly under threat of degradation as islands are used for livestock production or other industries (e.g., removal of woody vegetation for use in harvesting shrimp). These activities are related to both local subsistence and more commercial ventures, even though the islands are federally owned. This threat was rated as low for the Central management unit, because its extent is limited to the southern Laguna Madre in Mexico, with high severity and medium irreversibility. A management plan is in place for this Natural Protected Area, but implementation is limited.

Shrimp Aquaculture
Overall Rating: Low

Industrial shrimp production occurs or is anticipated mostly in Mexico. The construction of ponds, diversion of water and associated infrastructure (roads, utilities) can result in damage to mangroves (nesting habitat in Central management unit) and shallow waters (intertidal flats foraging areas in Central and Western management units.) Shrimp aquaculture already exists near the largest colony in the Yucatan, and in the coastal mudflats of Sinaloa, Sonora and Nayarit. Based on observed effects, the threat is rated as low to high in scope and low to medium in severity (varying with location). In all management units, irreversibility is rated as medium, because flooding regimes set up for aquaculture can be manipulated to improve habitat conditions.

Note. It is possible that the channelization created for flooding shrimp ponds might result in benefits to Reddish Egret habitat, if it forms shallowly flooded areas that serve as foraging habitat.

By far the greatest threat to mangrove swamps comes from the rapidly expanding shrimp aquaculture industry, which offers a high economic return. AMNH/CBC

CONTRIBUTING FACTORS AND THE CONCEPTUAL MODEL

Contributing Factors

For each direct threat, contributing factors (also referred to as indirect threats) exist. These are the factors considered root causes or drivers of direct threats to Reddish Egret populations and habitats. The team considered economic, political, institutional, social, and cultural influences, all of which provide context for Reddish Egret conservation activities and are usually where conservation activities must be applied. Contributing factors identified for each direct threat are summarized in Table 2.

Conceptual Model

Figure 5 depicts a conceptual model for Reddish Egret conservation – the Reddish Egret Working Group's common understanding of its work including the biological environment and the social, economic, political, and institutional systems that affect the conservation targets its members collectively want to conserve. This visual representation includes the targets, critical threats, contributing factors, and strategies. The targets are located in green circles, with the entire project's scope listed at the top. The direct threats are shown in the pink boxes (with each threat rating indicated—low, medium, high or very high), and the contributing factors are shown in orange boxes. The strategies are placed in the yellow hexagons and are discussed in the following section of the plan.

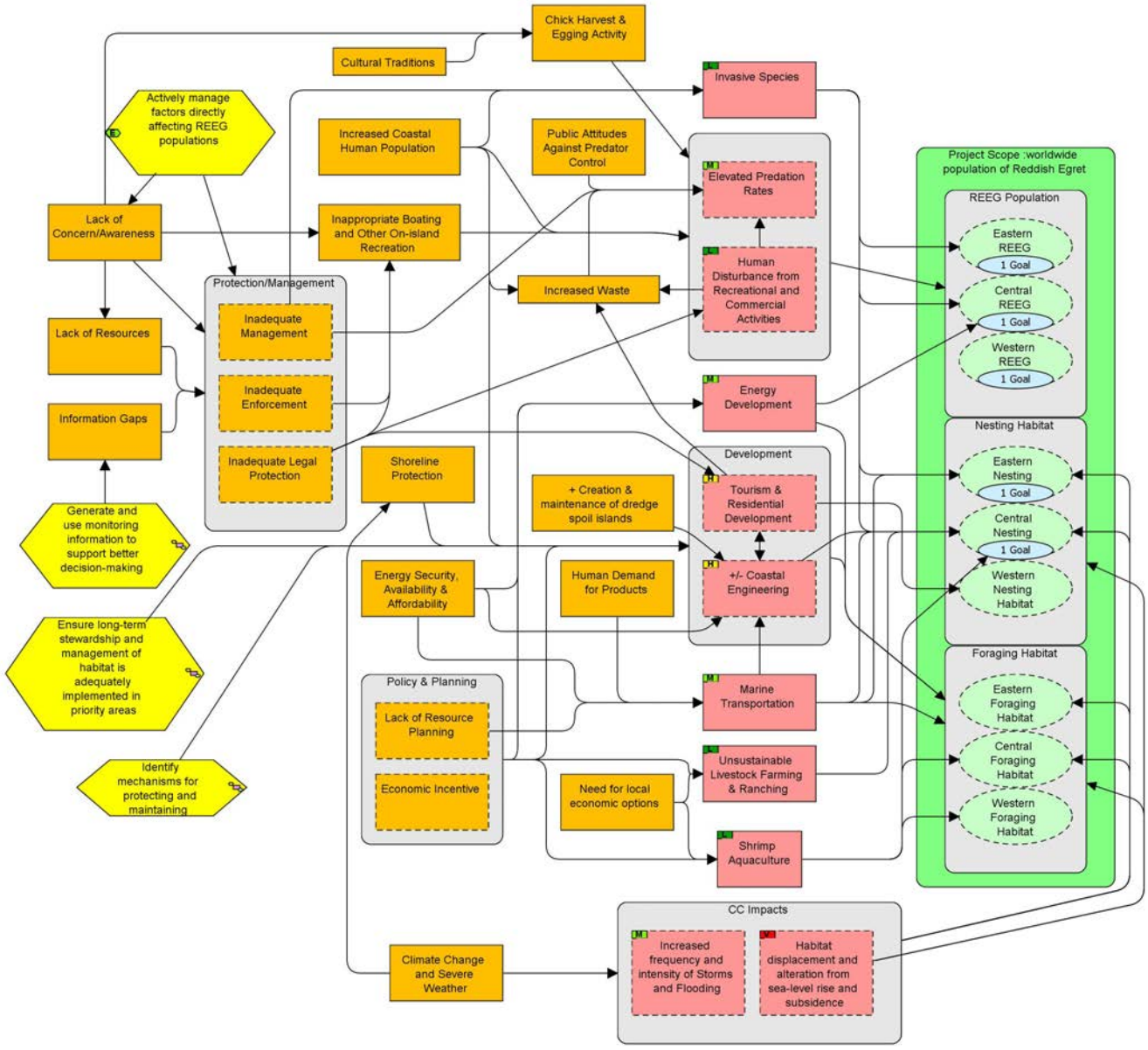


Figure 5. Conceptual model for Reddish Egret

Direct Threats	Contributing Factor
Habitat Shifting and Alteration from Sea-level Rise and Subsidence	Climate Change and Severe Weather
Tourism and Residential Development	Increased/Changing Coastal Human Population
	Impermeable Shoreline Protection
	Inadequate Legal Protection
	Lack of Resource Planning
Coastal Engineering	Increased Coastal Human Population
	Climate change and severe weather
	Impermeable Shoreline Protection
	Energy Security, Availability & Affordability
	Lack of Resource Planning
	Economic Incentive
Increased Frequency and Intensity of Storms and Flooding	Climate Change and Severe Weather
Marine Transportation	Lack of Resource Planning
	Human Demand for Products
Energy Development	Energy Security, Availability & Affordability
	Lack of Resource Planning
	Economic Incentive
	International investments and policies
Predators—Problematic Native Species	Chick Harvest & Egging Activity
	Increased Coastal Human Population
	Public Attitudes Against Predator Control
	Human Disturbance due to Recreational and Commercial Activities
	Increased Waste
	Inappropriate Boating and Other On-island Recreation
	Inadequate Management
Human Disturbance Due to Recreational and Commercial Activities	Chick Harvest & Egging Activity
	Increased Coastal Human Population
	Inappropriate Boating and Other On-island Recreation
Local Ranching and Other Land Use Activities	Lack of Resource Planning
	Need for Local Economic Options
	Economic Incentive
Shrimp Aquaculture	Lack of Resource Planning
	Need for Local Economic Options
	Economic Incentive

Table 2. Summary of Contributing Factors

PLAN ACTIONS AND MONITORING

GOALS FOR CONSERVATION TARGETS

The conservation targets are the Reddish Egret populations, the nesting habitats and foraging habitats in three management units (Western, Central and Eastern). A goal represents the desired long-term status of the target and is impact-oriented, measurable, time-bound, and specific (CMP 2007). Each target has its own associated goal.

Population Goals

Quantitative goals for Reddish Egret populations in the three management areas are presented in Tables 3, 4 and 5. These goals for maintenance of effective populations (based on minimum numbers of breeding pairs) are proposed based on current estimates and expert opinion about likely carrying capacity of the respective areas. These are stated as absolute numbers, although an alternative approach would be to set goals reflecting population increases (e.g., a 10% increase over a 5 year period). Over time, the Reddish Egret Working Group may refine these goals with other measures that indicate a sustainable population size, ensuring genetic variability, distribution of population centers across a management unit, etc.

Information Need: These goals are limited by gaps in colony information in certain areas, most notably the small, dispersed populations in Louisiana, Alabama, and Florida, and the populations in the Caribbean, especially in Cuba. While limited historical survey data for these regions exists, the data is at least 5 years old and expert opinion suggests current surveys are needed in these areas to better develop population goals. Moreover, ascertaining whether this global goal is achieved requires standardized, range-wide survey conducted within a limited window of time.

