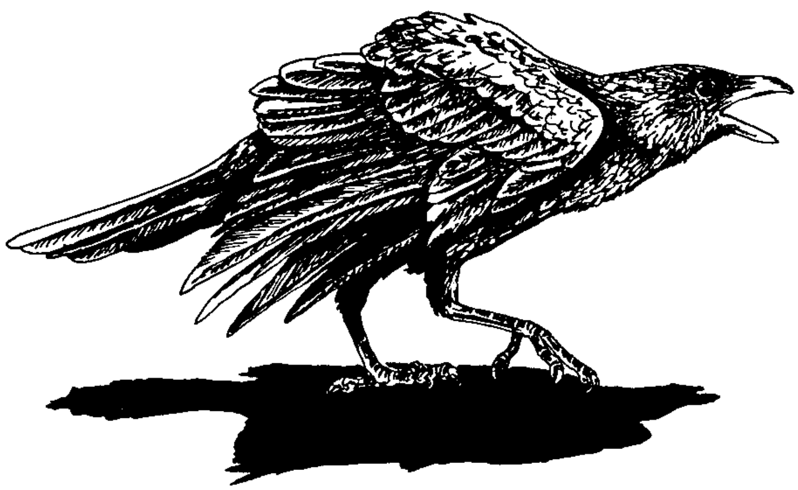
ENVIRONMENTAL ASSESSMENT

for

BIRD DAMAGE MANAGEMENT

IN TEXAS



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Animal and Plant Health Inspection Service
Texas Wildlife Services Program

In Cooperation with:

Texas A&M AgriLife Extension Service
Texas A&M University

Texas Wildlife Damage Management Association

February 2013

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ACRONYMS USED

A-C	Alpha-Chloralose
AI	Avian Influenza
APHIS	Animal and Plant Health Inspection Service
BBS	Breeding Bird Survey
BDM	Bird Damage Management
BO	Biological Opinion
CAFO	Confined Animal Feeding Operation
CBC	Christmas Bird Count
CFR	Codes of Federal Regulations
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
AgriLife Extension	Texas A&M AgriLife Extension Service
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FY	Fiscal Year
HP	Highly Pathogenic
IWDM	Integrated Wildlife Damage Management
LC50	Lethal Concentration in Water that Kills 50%
LD50	Lethal Dose that Orally Kills 50%
MA	Methyl-Anthranilate
MIS	Management Information System
MOU	Memorandum of Understanding
NAS	National Audubon Society
NEPA	National Environmental Policy Act
NHPA	National Historical Preservation Act
NWRC	WS-National Wildlife Research Center
P	Probability
PIF	Partners in Flight
RMBO	Rocky Mountain Bird Observatory
RMS	Rocky Mountain States
SMC	Species of Management Concern
SOP	Standard Operating Procedure
TDA	Texas Department of Agriculture
T&E	Threatened and Endangered
TPWD	Texas Parks and Wildlife Department
TWSP	Texas Wildlife Services Program
USC	U.S. Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WDM	Wildlife Damage Management
WS	Wildlife Services

CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

1.1 INTRODUCTION

While wildlife is a valuable natural resource, some species of wildlife can cause problems with human interests. Many bird species, those that reside in or migrate into or through Texas, can come into conflict with human interests, and the public or other agencies may need to be managed to control their damage. The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) program has personnel with expertise to respond to damage caused by wildlife, including birds.

USDA-APHIS-WS is authorized by Congress to manage a program to reduce human-wildlife conflicts. WS' mission, developed through a strategic planning process (APHIS 2012), is to "*...provide Federal leadership in managing problems caused by wildlife. WS recognizes that wildlife is an important public resource greatly valued by the American people. By its very nature, however, wildlife is a highly dynamic and mobile resource that can damage agricultural and industrial resources, pose risks to human health and safety, and affect other natural resources. The WS program carries out the Federal responsibility for helping to solve problems that occur when human activity and wildlife are in conflict with one another*."

This is accomplished through:

< training of wildlife damage management (WDM) professionals;
< development and improvement of strategies to reduce economic losses and threats to humans from wildlife;
< the collection, evaluation, and dissemination of management information;
< cooperative WDM programs;
< informing and educating the public on how to reduce wildlife damage; and
< providing technical advice and a source for limited use of management materials and equipment such as cage traps.

WS' Policy Manual[1] reflects this mission and provides guidance for engaging in WDM activities. WS is part of a cooperative program within Texas, henceforth known as the Texas Wildlife Services Program (TWSP), and operates under a Memorandum of Understanding (MOU) with Texas A&M AgriLife Extension (AgriLife Extension) within the Texas A&M University System and the Texas Wildlife Damage Management Association. TWSP receives State legislative support through legislative action. These bills mandate that the State of Texas shall cooperate through the A&M System with appropriate federal officers and agencies in controlling animals to protect livestock, food and feed supplies, crops, and rangeland. TWSP conducts WDM through this cooperative relationship as AgriLife Extension-WS under the A&M System. TWSP is the agency in Texas that has the expertise to respond to the majority of wildlife damage complaints.

The State AgriLife Extension-WS and federal WS program cooperate further, through a separate MOU, with the Texas Wildlife Damage Management Association which identifies requested services on a more localized basis. The Texas Wildlife Damage Management Association consists of local cooperative groups, including county governments, private associations, and individuals. This MOU also allows for sharing the direct operating costs of providing WDM services.

1 **WS Policy Manual** - Provides guidance for TWSP personnel to conduct WDM activities through Directives. WS Directives referenced in this EA will not be referenced in the Literature Cited Section, but can be found on-line @ http://www.aphis.usda.gov/wildlife_damage/ws_directives.shtml.

This document is an Environmental Assessment (EA) that describes and analyzes TWSP involvement in bird damage management (BDM) in Texas, one facet of WDM. While any species of bird can cause damage or concerns at some time or another, most species of birds in Texas represent little or no risk of problems to the endeavors of people. Appendix C lists all bird species with their scientific names that have been documented to occur in Texas (646 excluding extinct species, but including 3 not wholly accepted because of inadequate documentation, but not including an unknown alcid sp. and domestic varieties of species already included) by the Texas Bird Records Committee (TBRC 2012) along with feral domestic species of poultry and escaped exotic parrots that have established local populations. Appendix C: Table C1 lists those species that have the highest probability of coming into conflict with people in Texas or being part of disease surveillance projects (269), excluding feral, non-established populations. TWSP receives requests for assistance to conduct BDM for only a small percentage of the species in Texas (116 species/year aver. caused damaged from FY07 to FY11 – Table 2) and are most likely to respond to damage, excluding airports, caused by blackbirds, starlings, feral pigeons, crows, and vultures. In response, TWSP may provide direct control assistance to reduce damage caused by these species (e.g., starlings) because management for these species may be necessary. Other bird species in Texas only represent a medium to slight risk in particular situations, and do not cause consistent damage problems. Some birds are typically only a risk at airports or are the focus of a disease surveillance project, where otherwise they would not normally cause damage problems (e.g., doves, shorebirds, and kingbirds). Finally, some species of birds represent virtually no risk of damage in Texas at all, including airports (e.g., hummingbirds, vireos), but even these have the potential for causing some type of request for assistance and if in an airport environment can cause a strike particularly in migration. Additionally, TWSP could be involved in bird management activities where the target species are birds, but the management activities are for their protection. For example, WS nationally has conducted bird hazing activities at oil spills and toxic ponds to keep birds from a hazardous site and TWSP could become involved in such activities. This EA will describe and analyze effects on all bird species from TWSP BDM activities in Texas.

In Texas, all native birds are protected by federal or state laws. Migratory birds are protected under the Migratory Bird Treaty Act by the U.S. Fish and Wildlife Service (USFWS). Most birds in Texas are also managed and protected by laws regulated by the Texas Parks and Wildlife Department (TPWD). Under federal and state laws, though, private landowners or their lessees, public entities, or others can control most damaging species, but a permit may be required depending on the species. TWSP works with USFWS and TPWD to obtain the necessary permits to control birds and assists in providing annual data on take so that they can determine cumulative impacts on species and whether these are within the management objectives for the different avian species.

TWSP is a cooperatively funded and service oriented program. Before operational BDM is conducted, a *Work Initiation Document* or *TWSP Work Plan* must be signed by TWSP and the landowner or property administrator. TWSP cooperates with private property owners and managers and with appropriate land and wildlife management agencies, as requested, with the goal of effectively and efficiently resolving wildlife damage problems in compliance with all applicable federal, state, and local laws.

APHIS-WS has the Federal statutory authority under the Act of March 2, 1931, as amended, and the Act of December 22, 1987, to cooperate with other Federal agencies and programs, States, local jurisdictions, individuals, public and private agencies, organizations, and institutions while conducting a program of wildlife services involving animal species that are injurious or a nuisance to, among other things, agriculture, horticulture, forestry, animal husbandry, natural resources such as wildlife, and human health and safety as well as conducting a program of wildlife services involving mammalian and avian (*bird*) species that are reservoirs for zoonotic diseases. Even though APHIS-WS has the statutory authority to provide assistance for injurious wildlife, APHIS-WS has an MOU with the National Pest Management Association to reduce potential competition with private pest control applicators or organizations in urban areas which includes the control of pest birds. In areas where pest control applicators provide service, APHIS-WS does not solicit business to control pest birds and informs requestors of the availability of private individuals or companies to conduct the work. However, if the requestor insists on the services of APHIS-WS, then APHIS-WS can provide some services.

1.2 PURPOSE

The purpose of this EA is to analyze the effects of TWSP activities in Texas to manage damage caused by bird species or species groups or to monitor wild bird populations for the presence of disease on the human environment. TWSP BDM activities are conducted to protect human health and safety at airports and threats of human disease, and reduce or prevent damage to agricultural resources including livestock and their feed and health, crops, and aquaculture, property such as homes, aircraft, turf, machinery, electrical equipment, and ornamental trees, and natural resources such as threatened and endangered (T&E) species, other wildlife, fisheries, and public recreation areas. Texas has 460 species of birds that can be found regularly in all or a portion of the State at some time during the year. An additional 176 species have been documented to occur in Texas, but are normally outside of the species' normal range (accidentals); some of these species are seen annually and a few may even nest, but not in any abundance or regularity. Of the regular residents, 275 could be the focus of a BDM project. Of these, 128 species could be targeted to protect resources other than aircraft and human health and safety at airports. In addition to these species, TWSP could also be requested to assist with feral domestics like geese and chickens, or escaped exotics such as parrots and emus. Appendix C: Table C4 lists 12 additional species which commonly invoke requests for assistance.

Many species involved in WS BDM actions in Texas are individual actions because WS receives few requests for assistance for these species, even over several years; WS has conducted an average of 1 or fewer work tasks annually for 48 of the 129 species which includes 6 feral domestic/escaped species listed in Table 1 with few of these requests handled operationally which suggests that these activities would be categorically excluded from NEPA analysis. However, the purpose of this EA is to analyze the effects of TWSP activities in Texas to manage damage caused by bird species or species groups, conduct disease surveillance, and protect birds from hazardous situations. TWSP BDM activities are conducted to protect: human health and safety at airports and from threats of disease; agricultural resources including livestock and their feed and health, crops, and aquaculture; property such as homes, aircraft, turf, machinery, electrical equipment, and ornamental trees; and natural resources such as T&E species, other wildlife, fisheries, and public recreation areas. Texas has documented 638 species of birds in Texas (Appendix C: Tables C1, C2, and C3) (TBRC 2012), excluding additional feral poultry and parrots (12 additional species and 2 domestic varieties of wild species) that have been released (Appendix C: Table C4). Of these (excluding the 12 feral birds), 460 species are regularly found in Texas all year or seasonally, and their range may be widespread or restricted. BDM in Texas in the past 10 years has involved a low percentage of these species. Of the 460 regularly occurring species in Texas, 128 (28%) have been identified as having at least the potential of causing damage to resources, excluding BDM at airports and for disease surveillance or oil spills where more species could be involved (Table 1 and Appendix C: Table C1). In addition, 151 have been identified to have a high affinity for being a strike hazard at airports, to be hazed from an oil spill or other toxic site, or to be monitored in a disease surveillance operation. The other 185 (Appendix C: Table C2) are not likely to cause damage, except possibly very infrequently. In fact, only a few of these have been involved in a request for assistance in the last 10 years, such as a Ruby-throated Hummingbird that was found flying inside a grocery store where the owners became concerned for its well-being because it could not find its way out an open door. This was resolved by using a mist net to catch and release the hummingbird back outdoors.

Table 1. Avian species groups in Texas (Appendix C: Tables C1, C2, C3, but not including non-established domestic species given in Table C4). Those species that cause problems are given for the regularly occurring, non-accidental, species and the protection activities conducted by TWSP that involve them.

ORDER - Family	SPECIES GROUP (feral poultry and escaped exotics not included in numbers)	# Regular Occurring Species	Damaging Spp.- not airport/oil spill	Accidental Species	Federal\State T&E Species	TWSP PROTECTION ACTIVITY: Airport in Texas	Oil Spill Hazing	Agric.: Aquaculture	Agric.: Crops	Agric.: Livestock/Disease	Human Safety	Natural Resources	Property
ANSERIFORMES	Ducks, geese, swans	32	17	13	-	X	X	X	X	x	X	X	X
GALLIFORMES	Chachalaca, pheasant, grouse, turkey, quail	9	3	0	2	x	-	-	X	-	x	-	-
GAVIIFORMES	Loons	1	1	3	-	x	X	x	-	-	-	-	-
PODICIPEDIFORMES	Grebes	6	5	1	-	x	X	x	-	-	-	-	-
PHOENICOPTERIFORMES	Flamingoes	-	-	1	-	x	x	-	-	-	-	-	-
PROCELLARIIFORMES	Albatross, shearwaters, petrels, storm-petrels	2	-	9	-	-	X	-	-	-	-	-	-
PHAETHONTIFORMES	Tropicbirds	-	-	1	-	-	x	-	-	-	-	-	-
CICONIIFORMES	Storks	1	1	1	-	x	X	x	-	-	-	-	-
SULIFORMES	Frigatebirds, boobies, cormorants, Anhinga	6	3	3	-	x	X	X	-	-	-	x	-
PELECANIFORMES	Pelicans, bitterns, herons, egrets, ibises, spoonbill	18	13	1	3	X	X	X	-	-	x	x	x
ACCIPITIFORMES	Vultures, Osprey, kites, accipiters, hawks, eagles	20	9	8	6	X	x	X	-	X	x	x	x
FALCONIFORMES	Falcons, caracaras	5	1	3	2	X	-	x	-	x	x	-	x
GRUIFORMES	Rails, gallinules, coots, limpkin, cranes	11	2	2	1	X	X	x	X	-	-	-	x
CHARADRIIFORMES	Shorebirds, gulls, terns, jaegers	61	15	35	2	X	X	X	X	x	x	x	X
COLUMBIFORMES	Pigeons, doves	9	5	3	-	X	-	-	X	x	X	x	X
PSITTACIFORMES	Parakeets, parrots	3	1	0	-	x	-	-	X	-	x	-	x
CUCULIFORMES	Cuckoos, roadrunner, ani	4	1	2	-	x	-	-	-	-	-	x	-
STRIGIFORMES	Owls	12	3	5	1	X	-	-	-	x	-	x	x
CAPRIMULGIFORMES	Nighthawks, nightjars	7	0	-	-	x	-	-	-	-	-	-	-
APODIFORMES	Swifts, hummingbirds	7	1	15	-	x	-	-	-	-	-	-	x
TROGONIFORMES	Trogon	-	-	1	-	-	-	-	-	-	-	-	-
CORACIIFORMES	Kingfishers	3	3	1	-	x	x	x	-	-	-	-	-
PICIFORMES#	Woodpeckers	11	11	4	1	x	-	-	X	-	-	-	X
PASSERIFORMES	Passerines: perching birds												
- Thamnophilidae, Tityridae, Vireonidae, Paridae, Remizidae, Aegithalidae, Sittidae, Certhiidae, Troglodytidae, Polioptilidae, Cinclidae, Regulidae, Peucedramidae, Parulidae, Thraupidae	- Ant-shrikes, tityras, becards, vireos, chickadees, titmice, verdin, bushtit, nuthatches, creeper, wrens, gnatcatchers, dipper, kinglets, warblers	84	0	17	4	-	-	-	-	-	-	-	-
- Tyrannidae, Laniidae, Muscicapidae, Motacillidae, Ptilogonatidae, Calcariidae	- Flycatchers, shrikes, wheatears, pipits, silky flycatchers, longspurs	35	0	16	-	X	-	-	-	-	-	-	-
- Corvidae	- Crows, ravens, jays	9	8	5	-	X	-	x	X	X	X	x	x
- Alaudidae, Emberizidae	- Larks, seedeaters, towhees, sparrows	36	3	4	2	X	-	-	x	-	-	-	-
- Hirundinidae	- Swallows	8	4	1	-	x	-	-	-	x	x	-	x
- Turdidae	- Bluebirds, solitaires, thrushes	10	1	7	-	x	-	-	X	-	x	-	x
- Mimidae	- Catbirds, thrashers, mockingbird	7	1	2	-	x	-	-	-	-	x	-	-
- Sturnidae, Passeridae	- Starling, House Sparrow	2	2	-	-	X	-	-	X	X	X	X	X
- Bombycillidae	- Waxwings	1	1	1	-	x	-	-	X	-	-	-	-
- Cardinalidae	- Tanagers, cardinals, buntings, Dickcissel	14	1	3	-	x	-	-	-	-	-	-	x
- Icteridae	- Blackbirds, grackles, cowbirds, orioles	19	9	3	-	X	-	x	X	X	X	x	X
- Fringillidae	- Finches, crossbills, grosbeaks	7	3	5	-	x	-	-	X	-	x	x	x
TOTAL		460	128	176	24								

X - significant problem x - minor problem (-) - not associated with damage, but possible

Other species could cause damage, but would likely be very infrequent. This damage would be from species accidentally found in Texas. Texas has an additional 176 species that are accidental, having only been documented a limited number of times (Appendix C: Table C3). The species that have only been seen accidentally in Texas because they are outside of their normal range represent only a theoretical minimal threat of damage because they are often only solitary individuals that have strayed from their normal range and even if they belong to a group such as gulls that are a primary threat at airports. A variety of strategies is used to reduce damage or potential problems and is discussed in Section 3.3.1.3.

The species that this EA will primarily address are those species that are normally found in Texas that cause problems (Appendix C: Table C1). However, this EA will consider the impacts of BDM on all species of birds in Texas. The primary top ten species that TWSP receives requests for assistance, in order of work tasks associated with them, include Black Vultures, Great-tailed Grackles, Turkey Vultures, feral domestic pigeons, Common Grackles, European Starlings, Red-winged Blackbirds, Canada Geese, American Kestrels, and Laughing Gulls (Table 2). Groups of birds that cause considerable damage include waterfowl, blackbirds (blackbirds, grackles, and cowbirds) and European Starlings, herons and egrets, doves, gulls, corvids (ravens and crows), and raptors (hawks and owls). Several other species cause minor, but potentially locally serious, problems, especially at airports. These species or their groups are discussed in Section 2.2.1.

Ordinarily, according to APHIS procedures implementing the National Environmental Policy Act (NEPA), individual WDM actions which is the case for most bird species which cause only sporadic problems, and research and developmental activities may be categorically excluded (7 Code of Federal Regulation (CFR) 372.5(c), 60 Fed. Reg. 6000-6003, 1995). However, we prepared this EA on BDM considering all species in Texas to facilitate planning and interagency coordination, to streamline program management, and to involve the public and obtain their input through comments and feedback. This EA documents the need for BDM in Texas and assesses potential impacts and effects of various alternatives addressing the resolution of bird damage problems.

This EA includes an effort to consider existing data contained in other NEPA and related documents. WS completed an EA (WS 1998) that analyzed blackbird damage management for the protection of rice. The current WS blackbird damage management program in Texas to protect rice is similar or less to that analyzed in WS (1998). This EA also incorporates by reference pertinent sections of the USDA-APHIS-WS programmatic Environmental Impact Statement (EIS) (*hereinafter referred to as* USDA 1997) which covered many BDM activities.

1.3 NEED FOR ACTION

Birds are responsible for damaging a wide variety of agricultural resources, property, and natural resources (Table 1). In addition, birds can be a threat to human health and safety. From FY 07 (federal fiscal year 2006 = October 1, 2005 – September 30, 2006) to FY11 in Texas, birds were responsible for an annual average of 12,521 work tasks (individual species request actions) associated with them annually (Table 2), 51% for human health and safety, 36% for property, 13% for agriculture, and 0.4% for natural resources (Table 3). During this time, 160 species were involved in the work tasks, averaging 116 species per year (Table 2). This information is kept in the MIS[2]. The MIS has been in place since FY94 and an additional 12 species of birds[3] were responsible for damage from FY94 to FY06 indicating the low number of species that have caused requests for assistance. Requests for assistance are an indication of need, but the requests that TWSP receives likely represents only a small portion of the need in actuality. Many people may tolerate bird damage losses, effectively handle the problem themselves, or hire the assistance of private control operators (especially in urban areas). Thus, TWSP loss reports are only an

2 MIS - Computer-based Management Information System used by WS for tracking Program activities. WS in Texas has had the SQL-based MIS system operational since FY92. However, a new system, the MIS 2000, replaced an old system 10/01/05. MIS reports will not be referenced in the Literature Cited Section since MIS reports are not kept on file, but in the database.

3 Wood Stork, Common Gallinule, Black-bellied Plover, Snowy Plover, Great Black-backed Gull, Gull-billed Tern, Royal Tern, Burrowing Owl, Western Scrub-Jay, Fish Crow, Gray Catbird, and American Goldfinch

indicator of the annual losses and do not actually reflect the total value of bird damage in Texas. It should be noted that many people suffering bird damage are often unaware of the WS program and may try to resolve problems themselves without requesting WS assistance which can lead to problems depending upon the specifics of the damage situation, the level of professional assistance needed to resolve the problem, and the available methods to resolve the problem. In addition to the requests for assistance involving damage, WS was also involved in conducting disease surveillance (no damage associated with this) and collected an average of 1,500 samples annually from FY07 to FY11 from waterfowl, shorebirds, and their droppings (watched from a distance and collected following defecation). However, fewer samples were collected in FY11 (327) than FY07 (2,613), primarily from the lessened concern of avian influenza and budgetary constraints. Finally, people requested information about certain species of birds that did not necessarily have damage associated with it; this information was included by species in Table 2, but was only added as a line item in Table 3.

