TEXAS PARKS AND WILDLIFE

Restoration of Marsh in the Texas Mid-Coast and Benefits to Wetland Birds

Kevin M. Hartke and M. Todd Merendino[1], Texas Parks & Wildlife Department • Owen N. Fitzsimmons[2] and Bart M. Ballard, Caesar Kleberg Wildlife Research Institute, Texas A & M University-Kingsville

INTRODUCTION

The Texas Mid-Coast (TMC) has suffered widespread degradation and loss of its coastal wetland habitat, particularly fresh and intermediate marsh. The coastal wetlands in the TMC provide important habitat to a diverse group of birds. A significant portion of wetlands birds that reside in or migrate to the TMC depend on the threatened coastal marshes for their daily requirements. Texas Parks & Wildlife Department (TPWD) and their partners have implemented several wetland projects in the TMC in an effort to mitigate the degradation and loss of coastal marsh.

THE TPWD EXPERIENCE: RESTORING COASTAL HABITAT DIVERSITY

Starting in 1985, TPWD began acquiring coastal marsh lands along the TMC (Figure 1). While these sites were ecologically significant and relatively undeveloped, the coastal marsh habitat was degraded such that the historic distribution of fresh and intermediate marsh was altered by saltwater intrusion and erosion facilitated by the Gulf Intracoastal Waterway. The variety of coastal marsh habitats (i.e., saline, brackish, intermediate and fresh) along the Texas coast provide important resources for a large diversity of resident and migratory wetland birds. The conversion of fresh and intermediate marsh to marsh of higher salinity from saltwater intrusion can result in a reduction of bird diversity and abundance. Realizing the importance of habitat heterogeneity to maintain diversity and abundance of wetland birds, TPWD and their partners developed multiple wetland projects on coastal Wildlife Management Areas (WMA) in the TMC.

Figure 1. The Texas Mid-Coast and the three Wildlife Management Areas where wetland projects have been developed by TPWD in the region.

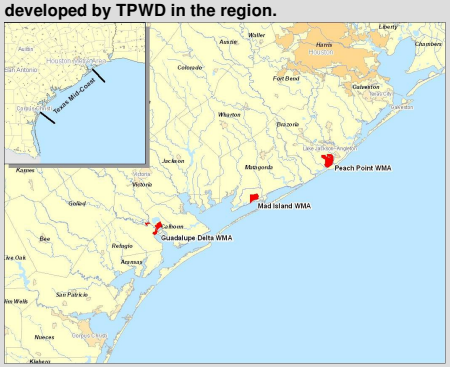
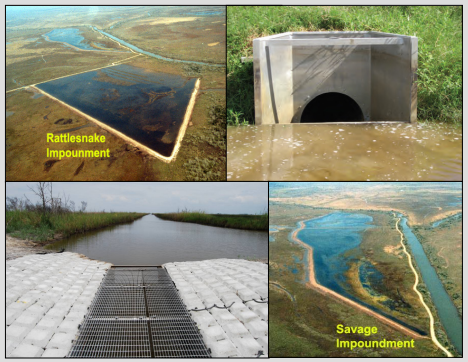
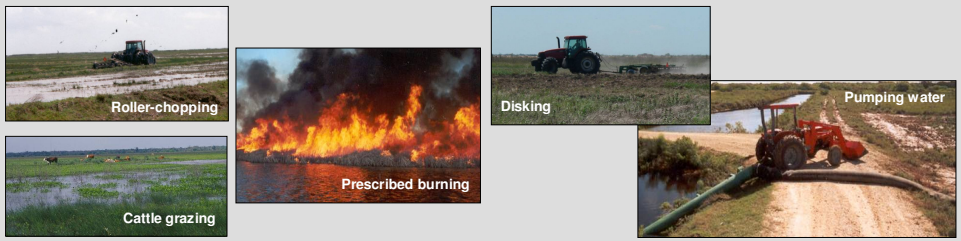


Figure 2. Images of managed wetland units with levees and typical water control structures.



These wetland projects were designed using a system of levees and water control structures to facilitate manipulation of duration, frequency and depth of flooding and to reduce saltwater intrusion (Figure 2). Management of these wetland units includes prescribed fire, livestock grazing, and mechanical manipulations in an attempt to improve vegetation and habitat for wetland birds (Figure 3). Water wells and pumps also can be used to increase surface water availability for wetland birds during extreme drought.

Figure 3. Examples of management techniques for manipulating rank vegetation and hydrology to provide high-quality habitat for wetland birds.