Due to limited gene flow, genetic differentiation exists among the three distinct regions. However, dark and white color morphs show no differentiation when present within the same region. Jim Gray

Table 3. Eastern Population Goal for Reddish Egret

Area	Population Estimate	Reference/Notes	Population Goals	Source/Rationale
Georgia/South Carolina				
Florida – subtropical (Florida Keys, Florida Bay)	30 breeding pairs (May 2007) 13 breeding pairs (winter 2007-2008) total – ~45 pairs	Unpublished survey data from Clay Green, Ann Hodgson, Ann Paul, Tom Wilmers)	400 pairs (not sure if this is realistic)	Hunter et al 2006 suggested a goal of ~500 pairs for subtropical Florida . Powell et al 1989 reported between 150-200 pairs during the 1950s,1960s
Florida – peninsular (Tampa Bay, Merritt Island National Wildlife Refuge / Indian River Lagoon)	Tampa Bay region averaged 69.4 pairs (1993-2011) Merritt Island region averaged ~10 pairs (1987-2012), high of 34 pairs in 1998 total – 80 pairs	Ann Hodgson and Ann Paul estimates E. Stolen, unpublished data	250 pairs	Hunter et al 2006 suggested ~275 pairs for peninsular Florida. Hodgson and Paul 2010 reported a high of 98 pairs in 2004 in Tampa/Sarasota population.
Bahamas	50 bp in Great Inagua 19 bp in Grand Bahama 2 bp in Bimini Island total – 71 pairs	Bahamas (Kushlan and Steinkamp 2007, Green et al 2011)	250 pairs with 150-200 pairs in Inagua	Based on Scott and Carbonell 1986 report of 200 pairs at Inagua
Other Caribbean	Turks and Caicos 500-1000 individuals Cuba 500 -999 individuals total – low estimate – 500 pairs Unsure numbers of breeding pairs	Pienkowski 2008 Acosta-Cruz y Mugica-Valdes 2006	>500 pairs	Need surveys to adequately determine current estimates, recent reports, communications suggest low numbers in Turks & Caicos and unclear estimates from Cuba
Current Estimate: 700 breeding pairs; Conservation Target Goal: 1,400 breeding pairs				

Chicks. Clay Green

Table 4. Central Population Goal for Reddish Egret

Area	Population Estimate	Reference/Notes	Population Goals	Source/Rationale
Alabama	5 – 10 breeding pairs	Green 2006	100 breeding pairs in Louisiana, Mississippi, and Alabama combined	Established by GCJV Waterbird Working Group (Vermillion and Wilson 2009). Hunter et al. 2006 suggested ~75 pairs for Louisiana Coastal Prairies.
Mississippi	No breeding records	Green 2006		
Louisiana	60 – 70 breeding pairs	Green 2006		
Texas/Tamaulipas	900 – 950 breeding pairs in Texas, ~100 pairs in Tamaulipas	Green 2006, TCWC 1976-2012, Newstead unpubl data.	2,000 breeding pairs	Established by GCJV Waterbird Working Group (Vermillion and Wilson 2009). Hunter et al. 2006 suggested ~1650 pairs for Texas Coastal Prairies]. Also based on historical numbers of 2600-3200 pairs during 1930s. Telemetry and banding data show clear link and exchange between TX and Tamaulipas (recommend manage as single population)
Yucatan Peninsula	897 pairs	Palacios 2012	1,500 pairs	
Chiapas/Oaxaca	282 pairs	Palacios et al. 2010	500 pairs	
Central America	Belize 500-1000 ind Small numbers visiting countries further south. No estimate of breeding pairs	Miller and Miller 2006	500 pairs	

Current Estimate: 2,750 breeding pairs; Conservation Target Goal: 4,600 breeding pairs

Table 5. Western Population Goal for Reddish Egret

Area	Population Estimate	Reference/Notes	Population Goals	Source/Rationale
Baja California Peninsula	570 pairs (Egretta rufescens dickeyi, in 2007-2008). Includes 550 pairs in Baja California Sur	Palacios et al. 2010	1,000 pairs	
Sonora/Sinaloa	~200 pairs in Sonora, ~50 pairs in Sinaloa	Palacios et al. 2010, Wittman unpubl data	500 pairs	

Current Estimate: 800 breeding pairs; Conservation Target Goal: 1,500 breeding pairs

Table 6. Global Population Goal for Reddish Egret

Area	Population Estimate	Reference/Notes	Population Goals	Source/Rationale
Global	3,500 – 4,250 breeding pairs, or approximately 5,000 – 7,000 individuals, including non-breeding birds	Green 2006 and recent surveys in Mexico, Bahamas, Texas, Louisiana and Florida		

Current Estimate: 4,250 breeding pairs; Conservation Target Goal: 7,500 breeding pairs

Nesting Habitat Goals

Interim Goal: Establish, maintain and increase habitat at "focal colony sites," defined as the locations that should be priorities for collective conservation effort. Appendix A lists the proposed focal colony sites as of early 2013.

Anticipated Goal: A quantitative goal for focal colony sites. Ultimately, the goal for nesting habitat should reflect both a number and distribution of potential breeding sites. Two agreed-upon principles are that conservation effort should be directed towards focal colony sites (to be defined in terms of size, longevity, productivity, stability/vulnerability and protection status) but that it is also important to maintain a distribution of breeding sites across the range.

The Reddish Egret Working Group will continue conversations in order to achieve consensus on the definition of focal sites, and then establish quantitative goals. There will need to be thresholds established, for example, some given number of sites which qualify by having hosted some number of birds over some number of years. Qualifying criteria should vary by subregion, especially because the patterns and knowledge of distribution are very different. The Reddish Egret Working Group also needs to define what constitutes a site – a single spoil island or a complex of keys, for example and if/how sites can be clustered for planning purposes. It is important to note that birds can move to nearby islands so an understanding of historic and potential site use is important. In the absence of information on population mixing, turnover, and survivorship, it is hard to build a justification for alternative sites, but unoccupied or potential sites are important to consider as options for restoration and as secondary breeding opportunities should conservation of focal sites fail. Finally, sea level rise and other effects of climate change must be taken in consideration relative to the time scale of habitat conservation planning and activities.

Once focal sites are identified, each should have a management plan that identifies threats and management activities. Management plans have been established for a set of priority colonies along the U.S. Gulf Coast from Alabama to Texas by the Gulf Coast Joint Venture (Vermillion and Wilson 2009). A plan for Mexico's Laguna Madre (el Plan de Manejo del Área Natural Protegida) is another example of a local management strategy, which if implemented, albeit indirectly will benefit the Reddish Egret.

Foraging Habitat Goals

Interim Goal: Identify and Protect Foraging Areas

Anticipated Goal: A quantitative goal for focal foraging areas. As discussed, the Working Group is committed to compiling and mapping information on known foraging areas and identifying potential, currently unknown, areas. As this is undertaken, the group will consider the criteria to select focal foraging areas during breeding, migration and wintering periods. For example, these might include those in proximity to focal breeding colonies as well as stopover sites and wintering areas in which a certain proportion of birds with satellite transmitters have been known to visit and/or wintering areas found to host some given number of individuals. In addition to information on habitat use, information on threats (e.g., development, marine transportation, and sea level rise) will be assembled to guide the discussion of focal foraging areas.

Once foraging habitat is better examined, quantitative goals may be possible to establish. It would be convenient if the needed number of acres to support a given number of Reddish Egrets could be calculated. However, given the ephemeral nature of the prey, and the dynamics of the available foraging area due to tides, this may not be possible. Goals may be more tied to sustaining some quantity of acreage relative to existing conditions. These discussions will be undertaken by the Reddish Egret Working Group.

STRATEGIES, OBJECTIVES, and ACTIVITIES

After setting goals for the conservation targets, the next step is to use the conceptual model to determine what strategies need to be taken to reduce the threats to the Reddish Egret and its habitats that are obstacles to achieving these goals. This is the most important step in conservation planning because it allows the working group to develop a comprehensive plan that includes a group of actions with a common focus that addresses all aspects of a conservation problem. Each group of actions is termed a strategy and should work together to reduce threats, or increase population viability, or increase conservation capacities (capacity-building), as well as capitalize on opportunities (FOS 2009).

The development of these strategies for Reddish Egret conservation involved extensive brainstorming by regional experts to identify the suite of possible interventions to address identified threats, including the nature of the intervention (i.e., research, information-sharing, advocacy for regulation and enforcement, increasing resources) and the other sectors of society that must be involved (i.e., since threats are related to energy, transportation, economic growth, etc.). The threats of climate change, and the vulnerability of coastal habitats was considered at length and strategies that facilitated adaptation of Reddish Egrets and their habitats were emphasized. This process generated several potential strategies, which were ultimately captured in the following four main strategies identified to address the threats to Reddish Egret targets. Note: Strategies should not be limited to mitigate or eliminate threats, but we can presume that other strategies might be implemented to increase REEG population viability (number of pairs, survival, nesting success, etc), and/or building conservation capacity (legal tools, education for conservation, outreach, local management plans, enforcement). Increasing population viability strategies are relevant to meet population goals. See Appendix A for individual Strategy Diagrams and Results Chains.

- Generate and use population monitoring information to support better decision-making.
- Actively manage factors directly affecting Reddish Egret populations.
- Ensure that the long-term stewardship and management of habitat is adequately implemented in focal colony sites and focal foraging areas.
- Identify mechanisms for conserving unprotected focal areas.

There is no strategy in this plan that undertakes directly to address the threats associated with climate change, specifically Habitat Shifting and Alteration from Sea Level Rise and Subsidence and Increased frequency and intensity of Storms and Flooding. Habitat Shifting and Alteration from Sea Level Rise was rated as Very High, and of all known threats, the most severe to the persistence of the Reddish Egret. The Reddish Egret Working Group discussed these threats at length, however, they were considered beyond its capacity to affect results that would directly reduce these threats (i.e., reducing the global release of carbon, slowing sea level rise, halting storms and flooding). Rather, the Reddish Egret Working Group will emphasize other strategies that increase the species' resiliency through population growth and maximizing the species' distribution across the range. As we must plan in the face of uncertainty, encouraging this approach will allow us to

best position the species to withstand or recover from negative effects of climate change. Specifically, we aim to maximize resiliency by addressing threats that lower productivity or increase mortality. Moreover, there other strategies that will aid Reddish Egrets in adapting to change, i.e., providing information to entities which do influence habitat management and can provide future refugia for Reddish Egret. Clearly articulating the habitat needs of Reddish Egret relative to changing landscapes is a necessary part to ensuring they are considered in decisions associated with acquisition or restoration.