Table 2. Work tasks (WTs) and the value of damage associated with birds in Texas. The value is that which is reported to or verified by TWSP from FY07 to FY11 and is only a fraction of the actual damage caused by birds in Texas. This table includes disease sampling requests where TWSP is requested to collect samples from particular groups of species (waterfowl and shorebirds) to determine the prevalence of different diseases and requests for information about a given species, but the requestor is not suffering damage.

SPECIES	FY07		FY08		FY09		FY10		FY11		Average	
	WTs	$ Value $	WTs	$ Value $	WTs	$ Value $	WTs	$ Value $	WTs	$ Value $	WTs	$ Value $
Emu	-	-	-	-	-	-	-	-	1	$0	0.2	$0
Black-bellied Whistling-Duck	239	$75	338	$0	435	$0	122	$0	34	$5,668	234	$1,149
Fulvous Whistling-Duck	-	-	-	-	2	$0	1	$0	2	$1,500	1	$300
Greater White-fronted Goose	1	$0	3	$0	8	$0	1	$0	5	$5,668	4	$1,134
Snow Goose	-	-	34	$0	138	$0	59	$45,000	19	$5,000	50	$10,000
Canada Goose	20	$30,500	46	$100	53	$13,900	40	$50,450	89	$15,718	50	$22,134
Feral Goose	6	$100	9	$0	6	$0	13	$0	11	$25	9	$25
Mute Swan	1	$0	1	$0	2	$0	-	-	-	-	1	$0
Wood Duck	-	-	-	-	3	$0	-	-	1	$0	1	$0
Feral ducks (Muscovy)	-	-	-	-	-	-	16	$50	9	$0	5	$10
Gadwall	176	$0	156	$0	188	$0	65	$0	56	$0	128	$0
American Wigeon	185	$0	188	$0	208	$0	71	$0	20	$31,000	134	$6,200
American Black Duck	1	$500	-	-	2	$0	11	$0	-	-	3	$100
Mallard	50	$6,650	50	$11,500	102	$2,450	59	$0	49	$50	62	$4,130
-Feral ducks (Dom. Mallard)	6	$2,300	86	$20,000	38	$2,300	45	$100	25	$25	40	$4,945
Mottled Duck	1	$0	34	$0	136	$0	43	$0	2	$0	43	$0
Blue-winged Teal	169	$0	193	$0	339	$0	98	$0	36	$3,000	167	$600
Cinnamon Teal	1	$0	1	$0	2	$0	-	-	-	-	1	$0
Northern Shoveler	45	$0	49	$0	22	$0	58	$0	47	$0	44	$0
Northern Pintail	5	$0	130	$0	183	$0	45	$0	30	$0	79	$0
Green-winged Teal	34	$0	41	$0	22	$0	22	$0	12	$0	26	$0
Canvasback	10	$0	-	-	5	$0	11	$0	9	$0	7	$0
Redhead	5	$0	2	$0	26	$0	29	$0	17	$0	16	$0
Ring-necked Duck	12	$0	6	$0	6	$1,608	18	$0	26	$0	14	$322
Greater Scaup	-	-	-	-	2	$0	-	-	-	-	0	$0
Lesser Scaup	7	$0	38	$0	148	$0	61	$0	28	$0	56	$0
Bufflehead	8	$0	-	-	4	$0	16	$0	8	$0	7	$0
Common Goldeneye	-	-	-	-	3	$0	-	-	-	-	1	$0
Hooded Merganser	-	-	-	-	2	$0	-	-	-	-	0.4	$0
Common Merganser	1	$50	-	-	2	$0	-	-	-	-	1	$10
Red-breasted Merganser	-	-	-	-	2	$0	-	-	-	-	0.4	$0
Ruddy Duck	2	$0	-	-	2	$0	17	$0	13	$0	7	$0
Scaled Quail	-	-	-	-	-	-	2	$25	-	-	0.4	$5
Ring-necked Pheasant	-	-	5	$1,200	2	$0	-	-	-	-	1	$240
Wild Turkey	5	$2,550	3	$200	1	$0	12	$1,200	14	$1,000	7	$990
Feral chicken	-	-	3	$0	4	$0	2	$0	5	$250	3	$50
Common Peafowl	7	$0	3	$0	-	-	9	$0	6	$200	5	$40
Helmeted Guineafowl	-	-	1	$0	1	$0	1	$0	1	$0	1	$0
Pied-billed Grebe	1	$5,000	1	$5,000	3	$6,000	4	$76,941	5	$96,941	3	$37,976
Horned Grebe	-	-	-	-	2	$0	-	-	-	-	0.4	$0
Eared Grebe	-	-	-	-	2	$0	-	-	-	-	0.4	$0
Western Grebe	-	-	-	-	2	$0	-	-	-	-	0.4	$0
American White Pelican	219	$81,750	145	$102,516	215	$10,002	74	$77,985	35	$161,082	138	$86,667
Brown Pelican	95	$0	1	$0	-	-	-	-	3	$3,500	20	$700

SPECIES	FY07		FY08		FY09		FY10		FY11		Average	
	WTs	$ Value $	WTs	$ Value $	WTs	$ Value $	WTs	$ Value $	WTs	$ Value $	WTs	$ Value $
Neotropic Cormorant	70	$0	150	$0	164	$0	31	$0	-	-	83	$0
Double-crested Cormorant	257	$111,600	247	$97,876	231	$57,502	91	$131,940	59	$192,750	177	$118,334
Anhinga	2	$0	1	$0	-	-	-	-	-	-	1	$0
Great Blue Heron	251	$156,750	305	$172,081	391	$70,602	180	$111,990	87	$199,844	243	$142,253
Great Egret	260	$136,750	324	$161,016	308	$65,002	89	$111,940	42	$116,653	205	$118,272
Snowy Egret	450	$114,000	236	$130,016	216	$47,502	56	$102,990	19	$175,087	195	$113,919
Little Blue Heron	4	$56,350	32	$9,376	4	$10,002	4	$13,700	5	$13,700	10	$20,626
Tricolored Heron	168	$0	150	$0	164	$0	30	$0	-	-	102	$0
Cattle Egret	46	$131,300	109	$6,600	190	$54,000	110	$14,500	143	$6,168	120	$42,514
Green Heron	4	$56,250	4	$66,516	3	$0	4	$13,700	19	$13,700	7	$30,033
Black-crowned Night-Heron	4	$56,450	6	$66,816	3	$10,002	5	$14,200	16	$13,850	7	$133,844
Yellow-crowned Night-Heron	11	$0	9	$250	12	$12,002	10	$13,700	24	$20,941	13	$9,379
White Ibis	1	$0	-	-	-	-	4	$0	2	$0	1	$0
White-faced Ibis	-	-	-	-	2	$0	1	$0	1	$5,668	1	$1,134
Black Vulture	1,059	$215,680	1,156	$160,810	1,351	$168,481	1,495	$6,775,185	1,812	$1,863,847	1,374	$1,836,801
Turkey Vulture	1,029	$21,025	964	$9,095	905	$101,428	653	$227,786	924	$77,984	895	$87,464
Osprey	172	$0	152	$11,305	164	$0	37	$50	1	$0	105	$2,271
Mississippi Kite	11	$50	10	$0	8	$1,200	11	$0	12	$0	10	$250
Bald Eagle	-	-	-	-	-	-	2	$0	-	-	0.4	$0
Northern Harrier	38	$0	153	$0	227	$0	94	$0	100	$0	122	$0
Sharp-shinned Hawk	26	$0	109	$0	189	$0	37	$0	-	-	72	0
Cooper’s Hawk	36	$200	60	$0	25	$480	13	$0	102	$0	47	$136
Harris’s Hawk	-	-	-	-	-	-	-	-	1	$0	0.2	$0
Red-shouldered Hawk	31	$0	42	$0	82	$250	67	$25	12	$0	47	$55
Broad-winged Hawk	-	-	19	$0	-	-	-	-	2	$0	4	$0
Swainson’s Hawk	182	$0	261	$1,215	387	$6,502	181	$8,000	36	$0	209	$3,143
Red-tailed Hawk	122	$509	172	$79,022	314	$1,100	183	$36,882	442	$125	247	$23,528
Rough-legged Hawk	26	$0	35	$0	-	-	6	$0	-	-	13	$0
Golden Eagle	1	0	1	$0	1	$700	11	$265	1	$0	3	$193
Crested Caracara	579	$1,090	573	$8,040	620	$0	487	$1,505	364	$780	525	$2,283
American Kestrel	284	$130,150	329	$0	455	$161,658	218	$0	340	$0	325	$58,362
Prairie Falcon	1	$0	-	-	-	-	-	-	-	-	0.2	$0
American Coot	27	$5,000	38	$5,000	14	$0	17	$66,666	13	$86,666	22	$32,666
Sandhill Crane	139	$5,800	167	$200	238	$0	86	$0	36	$5,668	133	$2,334
American Golden-Plover	-	-	-	-	-	-	-	-	1	$0	0.2	$0
Killdeer	59	$0	72	$0	32	$0	44	$0	87	$5,668	59	$1,134
Black-necked Stilt	5	$0	2	$0	2	$0	-	-	-	-	2	$0
Spotted Sandpiper	-	-	-	-	-	-	2	$103,000	-	-	0.4	$20,600
Long-billed Curlew	-	-	-	-	-	-	11	$0	2	$0	3	$0
Greater Yellowlegs	70	$0	150	$0	165	$0	30	$0	-	-	83	$0
Lesser Yellowlegs	73	$0	150	$0	164	$0	30	$0	-	-	83	$0
Upland Sandpiper	15	$0	65	$4,522	208	$0	106	$56	68	$0	92	$916
Long-billed Dowitcher	73	$0	150	$0	164	$0	30	$0	-	-	83	$0
Red Knot	-	-	-	-	-	-	4	$0	-	-	1	$0
Sanderling	-	-	-	-	-	-	-	-	1	$0	0.2	$0
Least Sandpiper	3	$0	-	-	-	-	-	-	1	$0	1	$0
Buff-breasted Sandpiper	2	$0	-	-	-	-	-	-	-	-	0.4	$0
Wilson’s Snipe	3	$0	-	-	1	$0	-	-	1	$0	1	$0
Bonaparte’s Gull	2	$0	-	-	-	-	-	-	-	-	0.4	$0
Laughing Gull	285	$6,500	332	$25,000	406	$8,000	177	$104,016	115	$227,686	263	$74,240
Franklin’s Gull	3	$16,095	4	0	2	$1,955	1	$0	-	-	2	$3,610
Ring-billed Gull	1	$0	10	$0	-	-	4	$0	71	$0	17	$0
Herring Gull	45	$0	40	$0	26	$0	10	$0	2	$0	25	$0
Least Tern	-	-	-	-	-	-	5	$0	2	$0	1	$0
Caspian Tern	1	$14,000	1	$26,000	-	-	1	$64,285	1	$35,714	1	$28,000
Common Tern	-	-	-	-	-	-	-	-	1	$20,000	0.2	$4,000
Forster’s Tern	75	$56,250	155	$66,516	169	$10,002	34	$13,700	8	$75,980	88	$44,490
Black Skimmer	169	$0	150	$0	164	$0	30	$0	-	-	103	$0
Seabirds (mixed) [1]	206	$0	165	$0	-	-	-	-	-	-	74	$0
Rock Pigeon (feral)	622	$15,940	659	$428,150	817	$25,300	940	$29,800	806	$181,250	769	$136,088
Eurasian Collared-Dove	-	-	1	$0	-	-	3	$0	35	$0	8	$0
White-winged Dove	168	$1,000	187	$440,979	221	$2,886	147	$19,150	370	$345,222	219	$161,847
Mourning Dove	185	$232,200	181	$1,480	133	$200	318	$2,200,144	419	$47,668	247	$496,338
Inca Dove	26	$0	69	$0	172	$0	46	$0	-	-	63	$0
Common Ground-Dove	-	-	-	-	-	-	1	$0	-	-	0.2	$0
Monk Parakeet	-	-	1	$0	2	$0	2	$0	2	$0	1	$0
Red-crowned Parrot	-	-	-	-	-	-	1	$0	-	-	0.2	$0
Parrot sp.	-	-	-	-	-	-	-	-	1	$0	0.2	$0

SPECIES	FY07		FY08		FY09		FY10		FY11		Average	
	WTs	**$ Value $**	**WTs**	**$ Value $**	**WTs**	**$ Value $**	**WTs**	**$ Value $**	**WTs**	**$ Value $**	**WTs**	**$ Value $**
Greater Roadrunner	1	$0	-	-	1	$0	-	-	-	-	0.4	$0
Barn Owl	13	$1,550	64	$870	8	$350	11	$300	32	$1,000	26	$814
Western Screech-Owl	-	-	-	-	-	-	1	$0	-	-	0.2	$0
Eastern Screech-Owl	3	$0	1	$0	1	$0	10	$100	1	$0	3	$20
Great Horned Owl	32	$6,160	91	$500	171	$100	46	$0	9	$640	70	$1,480
Barred Owl	2	$0	6	$85	6	$0	16	$15	1	0	6	$20
Nighthawks (all)	10	$0	40	$0	7	$36	24	$36	16	$5,668	19	$1,148
Chimney Swift	1	$0	1	$100	1	$0	2	$36	2	$6,991	1	$1,425
Ruby-throated Hummingbird	-	-	1	$0	2	$0	1	$0	1	$0	1	$0
Red-headed Woodpecker	51	$1,600	48	$0	9	$250	16	$200	12	$0	27	$410
Golden-fronted Woodpecker	50	$3,150	63	$4,800	28	$4,850	33	$2,450	43	$3,100	43	$3,670
Red-bellied Woodpecker	-	-	-	-	-	-	1	$0	1	$0	0.4	$0
Yellow-bellied sapsucker	3	$1,075	2	$750	1	$0	-	-	1	$500	1	$465
Downy Woodpecker	4	$900	3	$450	1	$450	2	$250	2	$50	2	$420
Northern Flicker	-	-	3	$200	-	-	-	-	-	-	1	$40
Pileated Woodpecker	7	$20,600	1	$3,400	-	-	-	-	2	$300	2	$4,860
Western Kingbird	11	$0	10	$0	25	$240,000	37	$0	15	$0	20	$48,000
Scissor-tailed Flycatcher	13	$0	15	$0	77	$0	72	$0	111	$14,381	58	$2,876
Blue Jay	2	$200	2	$0	2	$0	8	$0	72	$250	17	$90
American Crow	51	$7,318	67	$7,535	41	$4,750	33	$1,375	75	$8,430	53	$5,882
Chihuahuan Raven	83	$0	106	$0	-	-	-	-	-	-	38	0
Common Raven	126	$1,465	151	$350	46	$1,645	83	$1,535	158	$2,555	113	$1,510
Horned Lark	57	$0	94	$0	30	$21,262	100	$179,368	150	$1,000	86	$40,326
Purple Martin	-	-	40	$0	-	-	1	$0	-	-	8	$0
Bank Swallow	-	-	-	-	-	-	2	$36	-	-	0.4	$7
Cliff Swallows	3	$500	58	$640	143	$30,149	62	$180	125	$0	78	$6294
Barn Swallow	108	$2,725	221	$47,741	200	$50	107	$99,990	94	$800	146	$30,261
Wren sp.	-	-	-	-	1	$0	-	-	-	-	0.2	$0
Eastern Bluebird	-	-	-	-	-	-	-	-	1	$0	0.2	$0
American Robin	-	-	2	$0	1	$0	-	-	-	-	1	$0
Northern Mockingbird	2	$0	3	$0	6	$0	10	$0	8	$0	6	$0
Starling/blackbirds[1]	481	$398,300	499	$109,600	590	$297,250	375	$301,036	161	$204,000	421	$262,037
European Starling	100	$92,000	254	$96,050	380	$36,600	236	$280,000	331	$2,500	260	$101,430
American Pipit	-	-	-	-	-	-	-	-	3	$0	1	$0
Cedar Waxwing	3	$0	-	-	-	-	1	$0	-	-	1	$0
Chipping Sparrow	-	-	-	-	-	-	-	-	1	$9,716	0.2	$1,943
Lark Bunting	42	$0	26	$5,000	28	$5,000	42	$0	43	$1,500	36	$2,300
Savannah Sparrow	-	-	-	-	-	-	-	-	1	$0	0.2	$0
Northern Cardinal	-	-	10	$0	1	$0	6	$100	2	$0	4	$20
Red-winged Blackbird	436	$0	234	$500	221	$3,500	73	$0	43	$7,500	201	$2,300
Eastern Meadowlark	106	$0	229	$27,060	230	$0	256	$108	264	$676,668	217	$140,767
Western Meadowlark	60	$0	146	$0	167	$0	158	$102,000	429	$0	192	$20,400
Yellow-headed Blackbird	26	$0	35	$0	9	$0	8	$36	-	-	16	$7
Rusty Blackbird	26	$0	35	$0	-	-	6	$0	-	-	13	$0
Brewer's Blackbird	26	$0	35	$0	-	-	6	$0	-	-	13	$0
Common Grackle	222	$6,750	219	$1,550	366	$2,100	220	$2,500	302	$330	266	$2,646
Boat-tailed Grackle	1	$0	40	$0	138	$1,000	41	$1,500	4	$0	45	$500
Great-tailed Grackle	635	$13,325	617	$8,300	739	$24,450	485	$1,536	275	$23,025	550	$14,127
Brown-headed Cowbird	28	$0	63	$0	23	$0	17	$0	82	$5,000	43	$1000
House Finch	-	-	-	-	9	$0	-	-	3	$0	2	$0
Pine Siskin	-	-	-	-	1	$216	-	-	-	-	0.2	$43
House Sparrow	106	$2,300	112	$200	27	$1,200	25	$3,350	46	$112,354	63	$23,881
All birds (WHA[2] - oil)	-	-	-	-	105	$0	283	$0	113	$0	100	$0
Unidentified bird[3]	203	$5,211	423	$45,800	581	$49,363	129	$40,308	3	$1,000	268	$28,336
Total (160 spp.)	11,828	$2,235,543	13,995	$2,479,878	16,262	$1,577,587	10,260	$11,449,271	10,265	$5,152,504	12,522	$4,680,539
No. Spp. per year	114		113		119		121		114		116	

WTs. = Work Tasks associated with requests for assistance

1 - Species that commonly roost or feed together are often combined in the MIS

2 – WHA=Wildlife hazard Assessment which is a yearlong study at an airport to determine wildlife hazards including those caused by birds.

3 – Mostly birds involved in aircraft strikes that cannot be identified to species

4 – Total species and average per year includes feral peafowl, guineas, and chickens, as appropriate, and other feral domestic species

1.3.1 Summary of Proposed Action

The proposed action is to continue the current portion of the TWSP program in Texas that responds to requests for BDM to protect human health and safety, agricultural resources such as livestock feed, livestock, livestock health, aquaculture, and crops, property such as turf, landscaping, and structures, and natural resources such as T&E species, other wildlife, and forestry. Major components of the WS BDM program in Texas have been the goal of reducing threats or hazards to human health and safety from birds such as gulls, raptors, shorebirds, and pigeons at airports, damage or the threat to livestock feed and health from starlings and vultures, damage to rice crops from blackbirds, and property damage with the potential for human health concerns from feral pigeons.

To meet the WS mission and goals, TWSP has the objective of responding to all requests for assistance with, at a minimum, technical assistance or self-help advice, or, where appropriate and when cooperative or congressional funding is available, direct control assistance where professional TWSP personnel conduct BDM. An Integrated Wildlife Damage Management (IWDM) approach is implemented which allows the use of any legal technique or method (discussed in Section 3.3.1.3), used singly or in combination, to meet the needs of requestors for resolving conflicts with birds. Agricultural producers and others requesting assistance are provided with information regarding the use of effective nonlethal and lethal techniques, as necessary. Lethal methods for birds used by TWSP would include shooting, trapping, egg addling/destruction, DRC-1339, Avitrol®, sodium lauryl sulfate (SLS), and live capture by trapping or use of the tranquilizer alpha-chloralose (A-C) followed by euthanasia with a humane technique such as the use of an appropriate drug such as Fatal Plus®. Nonlethal methods used by TWSP may include wire barriers and deterrents such as porcupine wire, netting, and fencing, the tranquilizer A-C followed by relocation, chemical repellents (e.g., methyl anthranilate, polybutene products), and harassment with auditory devices (e.g., propane cannons, pyrotechnics, distress calls) and visual repellents (e.g., reflective tape, human effigies, balloons). In many situations, the implementation of nonlethal methods such as exclusion-type barriers would be the responsibility of the requestor to implement. Additionally, prey-base control at airports for insects and small rodents, attractants to birds at airports, may require the use of EPA-registered lethal pesticides for reducing bird strikes. However, following label directions, these primarily are toxic only to those species targeted and only indirectly affect birds, nonlethally (discussed further in Section 3.3.1.3). TWSP could conduct BDM on private property or at public facilities in Texas when a request for assistance is received and where a need has been documented and the appropriate *Work Initiation Document* is completed. All management actions would comply with appropriate federal, state, and local laws.

TWSP has conducted BDM throughout Texas to protect a variety of resources and human health and safety. From FY07 to FY11, TWSP conducted an annual average of 12,146 work tasks involving birds with the estimated value of losses at $4.6 million prior to receiving assistance from TWSP (Table 3). Much of TWSPs effort is focused on protecting human health and safety, but the protection of property and agricultural and natural resources is also a concern.

1.3.2 Need for BDM to Protect Human Health and Safety

Birds represent a variety of health and safety hazards to the public. For example, birds have been implicated in the transmission of several diseases to humans (Figure 1) and are a hazard to aircraft and their passengers at airports. Birds can harass and injure people especially those protecting nests and can pose a concern where they carry off potentially infectious or unsanitary items at landfills and open water treatment plants. And finally, birds can cause general concerns or are a nuisance to some people, but really do not cause monetary damage per se. Examples of the latter include birds making excessive noise (i.e., communal bird roosts, nesting crows, feral peacocks, woodpeckers hammering on a house), they are injured (i.e., wrapped with fishing line, stuck with toy dart, or struck by a car and need to be trapped/hand captured to be taken to a rehabilitator), stuck in a building (i.e., Cooper's Hawk in a warehouse, starling in a flume), leaving excrement on sidewalks (i.e., geese, ducks, starlings, swallows), or creating an unpleasant stench (i.e., droppings at communal bird roosts near residences, vulture roosts from vomitus and droppings, pigeon nests near air-intake to buildings).

Table 3. The number of requests for assistance and value of damage caused by birds in Texas as reported to or verified by TWSP from FY07 to FY11 to protect human health and safety, agricultural and natural resources, and property. The damage reported in this table is only a fraction of the actual damage caused by birds in Texas.