IMPLICATIONS ON THE WETLAND BIRD COMMUNITY

The success of such marsh management in attracting waterfowl has been documented. However, the implications of this type of management on wetland bird diversity are not well known. In an attempt to understand the value of marsh management in relation to the wetland bird community, TPWD and researchers from Texas A & M University-Kingsville conducted a 2-year study comparing bird communities and habitat characteristics between managed wetland units and natural coastal wetlands[3].

During the fall, winter and spring of 2007–08 and 2008–09, we surveyed the plant community, aquatic invertebrates, and the avian community on 4 managed and 4 natural coastal wetlands at WMAs along the TMC. Managed and natural wetlands were paired by location. Managed wetland units selected for the study were at least 9 years old; enough time for the desired change in plant community to be established.

Plant Community – The objective of establishing coastal habitat diversity from the construction of managed wetland units was achieved as managed and natural habitats were generally dissimilar in plant community at each sampling period (Table 1). Plant diversity was generally greater (15–29%) in managed wetlands compared to natural wetlands (Table 1) and was inversely correlated with water salinity ($r = -0.54$).

Table 1. Plant species diversity and similarity of vegetation community in managed and natural wetlands.

Year	Season	Shannon's Diversity Index: Managed	Shannon's Diversity Index: Natural	Jaccard's Similarity Index
1	Fall	2.41	2.10	0.24
	Winter	2.62	2.03	0.26
	Spring	2.44	1.97	0.33
2	Fall	2.31	1.93	0.28
	Winter	2.32	1.98	0.34
	Spring	1.54	1.65	0.31

Table 2. Total biomass (g dry mass) and estimated true metabolizable energy (TME; kcal) of invertebrates in managed and natural wetlands.

Year	Season	Managed: Biomass	Managed: TME	Natural: Biomass	Natural: TME
1	Fall	7.79	2.96	0.03	0.01
	Winter	9.59	3.65	2.16	0.82
	Spring	8.15	3.10	4.02	1.53
2	Fall	4.87	1.85	3.53	1.34
	Winter	0.57	0.22	0.01	< 0.01
	Spring	3.17	1.20	1.36	0.52

Aquatic Invertebrates – Aquatic invertebrates are an important food item for many wetland bird species, and thus, an important index of habitat quality. Biomass (g dry mass) of aquatic invertebrates was 8.5 times greater on managed wetlands compared to natural wetlands in year 1 (Table 2), suggesting that management of hydrology and vegetation can increase aquatic invertebrate productivity. Biomass of aquatic invertebrates was similar in managed and natural areas in year 2 as managed areas experienced increased water salinities from storm surge resulting from Hurricane Ike in September 2008. Estimated values of true metabolizable energy (kcal/total sample biomass) for invertebrates were consistently greater in samples collected from managed wetlands compared to those from natural wetlands (Table 2) suggesting that managed wetlands can provide important foraging habitat for birds.

Avian Community – A total of 115 bird species were detected on managed wetlands compared to 91 that used natural wetlands over the entire study; 33 species were unique to managed wetlands while 11 were unique to natural wetlands. Managed wetlands supported 1.6 times more bird species than natural wetlands across the study. On average, bird diversity (Shannon's Diversity Index) was greater in managed wetlands (mean = 2.34) compared to natural wetlands (mean = 2.06) over the entire study. Managed wetlands supported more bird species from each foraging guild except for above water and transition zone foragers (Table 3). Both wetland types supported similar densities of birds having high conservation priority status. However, managed wetlands supported more high-priority bird species within the mudflat and water column feeding guilds compared to natural wetlands (Table 3).

CONCLUSIONS

The results from our study suggest that managed wetland units can provide high quality habitat for wetlands birds compared to natural marsh. Manipulation of hydrology and vegetation through marsh management techniques was successful at increasing availability of aquatic invertebrates, an important food source for wetland birds. Managed wetlands also provided habitat requirements of some birds that were not available on natural marsh. Finally, managed wetland units can restore habitat diversity in coastal marsh systems that have been altered by anthropogenic effects and are limited in habitat heterogeneity.

Table 3. Total number of bird species and number of high conservation priority species by foraging habitat guild detected in managed and natural wetlands.

Guild	Managed: Total #	Managed: High Priority	Natural: Total #	Natural: High Priority
Benthic	11	1	6	1
Mudflat	23	6	16	4
Water Column	25	7	22	6
Water Surface	14	1	9	1
Above Water	6	1	6	0
Transition Zone	6	1	9	4
Terrestrial	30	2	23	1

[1] Currently with Ducks Unlimited, Inc. in Texas

[2] Currently with Coastal Bend Bays & Estuaries Program in Texas

[3] Fitzsimmons, O. N. 2010. The ecological implications of marsh management to wetland birds in coastal Texas. Thesis, Texas A & M University-Kingsville, Texas, USA.