Result Chain: A results chain is a tool that clarifies assumptions about how conservation strategies are believed to contribute to reducing threats (or increasing population viability and conservation capacity) and achieving the conservation of targets. This relationship is a connected series of assumptions or results that describe the sought-after result (i.e., the removal or lessening of a threat; which will in turn, contribute to meeting goals). The diagrams map out a series of causal statements that link factors in an "if…then" fashion – for example, if an opportunity is taken or a threat is reduced, then a conservation target is enhanced.

Results chains are described below for each major threat by key strategy, providing the objectives and activities that have been identified. Objectives can be thought of as mid- or short- term goals for specific threats or as the intermediate steps in reaching the final target goals. Like goals, objectives should be results oriented, measurable, time-bound, specific, and practical (CMP 2007). While not complete, our description lists activities that have been identified by the Working Group as actions we must take to achieve our Objectives. (see Appendix X for the diagrams for each key strategy and associated results chains thus far developed).

STRATEGY 1: DEVELOP AND IMPLEMENT LONG-TERM MONITORING OF POPULATIONS TO SUPPORT BETTER REGIONAL AND RANGEWIDE DECISION-MAKING

This strategy involves generating monitoring information in order to be proactive in our efforts to prevent development in sensitive areas, advocate for positive coastal engineering activities, and strengthen our capacity to deal with population threats such as disturbance, predation and invasive species. Moreover, land managers must use this information to prioritize funding and management actions. Conservation action cannot wait until perfect information is available; if uncertainty prevented action, many natural resources would be lost. However, goals can be more effectively reached if information is compiled, assessed and increased in a way that guides action. A number of Reddish Egret information needs have been identified throughout this plan. Objectives have been set for some of these needs, because of their importance to setting priorities for action across the range and guiding other strategies.

Population and Habitat Information

The Reddish Egret Working Group (REEG WG) has undertaken field studies to fill in gaps in knowledge about Reddish Egret populations and their habitats across the range. This work is ongoing, and focuses particularly on birds occurring in Caribbean and Central America as well as on confirming use of and threats to foraging areas throughout the range.

Objective: By November 2014, the REEG WG has compiled existing knowledge on focal breeding sites, including the nature and level of specific threats. By this time, the group will have reached consensus on and applied criteria for the selection of focal colonies.

Objective: By February 2015, the REEG WG will have mapped known foraging areas based on existing data, and begun modeling potential, but unconfirmed foraging areas (where sufficient data is available).

> ***Activity:*** Define and complete initial list of focal breeding colonies (Jan 2013-Fall 2014) and foraging areas (Fall 2013-Winter 2015).

Objective: By 2016, the REEG WG has undertaken field studies to fill in gaps in knowledge about Reddish Egret populations in 50% of their focus areas. This work will focus particularly on birds occurring in Caribbean (Cuba, Great Inagua) and Central America as well as on confirming use of and threats to foraging areas throughout the range.

Objective: By 2015, the REEG WG has developed standardized protocols for estimating trends in breeding abundance, counting wintering birds, and resightings. Promoting and designing unit specific approaches to monitoring trend estimation should be a priority and will not necessarily be standard across the range.

> ***Activity:*** Identify current methods that can be a model.
>
> ***Activity:*** Standardize metrics across range.
>
> ***Activity:*** Coordinate monitoring across range with standardized protocols.

Objective: By 2014, a REEG Clearinghouse is established, a protocol for data entry is developed, and existing data input into the Clearinghouse.

STRATEGY 2: ACTIVELY MANAGE FACTORS DIRECTLY AFFECTING REDDISH EGRET POPULATIONS

Management activities are an important component of our range wide efforts to maximize population growth and minimize the risk of extinction in the long-term. This strategy directly feeds into chains that address the threats of invasive species, predation, and human disturbance/harvest.

Invasive Species

Reducing the presence of the invasive species is necessary to minimize their effects on Reddish Egret populations and habitats. In order to ensure the most efficient use of resources spent toward managing populations, we must better understand the impacts of invasives where they are present.

Objective: Beginning in 2015, exotic species are assessed at focal breeding sites affected by exotic fauna.

> ***Activity:*** Study Effects of Exotic Ants – Launch a pilot study to determine effects of fire ant control, with experimental and control islands (e.g. upper Laguna Madre including Baffin Bay area).

Objective: Beginning in 2016, exotic fauna are actively managed at at least 75% of focal breeding sites that are affected by exotic species.

Predation Rates

Two aspects to lowering the abundance of artificially high numbers of native predators involve predator control and reducing predator resource subsidies (food sources resulting from anthropogenic activities, e.g. improper offal disposal). Successful implementation of these management activities relies on both increases in funding and public awareness.

Objective: Beginning in 2015, all focal colonies are being monitored for the presence of predators.

Objective: Beginning in 2015, predators are controlled on at least 75% of focal colonies.

Objective: By 2016, fisherman in priority areas where offal disposal presents a problem are aware of the impacts of improper offal disposal on predation of REEG.

> ***Activity:*** Educational Campaign (Greater awareness & concern about REEG).

Dinner. Jim Gray

Disturbance/Direct Harvest

There are several factors in reducing the direct impacts from human disturbance through recreational, commercial, or cultural activities that begin with reducing the activities that impact Reddish Egret populations themselves.

Reduction of the threat due to inappropriate recreational activities will result from outreach to the public and law enforcement, as well as stronger regulations and their enforcement. Efforts to establish partnerships through Working Group member affiliations will create a platform to advocate for stricter legislation.

Objective: By 2016, recreational boaters/fisherman/photographers/resource managers in priority areas where disturbance is a problem are aware of impacts to REEG.

Objective: Human disturbance trend is reduced by 25% by 5 years after launching outreach/enforcement campaigns.

To reduce these impacts in Mexico due to Chick Harvesting/Egging activity, it will be important to engage local communities to understand the extent and effects of their activities as well as motivations, in order to address the threat with incentives, enforcement or alternatives.

Objective: By 2016, target groups participating in chick harvesting and egging activity are made aware so that they understand the status of REEG and the impact of this activity.

Activity: Assessment of extent of chick harvest and egging activity in Mexico.

Objective: By 2017 chick harvesting and egging activity is reduced by 50%

STRATEGY 3: Ensure That The Long-Term Stewardship And Management Of Habitat Is Effectively Implemented In Focal Colony Sites And Focal Foraging Areas

This strategy directly feeds into chains that address threats to habitats, including Coastal Engineering (negative effects), Marine Transportation and Energy Development. (Though results chains not yet created, this would also apply to other habitat threats like Development, Ranching, and Aquaculture).

Development

Continuing development in coastal areas seems inevitable (despite the increasing risks with climate change), so the sought-after result of conservation effort is that residential and tourism development be lessened near Reddish Egret habitats.

Objective: None yet identified, but can be developed once Goals for habitat are quantified.

This relies on the authorities, conservation groups and land managers that control

or influence siting and construction be provided with appropriate technical information. As the legal status of a species occurring in an area influences land-use permitting decisions, it is important that such designations for Reddish Egret be accurate and up-to-date in all the political entities in which it is found. Moreover, access to information on focal habitats will allow for more informed permitting of land use changes. Both population and habitat information is important to guide acquisition or advocacy activities by conservation groups.

Similar to other forms of development, the desired condition is that energy development be directed away from Reddish Egret habitat. These projects are typically discrete and highly regulated, and it is possible to insert environmental needs (e.g., bird collision avoidance) into consideration in a way that doesn't occur with residential and tourism development.

Objective: By 2016, no further energy development will occur in the areas identified by the Reddish Egret Working Group as focal foraging areas.

To achieve this objective, and the greater consideration of environmental needs in energy projects by both industry and agencies, would appear to require an alliance of organizations. Reddish Egret concerns alone are unlikely to result in much influence, but integrated with concerns for other wildlife (especially commercially valuable wildlife like waterfowl and fishery species), and other natural resources, are more likely to influence decision-makers. In permitting decisions, the burden of proof (that the area is or not an important area) should be on the developers, and the management plans of NPAs should be reviewed, implemented and legally enforced.

Objective: By a date to be determined, an alliance of natural resource protection organizations has been formed to address appropriate siting of energy development in coastal areas with the stated goal that no further energy development occurs in the areas identified by the Reddish Egret Working Group as focal foraging areas.

Tourism and Residential Development is a major threat to both breeding and foraging habitat. USFWS

> ***Activity:*** Build an alliance for appropriate siting of coastal energy projects.

The communication of Reddish Egret concerns to an alliance focused on energy development issues relies on first understanding the nature of any effects, which are yet unstudied. Additionally, to assist agencies and industries in addressing concerns, this communication should be accompanied by mitigation possibilities and suggested best alternatives (e.g., alternate siting). The impacts of energy development on Reddish Egret foraging areas needs to be researched for a better understanding.
Coastal engineering projects can have adverse or positive effects for Reddish Egret habitat. The sought after result of conservation will be that habitat damage from projects is reduced, and positive effects (i.e., habitat creation and maintenance; reduction of erosion) are increased.

Objective: None yet identified.

Specific audiences for technical information as it relate to coastal engineering are those that undertake or oversee such projects. To communicate this technical information it must first exist.

Objective: By 2014, understand extent of existing problems caused by coastal engineering by assessing (through past observation or new study) effects at focal breeding and foraging sites.

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 US Army Corps of Engineers and State natural resource permitting agencies (in the US), Ministry of Environment and Natural Resources (SEMARNAT) and Ministry of Communications and Transportation (SCT) (in Mexico).

Additionally, effective channels of communication must exist with these agencies, which depends on proactive efforts to develop professional relationships.