Category	Resource	FY07		FY08		FY09		FY10		FY11		Average	
		WTs.	$ Value $	WTs.	$ Value $	WTs.	$ Value $	WTs.	$ Value $	WTs	$ Value $	WTs.	$ Value $
HUMAN HEALTH AND SAFETY (HH/S)													
HH/S	Aviation	6,709	$0	7,522	$27,060	8,102	$576	2,714	$0	1,863	$361,135	5,382	$77,754
	General	507	$3,540	552	$14,100	870	$1,200	921	25	995	$10,650	769	$5,903
HH/S TOTAL		7,216	$3,540	8,074	$41,160	8,972	$1,776	3,635	$25	2,858	$371,785	6,151	$83,657
AGRICULTURE													
Aquaculture	Bait/Ornam. Fish	3	$4,500	21	$242,232	11	$33,106	13	$37,875	13	$37,825	12	$71,108
	Bass	8	$134,000	5	$130,009	11	$30,006	20	$453,300	31	$517,588	15	$252,981
	Catfish	24	$479,100	42	$432,197	25	$105,006	21	$91,515	27	$103,969	28	$242357
	Other Food Fish	22	$211,250	20	$81,000	8	$105,000	22	$106,215	50	$434,515	24	$187,596
Aquaculture Subtotal		57	$828,850	88	$885,438	55	$273,118	76	$688,905	121	1,093,897	79	$754,042
Livestock	Cattle	145	$69,455	205	$122,500	401	$42,050	537	$67,325	600	$35,067	378	$67,279
	Goats	153	$7,450	188	$11,460	62	$3,150	262	$8,015	274	$28,765	188	$11,768
	Sheep	137	$4,515	204	$1,030	59	$1,975	337	$2,875	590	$7,380	286	$3,555
	Other Hoof-stock	5	$20,100	2	$1,000	40	$29,500	49	$14,000	70	$1,600	33	$13,240
	Poultry/Rabbits	8	$204	9	$95	2	$50-	15	$800	2	$125	7	$255
	Livestock Feed	8	$71,130	9	$730	11	$2,525	12	$16,500	14	$6,025	11	$19,382
Livestock Subtotal		456	$172,854	617	$136,815	575	$79,250	1,212	$109,515	1,550	$78,962	882	$115,479
Crops	Citrus	437	$12,000	285	$5,500	340	$16,200	248	$2,500	25	$12,080	267	$9,656
	Pecan/Nuts	19	$5,818	18	$1,665	12	$4,150	14	$250	14	$5,350	15	$3,477
	Rice	232	$296,450	282	$75,200	298	$285,800	250	$301,036	100	$110,000	232	$213,697
	Wheat	6	$30,200	2	$5,200	4	$1,800	6	$45,200	2	$5,000	4	$17,480
	Commercial Trees	12	$3,675	14	$6,500	5	$6,000	23	$500	7	$0	12	$3,355
	Other Crops	51	$11,100	51	$25,150	38	$11,850	87	$19,150	62	$1,200	58	$13,690
Crop Subtotal		757	$359,243	652	$119,215	697	$325,800	628	$368,636	210	580	589	$261,305
AGRICULTURE TOTAL		1,270	$1,360,947	1,357	$1,141,468	1,327	$678,168	1,916	$1,167,056	1880	$1,306,489	1,550	$1,130,826
PROPERTY													
Property	Pets/Zoo Animal	16	$600	18	$1,250	12	$910	16	5,300	12	$500	15	$1,712
	Aircraft	2,117	$384,806	3,207	$1,036,738	4,704	$593,544	3,459	$1,016,667	4,567	$1,219,712	3,611	$850,293
	Vehicle/Watercraft	11	$2,550	12	$9,201	7	$2,600	9	$10,650	26	$35,575	13	$12,115
	Equipment/Machine	107	$41,950	63	$43,900	128	$22,500	48	$25.000	40	$42,000	77	$30,075
	Landscape/Garden	46	$4,300	74	$18,500	27	$16,050	20	$51,125	36	$5,300	41	$19,055
	Buildings/Houses	320	$92,525	255	$33,120	285	$96,750	791	$6,325,350	271	$170,325	384	$1,343,614
	Utilities	82	$115,500	94	$27,950	136	$28,500	110	$2,480,600	173	$1,613,100	119	$853,130
	Other Structures	23	$4,400	9	$9,100	6	$900	8	$2,500	21	$0	13	$3,380
	Impoundments	9	$0	15	$200	2	$1,000	1	$67,000	29	$35,000	11	$20,640
	General Property	107	$75,950	97	$100,700	75	$126,300	130	292,748	136	$342,818	109	$187,703
TOTAL PROPERTY		2,838	$722,581	3,844	$1,280,659	5,382	$889,054	4,592	$10,251,965	5,311	$3,464,330	4,393	$3,321,718
NATURAL RESOURCES													
Natural Resources	T&E Species	-	-	4	$0	-	-	-	-	-	-	1	$$0
	Recreation Areas	6	$1,500	7	$1,700	19	$8,150	10	$0	94	$0	27	$2,270
	Wildlife	21	$6,000	1	$0	12	$0	12	$0	17	$0	13	$1,200
	Sport Fisheries	9	$10,000	2	$0	3	$0	7	$50	3	$0	5	$2,010
	Trees	9	$130,900	6	$6,500	1	$500	3	$4,200	10	$0	6	$28,420
TOTAL NAT. RESOURCES		45	$148,400	20	$8,200	35	$8,650	32	$4,250	124	$0	51	$33,900
TOTAL ALL DAMAGE		11,369	$2,235,468	13,295	$2,471,487	15,716	$1,577,648	10,175	$11,423,296	10,173	$5,142,604	12,146	$4,570,101
Bird Info. Requests Only		460	N/A	702	N/A	546	N/A	84	N/A	89	N/A	376	$0

WTs = Work tasks associated with requests for BDM assistance to protect that resource. One work task for livestock damage could involve multiple predations and one for aquaculture could be losses for the entire year and include brood fish that would not be sold.

TWSP responded to an annual average of 5,977 human health and safety complaints involving birds from FY07 to FY11 with 5,382 (90%) of these associated with protection of people at airports (Table 3).

Species that caused most human health and safety concerns in Texas from FY07 to FY11 were Turkey Vultures (7%), Black Vultures (5%), Rock Pigeons (5%), Great-tailed Grackles (4%), American Kestrels (4%), and Laughing Gulls (3%). Species' groups that caused most concerns were raptors (29%), blackbirds/starlings (13%), waterfowl (12%), wading birds (11%), and shorebirds (6%).

Bird-Aircraft Hazards to Humans

The first reported wildlife-aircraft collision occurred on April 12, 1912, when a Model EX Wright Pusher collided with a gull and crashed into the ocean, killing the pilot. Since that time, planes have become more numerous, larger and faster, and bird-aircraft collisions have increased exponentially (Dolbeer 2009). Texas airports and airbases reported an annual average of 660 annual bird strikes from FY02 to FY11 (Appendix D: Table D1) while 8,252 were reported annually in the United States (FAA 2012). The number of bird strikes has been increasing annually. Much of this increase is thought to have resulted from pilot and airport awareness to report bird strikes and the ease of reporting strikes. However, an increase in air traffic and some populations of hazardous birds has also been considered part of the increase in bird related strikes with aircraft (Dolbeer 2006). Two strikes in Texas resulted in catastrophic incidents where a person(s) lost their life. In 1992, an experimental plane crashed killing the pilot from a strike with an unknown bird. Another accident in 2003 involved a student and an instructor pilot that were killed following a collision with a vulture. Additionally, both of these aircraft were lost in the strike. Another incident in Texas involving the loss of an aircraft occurred in 2003 when a military aircraft struck a flock of horned larks; damage to the aircraft was so significant the pilot ejected (resulting in some injuries) and the aircraft was lost. Of the 660 bird strikes reported annually to FAA (2012) from civilian and military airfields in Texas, about 10% involved damage and 6% involved an aborted take-off, precautionary landing following a strike on take-off roll, after take-off, or on approach, or an engine shut-down; many of these had the potential to become catastrophic. The majority of these involved high-risk species such as raptors, waterfowl, gulls, wading birds, pigeons, blackbirds, meadowlarks, starlings, and horned larks (though small, horned larks have a high body density and congregate in large flocks).

Few birds are encountered higher than 2,000 feet above ground, as just over 90% of the strikes occur below this altitude. About 75% of all bird strikes experienced by civilian aircraft occur on, or in the immediate vicinity of, an airfield below 500 feet (Solman 1973; Blokpoel 1976), but recent data suggests that strikes are occurring more frequently outside these parameters outside the boundary of the airports (Dolbeer 2011). TWSP routinely receives requests to conduct BDM at, or near, airports or airbases. Most airport related requests are responded to by TWSP with technical assistance through site visits for observations, written wildlife hazard assessments, or the development of a comprehensive wildlife hazard management plan for a particular airport. TWSP has agreements for the management of bird hazards at airports or associated land areas (e.g., landfills); BDM activities may include habitat modifications to reduce the attractiveness of the airport to birds, local population reduction, or behavior modification (e.g., bird scaring/dispersal tactics) to move the birds from the airport environment. Such requests may follow a bird strike situation or be mandated to airport management by FAA under CFR 14 - Part 139.337 or from an airbase Bird Air Strike Hazard team. TWSP also assists FAA and the military with site observations and assessments when land use practices (i.e., landfill operations, water treatment facilities) may increase the risk of bird strikes near airports. High priority is placed on such requests due to the potential for loss of human life and because damage to aircraft can be very costly. In 1989, an MOU established a cooperative relationship between FAA and WS for resolving animal hazards to aviation that benefits public safety. The MOU defines agency roles in managing wildlife hazards to protect aviation pursuant to Federal Aviation Regulation (14 CFR Part 139).

TWSP has become involved at many airports and airbases in Texas and conducts wildlife hazard management at these facilities. Much of the BDM at these sites have been hazing and harassment activities, but TWSP takes several species at airports to reduce the potential for bird strikes, especially where nonlethal means to avoid strikes are not being effective. The species that have been identified to cause the most strikes in Texas have been somewhat similar to those nationally and include doves, grassland birds (primarily meadowlarks and Horned Larks), shorebirds, invasive birds, and raptors. From FY07 to FY11, TWSP recorded an annual average of 5,382 work tasks associated with protecting human health and safety from bird-aircraft strikes at airfields. The majority of these requests began in FY07 with 6,709 work tasks and 7,513 in FY08, rising significantly over the 1,246 work tasks conducted in FY06.

Avian Diseases Transmittable to Humans

Several species of birds are known to carry diseases that can be transferred to humans (Figure 1). TWSP conducts disease surveillance, though recently has tapered off. In FY07, 2,613 samples were obtained to test for a variety of maladies. However, as a result of declining funds, fewer samples have been taken, and in FY11, only 327 disease samples were collected. From FY07 to FY11, TWSP collected an annual average of 1,498 disease samples for monitoring and surveillance efforts.

Feral pigeons and starlings have been suspected in the transmission of 29 different diseases to humans, (Weber 1979 and Davis et al. 1971). These include viral diseases such as meningitis and seven different forms of encephalitis; bacterial diseases such as erysipeloid, salmonellosis, paratyphoid, Pasteurellosis, and Listeriosis; mycotic (fungal) diseases such as aspergillosis, blastomycosis, candidiasis, cryptococcosis, histoplasmosis, and sarcosporidiosis; protozoal diseases such as American trypansomiasis and toxoplasmosis; and rickettsial/chlamydial diseases such as chlamydiosis and Q fever (Figure 1). As many as 65 different diseases transmittable to humans or domestic animals have been associated with feral pigeons, starlings, and House Sparrows (Weber 1979). In most cases in which human health concerns are a major reason for requesting BDM, no actual cases of bird transmission of disease to humans have been proven to occur. The risk of disease transmission from birds is often the underlying reason people request assistance from WS. Many disease transmission cases in Texas have occurred from birds to humans. For example, cryptococcal meningitis was contracted by a woman in Texas from exposure to pigeon and grackle droppings. The disease was confirmed after several weeks of flu-like symptoms with intense headaches. An MRI (magnetic resonance imaging) examination revealed a massive, fungal, cerebral infection which was subsequently treated with a series of strong antibiotics. After nine months from the onset of the illness which included thirteen spinal taps and fourteen days of hospitalization, the woman fully recovered from the disease.

Old World viral diseases (e.g., St. Louis encephalitis and West Nile virus) have been well documented in bird populations in the Western Hemisphere. West Nile virus rapidly spread across the U.S. starting in 1999, reaching areas of east Texas in June 2002 with 202 human cases and 12 fatalities that year (Texas Department of State Health Services 2012). In 2003, the number of cases increased to 439 with 40 fatalities, the highest number of both. Since that time, the virus has been on the decline with 77 cases involving 7 deaths in 2010 and only 20 cases in 2011, but an unknown number of fatalities (Texas Department of State Health Services 2012). While mosquito transmission is known to be the principal vector, certain migratory bird populations serve as a host or reservoir organisms for the disease and have long been suspected as principal introductory hosts of West Nile virus into new regions (Centers for Disease Control 2006).

Other health issue problems can arise from waterfowl such as resident Canada Geese that have become accustomed to and are successful in suitable urban habitats. Overabundant populations of resident geese are becoming more and more common and are a nuisance around public parks, lakes, housing developments, and golf courses. The threat to human health from high fecal coliform (e.g., *Escherichia coli*) levels and other pathogens including *Crpytosporidium parvum*, *Giardia lambia*, and *Salmonella spp*. is also associated with large amounts of droppings (Clark 2003). Research (Texas A&M Univ. 2006) found that 28% of the *Escherichia coli* (*E. coli*) at sites in Belton Lake and Leon River were determined to be from birds.

TWSP receives requests for assistance from individuals concerned about diseases in areas of large bird concentrations (e.g., urban areas of communal blackbird roosts). Individuals may request assistance in removing or dispersing flocks in order to minimize possible risks. TWSP typically responds to such requests with direct and technical assistance aimed at dispersing target populations from such areas. Nonlethal dispersal techniques, as well as, limited, lethal control for collection, disease monitoring, and dispersal reinforcement may be used. TWSP may, upon request, assist local, county, state and federal health authorities with collection and monitoring efforts.

Many times, residents or property owners that request assistance with nuisance feral domestic pigeon, blackbird, starling, vulture, and egret roosts are concerned about potential disease risks but are unaware of the types of diseases that can be associated with these birds. Most of these requestors are primarily concerned by the continual clean-up costs, the unaesthetic appearance of their property, or foul stench from the droppings in the area.

In addition to diseases, ectoparasites (i.e., mites, lice, fleas, ticks, bed bugs and other arthropods) from birds that feed on their blood, body fluid, or feathers can negatively affect humans. Parasites thrive in and around bird nests and accumulated droppings, and, in the absence of birds, may feed on the blood and body fluids of people. These parasites can cause severe reactions in people, but the major problem with ectoparasites is that they are known vectors for transference of numerous viral and bacterial diseases. These pests infiltrate buildings, spread diseases, and cause problems to humans through numerous methods. Allergies to feather dander and bird droppings can also cause skin irritations and respiratory illnesses. Contamination and other negative, indirect effects are consideration for concern. TWSP frequently provides technical and direct assistance for problems with birds roosting and nesting in and near buildings. Both lethal and nonlethal methods are used to resolve conflicts.

Avian Influenza (AI). AI is caused by a virus in the Orthomyxovirus group. Viruses in this group vary in the intensity of illness they may cause (virulence). Wild birds, in particular waterfowl and shorebirds, are considered natural reservoirs for AI (Clark 2003). Most strains of AI rarely cause severe illness or death in birds although the H5 and H7 strains tend to be highly virulent and very contagious (Clark 2003). Recently, the occurrence of HP H5N1 AI virus has raised concerns regarding the potential impact on wild birds, domestic poultry, and human health should it be introduced into the U.S. It is thought that a change occurred in a low pathogenicity AI virus of wild birds, allowing the virus to infect chickens, followed by further change into the HP H5N1 AI. HP H5N1 AI has been circulating in Asian poultry and fowl resulting in death to these species. HP H5N1 AI likely underwent further changes allowing infection in additional species of birds, mammals, and humans. More recently, the virus moved back into wild birds resulting in significant mortality of some species of waterfowl, gulls, and cormorants. This is only the second time in history that a highly pathogenic form of AI has been recorded in wild birds. Numerous potential routes for introduction of the virus into the United States exist including illegal movement of domestic or wild birds, contaminated products, and the migration of infected wild birds.

The species that congregate to form communal roosts or nesting colonies in Texas that could in areas where people could be exposed include Black and Turkey Vultures, starlings and blackbirds, crows, egrets and herons, waterfowl, and swallows. TWSP has responded to several requests for assistance with several species and verified reports with people that have avian associated illnesses.

WS has been part of an interagency team conducting, assisting, or supervising in disease surveillance by collecting biological samples to monitor for the presence of various diseases such as highly pathogenic (HP) avian influenza (AI) such as the HP H5N1 AI virus. Both WS and USFWS have collected samples to test for the presence of this disease in western states. Samples were obtained from live and dead birds, and droppings, and often certain species were targeted. For example with HP H5N1 AI, waterfowl, gulls, and shorebirds were the focus of surveillance in Texas with only waterfowl samples collected in FY08; an average of 26 species were sampled from FY06 to FY08 with an annual average of 1,586 individual birds being sampled and 1,632 AI samples collected in Texas. Since that time, as discussed, fewer samples have been collected.

Disease	Human Symptoms	Potential for Human Fatality	Effects on Domestic Animals
BACTERIAL			
erysipeloid	skin eruption with pain, itching; headaches, chills, joint pain, prostration, fever, vomiting	sometimes - particularly in young children, old or infirm people	serious hazard for the swine industry
salmonellosis	gastroenteritis, septicemia, persistent infection	possible, especially in individuals weakened by other disease or old age	causes abortions in mature cattle, possible mortality in calves, decrease in milk production in dairy cattle
Pasteurellosis	respiratory infection, nasal discharge, conjunctivitis, bronchitis, pneumonia, appendicitis, urinary bladder inflammation, abscessed wound infections	rarely	may fatally affect chickens, turkeys and other fowl
Listeriosis	conjunctivitis, skin infections, meningitis in newborns, abortions, premature delivery, stillbirth	sometimes - particularly with newborns	In cattle, sheep, and goats, difficulty swallowing, nasal discharge, paralysis of throat and facial muscles
VIRAL			
meningitis	inflammation of membranes covering the brain , dizziness, and nervous movements	possible — can also result as a secondary infection with Listeriosis, salmonellosis, cryptococcosis	causes middle ear infection in swine, dogs, and cats
encephalitis (8 forms)	headache, fever, stiff neck, vomiting, nausea, drowsiness, disorientation	mortality rate for eastern equine encephalomyelitis may be around 60%	may cause mental retardation, convulsions and paralysis
MYCOTIC (FUNGAL)			
aspergillosis	affects lungs and broken skin, toxins poison blood, nerves, and body cells	not usually	causes abortions in cattle
blastomycosis	weight loss, fever, cough, bloody sputum and chest pains.	rarely	affects horses, dogs and cats
candidiasis	infection of skin, fingernails, mouth, respiratory system, intestines, and urogenital tract	rarely	causes mastitis, diarrhea, vaginal discharge and aborted fetuses in cattle
cryptococcosis	lung infection, cough, chest pain, weight loss, fever or dizziness, also causes meningitis	possible especially with meningitis	chronic mastitis in cattle, decreased milk flow and appetite loss
histoplasmosis	pulmonary or respiratory disease. May affect vision	possible, especially in infants and young children or if disease disseminates to the blood and bone marrow	actively grows and multiplies in soil and remains active long after birds have departed
PROTOZOAL			
American trypansomiasis	infection of mucous membranes of eyes or nose, swelling	possible death in 2-4 weeks	caused by the conenose bug found on pigeons
toxoplasmosis	inflammation of the retina, headaches, fever, drowsiness, pneumonia, strabismus, blindness, hydrocephalus, epilepsy, and deafness	possible	may cause abortion or still birth in humans, mental retardation
RICKETTSIAL/CHLAMYDIAL			
chlamydiosis - psitticosis	pneumonia, flu-like respiratory infection, high fever, chills, loss of appetite, cough, severe headaches, generalized aches and pains, vomiting, diarrhea, hepatitis, insomnia, restlessness, low pulse rate	occasionally, restricted to old, weak or those with concurrent diseases	in cattle, may result in abortion, arthritis, conjunctivitis, and enteritis
Q fever	sudden pneumonitis, chills, fever, weakness, severe sweating, chest pain, severe headaches and sore eyes	possible	may cause abortions in sheep and goats

Figure 1. Diseases transmittable to humans and livestock associated with feral pigeons, starlings and House Sparrows (*copied from* Weber 1979).

Bird Attacks on People

Another type of human safety problem that occurs with birds in Texas is attacks on people by nesting waterfowl, raptors, and passerines. Common species which attack people that TWSP receives complaints involve Canada Geese, Mute Swans, Mississippi Kites, Red-shouldered Hawks, Northern Mockingbirds, and Northern Cardinals. Additionally, crows and other birds that have been hand-raised and subsequently released can become serious problems and often find children at elementary schools easy to terrorize taking barrettes and pins to cache. These attacks are very infrequent, but TWSP responded to an average of 1 incident per year from FY07 to FY11 where people had been injured. In Randall County for example, Mississippi Kites attacked children at a daycare facility. One child was struck and injured (scalp laceration) by an adult kite when the children played near a tree with a nest. After several repeated attacks and threats to individuals nearby, TWSP personnel resolved the problem by coordinating the hand capture of the nestlings which were transferred to a wildlife rehabilitator to be raised in captivity. Once the nest and nestlings were removed, the aggressive, defensive behavior of the parent birds ceased and the problem was resolved. In FY11, an emu terrorized students at an elementary school in Caldwell County, but vacated the area after being harassed.