Objective: By 2016, information is shared with the USACE about the positive effects of dredge spoil islands on REEG breeding and USACE commits to further beneficial uses that would assist the species.
These relationships must exist at both the national and local levels, because local managers will be effective collaborators if political will and funding for environmental protection exists in the agency.

Marine Transportation

Marine transportation from huge commercial tankers to small fishing skiffs will also always be a reality for coastal areas used by Reddish Egret. The sought-after result of conservation effort is that negative effects (erosion and habitat damage) from marine transportation be minimized.

Objective: From now until 2020, at least 80% of focal REEG nesting habitat suffering erosion caused by marine transportation is maintained.

Considering just the habitat subject to erosion caused by marine transportation (as opposed to that eroding from natural causes) , the objective of minimizing loss of focal breeding habitat to less than 20% seems to be an acceptable level, primarily because small island formation from dredging operations or sea level rise could compensate for the loss.

Achieving the objective for marine transportation requires behavior changes on the part of fishermen and other boaters whose decisions affect erosion levels. These behaviors are informed by clear communication of the appropriate routes and areas (i.e., boat channels and protected zones are clearly marked) coupled with educational efforts that appeal to the boaters' sense of stewardship.

> ***Activity***: Relate boating rules that benefit Reddish Egret to other more well-known and valued resources, such as shrimp or game fish.

Commercial tankers like the one pictured above can have a profound affect on Reddish Egret habitat. Stephen Straighton, Creative Commons

Behavior change may be voluntary or forced by regulation; for the latter to work, there must be enforcement of penalties for rule violators, which in turn requires that enforcement is adequately funded and politically backed.

The designation of protected zones such as no-wake/reduced speed areas or non-motorized areas, relies on a sense of stewardship also being cultivated in the relevant authorities.

Objective: by 2016, decision-makers responsible for 50% of foraging areas with boating damage agree to limited closure areas.

> ***Activity***: Awareness campaign for decision-makers, pulling in allies that may favor closures for other reasons (kayakers supporting non-motorized areas).

STRATEGY 4: Identify Mechanisms For Implementing And Sustaining Protected Status For Focal Areas

This strategy currently lacks any developed results chains, but this would be a proactive strategy to get currently unprotected areas protected. 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, concessions of federal zone, 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). This strategy must take into account habitat shifts from climate change in order to effectively address the needs of the Reddish Egret over time.

> ***Activity***: Assess opportunities to incorporate important REEG foraging areas into the "Caribbean Challenge" establishing new Marine Protected Areas.

Reddish Egret with chicks. Bart Ballard

FINAL RECOMMENDATIONS AND FOLLOW-UP ACTIVITIES

This is Version 1.0 of an Action Plan. And it reflects only Steps 1 and most of 2 in the Open Standards.

Our efforts towards Reddish Egret conservation need to continue on multiple fronts: additional planning at the range-wide scale, implementation of identified activities, and monitoring and sharing of associated results. Moreover, as this plan is range-wide in scope, from it must flow plans that lay out the details of local strategies and projects.

Business Plan Approach

Business strategies differ from standard conservation plans by focusing on a set of well-developed actions that link funding to specific, measurable conservation outcomes. Typically, a conservation plan describes the natural history of species, lists conservation threats and needs, and presents a painstaking approach that applies objective criteria to determine high priority species. A business strategy builds on the scientific foundation of conservation plans by presenting strategic conservation solutions as actionable investment opportunities.

A business strategy emphasizes three additional aspects generally lacking or minimally developed in a conservation plan: prioritized actions, funding, and outcomes. Prioritizing actions, or grouping actions into tiers that rank their urgency, shows interested parties, particularly potential funders, that some actions need to be implemented more quickly than others to maximize conservation opportunities and successes. The linkage of funding to an explicit outcome goal is central to a business strategy. This allows the success of conservation investments to be evaluated based on progress toward measurable outcomes. Specific outcomes of conservation actions, such as reduced mortality or increased productivity, are often difficult to predict, and scientists can be hesitant to predict such outcomes in the face of uncertainty. Yet the best available information can generally be used to make an educated guess about how organisms will respond to conservation actions. By clearly describing the assumptions of predictions, effectively carrying out informative monitoring systems, and objectively evaluating conservation

success, a business strategy can be adapted over time to maximize the benefits of conservation investments in the face of uncertainty.

Outreach

Improving awareness and concern through outreach efforts for Reddish Egret spans multiple strategies and is an essential component for addressing most threats. Recognizing the importance of outreach in any conservation effort, we encourage those who are interested and engaged in Reddish Egret conservation and outreach to share successes, draw from other case studies and learn from similar efforts for other species. While various outreach strategies will need to be targeted to address specific local needs, an overall plan should highlight how Reddish Egret is likely to be incredibly sensitive to coastal change in general.

Coordination

The formation of a Reddish Egret Working Group allowed many subject experts and representatives to collaborate on the development of the contents of this document.

The Working Group will continue provide recommendations to guide the development, support, and implementation of rangewide research and management efforts that promote the conservation of Reddish Egret and their habitats through individual and partnership-based initiatives.

Continued international engagement by partners throughout the Reddish Egret's range is critical to the conservation of the species. In particular, the continued participation of partners in Mexico, and additional participation from the Caribbean and Central America, will best inform conservation actions in these areas.

Communication will be vital to the success of this plan and the Reddish Egret Working Group can provide a forum for partners to discuss ongoing activities and track the progress of Reddish Egret conservation.

Additionally, the group should explore opportunities for synergies with other international working groups, especially the Atlantic Flyway Shorebird Conservation Initiative.

Reddish Egret Working Group Website

To join the conservation effort, please visit the Reddish Egret Working Group's website for plan updates, monitoring information, current projects, and more at www.reddishegret.org.

REFERENCES

Bates, E.M., R.W. Deyoung, and B.M. Ballard. 2009. Genetic diversity and population structure of Reddish Egrets along the Texas coast. Waterbirds 32:430-436.

Bates, E. M. 2011. Foraging ecology of reddish egrets in the Laguna Madre of Texas. Ph.D. dissertation, Texas A&M University-Kingsville.

Conservation Measures Partnership (CMP) 2007. Open Standards for the Practice of Conservation. Version 2.0. October. www.conservationmeasures.org

Crossett, K.N., T.J. Culliton, P.C. Wiley and T.R. Goodspeed. 2004. Population trends along the coastal United States, 1980-2008. NOAA National Ocean Service Special Projects Office, Silver Spring, MD.

Ferguson, L.M., P.G.R. Iodice, W. Post, and F.l. Sanders. 2005. Reddish egret extends its breeding range along the North American Atlantic coast into South Carolina. Waterbirds 28: 525-526.

Fidorra, J, P Frederick, K Meyer, and D Evers. 2011. Local and long range movements of two populations of Great Egrets in the southeastern US. Paper presented at The Waterbird Society 35th Annual Meeting; Annapolis, MD.

Foundations of Success (FOS). 2009. Conceptualizing and Planning Conservation Projects and Programs: A Training Manual. Foundations of Success, Bethesda, Maryland, USA.

Geary, B. 2012. Satellite Tracking of Juvenile Reddish Egret (Egretta rufescens) Dispersal and Site Fidelity. M.Sc Thesis. Texas State University - San Marcos.

Gmelin, J.F., 1789. Ardea rufescens. Syst. Nat. 1, pt 2, p. 628, ex Daubenton p1. Enl. p1. 902: Louisiana.

Green, M.C. 2006. Status report and survey recommendations on the Reddish Egret (Egretta rufescens).

Green, M.C., A. Hill, and J.R Troy. 2011. Status of Breeding Reddish Egrets on Great Inagua, Bahamas with Comments on Breeding Territoriality and the Effects of Hurricanes. Waterbirds 34:213-217.

Harrison E.H, J.J. Lorenz and J.C. Trexler. 2013. Per capita effects of non-native Mayan cichlids (Chichlasoma urophthalmus; Gunther) on native fiush in the estuarine southern Everglades. Copeia 2013:80-95.

Hill, A., and M. C. Green. 2011. Reddish Egret (Egretta rufescens) in the Lower Florida Keys. Journal of Heron Biology and Conservation 1:6. [online] URL: www.HeronConservation.org/vol1/art6

Hill, A ., M.C. Green, and E. Palacios. 2012. Genetic diversity and population structure of North America's rarest heron, the reddish egret (Egretta rufescens). Conservation Genetics 13:535–543.

Holderby, Z., W. Simper and B. Geary. 2012. Potential Factors Affecting Nest Initiation Date, Clutch Size and Nest Success in the Plumage Dimorphic Reddish Egret. Waterbirds 35: Volume: 437-442.

Hunter, W.C., W. Golder, S. Melvin and J. Wheeler. 2006. Southeast U.S. Regional Waterbird Conservation Plan. September. Waterbird Conservation for the Americas (www.waterbirdconservation.org).

Kline, J.L., W.F. Loftus, K Kotun, J.C. Trexler, J.S. Rehage, J.J. Lorenz and M. Robinson. 2013. Recent fish introductions into Everglades NAtional Park: an unforseen consequence of water management? Wetlands: DOI 10.1007/s13157-012-0362-0.

Kushlan, J.A., M.J. Steinkamp, K.C. Parsons, et al. 2002. Waterbird Conservation for the Americas: The North

American Waterbird Conservation Plan, Version 1. Waterbird Conservation for the Americas, Washington DC, U.S.A., 78 pp. (www.waterbirdconservation.org).

Kushlan, J. A., and M. J. Steinkamp. 2007. Seabird nesting and conservation in the northern Bahamas. Waterbirds 30:618-628.

L Mugica, D Denis, M Acosta, A Jimenez and A Rodriguez. 2006. Aves Acuaticas en los Humedales de Cuba. BirdLife International.

Lowther, P.E. and R.T. Paul. 2002. Reddish Egret (Egretta rufescens), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology.

Miller, B. & Miller, C. 2006 The Waterbird Risk Assessment Project. Belize: Belize Audubon Society & BirdLife International (unpublished report).

Palacios, E., E. Amador, and M. C. Green. 2010. Conservation of Priority Wading Birds Breeding in Western México, specific to Reddish Egrets. Unpubl. Report. Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE), Pronatura Noroeste, A.C., and Centro de Investigaciones Biológicas del Noroeste. La Paz, Baja California Sur. 41 pp.

Paul, R. T. 1991. Status report – Egretta rufescens (Gmelin) Reddish Egret. U.S. Fish and Wildlife Service, Houston, TX. 73 pp.

Payne, R. B. 1979. Family Ardeidae. Pages 193-244 in Check-list of birds of the world. Vol. 1, 2nd ed. (Mayr, E. and G. W. Cottrell, Eds.) Mus. Comp. Zool. Cambridge, MA.

Pearson, G. T. 1923. Herons of the United States. Bird Lore 25(3):218-221. May-June, 1923.

Pienkowski, M.w., Pienkowski, A.e. & Manco B.n. 2005 Birds on the outer cays of the Turks and Caicos Islands. J. Carib. Ornithol 18: 31-43.

Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT). 2010. Norma Oficial Mexicana NOM-059 SEMARNAT-2010. Protección ambiental – Especies nativas de México de flora y fauna silvestres – Categoría de riesgo y especificaciones para su inclusión, exclusión o cambio – Lista de especies de riesgo. Diario Oficial de la Federación. Diciembre 30 de 2010. Tomo DCLXXXVII Nº 23 (2ª Sección):1-77.

Seymour MA. 2007. Effect of Red Imported Fire Ant (Solenopsis invicta Buren) on the nesting success of Northern Bobwhite (Colinus virginianus L.). M.S. Thesis. Louisiana State University. Baton Rouge, Louisiana, USA. http://etd.lsu.edu/docs/available/etd-03132007-123855/. Pp. 142.

Stedman, S. and T.E. Dahl. 2008. Status and trends of wetlands in the coastal watersheds of the Eastern United States 1998 to 2004. National Oceanic and Atmospheric Administration, National Marine Fisheries Service and U.S. Department of the Interior, Fish and Wildlife Service.

Turcotte, W.H., and D.L. Watts. 1999. Birds of Mississippi. Mississippi Department of Wildlife, Fisheries and Parks. University Press of Mississippi, Jackson. 455pp.

Van Rossem, A. J. 1926. The Lower California Reddish Egret. Condor 28:246.

Vermillion, W.G., and B.C. Wilson. 2009. Gulf Coast Joint Venture Conservation Planning for Reddish Egret. Gulf Coast Joint Venture, Lafayette, LA. 18pp.

APPENDIX A. STRATEGY DIAGRAMS AND RESULT CHAINS

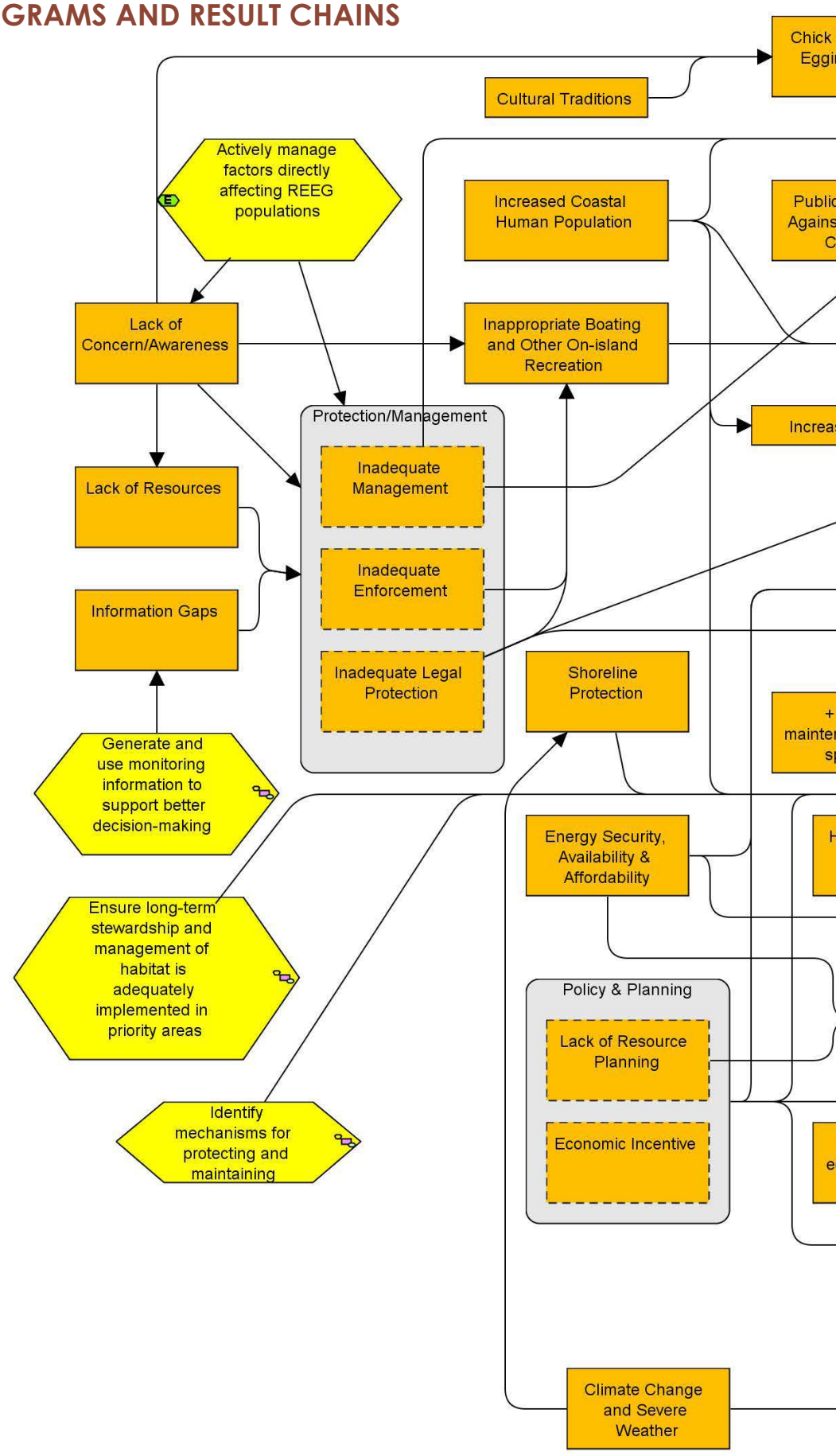
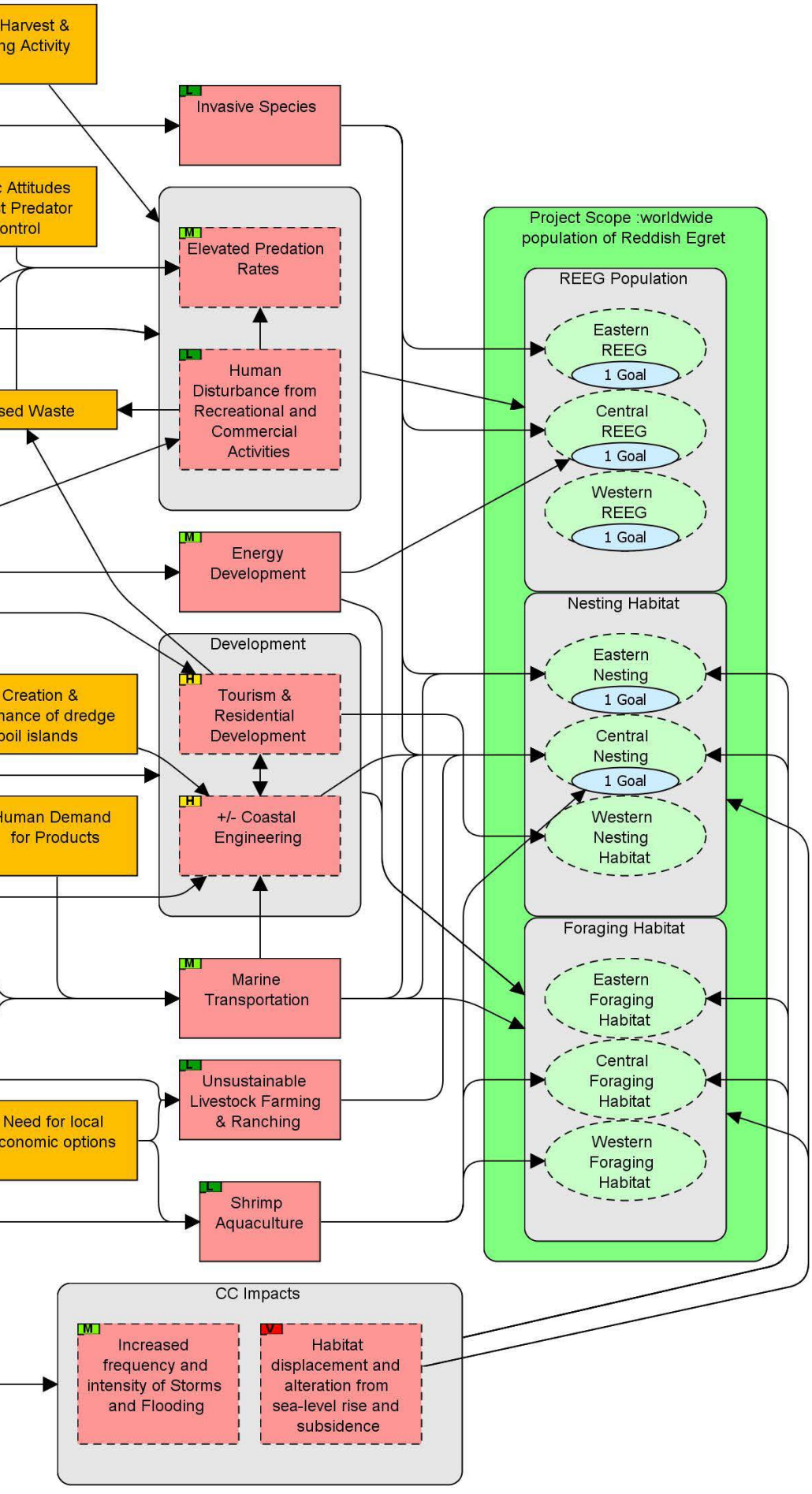