1.3.3 Need for BDM to Protect Agriculture

In 2007, Texas agriculture generated about $21.0 billion in annual sales from farm and ranch commodities (National Agricultural Statistics Service (NASS) 2009b). Of this, livestock (primarily cattle, milk, poultry, eggs, and hogs) production including aquaculture, accounted for about ⅔ of total farm commodity cash receipts, $14.4.billion, and, therefore, is considered a primary agricultural industry sector in the State. Crops accounted for the other ⅓ of sales in Texas, $6.6 billion with about ½ of this for crops such as cotton and greenhouse/nursery crops which are not typically involved in bird damage (House Sparrows can get into greenhouses where they cause damage). These agricultural products have a tremendous effect on local economies. Birds can cause extensive damage to agricultural products and accounted for an average of $1.4 million dollars in damage reported to or verified by TWSP from FY07 to FY11 from an average of 1,550 work tasks associated with agriculture (Table 3). Verified losses are defined as those losses examined by a TWSP Specialist during a site visit and identified to have been caused by a specific bird species or group of birds. Often a TWSP Specialist can determine the species by observing it (them) causing the damage. Sometimes, damage and other sign may have to be examined to determine the causative species. For example, predatory birds may not be at the kill site when a TWSP Specialist responds to a predation complaint. Bird kills can be typically distinguished from mammals, but determination of the bird often depends on the species that are present in the area. Some species' kills, such as vultures, are similar to other bird kills, such as ravens, and, therefore, the TWSP Specialist must observe the birds in the area. A few species, though, cause characteristic kills that are specific to them; for example, Great Horned Owls often kill poultry with the back area typically exhibiting wide talon marks and the head only partially consumed. Confirmation of the species that caused the loss is often a vital step toward establishing the need for control and the BDM necessary to resolve the problem. A TWSP Specialist not only tries to confirm the predator responsible, but also records the extent of the damage when possible. Losses that cannot be confirmed (the best guess is recorded) or those that are reported by a cooperator, but not confirmed are defined as reported losses.

Aquaculture

Fish production in the United States is on the rise, particularly in the East, where millions of dollars of catfish, bass, tilapia, and other foodfish, baitfish, shellfish, and crawfish are grown and harvested annually (NASS 2007). American aquaculturists raised an estimated 800 million pounds of fish each year worth an estimated $1.2 billion (NASS 2007). In Texas, aquaculturists have historically produced 30 million pounds or more. In 2010, the Texas Aquaculture Industry produced 30 million pounds of aquaculture products worth about $60 million and having an impact of $180 million on the economy (Treece 2012), about 5% of the U.S. production. Catfish remained the largest crop from 2008 to 2010 with an average of 28 million pounds produced. The Texas Aquaculture Association (Treece 2012) reported that the top 5 economic aquaculture products in 2011 were 14.4 million pounds of catfish valued at $14.4 million, 3.5 million pounds of striped bass valued at $9 million, 3.3 million pounds of red drum valued at $9 million, water garden retail sales valued at $7 million, and 2.2 million pounds of marine shrimp valued at %5.2 million. Additionally, other products include tilapia, crawfish, baitfish, eels, and alligators. It is anticipated that aquaculture will continue to increase in in the United States with Texas aquaculture increasing 11% from 2005 to 2012 (Treece 2012).

This growing industry is not without its problems. Aquaculturists report that fish-eating birds cause a significant economic loss (Gorenzel et al. 1994). Cormorants, herons, ducks, egrets, gulls, terns, Ospreys, pelicans, Wood Storks, and other fish-eating birds eat away at aquaculture profits, with some operations reporting 1-year losses in excess of $200,000 including loss of their brood stock. Cormorants have been a primary contributor to depredation losses in aquaculture in the United States. The Double-crested Cormorant is a species that has increased significantly in the interior States and responsible for significant depredations (USFWS 2003). Glahn et al. (2002) investigated predation losses to catfish by Double-crested Cormorants and found a 19.6% biomass production loss. Using this ratio, it was determined that Mississippi Delta producers may lose up to $25 million in catfish production annually from Double-crested Cormorants (USFWS 2003). Several other species are similarly responsible for aquaculture production losses. In Texas, aquaculturists have reported to TWSP or TWSP personnel have verified an average of about $800,000 in damage to fish and shellfish annually from FY07 to FY11 in 79 work tasks associated with aquaculture from fish-eating birds (Table 3) representing about 1.5% of the Texas aquaculture sales. TWSP primarily responded to complaints involving cormorants, herons, egrets, pelicans, terns, and gulls depredating a variety of fish, but primarily catfish at aquaculture sites (Table 3). About a third of the work tasks (28) were associated with protecting catfish.

In most cases, TWSP only provides advice (technical assistance) to aquaculture facility operators on how to resolve such problems through primarily nonlethal means such as barrier/deterrent wires or harassment. In some cases, the facility might need to obtain a depredation permit from the USFWS to kill a few of the birds to reinforce the remaining birds' fear of harassment and exclusionary techniques. Under the proposed action, TWSP could also be requested to provide on-site operational assistance involving the use of nonlethal and lethal means of resolving bird damage problems at these or similar facilities. Lethal methods would generally be restricted to taking only a few birds to reinforce the remaining birds' fear of harassment and exclusionary techniques.

Livestock

Livestock production in the United States and Texas contributes greatly to local economies. Texas produces a wide variety of livestock. Cattle and calf production inventory with 13.6 million cows in 2008 (NASS 2009b) was the most significant agriculture product in Texas contributing to about 40% of all agricultural sales or about $7.6 billion (NASS 2009b); other livestock and products that contributed significant sales in Texas included broilers ($1.4 billion), milk ($1.4 billion million), chicken eggs ($373 million), hogs ($94 million), and sheep and lambs ($39 million). Several other livestock such as goats are important in Texas. Livestock, their products, and feed losses cause economic hardships to their owners, and without effective BDM to protect them, depredation losses and, hence, economic impacts, would be greater (Nass 1977, 1980, Howard and Shaw 1978, Howard and Booth 1981, O'Gara et al. 1983). Damage to livestock and associated resources by birds reported to or verified by TWSP averaged about $120,000 between FY07 and FY11 and resulted in an average of 882 work tasks associated with requests from producers per year (Table 3). Though damage from birds is only a very small portion of the overall sales, it can be significant locally to a given rancher or group of ranchers.

Livestock Depredations. TWSP personnel respond to reports from resource owners of losses to predatory birds which may or may not be verified. Predatory birds are responsible for the depredation of a wide variety of livestock including cattle, goats, sheep, swine, exotic pen-raised game, other hoofed-stock, and poultry. Depredation to livestock is defined as the killing, harassment, or injury of livestock resulting in monetary losses to the owner. These impacts in Texas, chiefly livestock injury or fatality, have been primarily attributed to the Black Vulture, Crested Caracara, Great Horned Owl, Common Raven, Chihuahuan Raven, American Crow, Turkey Vulture, Red-tailed Hawk, and Red-shouldered Hawk. To a lesser extent, other raptors including eagles, other owls, falcons, and accipiters have also impacted livestock resources. From FY07 to FY11, an average of 394 livestock were killed by avian predators (all raptors) valued at about $96,000 (Table 3).

Predatory birds mostly kill or injure small (e.g., rabbits, poultry) or young (e.g., lambs, calves, kids) livestock, or incapacitated (i.e., injured, cows calving) adult hoof-stock. Domestic fowl (i.e., chickens, ducks, geese, guineas) resources are reported as livestock and are included in this discussion as well. Livestock depredations by birds typically are sporadic, but can get very serious for some producers. Of all predatory birds, the Black Vulture alone is responsible for over 90% of the value of damage to livestock in Texas as they predated all hoofed livestock.

TWSP considers nonlethal dispersal techniques (i.e., pyrotechnics, live trapping and relocation, modified animal husbandry practices, laser lights to disperse roosts) as the initial course of action. However, in situations where birds do not respond to nonlethal techniques, or where the use of these techniques is not practical, problems may be more effectively resolved using lethal methods. Population reduction or removal of specific problem-causing birds by live trapping and relocation, trapping and euthanasia, shooting, and the selective use of the avicide DRC-1339 (egg baits placed for problem causing ravens and crows) is sometimes required to resolve specific conflicts. TWSP also investigates and sometimes recommends resource owners or managers be given depredation permits by USFWS to allow for lethal control of certain species (e.g., Black Vulture, Turkey Vulture, Crested Caracara). Avian depredation is often difficult to control, but eagle depredation can be particularly problematic due to additional protective laws. Eagle depredation, though, has been highly sporadic in Texas. From FY00-FY02, FY03-FY05, FY06-FY08, and FY09-FY11, Golden and Bald Eagles were responsible for the annual loss of 49 and 1, 8 and 5, 1 and 0, 7 and 0, and 7 and 0 goats/sheep, respectively. Thus, damage for both has been relatively low, but declined sharply for Golden Eagles from 49 to 1, but back up to 7. TWSP would respond to eagle depredation requests in accordance with USFWS regulations which require a special permit to harass, live trap/relocate, or kill in order to deter further damage from problem causing birds.

Livestock Feed Losses at Confined Animal Feeding Operations (CAFOs). Blackbirds, starlings, House Sparrows, feral domestic pigeons and, to a lesser extent, crows and ravens often cause damage at cattle feedlots, dairies, and other CAFOs where congregations of these birds consume and contaminate feed. Losses are most significant in winter and spring months when tens of thousands of birds will concentrate at CAFOs. Texas' approximate 200 CAFOs produce about 25% of the fed cattle in the United States; while not every operation experiences heavy infestations of birds and associated damage, some operations do, and therefore request assistance from TWSP. Technical and direct control is used to provide a comprehensive BDM plan which may include both lethal and nonlethal BDM approaches. TWSP personnel responded to an average of 11 complaints involving livestock feed annually from FY07 to FY11 (Table 3) with an average of about $19,000 in losses. European Starlings and feral pigeons are the primary cause of the damage, especially in the panhandle region of Texas.

The problem of starling damage to livestock feed has been well documented in France and Great Britain (Feare 1984), and in the United States (Besser et al. 1968, Shwiff et al. 2012). The concentration of larger numbers of cattle eating huge quantities of feed in confined pens results in a tremendous attraction to starlings, blackbirds, and feral domestic pigeons. Diet rations for cattle contain all of the nutrients and fiber that cattle need, and are so thoroughly mixed that cattle are unable to select any one component over others. The basic constituent of most rations is silage which is supplemented with a high energy portion like protein pellets or grains such as corn, milo, or barley (incorporated as whole grains, or crushed and ground cereal). While cattle cannot select individual ingredients from that ration, starlings and other birds will select the component they want which alters the energetic value of the complete diet. The removal of this high energy fraction by starlings, is believed to reduce milk yields, weight gains, and is economically significant (Feare 1984). Glahn and Otis (1986) reported that starling damage was also associated with proximity to roosts, snow, and freezing temperatures and the number of livestock on feed. The economic significance of feed losses to starlings has been demonstrated by Besser et al. (1968) who concluded that the value of losses in feedlots near Denver, Colorado was $84 per 1,000 birds in 1967. Forbes (1995) reported starlings consume up to 50% of their body weight in feed each day. Glahn and Otis (1981) reported losses of 4.8 kg of pelletized feed consumed per 1,000 bird minutes. Glahn (1983) reported that 25.8% of farms in Tennessee experienced starling depredation problems with 6.3% experiencing significant economic loss. Williams (1983) estimated seasonal feed losses to five species of blackbirds (primarily Brown-headed Cowbirds) at one feedlot in south Texas at nearly 140 tons valued at $18,000.

TWSP personnel responded to a request for assistance from a large cattle feedlot in the panhandle of Texas which had upwards of one million starlings and blackbirds using the facility per day; the operators had a similar facility that did not have a bird damage problem. They reported that, based on a comparison of feed losses, livestock health problems (primarily coccidiosis), and water trough maintenance costs (continuous labor costs for cleaning bird droppings out of water troughs), bird damage was costing them about $5,000/day. Recent research confirmed the role of starlings in the spread of *Salmonella* within CAFOs (Carlson et al. 2011). An analysis of blackbird and starling depredation at 10 cattle feeding facilities in Arizona that used WS BDM services conservatively estimated that the value of feed losses on the 10 facilities would have been about $120,000 without WS BDM services which was reduced to $40,000/year (WS 1996) with operational assistance. Similar results conducting BDM at CAFOs was achieved in Kansas and Nevada (WS 2001, 2008, 2006).

Livestock Health Problems. Pathogens of livestock disease (e.g., coccidiosis, salmonella) are often associated with bird contamination from feces in feed and water troughs and in pastures and many of these and their problems associated with them are listed in Figure 2. A number of diseases that affect livestock have been associated with feral domestic pigeons, starlings, blackbirds, and House Sparrows (Weber 1979). Transmission of diseases such as transmissible gastroenteritis virus (TGE), tuberculosis (TB), and coccidiosis to livestock has been linked to migratory flocks of starlings and blackbirds. As a result of disease spread potential (from all causes), public health agencies began monitoring different aspects of livestock production. For example, Public Health Service activities in the area of milk sanitation began at the turn of the century with studies on the role of milk in the spread of disease. These studies led to the conclusion that effective public health control of milk borne disease requires the application of sanitation measures throughout the production, handling, pasteurization, and distribution of milk. The 1995 *Grade A Pasteurized Milk Ordinance,* recommended by the United States Public Health Service and the Food and Drug Administration (FDA), is used as the sanitary regulation for milk and milk products. The Milk Ordinance says “Cows should not have access to piles of manure, in order to avoid the soiling of udders and the spread of diseases among cattle” and that manure may not accumulate so as to permit the soiling of udders. Regulations in some states require fowl to be kept out of milking barns, stables, cow yards, and loafing and housing areas for fear of contamination. These regulations have been issued for dairy cattle because the accumulation of bird feces where cattle can lay could potentially contaminate the udder with pathogens and contamination of feed bunks with bird feces could transmit disease. Pigeons, starlings, and blackbirds commonly create these concerns at dairies because of the sheer numbers that can invade feedlots. The number of starlings present at CAFOs was positively correlated with contamination of feed and water troughs with *Salmonella enterica* which in turn infected cattle (Carlson et al. 2011). Estimates of the dollar value of this type of damage are not available. A consulting veterinarian for a large cattle feeding facility in the Texas panhandle indicated problems associated with coccidiosis declined following reduction of starling and blackbird numbers using the facility.

TWSP often receives requests from CAFO operators to conduct BDM to protect their herds from the potential for disease. In FY07 to FY11, disease outbreaks occurred with losses averaging 32 calves/cattle worth $36,000. Because disease has the potential for catastrophic results at a facility, this is a real concern and TWSP assists those that request BDM for livestock protection where congregations of birds amass.

Disease	Livestock affected	Symptoms	Comments
		BACTERIAL	
erysipeloid	cattle, swine, horses, sheep, goats, chickens, turkeys, ducks	Pigs - arthritis, skin lesions, necrosis, septicemia Sheep - lameness	serious hazard for the swine industry, rejection of swine meat at slaughter due to septicemia, also affects dogs
salmonellosis	all domestic animals	abortions in mature cattle, mortality in calves, decrease in milk production in dairy cattle Colitis in pigs,	over 1700 serotypes
Pasteurellosis	cattle, swine, horses, rabbits, chickens, turkeys	Chickens and turkeys die suddenly without illness pneumonia, bovine mastitis, abortions in swine, septicemia, abscesses	also affects cats and dogs
avian tuberculosis	chickens, turkeys, swine, cattle, horses, sheep	Emaciation, decrease in egg production, and death in poultry. Mastitis in cattle	also affects dogs and cats
Streptococcosis	cattle, swine, sheep, horses, chickens, turkeys, geese, ducks, rabbits	Emaciation and death in poultry. Mastitis in cattle, abscesses and inflammation of the heart , and death in swine	feral pigeons are susceptible and aid in transmission
yersinosis	cattle, sheep, goats, horses, turkeys, chickens, ducks	abortion in sheep and cattle	also affects dogs and cats
vibriosis	cattle and sheep	In cattle, often a cause of infertility or early embryonic death. In sheep, the only known cause of infectious abortion in late pregnancy	of great economic importance
Listeriosis	Chickens, ducks, geese, cattle, horses, swine, sheep, goats	In cattle, sheep, and goats, difficulty swallowing, nasal discharge, paralysis of throat and facial muscles	also affects cats and dogs
		VIRAL	
meningitis	cattle, sheep, swine, poultry	inflammation of the brain, newborn calve unable to suckle	associated with Listeriosis, salmonellosis, cryptococcosis
encephalitis (8 forms)	horses, turkeys, ducks	drowsiness, inflammation of the brain	mosquitoes serve as vectors
		MYCOTIC (FUNGAL)	
aspergillosis	cattle, chickens, turkeys, and ducks	abortions in cattle	common in turkey poults
		Rarely	affects horses, dogs and cats
candidiasis	cattle, swine, sheep, horses, chickens, turkeys	In cattle, mastitis, diarrhea, vaginal discharge, and aborted fetuses	causes unsatisfactory growth in chickens
cryptococcosis	cattle, swine, horses	chronic mastitis in cattle, decreased milk flow and appetite loss	also affects dogs and cats
histoplasmosis	horses cattle and swine	(in dogs) chronic cough, loss of appetite, weakness, depression, diarrhea, extreme weight loss	also affects dogs; actively grows and multiplies in soil and remains active long after birds have departed
		PROTOZOAL	
Coccidiosis	poultry, cattle, and sheep	bloody diarrhea in chickens, dehydration, retardation of growth	almost always present in English sparrows; also found in pigeons and starlings
Chagas - American trypanosomiasis	all domestic mammals	infection of mucous membranes of eyes or nose, swelling, possible death (1%-5%) in 2-4 weeks	caused by the conenose bug found on pigeons
toxoplasmosis	cattle, swine, horses, sheep, chickens, turkeys	In cattle, muscular tremors, coughing, sneezing, nasal discharge, frothing at the mouth, prostration and abortion	also affects dogs and cats
		RICKETTSIAL/CHLAMYDIAL	
chlamydiosis	cattle, horses, swine, sheep, goats, chickens, turkeys, ducks, geese	In cattle, abortion, arthritis, conjunctivitis, enteritis	also affects dogs and cats and many wild birds and mammals
Q fever	affects cattle, sheep, goats, and poultry	may cause abortions in sheep and goats	can be transmitted by infected ticks

Figure 2. Diseases of livestock linked to feral pigeons, starlings, blackbirds, and House Sparrows (*taken from* Weber 1979).

Crops

Texas produces a wide variety of crops and many of them are damaged by birds. Greenhouse and nursery production is the leading crop industry in Texas generating over $1.4 billion in sales 2008 (NASS 2008b); however, BDM is only requested occasionally to protect this resource. Of the crops, TWSP documented most damage during FY07 to FY11 to wheat, rice, citrus, and pecans from a variety of birds including blackbirds, crows, ravens, Sandhill Cranes, starlings, House Sparrows, doves, and gulls. Birds that cause the most damage to crops are mostly those that congregate into large flocks. Damage is often not widespread, but localized within short flying distance of nighttime roosts. The local producers that lie where these roosts form, which are not necessarily at the same location each year, can suffer extreme damage, whereas other producers may not be afflicted. TWSP has recorded an average of 589 work tasks associated with protecting crops in Texas annually resulting in about $260,000 damage by birds (Table 3) from FY07 to FY11.

Several studies have shown that blackbirds can pose a significant economic threat to agricultural producers (Besser et al. 1968, Dolbeer et al. 1978, and Feare 1984). Blackbird damage to crops has often been identified as a serious problem in Texas to rice and other grain crops, and citrus. Blackbirds congregate in fields or citrus orchards where they can cause significant damage to individual producers who then seek assistance from TWSP. Federal and State governments recognize that blackbirds are important depredators of agricultural commodities. Although they are migratory birds, blackbirds are currently provided no protection under provisions of the Migratory Bird Treaty Act when they cause or threaten damage to crops (see 50 CFR, Part 21.43). Additionally, the State of Texas considers blackbirds to be crop pests that may be taken any time by any legal means (see TPWD Laws Ch.64, subch. A, sect. 64.002(c)). No one blackbird control method has proven to be entirely satisfactory in alleviating rice or other crop damage. Hence, TWSP currently recommends and uses the IWDM approach to blackbird damage management, and IWDM methodologies are continuously updated as new blackbird management tools become available.

Rice. Rice production is a major industry in Texas producing about 537,000 tons annually from 2006-2008 valued at about $140 million (NASS 2009b). The price of rice increased significantly in 2008 with production valued at $195 million. Damage to the Texas rice crop by large concentrations of blackbirds, primarily Red-winged Blackbirds, Brown-headed Cowbirds, Common Grackles, and Great-tailed Grackles, has been estimated at about 10% of the crop annually. Bird damage to rice is greatest during planting, the seedling stage, and during ripening (Way 2012). Where bird damage is severe, many producers do not attempt a ratoon (second) rice crop. TWSP became operationally involved with assisting rice producers in FY95 and have been providing some assistance since. This has consisted of consultation to farmers on the best lethal and nonlethal methods to use in decreasing blackbird depredation. In addition, in areas of severe depredations, TWSP may reduce the local population of blackbirds to decrease rice depredations. Rice is also damaged by other species locally such as waterfowl (e.g., whistling-ducks, teal).

Rice fields in the gulf coast prairies and marshes of Texas provide a readily available food supply for resident and migrant blackbirds. In the fall, northern blackbirds and cowbirds migrate to Texas joining the residential flocks. The tendency of blackbirds to form large communal roosts in rice-growing areas and to travel and feed in large social flocks often results in locally serious damage to rice crops, and monetary losses to individual farmers can be substantial. Blackbirds damage rice at many different times during the season. They consume rice seed before it sprouts, pull sprouts as the plants emerge from the soil, and consume the mature rice once it has headed. From FY07 to FY11 (Table 3), TWSP recorded an average of 232 work tasks associated with assisting rice producers and documented an average of $210,000 damage at these sites. However, damage to rice has been quite variable depending on the year varying from $75,000 to $370,000. Damage with crops often depends on the availability of insects, wild mast, and other, more preferable, feed.

Pecans. Pecans are another important cash crop in Texas providing about $46 million in sales annually from 2006-2008 for the estimated 21,000 tons produced (NASS 2009b). Pecans can be severely damaged by crows, and to lesser extent ravens, blue jays, grackles and woodpeckers which mostly migrate into Texas during the fall. Damage primarily occurs following ripening (shuck split) from late September until December. While loss estimates due to birds are not available industry-wide, individual producers have reported as much as $100,000 loss to one 2,600 acre orchard; this loss would have been even higher without the producer employing both lethal and nonlethal control measures for crows. Assistance to protect pecan resources by TWSP has generally been limited to technical assistance which includes loaning of propane cannons and pyrotechnic equipment, but in 2002 Texas registered the use of DRC-1339 with the Texas Department of Agriculture (TDA) to reduce crow populations in orchards. TWSP has recorded an average of 15 work tasks associated with protecting pecans and other nuts resulting in $3,400 damage to pecans from FY07 to FY11. In FY03 and FY04, TWSP received about 149 and 109 requests for assistance and recorded about $116,000 and $77,000 damage to pecans, the highest damage years. Thus, damage as with other crops can vary sporadically.