Figure 1. Conceptual model for Reddish Egret


Harvest &
ng Activity
Invasive Species
Attitudes
t Predator
ontrol
Elevated Predation Rates
Human Disturbance from Recreational and Commercial Activities
sed Waste
Energy Development
Development
Tourism & Residential Development
+/- Coastal Engineering
Creation &
nance of dredge
oil islands
Human Demand for Products
Marine Transportation
Unsustainable Livestock Farming & Ranching
Need for local
conomic options
Shrimp Aquaculture
Project Scope :worldwide population of Reddish Egret
REEG Population
Eastern REEG
1 Goal
Central REEG
1 Goal
Western REEG
1 Goal
Nesting Habitat
Eastern Nesting
1 Goal
Central Nesting
1 Goal
Western Nesting Habitat
Foraging Habitat
Eastern Foraging Habitat
Central Foraging Habitat
Western Foraging Habitat
CC Impacts
Increased frequency and intensity of Storms and Flooding
Habitat displacement and alteration from sea-level rise and subsidence

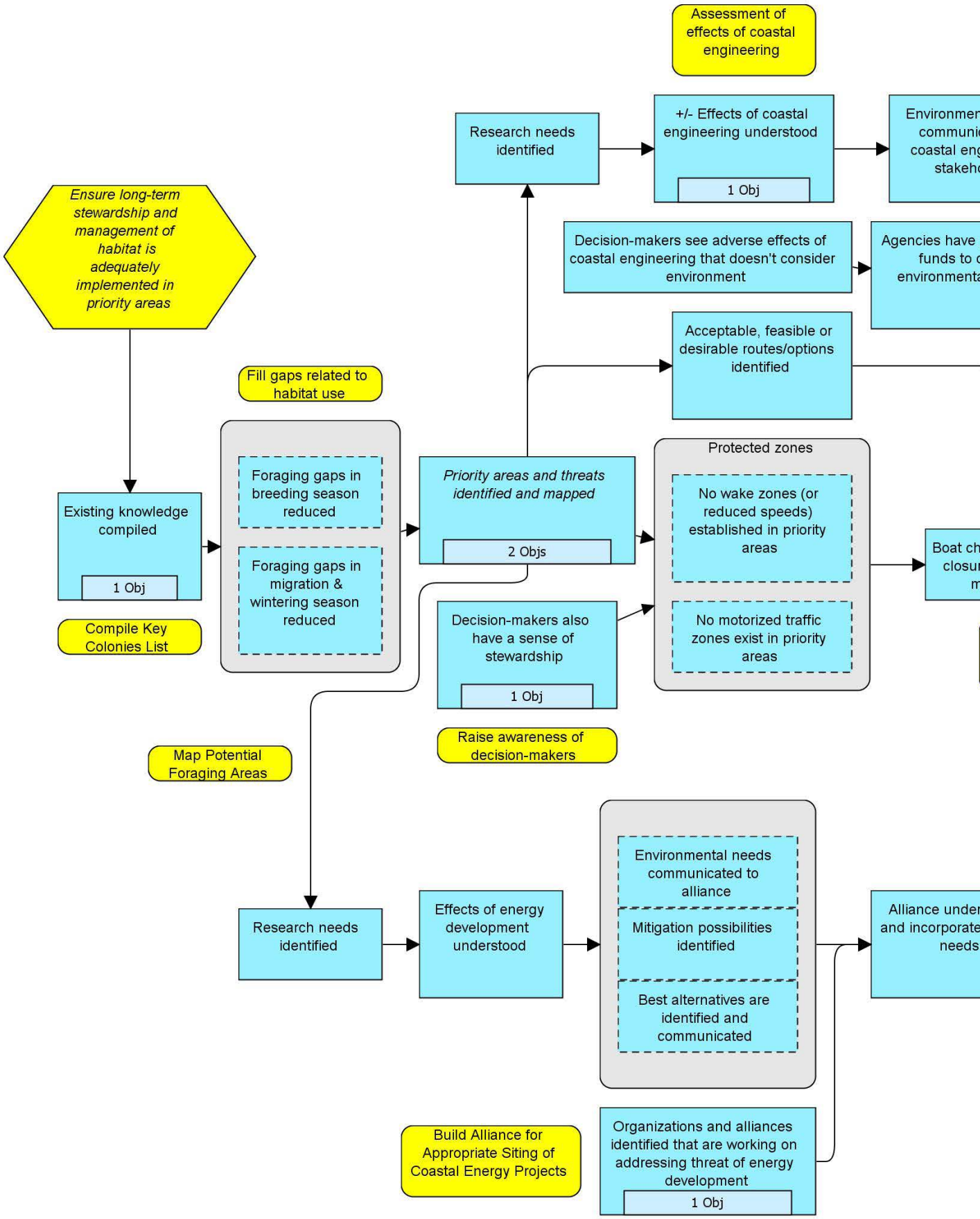
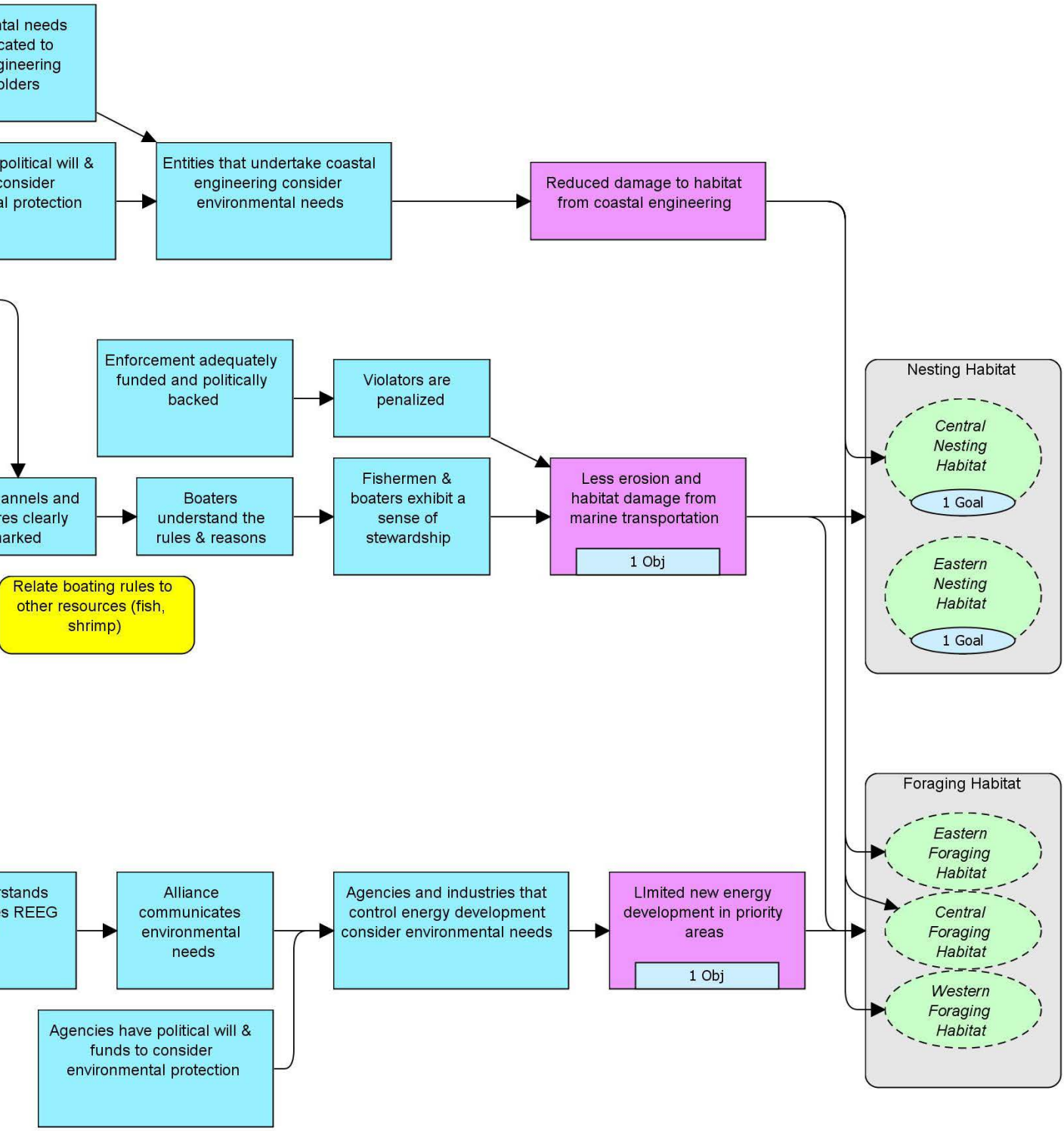


Figure 2. Strategy to Actively Manage Factors Directly Affecting REEG Populations


tal needs
cated to
gineering
olders
political will &
consider
l protection
Entities that undertake coastal engineering consider environmental needs
Reduced damage to habitat from coastal engineering
Enforcement adequately funded and politically backed
Violators are penalized
annels and
es clearly
arked
Boaters understand the rules & reasons
Fishermen & boaters exhibit a sense of stewardship
Less erosion and habitat damage from marine transportation
1 Obj
Relate boating rules to other resources (fish, shrimp)
Nesting Habitat
Central Nesting Habitat
1 Goal
Eastern Nesting Habitat
1 Goal
Foraging Habitat
Eastern Foraging Habitat
Central Foraging Habitat
Western Foraging Habitat
rstands
s REEG
Alliance communicates environmental needs
Agencies and industries that control energy development consider environmental needs
LImited new energy development in priority areas
1 Obj
Agencies have political will & funds to consider environmental protection

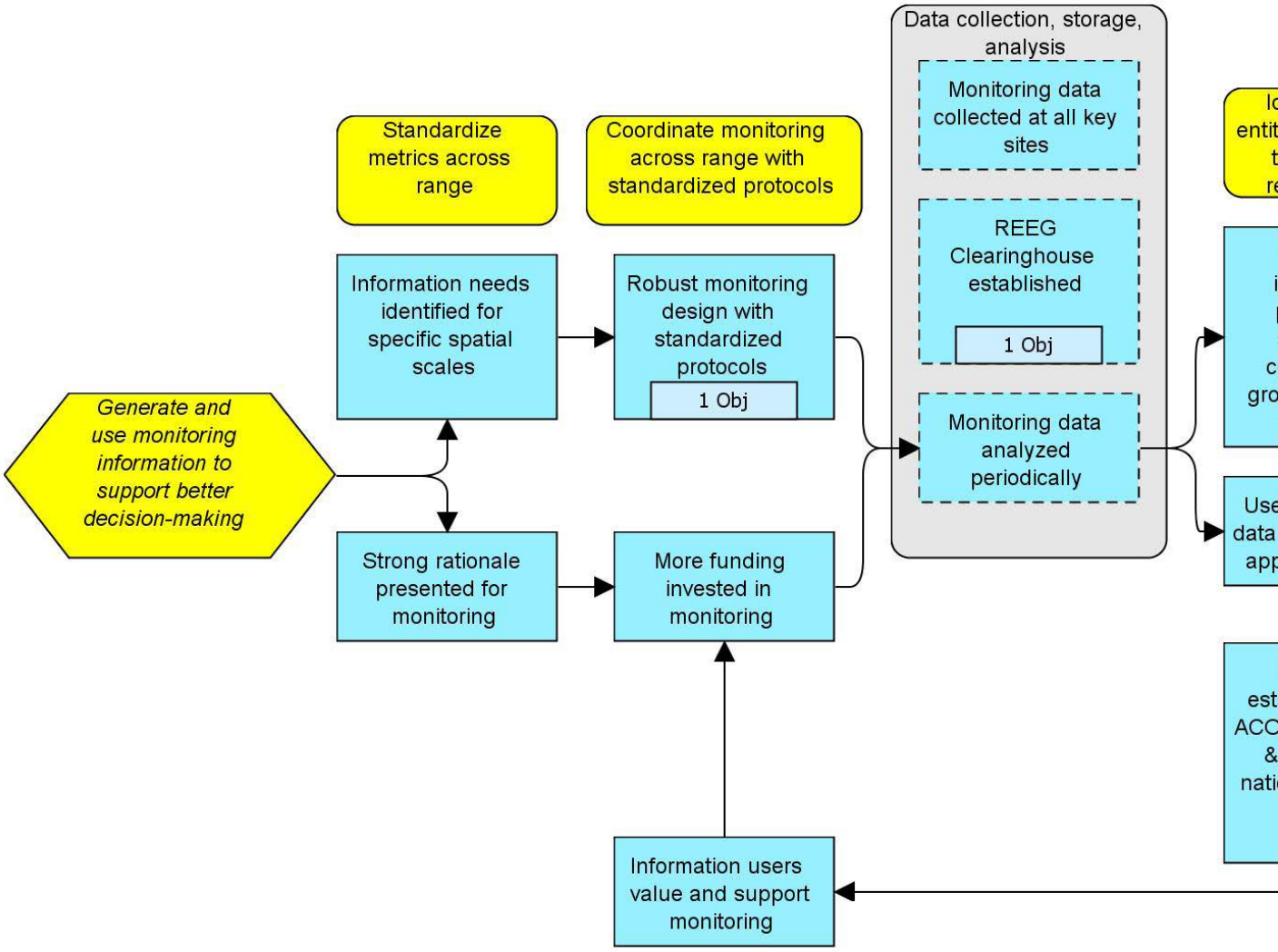
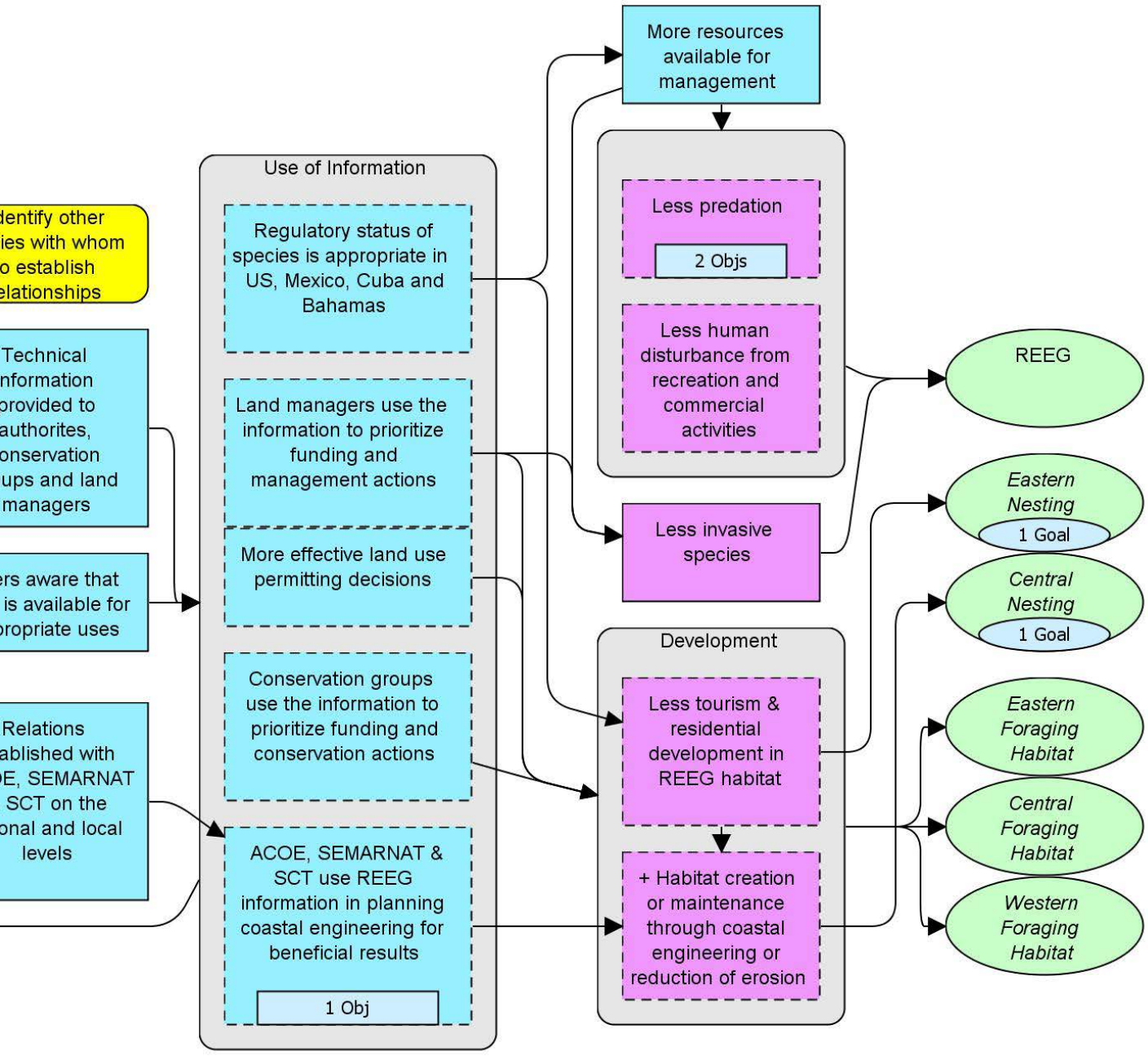


Figure 3. Strategy to Ensure Long-term Stewardship and Management of Habitat is Adequately Implemented in Priority Are


More resources available for management
Use of Information
Regulatory status of species is appropriate in US, Mexico, Cuba and Bahamas
Land managers use the information to prioritize funding and management actions
More effective land use permitting decisions
Conservation groups use the information to prioritize funding and conservation actions
ACOE, SEMARNAT & SCT use REEG information in planning coastal engineering for beneficial results
1 Obj
Less predation
2 Objs
Less human disturbance from recreation and commercial activities
Less invasive species
Development
Less tourism & residential development in REEG habitat
+ Habitat creation or maintenance through coastal engineering or reduction of erosion
REEG
Eastern Nesting
1 Goal
Central Nesting
1 Goal
Eastern Foraging Habitat
Central Foraging Habitat
Western Foraging Habitat
dentify other ies with whom o establish elationships
Technical nformation provided to authorites, onservation ups and land managers
ers aware that is available for propriate uses
Relations ablished with DE, SEMARNAT SCT on the onal and local levels

as.