Wheat. Wheat is another valuable commercial crop in Texas with an average harvest between 2006 and 2008 of 2.7 million tons worth about $600 million in sales (NASS 2009b). Wintering populations of Canada, White-fronted and Snow Geese, and Sandhill Cranes occur across much of Texas with larger concentrations associated to the high plains and coastal agricultural areas. TWSP responds to requests from wheat and other grain producers who experience losses to winter grain crops due to concentrations of migratory birds feeding on crops. However, TWSP responds to relatively few requests for assistance. From FY07 to FY11, TWSP had an average of 4 work tasks associated with wheat damage averaging $17,500 in damage (Table 3). Crop damage can be excessive during dry conditions when young plants (i.e., winter wheat) have a poorly developed root system. During dry conditions, the birds tend to pull the plants out of the ground and destroy them whereas they tend to only clip, but not destroy established plants during better growing conditions. This is very evident in requests for assistance in different years. For example, in FY06 when the wheat crop was down, most damage occurred on only 4 wheat producers requesting assistance from TWSP. Many operations who experience annual problems have devised hazing plans, many following initial TWSP technical guidance. A typical goose hazing program to protect winter wheat consists of using scare tactics such as propane cannons, pyrotechnic devices, physical harassment and flagging (visual deterrence). Sport hunting may also be recommended in some cases during hunting seasons to further enforce the effectiveness of scare and harassment tactics. Most of the assistance offered by TWSP involves technical guidance and loaning or sale of nonlethal scaring equipment and materials.

Citrus. The Texas citrus industry located in the Lower Rio Grande Valley is dominated by grapefruit and orange production. From 2006-2008, grapefruits and oranges annually yielded about 336 tons worth an estimated $73 million (NASS 2009b). Bird damage to citrus resources results primarily from Great-tailed Grackle populations that concentrate in groves and pecks fruit rinds in order to eat the meat of the fruit. The fruit is easily damaged cosmetically, or destroyed when the rind is broken. Grackles cause the most damage to the citrus crop which has been estimated at 7% of the Texas crop, but varies considerably year to year. Damage to citrus by birds has been historically severe in Texas and prompted a Congressional Directive to resolve the problem. TWSP assists producers with nonlethal approaches which incorporates the use of pyrotechnics and visual deterrents and local population reduction with applications of the avicide DRC-1339 specific to the label for grackles damaging citrus crops, and direct shooting. This has helped reduce damage. From FY07 to FY11, TWSP had an average of 267 work tasks associated with assisting citrus producers in Texas and documented an average of $9,700 damage annually (Table 3). The value has dropped recently due to the significant drop in grapefruit prices from more than $14.00/box in 2005 to less than $7.00/box in 2008.

Commercial Trees. Texas has a fairly lucrative tree farming business. Texas was #2 in production of short-term woody crops and #4 in acreage of orchards in the United States in 2007 (NASS 2009b). , ranking 6 in the total number of certified tree farms in the United States. Bird damage to commercially grown trees comes directly from species such as woodpeckers and indirectly from communally roosting or nesting birds such as vultures, cormorants, egrets, and blackbirds because their fecal droppings can eventually kill the trees. From FY07 to FY11, TWSP got an average of 12 work tasks associated with protecting commercial trees annually and recorded about $3,400 damage (Table 3).

Other Crops. TWSP responds to damage and losses to many other crops. Examples include milo, peaches, corn, watermelon, grapes, soy beans, truck garden plants, greenhouse/nursery plants, sunflowers, and barley. TWSP recorded an average of about 58 work tasks annually resulting in $14,000 damage to these other crops from FY07 to FY11 (Table 3). Other than the species mentioned above, feral pigeons, Lark Buntings, White-winged Doves, quail, pheasants, and Wild Turkeys were the only other species responsible for damage to crops from FY07 to FY11, but species such as exotic parrots, mockingbirds, and woodpeckers were the only other species that caused damage to crops from FY03 to FY06. TWSP typically only responds to most of these problems with technical assistance.

1.3.4 Need for BDM to Protect Property

TWSP has conducted many BDM projects to protect property with about 36% of the work tasks conducted from FY07 to FY11 were associated with the protection of property. Property encompasses a wide range of people-owned resources that are damaged by birds. The majority of BDM from FY07 to FY11 was focused on the protection of aircraft from bird strikes, 82% of the work tasks (Table 3). However, the majority of damage from FY07 to FY11 was to buildings (40%), then to aircraft (26%), which is normally number one, and utilities (26%) (Table 3). As discussed, under human health and safety at airports, most birds in Texas could cause a strike and damage to aircraft can be in the millions. Buildings are most often damaged by birds that are primarily colonial (e.g., Rock Pigeons and Cliff Swallows) or cavity nesters (European Starlings and House Sparrows); especially on roofs where droppings are allowed to build up because the acid can degrade structures. Additionally, woodpeckers can cause a great deal of damage where they drill holes for nesting or for feeding. Utility towers are sometimes used by Turkey Vultures and other flocking birds for roosting where they, as well as other flocking birds such as starlings and crows, can cause damage problems, primarily from their droppings. Other property can be damaged because birds will feed on it such as landscaping, grass, and flowers. Finally, the bulky nests of some species can be damaging, but most are more of a fire hazard when built in or on structures. Costs associated with property damage include labor and disinfectants to clean and sanitize fecal droppings, implementation of nonlethal BDM methods, and loss of property use, but these costs are generally not included in damage estimates.

Aircraft

Aircraft collisions with birds (bird strikes) and other wildlife are a serious economic concern (hazards to humans were discussed above). Wildlife strikes have increased in the past 20 years because many bird species populations that are hazardous to aviation have increased significantly (Dolbeer and Eschenfelder 2002). For example, 13 of the 14 largest (>8 lbs.) bird species in North America have shown significant population increases in the past 20 years. These species include Canada Geese, Brown Pelicans, Sandhill Cranes, and Bald Eagles. Populations of many other hazardous species such as Turkey Vultures, Snow Geese, Red-tailed Hawks, and Double-crested Cormorants have also increased dramatically. Furthermore, many of these species have adapted to living in urban environments such as at airports. In addition, birds are less able to detect and avoid the quieter turbofan-powered aircraft in use today compared to older, noisier aircraft. Finally, air traffic has increased over the last 20 years and all of these factors equate to higher numbers of strikes.

About 11% and 10% of all bird strikes in the United States and Texas from FY02 to FY11 caused damage; of the known waterfowl, waterbird, wading bird, raptor, and gull strikes in the United States, 50%, 56%, 28%, 24%, and 18%, respectively, caused damage (Appendix: Table D1). These species, in particular, are of greatest concern at airports because they cause a significant number of strikes (about 35% of all known bird strikes) that frequently cause damage to aircraft. Allan and Orosz (2001) estimated that bird strikes annually cost commercial air carriers over $1.2 billion worldwide from 1999 to 2000. At least 118 aircraft were destroyed from bird strikes with civil and military aircraft from 1990-

2002 (Richardson and West 2000, Thorpe 2003). Most airports account for less than 20% of the actual number of strikes that take place (Dolbeer 1995) and, therefore, the figures given are a proportion of the actual damage caused by birds (strike reporting by pilots and airports has increased in the last few years as a result of increased awareness of their importance to understanding the problem). FAA (2012) reported 82,516 and 6,601 bird strikes from FY02 to FY11 on civilian and military airports (Appendix D: Table D1). TWSP reported an average of 3,611 work tasks associated with aircraft protection with an average of $850,000 in damage from FY07 to FY11 (Table 3).

Finally, a question often arises whether or not airports are legally liable for such losses. Several airports have been sued due to damage to aircraft at an airport. One, of many, examples was for a bird strike in 1995 at John F. Kennedy Airport in New York. An Air France Concorde, at about 10 feet above ground while landing ingested 1 or 2 Canada geese into the #3 engine. The engine suffered an uncontained failure. Shrapnel from the #3 engine destroyed the #4 engine and severed several hydraulic lines and control cables. The pilot was able to land the plane safely, but the runway was closed for several hours. Damage to the Concorde was estimated at over $7 million. The French Aviation Authority sued the Port Authority of New York and New Jersey and eventually settled out of court for $5.3 million (MacKinnon et al. 2001). Based on a summary of cases by MacKinnon et al. (2001) and Dolbeer (2005) and legal reviews by Michael (1986), Wilkinson (1998), Robinson (2000), and Matijaca (2001), it is apparent that airport operators must exercise "due diligence" in managing wildlife hazards to avoid potentially serious liability issues. The exercise of "due diligence" to manage wildlife hazards initially involves (in the USA) an assessment of wildlife hazards at the airport. Based on the assessment, a wildlife hazard management plan may need to be developed (requirements for the development of a wildlife hazard management plan are outlined in 14 U.S. Code of Federal Regulations (CFR) Part 139.337) and implemented, particularly for certificated airports (airports that serve scheduled and unscheduled air carrier aircraft with more than 30 seats). Based on "Part 139," certificated airports experiencing hazardous wildlife conditions must conduct formal Wildlife Hazard Assessments and develop Wildlife Hazard Management Plans as part of the certification standards.

Buildings and Houses

Birds can cause significant damage to homes and buildings, following protection of aircraft for eliciting the most requests for assistance. TWSP annually averaged 384 work tasks associated with damage to houses and buildings from FY07 to FY11, or about 9% of all bird requests for property damage and protection. Buildings and residences suffer damage from several bird species. Most requests arise from bird droppings that have accumulated to the point that they are aesthetically displeasing or smell. In fact, though many requesters are unaware, accumulated bird droppings can reduce the functional life of some building roofs by 50% (Weber 1979); feral pigeons are the primary species responsible for damage, but starlings, House Sparrows, gulls, blackbirds, and vultures also cause this type of damage. Bird droppings are highly corrosive, especially to metal structures. Bird droppings can result in an entire roof having to be replaced at considerable expense, frequently occurring where droppings are allowed to accumulate for an extended period of time.

Woodpeckers sometimes cause structural damage to wood siding and stucco on homes by drilling holes. Several species of woodpeckers are responsible for this type of damage, but the Northern Flicker and Golden-fronted Woodpecker which are commonly found in urban settings create the biggest problems in Texas. Damage, if unabated, can result in thousands of dollars of damage to homes or buildings. TWSP received a call from a Randall County resident who had experienced repeated and accumulative damage to unoccupied residential property by woodpeckers. Wood and stucco construction of the home was damaged and required complete replacement at a cost of $50,000 to repair. TWSP recommended several nonlethal approaches which included exclusion, scare away devices and alternative food and nest sources for the problem birds.

Some birds, typical of cardinals, see their reflection in windows and will peck at the window. Sometimes, even screens and caulking are pecked until they need to be replaced. These are mostly a nuisance type problem. In addition, birds will often fly into windows and people request assistance in methods to decrease this type of problem.

Finally nesting birds can cause problems; starlings, House Sparrows, and House Finches have bulky nests built of straw and other similar items that, in an attic, become an extreme fire hazard and a source of bird ectoparasites such as mites that can cause problems. Some swallows build nests under eaves and their droppings and mud can be a nuisance and create continual clean-up costs. Additionally, gulls like to nest on gravel roof-tops that simulate their natural nesting sites and they can amass debris from trash that carry to the building. These types of problems cause mostly aesthetic problems and have clean-up costs associated with them, but do not typically have monetary value associated with damage.

Utilities

Corrosion damage to metal structures can occur because of uric acid from bird droppings. Electric utility companies frequently have problems with birds causing power outages by shorting out transformers and substations. Nests of species such as Monk Parakeets, Common Ravens, Red-tailed Hawks, and Golden Eagles are a potential fire hazard on telephone poles which, if set afire by a short circuit, can cause extensive damage to transmission lines and, thereby, causing power outages. With other species, roosting birds and their excrement cause problems for utilities such as vulture and starling roosts. TWSP responded to a request to alleviate property damage and power outage losses for a central Texas electrical power company in 2000 from vultures roosting on transmission line towers. A power outage caused by the bird excrement on transmission line insulators caused an estimated $2 million loss to a production facility in Austin. An additional $3,000 clean up expense followed the outage loss. TWSP developed and implemented a vulture damage management plan for the company. Live trapping, harassment and shooting was used to disperse the problem birds from the transmission towers. On average, TWSP had 119 work tasks annually associated with protecting utilities resulting in $850,000 damage from FY07 to FY11 (Table 3).

Landfills and water treatment plants, where not confined in a building, can have problems with gulls, crows and other birds that carry away waste. Waste clean-up can be costly because areas where birds carry debris need to be sanitized and disinfected because of the potential for additional human health concerns. Safety inspectors often will not certificate these sites without an appropriate bird abatement program in place. From Fy07 to FY11, TWSP had an annual average of 11 work tasks associated with these types of impoundments (Table 3).

Heavy Equipment, Automobiles, Boats, and Other Equipment

Corrosion damage to metal structures and painted finishes of vehicles and boats can occur when concentrations of birds roost or loaf over such property. Losses can be substantial and are caused by species such as blackbirds, starlings, gulls, vultures, House Sparrows, and egrets. Parking lot owners, such as at airports, where birds roost have had to pay for damage to cars where a car sits for extended period of time and gets covered in droppings; the droppings can etch the paint. Farm and road maintenance equipment that sits in yards during the off-season are frequently plagued with nesting birds such as feral pigeons, starlings, and House Sparrows and their droppings. New owners of vehicles are often unaware that these problems will occur. Typically, these problems occur during the first roosting season without the property owner realizing that damage will occur, but then they contact TWSP for assistance to prevent it from occurring during the next season. Often, exclusionary techniques, garaging vehicles, or harassment resolves the problem. TWSP had an annual average of 90 work tasks associated with protecting vehicles and equipment from birds which had already resulted in an average $42,000 damages from FY07 to FY11 (Table 3).

Landscaping

Several species of wildlife that have adapted to urban and suburban settings cause damage to landscaping. Turf, flowers, other ornamental plants, and trees are often damaged from excessive feeding or fecal accumulations by species such as Canada Geese, Mallards, feral waterfowl, American Coots, starlings, crows, Cattle Egrets, and vultures. Costs associated with property damage include labor and disinfectants to clean and sanitize fecal droppings, loss of property use, loss of aesthetic value of flowers, gardens, and lawns consumed by waterfowl, loss of customers or visitors irritated by walking in or breathing the fumes of fecal droppings, repair of golf greens, replacing grazed turf, and costs of implementing nonlethal wildlife management methods. TWSP had an annual average of 41 work tasks with damage valued at $19,000 from FY07 to FY11 associated with landscape protection (Table 3). TWSP responds to such requests with direct and technical assistance. Nonlethal live trapping and removal, immobilization drugs and removal, egg/nest removal, scare tactics, visual and barrier devices may be used to resolve conflicts. In some instances, euthanasia is required in place of relocation.

Pets and Zoo Animals

Pets and zoo animals can be harassed, injured and predated, or have an avian borne disease transmitted to them (similar to livestock diseases that affect poultry – Figure 2). Species such as corvids and raptors, including Black Vultures and Great Horned Owls, will attack and kill small pets such as cats and little dogs. Some species of birds such as crows, mockingbirds, and kites endlessly harass pets, especially where they are defending a nesting territory. They typically swoop upon pets such as small dogs causing them to bark incessantly. Zoo animals, especially birds in outdoor aviaries, are susceptible to many diseases transmitted by birds such as avian tuberculosis and streptococcosis. However, these problems are not too common. From FY07 to FY11, TWSP had an annual average of 15 work tasks associated with protecting pets and zoo animals with about $1,700 damage assigned to them (Table 3). TWSP Specialists often do not give a value to pets because the loss of a cherished pet to its owner is immeasurable.

Other Property and Structures

Similar damages as discussed above from many of the same bird species can occur to a variety of other structures and property. Swimming pools, bridges, refineries, beaches, food items, clothes, and more can all be damaged by birds. Businesses are often concerned about the negative aesthetic appearance of their property caused by excessive droppings, and are sensitive to comments by clients and guests. As discussed, costs associated with property damage include labor and disinfectants to clean and sanitize fecal droppings, implementation of nonlethal BDM methods, and loss of property use, but these costs are generally not included in damage estimates. TWSP had an annual average of 122 work tasks valued at about $190,000 associated with other property and structures from FY07 to FY11 (Table 3). It should be noted that some problems can be very significant to other structures. Newspapers reported that pigeons were thought to have been a contributor to the bridge collapse in Minneapolis that killed 13 people in 2007 from corrosion that occurred because of their droppings on the steel girders.

1.3.5 Need for BDM to Protect Natural Resources

Several bird species can impact natural resources such as wildlife, fisheries, plants, recreational areas, beaches, watersheds, and water quality. Additionally, species of wildlife and plants listed as T&E species may be affected by birds. Damage is typically from predation, overgrazing, competition, hybridization, trampling, accumulating feces, and introduction of disease. However, some people are emotionally distraught seeing young animals or songbirds picked to death at their birdbaths by birds such as raptors or corvids, or a hawk or owl endlessly chased, harassed, and picked at by crows. From FY07 to FY11

TWSP had an annual average of 51 work tasks with a value of about $34,000 associating with protecting natural resources with most of this damage to recreational areas (Table 3).

T&E, Sensitive, and Other Wildlife Species

TWSP is involved in several projects in Texas to protect T&E and other wildlife species. Nationally, WS is involved in many T&E or other wildlife species protection projects where predation, herbivory, competition, hybridization, or disease introduction has been identified as a limiting factor for local or entire populations. TWSP is involved in only a few wildlife projects. However, this number could increase because research on many species is indicating that predation, sometimes from birds, is a limiting factor to already limited populations.

Inter-specific nest competition has been well documented in starlings. Miller (1975) and Barnes (1991) reported starlings were responsible for a severe depletion of the Eastern Bluebird population due to nest competition. Nest competition by starlings has also been known to adversely impact American Kestrels (Nickell 1967, Von Jarchow 1943, Wilmer 1987), Red-bellied Woodpeckers, Gila Woodpeckers (*Centurus uropygialis*) (Ingold 1994, Kerpez and Smith 1990), and Wood Ducks (Shake 1967, Heusmann et al. 1977, Grabill 1977, McGilvery and Uhler 1971). Weitzel (1988) reported 9 native species of birds in Nevada had been displaced by starling nest competition, and Mason et al. (1972) reported starlings evicting bats from nest holes. Control operations as proposed under the current program could reduce very local starling populations, but it is not likely to reduce them enough unless BDM were focused at the time of nesting. Reduction in nest site competition would be a beneficial impact on the species listed above. Although such reductions are not likely to be significant over large areas, there could be some cases where some individuals limited by environmental factors could benefit by enhanced recruitment during nesting seasons.

One BDM project that TWSP has conducted was for the protection of nests of the endangered Black-capped Vireo and Golden-cheeked Warbler from nest parasitism by the Brown-headed Cowbird. Nests of the vireo and warbler are frequently parasitized by Brown-headed Cowbirds. The cowbirds lay their eggs in active nests of other bird species. The cowbird eggs hatch first, much quicker than the native songbirds, and the young are cared for by the host bird as if they were its own. By the time the host birds' own eggs hatch, the cowbird young are larger and out-compete the host birds' young for food and frequently push them out of the nest. With endangered bird species, such parasitism can cause enough nest failures to jeopardize the host species. In 1999, the USFWS entered into an MOU with the United States Army, TPWD, Central Texas Cattlemen's Association, and WS to implement a Brown-headed Cowbird trapping program. The cowbird trapping program is aimed at reducing nest parasitism to the endangered Black-capped Vireo and Golden-cheeked Warbler on the 220,000 acre Fort Hood Military Reservation and surrounding private lands. The removal of Brown-headed Cowbirds from nesting habitat of the vireos and warblers has been successful in increasing local populations of these T&E species. The Black-capped Vireo population at Fort Hood is the largest known in Texas under a single management authority. A similar trapping program conducted by TPWD on the Kerr Wildlife Management Area reduced cowbird parasitism of Black-capped Vireo nests from 90% to 9%. In Oklahoma, trapping reduced parasitism from 81% to 24% at the Wichita Mountains Wildlife Refuge (Grzybowski 1990, 1995). Cowbird trapping programs are considered a viable component of integrated Black-capped Vireo and Golden-cheeked Warbler management.

Direct predation has been shown to seriously limit the recovery of endangered bird species, particularly ground nesting birds. The Interior Least Tern is endangered species in Texas that could be subjected to damage from predators. Studies have been conducted in other states to determine population trends of least terns and these studies have shown that predation plays a significant role in nest losses (Kirsch 1993). Birds of prey, as well as mammalian carnivores, kill adult California Least Terns and their young, and destroy nests in nesting colonies of this endangered species. The California WS program traps raptors in a number of these areas at the request of land managing agencies to protect this species and allow for successful reproduction (Butchko and Small 1992). In California, bird species known as potential threats to the long term nesting success of terns include Red-tailed Hawks, Great-horned Owls, American Kestrels, Northern Harriers, and Burrowing Owls. Black-crowned Night-Herons are another potential predator to terns and plovers (Kirsch 1993). Interior Least Terns are present in the Arkansas/Red River Ecosystem from April through August. Small nesting colonies may be found on salt flats, reservoir beaches, and river sandbars in the larger rivers in the state (Thompson et al. 1997). WS could be requested to assist with reducing predation where it becomes a limiting factor.

Prairie-chickens were once common birds in parts of Texas; the Lesser Prairie-Chicken is found in the panhandle and the Attwater's Greater Prairie-Chicken is found along the Gulf Coast. A lack of quality habitats, along with other factors have contributed to over a 90% decline in prairie-chicken numbers over time. The Lesser Prairie-Chicken is currently at a critical period for long-term survival (Hagen 2003) and has been listed as a species "warranted but precluded" for listing under the ESA (Fed. Reg. Notice 63(110):31400-31406). Some research has shown that management of predator species, including predatory birds, in fragmented habitat can enhance prairie-chicken recruitment (Schroeder and Baydack 2001). Primary predators of Lesser Prairie-Chickens are Red-tailed Hawks, Rough-legged Hawks, Ferruginous Hawks, Prairie Falcons, Great Horned Owls, Golden Eagles, and Northern Harriers. The Attwater's Greater Prairie-Chicken is endangered and TWSP has conducted some owl management for their protection with success.

TWSP has conducted projects to protect sensitive and other wildlife. TWSP has had programs to protect breeding colonies of nesting birds, especially seabird colonies, from species such as ravens and grackles that depredate eggs and nestlings from their nests. TWSP has protected nesting seabirds on various islands along the Texas coast for many years.

TWSP may enter in agreements to protect other T&E species that have birds identified as being a limiting factor for reasons identified above. For example, Texas wild-rice (*Zizania texana*) has been severely depleted and overgrazing by waterfowl has been identified as a problem. Sea turtles nest along coastal beaches (rarely in Texas, though) and hatchlings are easily predated by gulls and other coastal predatory birds. If USFWS, TPWD, or other management agency requests TWSP to assist in resolving a bird associated problem, TWSP could enter into an MOU and assist with such program.

Fisheries

Recreational fisheries are important to the economy of Texas with $2 billion in annual fishing expenditures (USFWS 2003). Several species of birds can have an impact on fisheries including the Double-crested Cormorant. Several of the fish-eating birds have increased significantly in Texas and the United States over the past few decades such as several gull species, egrets and herons, and cormorants and these species can have significant impacts locally. TWSP receives requests for assistance routinely to protect fisheries. For the most part, though, TWSP only provides technical assistance for these requesters and recommends many of the hazing techniques, potentially with a limited shooting permit. From FY07 to FY11, TWSP had an annual average of 5 work tasks associated with protecting wild fisheries with damage valued at $2,000 (Table 3), mostly for Double-crested Cormorants.

Other Natural Resources

Several other natural resources are impacted by birds including trees, water quality, beaches, and recreational areas. A common concern among members of the public is the loss of trees to heron/egret/cormorant rookeries, and vulture, starling, crow, and blackbird roosts. These species nest or roost in trees and the excessive fecal output at the local site eventually kills the trees. Where these sites are located near urban areas and recreational sites such as swimming areas the concern is often increased.

The dead trees can equate to a loss of aesthetic value. TWSP had an annual average of 6 work tasks to protect trees with damages averaging $28,000 from FY07 to FY11 (Table 3).

Water quality is often decreased when large concentrations of birds gather on or over water. The ecology of aquatic environments and available water supplies for human consumption may be threatened as a result of concentrated numbers of geese defecating in or near water sources, increasing the bacteria and nutrient levels in the water and providing a possible introduction of disease organisms, such as Salmonella (Lyons 1995). Urban pond managers can attest that high domestic duck and goose populations in ponds create an "over-fertilized" condition from the abundance of feces in pond water. This condition gives rise to high algae blooms and decomposing organic matter that robbed the water of oxygen for fish populations. Removal of excess numbers of resident waterfowl from ponds often restores proper oxygen and pH levels to the water. Additionally, beaches and other recreational sites often can be gathering areas for waterfowl and other birds. Water, hand-outs, and refuse often attract species such as gulls, pigeons, and waterfowl to particular sites. Defecation can create unsanitary conditions on beaches, in the water, and on sod areas. Swimming areas can be shut down from fecal input creating conditions such as high coliform counts. TWSP received only an average of 27 requests to protect these resources from FY07 to FY11 (Table 3), mainly to reduce waterfowl around beaches.

1.4 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

WS issued a Final EIS on the national APHIS-WS program (USDA 1997). Some pertinent information from USDA (1997) has been incorporated by reference into this EA, but because of the age of that document, it is not all incorporated into this document. TWSP has covered BDM activities in Texas under a previous EA, Finding of No Significant Impact, and Decision for blackbird control in rice fields of southeast Texas (WS 1998). This EA will supersede that Decision.

1.5 DECISION TO BE MADE

Based on the scope of this EA, the decisions to be made are:

- Should BDM as currently implemented by TWSP be continued in the State?
- If not, how should TWSP fulfill its legislative responsibilities for managing bird damage in the State?
- What standard operating procedures (SOPs) should be implemented to lessen identified potential impacts?
- Do TWSP BDM activities have significant impacts requiring preparation of an EIS?

1.6 SCOPE OF THIS EA ANALYSIS

1.6.1 Actions Analyzed

This EA evaluates TWSP BDM to protect human health and safety, agricultural resources, property, and natural resources on private or public lands throughout Texas wherever such management is requested. This includes BDM for the protection of resources and bird management for monitoring and surveillance purposes and research conducted by the WS-National Wildlife Research Center (NWRC) on the effectiveness of methods to reduce bird damage.

1.6.2 American Indian Lands and Tribes

TWSP only conducts BDM at a Tribe's request. TWSP has not been requested to provide assistance with BDM in Texas on tribal lands. Since tribal lands are sovereign and the methods employed are the same as for any private land upon which TWSP provides services, tribal officials determine if BDM is desired and the BDM methods allowed. Because tribal officials have the ultimate decision on whether BDM is conducted, no conflict with traditional cultural properties or beliefs is anticipated. Therefore, this EA would cover BDM on tribal lands, where requested and implemented.

1.6.3 Federal Lands

TWSP provides BDM on federal lands in Texas including USFWS, USFS, Department of Defense, and others. If TWSP were requested to conduct BDM on federal lands for the protection of private resources, this EA would cover the actions implemented. However, if the request is to protect federal resources, such as T&E species on USFWS lands, the requesting federal agency is responsible for NEPA documentation. This EA would cover such actions, though, if the requesting federal agency determined that this EA had an adequate analysis to cover the actions to be implemented. However, TWSP could accept the NEPA responsibility at the request of another agency, but that agency would still be responsible for issuing a NEPA Decision.

1.6.4 Period for which this EA is Valid

This EA will remain valid until TWSP determines that new needs for action or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document will be reviewed and revised as necessary. This EA will be reviewed each year to ensure that it is complete and still appropriate to the scope of the State BDM activities.

1.6.5 Site Specificity

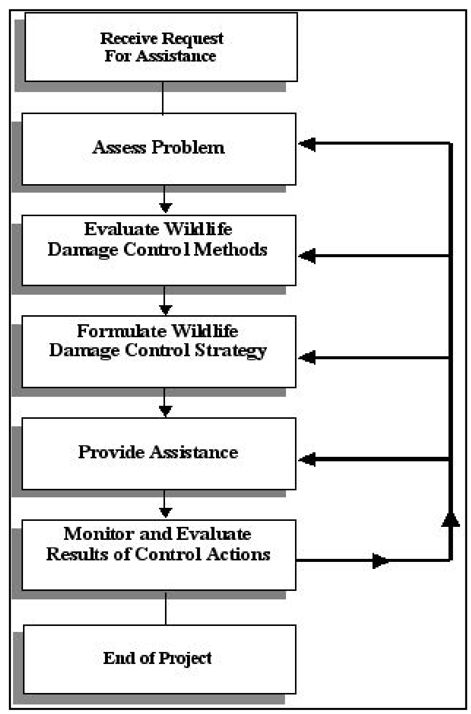

Figure 3. WS Decision Model used at the field level to evaluate a wildlife damage problem (*copied from* Slate et al. 1992).

This EA analyzes potential impacts of BDM on the human environment as required by NEPA and addresses TWSP BDM activities on all lands under Cooperative Agreement or Agreements for Control or as otherwise covered by TWSP Work Plans (e.g., on federal public lands) within Texas. It also addresses the impacts of BDM on areas where additional agreements with TWSP may be written in the reasonably foreseeable future in Texas. Because the proposed action is to continue the current BDM program, and because the current program's goal and responsibility is to provide service when requested within the constraints of available funding and manpower, it is conceivable that additional BDM efforts could occur. Thus, this EA anticipates potential expansion and analyzes the impacts of such expanded efforts as part of the current program.

Planning for the management of bird damage must be viewed as being conceptually similar to federal or other agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they will occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire and police departments, emergency clean-up organizations, insurance companies, and other emergency response agencies. Although some of the sites where bird damage is likely to occur and lead to requests to TWSP for assistance can be predicted, all specific locations or times where such damage will occur in any given year cannot be predicted. This EA emphasizes major issues as they relate to specific areas whenever possible; however, many issues apply wherever bird damage and resulting management occurs, and are treated as such.

The standard WS Decision Model (Figure 3) and WS Directives 2.105 and 2.201 provide the site-specific routine thought process for determining methods and strategies to use or recommend for individual actions conducted by TWSP (see USDA 1997, Chapter 2 and Appendix N for a more complete description of the WS Decision Model and examples of its application). The Decision Model is not intended to require documentation or a written record each time it is used, and it necessarily oversimplifies complex thought processes (Slate et al. 1992). Decisions made using the model would be in accordance with SOPs described herein and adopted or established as part of the decision.

The analysis in this EA considers impacts on target and nontarget wildlife species, people, pets, and the environment. Wildlife populations, with the exception of T&E species, are typically monitored over large geographic areas (i.e., the West, the State) and smaller geographic areas by the State Wildlife agency (i.e., TPWD game management units). TWSP monitors target bird and nontarget take for Texas and in each county. The game management units and counties do not correspond to each other in Texas, thus, analysis of wildlife population impacts is better analyzed at the statewide level. Additionally, because most birds migrate, harvest is analyzed better at the statewide and regional levels (i.e., Central Flyway). Waterfowl harvest by sportsmen in Texas is estimated by TPWD and USFWS from mail surveys. Statistically, the variance at the local level (i.e., the game management unit or County) is very high and can be ± 100% making the data not as useful. However, the variance is much lower at the statewide level and regional level. Thus, harvest data at the statewide or regional level is much more reliable. Impacts to target bird species will be analyzed at the statewide level in this EA.

1.7 AUTHORITY AND COMPLIANCE

1.7.1 Authority of Federal and State Agencies for BDM in Texas

WS Legislative Authority. USDA is authorized and directed by law to protect American agriculture and other resources from damage associated with wildlife. Under the Act of March 2, 1931, as amended (7 U.S.C.426-426b), APHIS-WS is authorized to conduct a program of wildlife services with respect to injurious animal species; and, under the Act of December 22, 1987 (7 U.S.C. 426c), APHIS-WS is authorized to control nuisance mammals and birds and those mammal and bird species that are reservoirs for zoonotic diseases.

TWSP conducts WDM in cooperation with and under the authorities of USFWS, TPWD, and TDA. TWSP works cooperatively with local livestock associations and county governments to provide BDM assistance for its constituents. BDM assistance is provided statewide in areas where funding has been provided. BDM activities occur on both private and public lands as addressed in Section 1.6.2. The BDM methods that can be used in Texas are discussed in Section 3.3.1.3 and each bird damage operational project may require the use of one or more of these.

Texas A&M AgriLife Extension-Wildlife Services Legislative Authority. The Federal Smith-Lever Act of 1914 (7 USC 341 et seq.) authorizes and provides for the conduct of cooperative extension work in agriculture and related subjects by the land-grant colleges and universities in several states where USDA is cooperating with that state. The Texas Legislature accepted the provisions of this Act in 1915 with the passing of House Concurrent Resolution No. 2 and designated Texas A&M University as the institution to receive and administer funds made available under the Smith-Lever Act. TWSP is a unit within the

Texas A&M University System, Texas A&M AgriLife Extension Service-Wildlife Services. The Legislature authorized the State of Texas to cooperate through the Texas A&M University System with the appropriate federal officers and agencies in the control of predatory animals and rodent pests and placed responsibility for administering the Act with the Director of TWSP (Texas Health and Safety Code, Ch. 825, Subch. A).

U.S. Fish and Wildlife Service. USFWS has statutory authority to manage migratory birds under the Migratory Bird Treaty Act of 1918 (16 U. S. C. 703-711; 40 Stat. 755), as amended, and Federally listed T&E species through the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531-1543, 87 Stat. 884). TWSP works with USFWS to ensure that WDM activities do not have significant impacts on migratory birds under their jurisdiction or jeopardize T&E species, and obtains the necessary permits to conduct migratory bird damage management activities. Sections 1.7.2.2 and 1.7.2.3 below describe WS' interactions with the USFWS under these two laws.

Texas Parks and Wildlife Department. TPWD has the primary responsibility to protect the State's fish and wildlife resources as directed in the Texas Statutes (Titles 1-7) and as authorized by USFWS under the Migratory Bird Treaty Act, including resident and migratory.

Texas Department of Agriculture. TDA is responsible for regulating pesticide use. TWSP registers pesticides with TDA and has several registrations for DRC-1339. Additionally, TWSP uses other pesticides such as Avitrol® and potentially restricted-use repellents which are also registered with them. TWSP personnel that use restricted-use pesticides in their job duties must become a certified pesticide applicator by TDA to use them, or be supervised by a certified applicator.

U.S. Environmental Protection Agency (EPA). EPA is responsible for registering and regulating pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

U.S. Food and Drug Administration (FDA). It is FDA's responsibility to promote the public health by promptly and efficiently reviewing clinical research and taking appropriate action on the marketing of regulated products in a timely manner. With respect to such products used in BDM, FDA's mission is to protect the public health by assuring that drugs used for birds are safe and effective including birds intended for human consumption. A-C, a tranquilizer, is an experimental drug that is used to capture waterfowl, pigeons, and other nuisance birds and is regulated by the FDA.

1.7.2 Compliance with Federal Laws

Several federal laws authorize, regulate, or otherwise affect TWSP WDM activities. TWSP complies with these laws and consults and cooperates with other agencies as appropriate.

National Environmental Policy Act. TWSP prepares analyses of the environmental impacts of program activities to meet procedural requirements of this law. This EA meets the NEPA requirement for the proposed action in Texas. Most Federal actions are subject to NEPA (Public Law 91-190, 42 USC 4321 et seq.) and its implementing regulations established by the Council on Environmental Quality (40 CFR 1500-1508). In addition, WS follows USDA (7 CFR 1b) and APHIS (7 CFR 372) NEPA implementing regulations as a part of the decision-making process When WS operational assistance is requested by another federal agency, NEPA compliance is the responsibility of the other federal agency.

Endangered Species Act. It is federal policy, under ESA, that all federal agencies shall seek to conserve T&E species and shall utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). WS conducts Section 7 consultations with USFWS to use the expertise of the USFWS to ensure that "*any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species . . . Each agency shall use the best scientific and* *commercial data available . . .*" (Sec.7(a)(2)). WS obtained a Biological Opinion (BO) from USFWS in 1992 describing potential effects on T&E species and prescribing reasonable and prudent measures for avoiding jeopardy (USFWS 1992). This NEPA document fully evaluates the potential effects of BDM on T&E species listed or proposed for listing.

Migratory Bird Treaty Act. The Migratory Bird Treaty Act of 1918 (16 USC 703-711; 40 Stat. 755), as amended, provides the USFWS regulatory authority to protect species of birds that migrate outside the United States. The law prohibits any "*take*" of bird species, eggs and nests and possession of birds or bird parts by private entities, except as permitted by the USFWS; therefore, USFWS issues permits to private and public entities for reducing bird damage. As a result of Executive Order 13186 of January 10, 2001, the Responsibilities of Federal Agencies to Protect Migratory Birds, (Section 1.7.2.7 below) a draft MOU is being developed by WS at this time with USFWS for the purpose of migratory bird conservation.

TWSP may provide on-site assessments for persons experiencing migratory bird damage to obtain information on which to base damage management recommendations. Damage management recommendations could be in the form of technical assistance or operational assistance. When appropriate, TWSP may provide recommendations to the USFWS for the issuance of depredation permits to private entities to resolve a bird damage problem. The ultimate responsibility for issuing such permits rests with the USFWS (50 CFR 21.41). Starlings, feral domestic pigeons, House Sparrows, and domestic waterfowl are not classified as protected migratory birds and, therefore, have no protection under this Act. USFWS depredation permits are not required to kill blackbirds excluding the Rusty Blackbird, cowbirds, all grackles, crows excluding the Tamaulipas Crow, or magpies in Texas found committing or about to commit depredation upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance. Double-crested Cormorants can also be taken without a permit if depredating or about to depredate on stocks at commercial aquaculture facilities. Based on evidence that migratory game birds have accumulated in such numbers to threaten or damage agriculture, horticulture or aquaculture, the Director of the USFWS is authorized to issue a depredation order to permit the killing of such birds (50 CFR 21.42-47).

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The Environmental Protection Agency (EPA) is responsible for implementing and enforcing FIFRA. All chemical methods used or recommended by TWSP are registered with and regulated by the EPA and TDA, and are used by TWSP in compliance with labeling procedures and requirements.

Fish and Wildlife Coordination Act. The Fish and Wildlife Coordination Act encourages federal agencies to conserve and promote conservation of nongame fish and wildlife and their habitats to the maximum extent possible within each agency's statutory responsibilities.

Food, Drug, and Cosmetic Act. This Act, as amended, gives the Food and Drug Administration (FDA) the authorization to regulate the study and use of animal drugs. FDA regulates A-C and other immobilization drugs used by TWSP under this Act.

National Historic Preservation Act (NHPA). NHPA of 1966, as amended, and its implementing regulations (36 CFR 800) requires federal agencies to: 1) determine whether activities they propose constitute "undertakings" that can result in changes in the character or use of historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources, and 3) consult with appropriate American Indian Tribes to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings. Tribe's request TWSP BDM and sign agreements for TWSP to conduct BDM on their lands; thus, tribes have control over any potential conflict with cultural resources on tribal properties. TWSP activities as described under the proposed action do not cause ground disturbances nor do they otherwise have the potential to significantly affect visual, audible, or atmospheric elements of historic properties and are thus not undertakings as defined by NHPA. BDM could benefit historic properties if birds were damaging such properties. In those cases, the officials responsible for management of such properties would make the request and would have decision-making authority over the methods to be used. Harassment techniques that involve noise-making could conceivably disturb users of historic properties if they were used at or in close proximity to such properties; however, it would be an exceedingly rare event for noise-producing devices to be used in close proximity to such a property unless the resource being protected from bird damage was the property itself, in which case the primary effect would be beneficial. Also, the use of such devices is generally short term and could be discontinued if any conflicts with historic properties arose. WS has determined BDM actions are not undertakings as defined by the NHPA because such actions do not have the potential to result in changes in the character or use of historic properties. A copy of this EA is being provided to each American Indian Tribe in Texas to allow them opportunity to express any concerns that might need to be addressed prior to a decision.

Bald Eagle Protection Act. The Bald Eagle Protection Act of 1940 (16 USC, 668-668d), as amended, allows for the protection and preservation of Bald Eagles and Golden Eagles by prohibiting, except under certain specified conditions, the taking, possession and commerce of these birds. The Secretary of the Interior can permit the taking, possession and transportation of specimens for scientific or exhibition purposes or for the religious purposes of Native American Tribes if the action is determined to be compatible with the preservation of the Bald or Golden Eagle.

BDM could benefit eagles by providing protection from a direct wildlife threat to birds, nests or eggs by predation or disease, protection to individuals from being killed by aircraft strikes, or prevent eagles from being killed illegally by frustrated or careless individuals experiencing eagle damage or damage threats to resources. Depredation to livestock and wildlife by eagles has been documented in Texas. Generally, depredation to livestock is associated with Golden Eagles. Under the Act, TWSP would obtain a permit from USFWS to take a depredating eagle, which includes harassment. Any interaction with eagles by WS is further tempered by WS policy (WS Directive 2.315).

Controlled Substances Act of 1970. This law requires an individual or agency to have a special registration number from the federal Drug Enforcement Administration (DEA) to possess controlled substances, including those that are used in wildlife capture and handling. TWSP has this registration.

Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA). The AMDUCA and its implementing regulations (21 CFR Part 530) establish several requirements for the use of animal drugs. Those requirements are: (1) a valid “veterinarian-client-patient” relationship, (2) well defined record keeping, (3) a withdrawal period for animals that have been administered drugs, and (4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs under the proposed action. APHIS-WS establishes procedures in each state for administering drugs used in wildlife capture and handling that must be approved by state veterinary authorities in order to comply with this law.

Executive Order 13186 - Responsibilities of Federal Agencies to Protect Migratory Birds. Executive Order 13186 of January 10, 2001 directs federal agencies taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement, within 2 years, an MOU with USFWS that shall promote the conservation of migratory birds. WS currently has been working with USFWS on the MOU to cover such activities.

Executive Order 13112 - Invasive Species. Nonnative plants and animals that inadvertently find their way to the United States are of increasing concern as they threaten our natural resources. One study estimates that the total costs of invasive species in the United States amount to more than $100 billion each year (Pimentel et al. 1999). Invasive species impact nearly half of the species currently listed as T&E under the ESA. On February 3, 1999, Executive Order 13112 was signed establishing the National Invasive Species Council. The Council is an inter-Departmental body that helps to coordinate and ensure complementary, cost-effective Federal activities regarding invasive species. Council members include the Departments of the Interior, Agriculture, Commerce, State, Treasury, Transportation, Defense, and Health and Human Services, and EPA, and the U.S. Agency for International Development. Together with the Invasive Species Advisory Committee, stakeholders, concerned members of the public, and member departments, the National Invasive Species Council (2001) formulated an action plan for the nation. The Council issued the National Invasive Species Management Plan early in 2001 to provide an overall blueprint for Federal action. The Plan recommends specific action items to improve coordination, prevention, control and management of invasive species by the Federal agency members of the National Invasive Species Council.

Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. Environmental Justice is a movement promoting the fair treatment of people of all races, income levels and cultures with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Environmental justice, also known as Environmental Equity, has been defined as the pursuit of equal justice and equal protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. This Executive Order is a priority within both APHIS and WS. Executive Order 12898 requires Federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies and activities on minority and low-income persons or populations. APHIS plans to implement Executive Order 12898 principally through its compliance with the provisions of NEPA. All WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898 to insure environmental justice. WS personnel use WDM methods as selectively and environmentally conscientiously as possible. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations.

Native American Graves Protection and Repatriation Act. The Native American Graves Protection and Repatriation Act requires Federal agencies to notify the Secretary of the Department that manages the Federal lands upon the discovery of Native American cultural items on Federal or tribal lands. Federal projects would discontinue work until a reasonable effort has been made to protect the items and the proper authority has been notified.

Executive Orders 11988 and 11990 – Floodplain Management and Protection of Wetlands. These Executive Orders require that agencies avoid, to the extent possible, long and short term adverse impacts associated with the destruction or modification of floodplains and wetlands and minimize impacts to these areas. The purpose of these Executive Orders was to ensure protection and proper management of flood plains and wetlands by Federal agencies. The Executive Orders require Federal agencies to consider the direct and indirect adverse effects of their activities on flood plains and wetlands. This requirement extends to any Federal action within a floodplain or a wetland except for routine maintenance of existing Federal facilities and structures. The Clinton administration had proposed revising Executive Order 11990 to direct Federal agencies to consider wetland protection and restoration planning in the larger scale watershed/ecosystem context. The only BDM activity that would pose a threat to floodplains and wetlands is habitat management. TWSP requires landowners to obtain all necessary permits prior to implementing habitat management that would have an impact on these types of sites. Therefore, TWSP will not have an effect on floodplains or wetlands in BDM.C

Executive Order 13045 - Protection of Children from Environmental Health and Safety Risks. Children may suffer disproportionately from environmental health and safety risks for many reasons, including their development, and physical and mental status. Because TWSP makes it a high priority to identify and assess environmental health and safety risks that may disproportionally affect children, TWSP has considered the impacts that this proposal might have on children. The proposed BDM program would occur by using only legally available and approved methods where it is highly unlikely that children would be adversely affected. For these reasons, TWSP concludes that it would not create an environmental health or safety risk to children from implementing this proposed action.