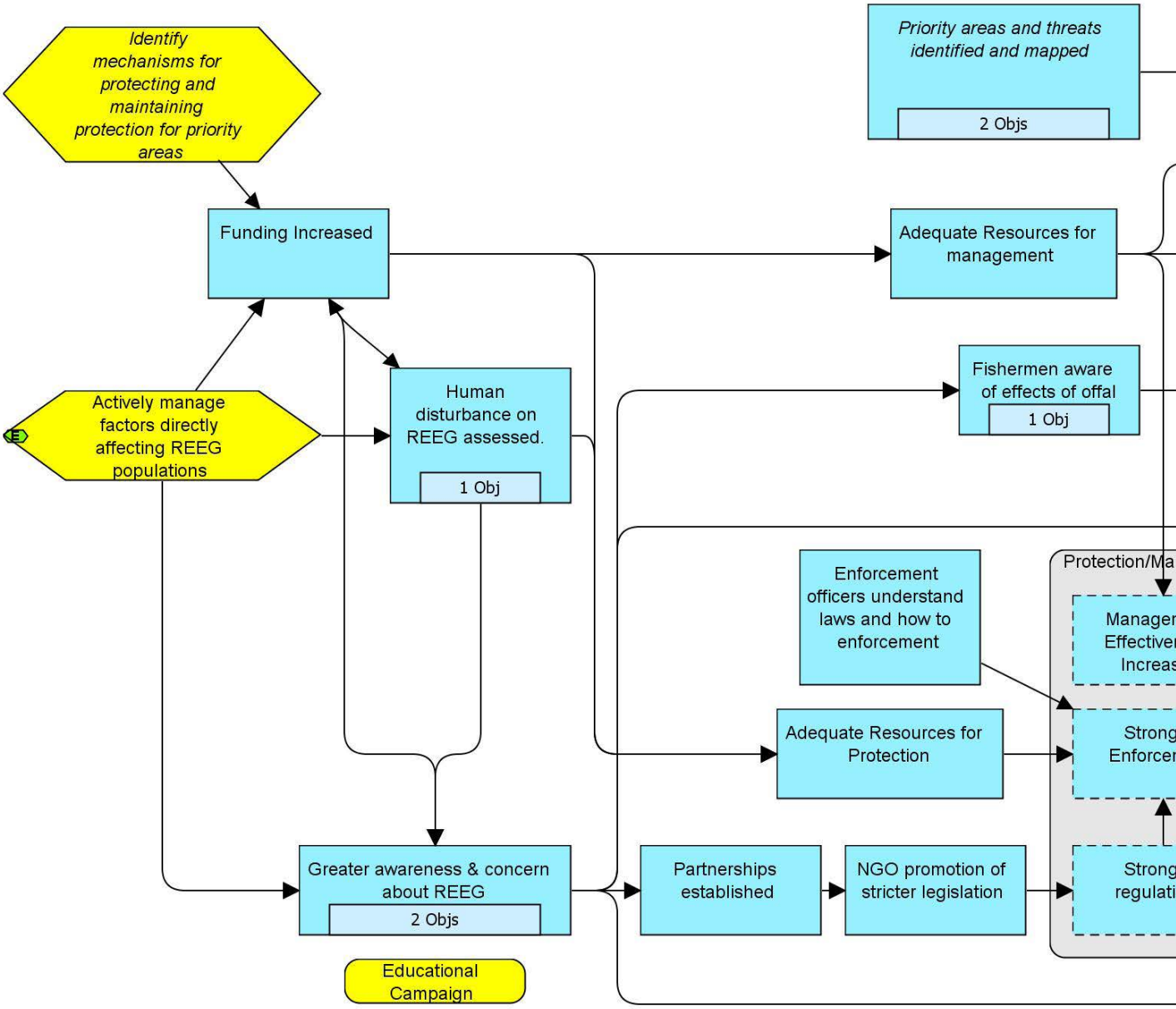
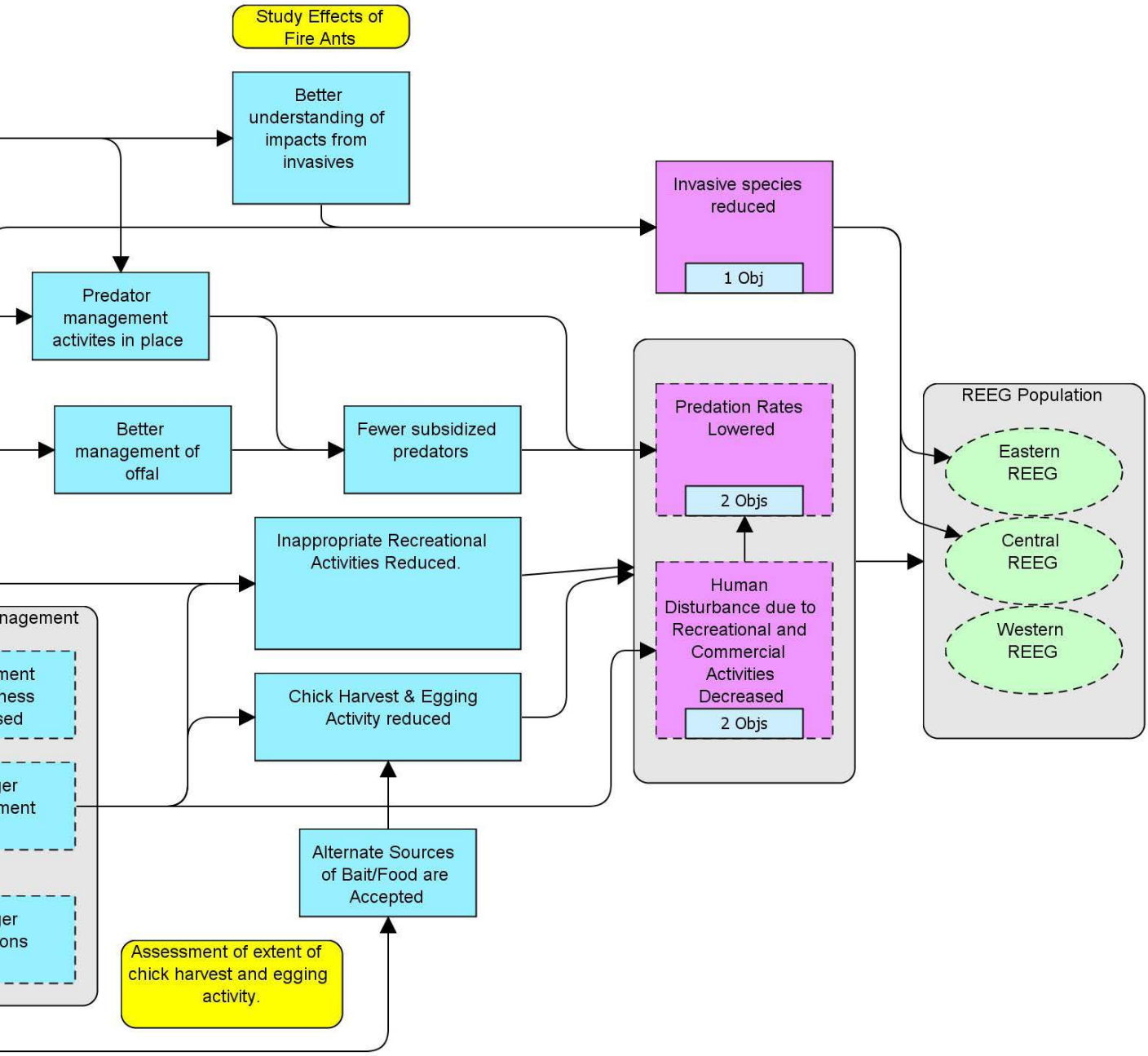


Figure 4. Strategy to Generate and Use Monitoring Information to Support Better Decision-making.


Study Effects of Fire Ants
Better understanding of impacts from invasives
Invasive species reduced
1 Obj
Predator management activites in place
Better management of offal
Fewer subsidized predators
Predation Rates Lowered
2 Objs
REEG Population
Eastern REEG
Central REEG
Western REEG
Inappropriate Recreational Activities Reduced.
Human Disturbance due to Recreational and Commercial Activities Decreased
2 Objs
Chick Harvest & Egging Activity reduced
Alternate Sources of Bait/Food are Accepted
Assessment of extent of chick harvest and egging activity.

APPENDIX B. Participants at REEG Conservation Workshop

Name	Email	Affiliation
Alfredo Alvarez	aalvarez@pronaturane.org	Pronatura Noreste A.C.
Bart Ballard	bart.ballard@tamuk.edu	Texas A&M - Kingsville
Marcia Brown	marcia@fosonline.org	Foundations of Success
Robyn Cobb	robyn_cobb@fws.gov	USFWS, Corpus Christi ESFO
Melanie Driscoll	mdriscoll@audubon.org	Audubon Louisiana Coastal Initiative
Owen Fitzsimmons	owen@cbbep.org	Coastal Bend Bays & Estuaries Program
Clay Green	claygreen@txstate.edu	Texas State Univeristy
Amanda Hackney	ahackney@audubon.org	Audubon Texas
Amador Hernandez	ahernandez@pronaturane.org	Pronatura Noreste A.C.
Ken Meyer	meyer@arcinst.org	Avian Research & Conservation Institute, Inc.
David Newstead	dnewstead@cbbep.org	Coastal Bend Bays & Estuaries Program
Brent Ortego	Brent.Ortego@tpwd.state.tx.us	Texas Parks and Wildlife Department
Eduardo Palacios Castro	epalacio@cicese.mx	Pronatura Noreste, A.C.
Ann Paul	apaul@audubon.org	Audubon Florida
Micheal Seymour	mseymour@wlf.la.gov	Louisiana Department of Wildlife and Fisheries
Bill Vermillion	william_vermillion@fws.gov	Gulf Coast Joint Venture
Jennifer Wheeler	jennifer_wheeler@fws.gov	USFWS, Migratory Birds
Troy Wilson	troy_wilson@fws.gov	USFWS, Migratory Birds

Workshop attendees (Not pictured: Marcia Brown, Ann Paul,Bill Vermillion, Brent Ortego, and Ken Meyer). USFWS

"Some of them were as white as driven snow, the rest of a delicate purplish tint, inclining to grey on the back and wings, with heads and necks of a curious reddish color. You may imagine the pleasure I felt, as well as that which I experienced on becoming better acquainted with this species."

~John J. Audubon

Adult white morph. Jim Gray