1.7.3 Compliance with State Laws

Several Texas laws regulate TWSP and BDM. TWSP complies with these laws, and consults and cooperates with State agencies as appropriate.

Title 10 Health and Safety Code

Subchapters 825.001 - 825.007. These statutes of the Health and Safety Code establish the cooperative arrangement between WS and the Texas A&M University System and allow TWSP to operate as a cooperative program controlling predatory animals and rodents to protect livestock, food and feed supplies, crops, and ranges. The statutes also allow local governing bodies such as counties to enter into an agreement with TWSP. Section 825.007 specifically exempts personnel performing their duties under this subchapter from licensing requirements under Title 5 of the Parks and Wildlife Code.

Title 5 Parks and Wildlife Code

Subchapter 43.151-57. These statutes provide the permitting process to control protected wildlife, including T&E species that are causing damage or public health concerns.

Subchapter 43.154 (d). This statute requires landowners or their agents who wish to take birds on that person's land to relieve damage-related situations obtain a USFWS permit for migratory birds or a TPWD permit for protected resident birds for such activities.

Subchapter 64.002. This statute prohibits a person from catching, killing, injuring, pursuing, or possessing, dead or alive, or purchasing, selling, exposing for sale, transporting, shipping, or receiving or delivering for transportation, a bird that is not a game bird.

Subchapter 68.001 - 68.021. Chapter 68 of the Parks and Wildlife Code established Texas' endangered species law equivalent to the ESA. The statute requires that Federally listed T&E species be placed on the list. In addition, on the basis of investigations on wildlife, other available scientific and commercial data and after consultation with wildlife agencies in other states, appropriate federal agencies, local and tribal governments and other interested persons and organizations, the commission director shall by regulation develop a list of those species of wildlife indigenous to the state that are determined to be threatened or endangered within Texas.

1.8 PREVIEW OF THE REMAINING CHAPTERS IN THIS EA

This EA is composed of 5 chapters. Chapter 2 discusses and analyzes the issues and affected environment. Chapter 3 contains a description of each alternative, alternatives not considered in detail, and mitigation and SOPs. Chapter 4 analyzes the environmental impacts associated with each alternative considered in detail. Chapter 5 contains the list of preparers of this EA, persons consulted, and literature cited in the EA. Additionally, this EA has 4 appendices: A) Population Estimates, B) Estimated Bird Take in Texas and the Central Flyway by WS for Those Birds Taken with Toxicants, C) Birds of Texas, and D) Bird Strikes in the United States and Texas.

CHAPTER 2: DISCUSSION OF ISSUES

Chapter 2 contains a discussion of the issues, including issues that will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences), issues that have driven the development of SOPs, and issues that will not be considered in detail, with rationale. Pertinent portions of the affected environment will be discussed with the issues used to develop SOPs in this chapter. Additional information on the affected environment will be incorporated into the discussion of the environmental impacts in Chapter 4.

A major overarching factor in determining which issues to include for analysis of the potential environmental impacts of TWSP's involvement in BDM in Texas is that if, for whatever reason, the BDM conducted by TWSP were discontinued, similar types and levels of BDM will most likely be continued by State or local governments or private entities as allowed by state and federal laws. Thus, many of the BDM activities could take place without federal assistance, and, hence, would not trigger NEPA. From a practical perspective, this means that the Federal WS program has limited ability to affect the environmental outcome of BDM in Texas, except that, based on TWSP employees' years of professional expertise and experience in dealing with BDM actions, TWSP is likely to have lower risks to and effects on nontarget species and the human environment in general, including people and pets, than some other programs or alternatives available to State agencies and private landowners. In other words, TWSP BDM activities most likely have less of an adverse effect on the human environment than would BDM programs that would be likely to occur in the absence of TWSP BDM assistance. Thus, TWSP has a limited ability to affect the environmental status quo in Texas. Despite this limitation of Federal decision-making in this situation, this EA process is valuable for informing the public and decision-makers of relevant environmental issues and analyzing these under the potential alternatives of BDM to address the various needs for action described in the EA.

2.1 ISSUES

The following issues or concerns about BDM have been identified through interagency planning and coordination, from an EA which preceded this document (WS 1998) and WS EAs in other states as areas of primary concern that will be addressed in this EA.

- Effects of BDM on Target Bird Species Populations
- Effects of BDM on Nontarget Species Populations, including T&E Species
- Effects of BDM on Public and Pet Safety and the Environment
- Effects of BDM on Aesthetics

2.1.1 Effects of BDM on Target Bird Species Populations

A common concern among members of the public, wildlife management agencies, and WS is whether BDM actions adversely affect the viability of target native species populations. The target species selected for analysis in this EA are the primary ones which may be affected by TWSP BDM activities, especially those species that more than just a few individuals would likely be killed with lethal control measures under the proposed action in any one year. From FY07 to FY11, species taken lethally by TWSP with an average of more than ten taken included blackbirds (Red-winged, Brewer's and Rusty Blackbirds, Common, Great-tailed and Boat-tailed Grackles, and Brown-headed and Bronzed Cowbirds), three nonindigenous commensal birds (feral domestic Rock Pigeon, European Starling, and House Sparrow), three raptors (Black and Turkey Vultures, and Swainson's Hawks), two waterbirds (Laughing Gull and Double-crested Cormorant), three shorebirds (Upland Sandpipers, Killdeers, and Lesser Yellowlegs), two wading birds (Cattle Egrets and Great Blue Heron), one waterfowl (feral domestic Mallard), and an assortment of miscellaneous birds (Eastern and Western Meadowlarks, Lark Bunting, Scissor-tailed Flycatcher, Western Kingbird, Mourning and White-winged Doves, Nighthawks, and Barn

Swallows) (Chapter 4, Table 8). Additionally, 56 other species were taken, but annual take averaged less than 10 for FY07 to FY11 (Chapter 4, Table 8). Other species have been taken by TWSP in BDM from FY93 to FY02, but only sporadically and in minimal numbers. This analysis will address impacts to these species.

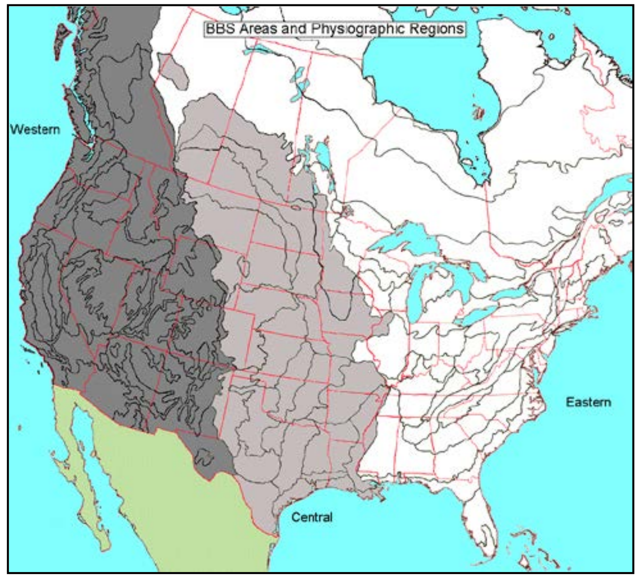

Figure 4. The BBS areas (shaded white, gray, and dark gray) and physiographic regions (outlined in black) analyzed by Sauer et al. (2011) for trends. The survey-wide area includes everything above Mexico to about the top of the gray shaded area, as much of Canada and Alaska are excluded.

In addition, some bird concerns are voiced about potential impacts from WS' harassment and hazing activities (Chapter 4, Table 10). Finally, some species of birds taken or harassed by TWSP are also harvested by hunters. Where data is available, harvest will be used with WS take to determine cumulative impacts.

Some persons believe WDM interrupts the "balance of nature" which should be avoided. Others believe that the "balance" has shifted to unfairly favor generalist species, including birds. Several species' populations have steadily increased over the past several years due to adaptability to human-made environments and damage from these species has increased accordingly (International Association of Fish and Wildlife Agencies 2004). To address these concerns, the effects of the alternatives on populations for the target species are examined. To fully understand the need for BDM, it is important to have knowledge about the species that cause damage and the likelihood of damage. Full accounts of life histories for these species can be found in bird reference books. Some background information is given here for the bird species in Texas covered by this EA, especially information pertaining to their range and seasonal movements in Texas. Species are primarily given in order of TWSP BDM efforts directed towards them, their subsequent take, and the occurrence and value of damage that the species cause in Texas. However, less damaging species may be combined with species that cause more damage where life history and damage are somewhat similar. Finally, it should be noted that jurisdiction and management of these species mostly lies with USFWS and TPWD which was discussed in Section 1.7.1.3 and 1.7.1.4.

2.1.1.1 Basic Bird Species Information. Bird species that cause damage, especially to particular resources, do not fall into regularly designated groups of birds. For this document, we have designated the following groups of birds: blackbirds (blackbirds, cowbirds, and grackles), introduced/invasive commensal birds (feral or Rock Pigeons[4], Eurasian Collared-Dove, starlings, House Sparrows, feral poultry including emus, chickens, peafowl, and guineas, and several parrots), corvids (jays, magpies, crows, and ravens), raptors (hawks, eagles, kites, harriers, accipiters, vultures, owls, and shrikes), larids (gulls, terns, jaegers, and skimmers), shorebirds (plovers, sandpipers, and allies), wading birds (herons, egrets, ibis, bitterns, flamingoes, and storks), waterbirds (loons, grebes, boobies, cormorants, pelicans, frigatebirds, tubenoses, and kingfishers), grassland species (meadowlarks, Lark Buntings, kingbirds, Horned Larks, pipits, Dickcissels, Bobolinks, longspurs, orioles, and goldfinches), native doves and pigeons, aerialists (swifts, nightjars, and swallows), woodpeckers, gallinaceous birds (chachalaca, pheasant, prairie-chicken, turkey, quail), frugivorous birds (robins, waxwings, and finches), and other

[4] Rock Pigeons in North America were actually from domestic stocks brought to the United States by early settlers and escaped (Johnston 1992). Therefore, they are truly feral domestic pigeons with less genetic variability than wild Rock Pigeons, the species they are derived from, and are referred to as feral or domestic pigeons or Rock Pigeons in this EA. This is similar to the most common domestic ducks which were derived from wild Mallards and Muscovy Ducks (both wild and feral populations exist in Texas of these two species).

miscellaneous birds such as mockingbirds and roadrunners that can cause damage and hummingbirds and wrens which usually are not involve in damage (many of these requests involve injured birds, birds that get indoors and cannot escape, or build a nest in an area where it is not welcome, especially those species that attack passersby like the Northern Mockingbird. Many species of birds can belong to more than one category, but they are placed more by the primary BDM program that they fit into (e.g., grassland passerines are species that are often encountered at airports).

Blackbirds. Nine species of blackbirds are commonly found in Texas at some time during the year (Appendix C), the Red-winged, Yellow-headed, Brewer's, and Rusty Blackbirds, Common, Great-tailed, and Boat-tailed Grackles, and Brown-headed and Bronzed Cowbirds. All of these species are abundant seasonally, except the Rusty Blackbird. Additionally, a few sightings of Shiny Cowbirds have been documented in Texas. From FY07 to FY11, blackbirds, sometimes mixed with starlings (Table 2), had an average of 1,568 work tasks associated with them and an average of about $150,000 damage (attributing half the value of damage caused by mixed flocks of starlings and blackbirds to blackbirds). Several BDM methods are used to manage damage caused by blackbirds (Dolbeer 1994) with the most applicable and current techniques discussed in Section 3.3.1.3.

Blackbirds are medium sized songbirds with heavy bills. They have iridescent black feathers and medium length tails. All are gregarious, especially in winter when they form mixed species roosts in the thousands. Large flocks begin to form roosts as early as August and disband in April. Blackbirds are primarily granivorous with the exception being the Rusty Blackbird. Blackbirds are attracted to a variety of habitats depending on the species. Brewer's Blackbirds and Bronzed Cowbirds are attracted to urban areas such as at an airport, grass and weedy fields, fallow croplands, and livestock feeding operations. Great-tailed Grackles and often Common Grackles are found in open areas with scattered trees including residential neighborhoods and marshlands. Brown-headed Cowbirds are found in similar environments and open woodlands. Red-winged and Yellow-headed Blackbirds, and Common Grackles are attracted to croplands and weedy fields, and roost and nest in marshy areas, especially cattails. Rusty Blackbirds are most common in wet woodlands where they prefer a diet of invertebrates rather than grain. This species roosts with other blackbird species, but often is found foraging in single species flocks or together with Common Grackles in or near wooded wetlands. Only rarely are Rusty Blackbirds observed foraging in agricultural fields or feedlots with other blackbirds.

Six species of blackbirds are primarily found in Texas year-round (Appendix A) and three migrate through or winter in Texas. Most BDM projects are conducted by WS from late fall to spring when most species can be present. The Red-winged Blackbird, Brown-headed and Bronzed Cowbirds, and Great-tailed, Common and Boat-tailed Grackles are found in Texas year-round with estimated breeding populations in Texas, using BBS raw data (U.S. Geological Survey (USGS) 2012) from 2007 to 2011 (Appendix A), of 9.9 million, 3.1 million, 800,000, 8.1 million, 2.6 million, and 250,000, respectively. The Red-winged Blackbird, Brown-headed Cowbird, and Great-tailed Grackle are found throughout Texas; the Common Grackle is primarily found in east Texas; the Boat-tailed Grackle is found in coastal areas, and the Bronzed Cowbird in south-central Texas. The Brewer's Blackbird nests further north and west of Texas, starting in South Dakota and increasing in numbers north and west. This species has an estimated population of 1.2 million in the Plains States (Appendix A). Yellow-headed Blackbirds primarily migrate through Texas with a small population that summers and another that winters, primarily in west Texas (Appendix A). Its population in the Central Plains States is 7.1 million. The Rusty Blackbird nests in the boreal forests of Canada. It has declined precipitously over the last 30 years and has an estimated population of 2 million throughout its range (NAS 2012b). A small percentage of Rusty Blackbirds overwinter in east Texas. Finally, a recent arrival to the United States, the Shiny Cowbird, has been documented in Texas where it could become more abundant.

Blackbirds are classified as migratory nongame birds, but can be taken under a USFWS Depredation Order when concentrated in a manner that constitutes a health hazard (Rusty Blackbirds were removed from this list). Blackbirds are considered a great threat to aviation because of the large flocks they form. In addition, winter roosts are a noise nuisance and their droppings damage buildings and property, and, where droppings are allowed to build up, they can become a source of several infectious diseases. Brewer's Blackbirds, in particular, are very aggressive nest protectors and will often attack people nearing their nest. Finally, the Brown-headed and Bronzed Cowbirds are parasitic nesters, laying eggs in other bird nests. This has been linked to add to the decline of several song birds such as the Golden-cheeked Warbler by the Brown-headed Cowbird (Ladd and Gass 1999) and the Audubon's Oriole by the Bronzed Cowbird (Flood 1990), but usually not the primary a causative factor for the species' declines because habitat loss and fragmentation usually is considered the primary factor.

Introduced/Invasive Commensal Birds. Several species of birds have been introduced into the United States from other parts of the world or have escaped captivity. Most of these are considered invasive or non-native species to the ecosystem (introduced) and cause economic or environmental harm or harm to human health (National Invasive Species Council 2001, 2008). These species often compete with native wildlife (see Section1.3.4) and cause billions of dollars of damage in the United States annually (Pimental et al. 2005). Many different exotic species have been found in Texas. Some species have been established for many decades with established breeding populations throughout the United States such as feral pigeons, starlings, and House Sparrows, all introduced from Europe. Other species have only recently been found in the United States, but have rapidly expanded their population throughout the United States (Eurasian Collared-Dove) or persist in only small numbers (Monk Parakeet). Others are escaped domestic species such as feral waterfowl and other poultry. Appendix C lists many introduced species, but Appendix C: Table C4 lists most escapes not acknowledged as established in Texas that could be the focus of a BDM project. As invasive species, the goal of BDM may be eradication, especially for those species that cause significant damage to resources such as the European Starling. This is true, especially considering that invasive species cost billions of dollars in damage. It should be noted that a few introduced species have not received the status of "invasive species" primarily because they do not meet the definition of the National Invasive Species Council (2001) such as Ring-necked Pheasants.

European Starlings. European Starlings are common residents and migrants in Texas. They have long beaks, compared to blackbirds, and are stockier with a shorter tail. They have iridescent feathers, but appear speckled in winter following their molt (these wear off by breeding). Starlings were introduced into North America from Europe in the late 1800s into New York and expanded nationwide within decades after their release. Starlings are cavity nesters and will use any structures with holes for nesting. They often compete for nesting cavities with native birds such as the Eastern Bluebird and usually dominate the native species because they are much more aggressive. Starlings are gregarious, especially in winter when they form roosts in the thousands, often with blackbirds. Large flocks begin to form roosts as early as August and disband in April. Starlings require a high protein diet consisting of mainly fruits, insects, and some grains. The starling is unprotected by State and Federal laws and can be taken at any time. Starlings cause significant damage to livestock operations through consumption and contamination of feed and the potential for infecting livestock with disease. Starlings are considered a great threat to aviation because of the large flocks they form and have been responsible for catastrophic incidences involving the loss of aircraft and lives. In addition, winter roosts are a noise nuisance and their droppings damage buildings and property; if droppings are allowed to build up, they can become a source of several infectious diseases. Nesting by starlings can create a number of problems, including nuisance and fire hazards to buildings. The starling population BBS surveywide has been declining significantly (P<.05[5]) rate of -1.2% annually (Sauer et al. 2011). The estimated population for Texas is 1.8 million (Appendix A). However, during winter the population increases with migrants from northern states.

[5] The exact significance of trend is not given, but less than 0.05, a standard level of significance. The *P* value will no longer be given in the document, but understood that the 95% confidence interval range for a significant negative trend is wholly negative.

They often concentrate in feedlots, especially in the panhandle area of Texas. BDM methods to control starlings are discussed in Johnson and Glahn (1994) and Section 3.3.1.3.

Feral Pigeons and Eurasian Collared-Doves. Feral pigeons (Rock Pigeons) and Eurasian Collared-Doves are found throughout Texas. The Rock Dove was introduced to North America in the early 17th-century by colonists who brought domestic pigeons to Atlantic coast settlements that escaped and became feral (Johnston 1992). It is actually one of the few domesticated species that was able to establish a widespread feral population that thrives. The feral pigeon has been most successful in urban areas where they can cause a great deal of damage and represent a significant health risk to people. The Eurasian Collared-Dove, an invasive species, is rapidly becoming common after self-introduction into Florida from a population introduced on the Bahamas in the 1970s (Romagosa 2002). In addition to these two species, escaped Ringed Turtle-Doves can also be found in Texas. This species is typically not associated with damage as often as the other species and rarely establish a self-sustaining population. Several BDM methods are used to manage damage caused by pigeons and doves (see Section 3.3.1.3) with most emphasis placed on controlling Rock Pigeon damage to property (Williams and Corrigan 1994) and dispersing birds from damage situations such as feedlots and airports (Booth 1994, Godin 1994).

Feral pigeons are mid-sized familiar urban birds. Eurasian Collared-Doves are smaller, but larger than most other doves. Ringed Turtle-Doves are smaller, but similar to the collared-dove. These birds have robust bodies with small heads and short beaks, and are powerful fliers. Feral pigeons are found in urban and agricultural areas in close association with man, especially inhabiting buildings because they provide desirable nesting areas (i.e. flat surfaces under eaves). Eurasian Collared-Doves are common in a wide variety of habitats, but most common near wooded streams, in agricultural and weedy fields, and in urban areas. Ringed Turtle-Doves are usually found in urban areas, but typically are not able to survive colder climes or for long time periods in the wild.

Feral pigeons and collared-doves cause a wide variety of damage and are a threat to aviation due to size and flocking behavior, abundance, and medium size. Feral pigeons have an impact on property from their droppings; their droppings will deface buildings and paint on airplanes in hangars. Pigeons and their droppings, if allowed to build up, are a source of several diseases such as psittacosis that can infect people. From FY07 to FY11, feral pigeons had an annual average of 769 work tasks associated with them for an average of $140,000 damage (Table 2). Eurasian Collared-Doves had 8 work task associated with it from FY07 to FY11; this is expected to increase drastically over the next few years as their population has increased exponentially across the Country. Figure 4 shows their growth in Texas from BBS counts (Figure 4).

Feral pigeons and Eurasian Collared-Doves are not regulated by federal or Texas laws. These species are considered exotics and can be taken at any time. The estimated breeding population of Rock Pigeons in Texas is 890,000 (Appendix A) which has decreased in the last 40 years. The rate of decrease has been significant surveywide and in the central BBS area dropping -0.9% annually from 1966 to 2010 (Sauer et al. 2011). This decline is most likely attributed to a loss of habitat such as buildings and other structures which have fewer nesting areas. The Eurasian Collared-Dove is a recent arrival in Texas, being recorded in the BBS for the first time in 1996. Since that time, the count has risen to 4.4 doves/route (USGS 2012) (Figure 4). Their population is estimated at 1.1

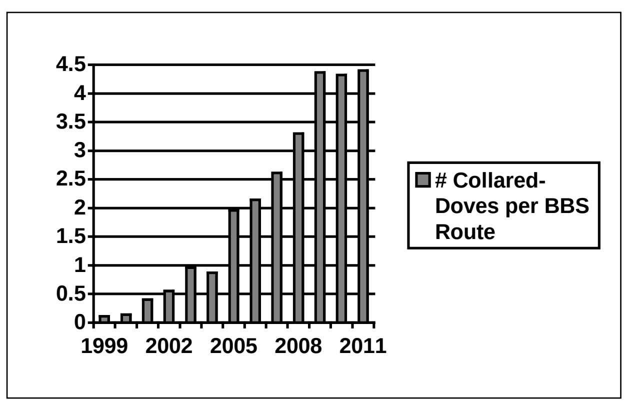

Figure 4. Eurasian Collared-Dove population growth in Texas documented in the BBS (Sauer et al. 2011).

million for Texas (Appendix A), but is expected to continue growing. This suggests that TWSP will be getting more requests for assistance with these birds because their population is still increasing at an exponential rate in all available habitats.

House Sparrows. The House Sparrow, sometimes referred to as the English Sparrow, is a common bird in urban and agricultural areas. They were introduced into the United States from Europe and have become established from coast to coast. They are very common in Texas. House Sparrows are small chunky birds with thick bills. Males have a gray crown, chestnut nape, black bib, and black bill. Females are brown overall with streaked backs, buffy eye-stripes, and unstreaked breasts. House Sparrows are found in close association to people, especially on farms, where cavities for nesting, dense trees for roosting, and food sources are available. House Sparrows are primarily granivorous; seeds, grains, and fruits make up almost their entire diet, but they will also feed on refuse from trash bins and in parking lots. Damage includes consumption and contamination of stored grains and damage to structures and other property from pecking. Their bulky nests in the cavities of buildings and other structures create a fire hazard and require constant cleaning maintenance. Their winter roosts, often in the thousands, are a noise nuisance and their droppings are a source of several diseases and parasites that increase custodial maintenance costs. House Sparrows are not usually considered a great airstrike hazard. House Sparrows are classified as unprotected nongame birds and can be taken at any time without a permit. From FY07 to FY11, TWSP recorded an annual average of 63 work tasks where damage was estimated to be $24,000 to a variety of resources. Their estimated breeding population in Texas is 3.8 million (Appendix A), down from an estimated 6 million in the 1990s (RMBO 2007). BBS data reflect this decrease with the population declining at -3.6% and -3.9% annually ($P<.01$) in Texas, the Central BBS area, and BBS surveywide (Sauer et al. 2011). Their population is thought to be declining from a reduction in habitat and feed such as seed gleaned from horse droppings (Lowther and Cink 2006). BDM methods for House Sparrows are discussed in Fitzwater (1994) and Section 3.3.1.3.

Feral Poultry. Feral poultry includes a variety of birds with the most common being domestic ducks, geese, Mute Swans, chickens, peafowl, and guineas. Feral ducks and geese are common in Texas, especially in urban area parks. TWSP had an annual average of 54 work tasks associated with feral domestic waterfowl from FY07 to FY11 causing about $5,000 in damage. These commonly damage turf, landscaping, and other property, and have the potential for closing swimming areas from high coliform counts and other potential diseases. Additionally, feral domestic ducks and geese hybridize with their wild counterparts and have an effect on the gene pool of wild ducks and geese such as Mallards and Canada Geese. Hybrids are often found in parks along with the feral domestic ducks. Mute Swans are often escaped ornamental pets, but some possibly could arrive from the eastern United States where a feral population exists. Their primary damage, human health and safety concerns, occurs in the breeding season when they can get very aggressive and attack people. If a feral population were to get started, this species can cause damage to natural resources such as they have in the eastern United States. Feral chicken, peafowl, and guinea problems are not as common, but TWSP had an average of 9 work tasks associated with them from FY07 to FY11 with damage typically very low at $90 (Table 2). Some poultry are more of a nuisance to homeowners in urban areas, especially peafowl which are very noisy on their roosts.

Exotic Birds. Texas has many exotic birds that have escaped captivity or intentionally released. The most common of these is the Monk Parakeet. This particular species builds large stick nests, often on telephone poles where they can cause a short creating an electrical outage or start a fire. TWSP had 1 work task annually from FY07 to FY11 associated with this species (Table 2). Several other species have been released, but few cause damage problems. However, a primary concern to most biologists is the potential impact to native species from the exotics.

Corvids. Corvids are well-known, boisterous birds and include crows, jays, magpies, and ravens. Crows and ravens are black, medium sized birds that are slightly iridescent in sunlight. Magpies are black and white birds that appear medium-sized because of their relatively long tail. Jays, other than the Gray Jay, have blue in varying amounts contrasted with gray, black and white. Clark's Nutcrackers and Gray Jays are white, black, and gray. Ravens, crows, magpies and Western Scrub-Jays are common in open areas close to dense or scattered trees, or brushy or riparian habitats. The other jays are more common in coniferous forests with some open areas. Corvids are opportunistic feeders and will feed on a wide variety of food including fruits, nuts, small animals, insects, refuse, and carrion. Activities such as plowing are very attractive to ravens, crows, and magpies because of the food that becomes exposed. Most corvids are flocking during the winter and can cause problems. The winter roosts of magpies and crows can be a noise nuisance and potential health hazard from accumulated fecal material. Non-breeding ravens are also flocking and are often the ravens implicated in damage to livestock. All of these species, but especially flocking birds, can cause damage to crops such as pecans and corn. Ravens and magpies will kill livestock, primarily those that are somewhat incapacitated such as newborns or cows calving. Crows and ravens are medium size and can inflict severe damage to airplanes, especially where they are hunting insects in the airfield. Crows are commonly struck by aircraft. Corvids are migratory birds; the crow is a game bird and the others are nongame. Crows and magpies can be taken without a permit when found doing damage, but USFWS permits are required to take the other species.

Corvids are represented by 14 species that have been found in Texas, but only 10 are regular occurring species. Based on BBS 2007 to 20111 data (USGS 2012) and detectability parameters from Rich et al. (2004), the most abundant is the American Crow with a breeding population of 1.3 million in Texas followed by the Blue Jay at 1.1 million. Less abundant species include the Western Scrub-Jay (52,000) in west Texas, Steller's Jay (a winter migrant), Green Jay (170,000), Mexican Jay (4,400) in Big Bend National Park area, Pinyon Jay (appear in the Panhandle erratically), the Fish Crow (11,000) of far eastern Texas, and the Chihuahuan (62,000) and Common (7,600) Ravens of western Texas. Additionally, Black-billed Magpies and Clarke's Nutcrackers have been recorded in northwestern Texas and Brown Jays and Tamaulipas Crows in southern Texas along the Rio Grande Valley. Of the species in Texas, the Common and Chihuahuan Ravens, American Crow, and Blue Jay were the only corvids associated with work tasks from FY07 to FY11, annually averaging 113, 38, 53, and 17, respectively, and a value of $7,500 for all species. The American Crow caused most damage, primarily to pecans, along with Blue Jays. The ravens were associated with livestock damage, typically pecking the eyes or other soft tissue of newborns causing them to die. Additionally, from FY96 to FY05, TWSP did receive requests for assistance with Fish Crows, Western Scrub-Jays, and Green Jays. However, TWSP has only lethally taken the crows and ravens in BDM.

Corvid populations have been negatively and positively affected by habitat changes depending on the species. Of the 10 species found most frequently in Texas (Appendix C: Table C1), excluding the Mexican Jay which has no trend data, for the BBS surveywide from 1966 to 2010, the Blue Jay and Pinyon Jay have significantly decreasing populations at -0.7% and -4.0% annually, and the Western Scrub-Jay a nonsignificant decreasing trend at -0.2%/year (Sauer et al. 2011). The Green Jay, Common Raven, American Crow, and Fish Crow show significant increases of 6.6%, 2.5%, 0.3%, and 0.5% per year while the others show no trend or nonsignificant increases. The significant increase in the Common Raven population, which is higher in the Central BBS area (+6.0%/year) (Sauer et al. 2011), is believed to be partly attributed to the availability of anthropogenic, year-round food sources from landfills, urban areas, and agricultural production areas (Boarman and Heinrich 1999). Of these species, TWSP has the highest impact on the American Crow (discussed in Chapter 4), a species significantly increasing in Texas (1.0%/year) (Sauer et al. 2011) despite control efforts. Several BDM methods are used to manage damage caused by corvids (see Section 3.3.1.3) and are specifically discussed for American Crows (Johnson 1994), magpies (Hall 1994), and Western Scrub-Jays (Clark and Hygnstrom 1994c). Several corvids flock from late summer through winter causing associated damage problems and BDM efforts can be focused on dispersing these birds from damage situations such as crop fields and airports (Booth 1994, Godin 1994).

Raptors. Raptors include vultures, eagles, hawks (Osprey, kites, harriers, accipiters, buteos, and falcons), and owls. Shrikes are also included in this category because of behavioral similarities. Raptors are predatory birds or scavengers that possess hooked beaks and talons to capture and feed on prey. Shrikes do not have talons; they impale their prey on thorns or barbed-wire to feed on them. Raptors range in size from small species such as the Elf Owl and American Kestrel to the larger ones such as the Golden Eagle and Turkey Vulture. Most species have typical hunting styles including soaring (vultures, eagles, Red-tailed Hawks), low-flying ambush (harriers), dense forest ambush (accipiters), hovering (kestrel, Rough-legged Hawk), or watching from perches (buteos, owls). Most are solitary hunters. Most owls are nocturnal and hunt at night. The combination of abundant small mammal populations, open spaces, and roosting and perching structures provides ideal habitat for most raptors. Most raptors do not cause significant problems, except potentially at airports. Black Vultures, eagles, Red-tailed Hawks, Great Horned Owls, and, to a lesser extent, other raptors will take livestock and poultry. Turkey Vultures will roost sometimes in large flocks and can be an odor nuisance in and around residences or cause property damage to structures. Cooper's Hawks sometimes chase prey, birds, into warehouses where, often, they cannot find their way out. Kites are very aggressive nest defenders and will occasionally strike people that near their nest, often drawing blood from the victim in the attack. Most raptors represent a significant hazard to aircraft due to their larger sizes and hunting over open spaces such as airfields.

Texas has 2 species of vulture, 2 eagles, 21 hawks, 8 owls, and 2 shrikes that regularly occur in Texas with most having the potential to be involved in BDM projects,. In addition, 4 species of owls are found regularly in Texas that will not likely be the focus of BDM because these are found in habitats not conducive to causing damage, including airports. Lastly, 16 species of raptors have been found in Texas only rarely and, as a result, are not likely to be the focus of a BDM project. From FY07 to FY11, raptors were associated with an annual average of 4,104 work tasks valued at $2.0 million. Black Vultures accounted for the majority of damage and work tasks from FY07 to FY11 with 1,374 work tasks and $1.8 million in damages recorded. Damage to livestock and property accounted for the majority of their damage. Average annual work tasks associated with raptors included 1,374 for Black Vultures, 895 for Turkey Vultures, 525 for Crested Caracaras, 325 for American Kestrels, 247 for Red-tailed Hawks, 302 for Swainson's Hawk, 122 for Northern Harriers, and 105 for Ospreys (Table 2). Additionally, 285 work tasks were associated with 15 other species and most of these were conducted at airports. Raptors were responsible for 17% of the strikes (6,818) and 10% (331) at airports in the United States and Texas from FY02 to FY11 with 24% causing damage (Appendix D: Table D1). Several BDM methods are used to manage damage caused by raptors (see Section 3.3.1.3) and can be focused on hawks and owls (Hygnstrom and Craven 1994), eagles (O'Gara 1994), and Mississippi Kites (Andelt 1994). Several species of raptors are significant problems at airports, and are often hazed or trapped (Godin 1994), but hazing efforts usually are not as effective for them.

Raptors are protected as migratory birds. Eagles are specifically protected under their own Act and a permit is required to harass or take them. Wildlife control personnel avoid harassing eagles, but would if it became necessary at an airport or livestock facility where they were a potential threat to aircraft or where they were killing livestock. With the appropriate permit from USFWS, WS could trap and relocate or haze eagles from damage situations. The Aplomado Falcon is listed federally as endangered and would require permits to harass (they are currently found only in south Texas. The Swallow-tailed and Mississippi Kites, Bald and Golden Eagles, Common Black-, Harris's, White-tailed, and Ferruginous Hawks, American Kestrel (*F. s. paulus* spp.), Peregrine and Prairie Falcons, Flammulated, Elf, Burrowing, and Short-eared Owls, and Loggerhead Shrike are birds of conservation concern (USFWS 2008) and considered accordingly.

Larids. Larids are gulls, terns, jaegers, and skimmers. Gulls are familiar birds. They are robust birds with webbed feet, long pointed wings, a stout slightly-hooked bill, and, typically, a square tail. Most gulls are white with gray backs and black wing tips and, sometimes, heads. Gulls are attracted to water or food including refuse from dumpsters and landfills, earthworms, insects, and carrion. They are also attracted to lakes, sandy beaches, flat-roofed buildings, parking lots, and airports because they often provide ideal loafing sites. Terns are typically similar to gulls, except that they are smaller and slimmer with long narrow wings, forked tails, and pointed beaks. Terns are piscivorous (eat fish), diving into water after their prey. The jaegers are predatory seabirds that are similar to gulls in beak and robustness, but are more like terns with more pointed wings. They often rob other birds of their catch, or prey on rodents and birds and their eggs. The Black Skimmer is a unique bird with a larger lower mandible than the upper one, built like a large tern. It flies along the surface with its lower beak in the water where it snaps up fish. Most are found in coastal areas, but several species of gulls and terns are often found inland, typically associated with water.

All of these species represent a significant strike hazards at airports. Gulls are considered a primary hazard at airports because of their size, abundance, wide and expanding distribution, flocking behavior, and general tendency to concentrate at airports. TWSP had an annual average of 501 work tasks associated with larids (Laughing Gull (263), Black Skimmer (103), and Forster's Tern (88) were most frequent) from FY07 to FY11 resulting in an average of $150,000 damage. As a group, gulls caused 11% of the strikes at civil airports in the United States from FY02 to FY11 where the species was identified with most strikes occurring at less than 500 feet above ground and at or near the airport (Appendix D: Table D1). Several have been struck at airports in Texas, but at a much lower rate (3.3%) than the national average, averaging about 11 struck annually, with most (> 95%) being gulls. Gulls are also a problem at landfills where they may carry off refuse, potentially hazardous materials, to nearby residential areas (landfills are often cited by the Health Department for not having adequate bird control programs). Finally, gull fecal material, such as on a rooftop, can build-up to the point of causing damage. Gulls occasionally will also damage agricultural crops. Terns and gulls can cause problems at aquaculture facilities. Texas has a high number of these species, primarily for being a coastal state. BDM methods for gulls are discussed in Solman (1994) and Section 3.3.1.3. BDM methods to protect aquaculture facilities from fish-eating birds including Larids are discussed in Gorenzel et al. (1994) and Section 3.1.3.3; several of these methods generally apply to protection of other resources.

Ten species of gulls, 9 terns, 2 jaegers, and the Black Skimmer can be found in Texas regularly (Appendix C: Table C1). Only the Laughing Gull, Gull-billed, Caspian, Royal, Forster's, and Least Terns, and Black Skimmer are found in Texas year-round. In addition, 20 other species of larids, including skuas and noddies, have been recorded in Texas (Appendix C: Table C3). Larids are protected as migratory birds under the Migratory Bird Treaty Act by USFWS, and are classified as migratory nongame birds by TPWD. The Least Tern is a federally listed endangered species, the Sooty Tern a state threatened species, and the Gull-billed Tern, Sandwich Tern, and Black Skimmer birds of conservation concern (USFWS 2008). Of the species that breed in the BBS surveywide area that are found during the year in Texas (13), the Herring Gull, Franklin's Gull, and Black Tern have significant downward trends from 1966-2010, decreasing at rates of -3.4%/year, -4.7%/year, and -3.4%/year while the Laughing Gull and Ring-billed Gull have significantly increasing trends at 3.4%/year and 3.7%/year from 1966 to 2010 (Sauer et al. 2011). Many other larids are showing downward trends and much seems related to loss of nesting habitat.

Shorebirds. Texas regularly hosts 39 species of shorebirds including avocets, stilts, plovers, sandpipers, and phalaropes (Appendix C: Table C1) with an additional 14 species being documented once or infrequently (Appendix C: Table C3). Most only migrate through Texas with only 10 species being seen on BBS routes from 2007 to 2011. Additionally, 17 species of shorebirds are accidental or rare in Texas. Avocets and stilts are sleek and graceful waders with long slender beaks, and spindly legs. Plovers are compact birds with short beaks; they dart across mudflats, will stop abruptly, and race off again. Sandpipers vary much more, but typically have medium to long legs and beaks, and flocks fly seemingly erratic, but in unison. Phalaropes are similar to plovers with semi-webbed feet, but spin like tops in the water when they are feeding; phalaropes are somewhat unique in that the female is the more colorful and larger than the male. Most shorebirds are attracted to open, shallow water and mudflats. A few can be seen around agricultural fields and airport operating areas, especially fallow or short grass fields, after rains. They feed on invertebrates, typically probing mudflats with their beaks. Shorebirds are commonly hit by aircraft on or around airports where they are abundant (Dolbeer 2006). A few shorebirds are medium in size and most flock presenting their biggest threat to aviation. Aviation safety is again the primary concern with these species and BDM methods used to reduce their hazards at airports are discussed in Godin (1994), Booth (1994), and Section 3.3.1.3. Much involvement by TWSP with shorebirds, though, has been for disease monitoring. Shorebirds are protected as migratory nongame birds. The Eskimo Curlew, which was known to migrate through Texas from arctic breeding grounds is listed as endangered, but is likely extinct. The Piping Plover, listed as threatened migrates through Texas. Additionally, USFWS (2008) or NAS (2007) lists the American Golden-Plover, Snowy Plover, Wilson's Plover, Mountain Plover, American Oystercatcher, Solitary Sandpiper, Whimbrel, Long-billed Curlew, Hudsonian Godwit, Marbled Godwit, Red Knot, Stilt Sandpiper, Buff-breasted Sandpiper, Short-billed Dowitcher, and Wilson's Phalarope as birds of conservation concern. Shorebirds mostly pose threats to aircraft. BDM methods used to haze birds from airports are discussed in (Booth 1994, Godin 1994) and Section 3.1.3.3. Shorebirds had 317 work tasks associated with them from FY07 to FY11 (Table 2) with damages valued at about $23,000. In addition to conducting BDM at airports, TWSP did collect several species of shorebirds for disease monitoring.

Wading Birds. Waders include herons, egrets, ibis, bitterns, flamingoes, and the Jabiru. Wading birds in Texas include 17 species regularly found (Appendix C: Table C1) and 2 others species that have only been occasionally to accidentally found (Appendix C: Table C3). The largest, the Great Blue Heron, is somewhat common year-round. The Cattle Egret, White Ibis, and Great Egret are the most abundant species year-round. Several other species are fairly abundant. However, colonial waterbirds are difficult to monitor with the BBS data. Most wading birds are medium-sized and have long legs, beaks, and necks for stalking and hunting foods in shallow waters and open fields. Many are adorned with plumes in the breeding season. Wetlands and open areas with abundant prey such as rodents, amphibians, insects, and crayfish are attractive to most wading birds. Many of these species nest communally in rookeries which can become an odor and noise nuisance in residential areas. Additionally, where these nesting areas are used year after year, the trees often die from fecal contamination. Wading birds can be a significant problem at aquaculture facilities (Dorr and Taylor 2003) and to aircraft because of their size and slower flight speeds (Dolbeer and Wright 2008); the feeding behavior of Great Blue Herons and Great Egrets in open grasslands and the flocking behavior of particularly the Cattle Egret presents hazards to aircraft. Wading birds are protected as migratory nongame birds. BDM methods for use at aquaculture facilities are discussed in Gorenzel et al. (1994) and, for general use, in Section 3.3.1.3. These species are managed as migratory nongame birds by USFWS and TPWD and can only be taken with a permit. It should be noted that the Little Blue Heron, Reddish Egret, and White Ibis are birds of conservation concern (USFWS 2008). Of the damage caused by these species, most occurred at aquaculture facilities and airports by Snowy Egrets, Great Egrets, and Great Blue Herons. TWSP had an annual average of 904 work tasks associated with wading birds from FY07 to FY11, with an average value of about $610,000.

Loons, Grebes, Pelicans, Cormorants, and Kingfishers (Waterbirds). Texas commonly has one species of loon, 6 grebes, 2 pelicans, 2 cormorants, the Masked Booby, Northern Gannet, Anhinga, Magnificent Frigatebird, and 3 kingfishers that are regularly found in Texas with several only migrating through or into the State during winter. None of these species is particularly common in Texas, except the cormorants (Double-crested mostly in winter) and pelicans. Loons are large waterbirds with thick bills and necks, and webbed feet; they submerge directly underwater to feed on fish, crustaceans, and aquatic plants. Grebes are smaller with narrow beaks, long thin necks, and lobed toes; they dive forward to submerge under water and feed on fish. Loons and grebes are rarely seen in flight. Loons and grebes live in close association to wetlands with abundant fish, invertebrates, and aquatic vegetation. The pelicans are large, white or brown (as their names imply) waterbirds with a massive bill and throat pouch. Pelicans dive from the air to catch fish, and they primarily roost and nest on the ground. The boobies and gannets are high-diving seabirds that plunge into the ocean after fish. They breed on islands, but during the nonbreeding season, the gannets roost at sea while the boobies roost on land. Cormorants are large, black birds with set back legs, a hooked bill, and reddish-orange facial skin and throat pouch. Anhingas are similar to cormorants in appearance, except that have a heron-like neck and beak. Cormorants and the Anhinga dive from the water's surface to catch fish. Cormorants nest in colonies in trees that are submerged in water. Kingfishers are smaller stocky birds with slate blue or green backs and often have breast bands. Kingfishers dive from the air to ambush fish or invertebrates just under the surface and typically nest in banks. These species are attracted to open waters with a good fishery. Kingfishers are usually associated with wooded streams and lakes where they hunt fish and aquatic invertebrates from trees, wires, or other perches. Many of these species, especially cormorants and pelicans, depredate fish at aquaculture facilities and can reduce native fisheries where their populations are abundant; applicable BDM methods used to protect aquaculture are discussed in Gorenzel et al. (1994) and Section 3.3.1.3. Most of these species do not represent a significant hazard to aircraft because they are mostly solitary and stay close to water. Pelicans and cormorants, though, can be extremely hazardous, because of their large size, slow flight, and flocking. Loons, pelicans, and cormorants have been struck by aircraft, though infrequently, and have the potential to cause severe damage. These species are migratory nongame birds and managed by the USFWS and TPWD.

The kingfishers, the only "landbirds" in this group, have small breeding populations in Texas. RMBO (2007) using BBS data determined that the Belted Kingfisher and Ring Kingfisher have breeding population of 29,000 and 120 in Texas. Recent data suggests that the Green Kingfisher has been seen more than the Ringed Kingfisher, both from south-central Texas, in the last 5 years (USGS 2012). In fact, the Ringed Kingfisher has not been documented, but 1 Green Kingfisher has (this would likely give it a population of about 1,000 using a slightly higher detectability than the Belted Kingfisher which is not as secretive as the green. BBS data from 2007 to 2011 suggest that the most abundant waterbirds in Texas are Neotropic Cormorants, Belted Kingfisher, Brown Pelicans, Double-crested Cormorants, Pied-billed Grebes, American White Pelicans, and Anhingas. However, it should be noted that, with the exception of kingfishers, the BBS does not monitor waterbirds well and no detectability parameters were determined for them. Some species such as the Anhinga are rather cryptic and, thus, their detectability parameter would be high and their population may be higher than other species. In addition to these species, 3 loons, 2 grebes, a tropicbird, and 3 boobies have been documented to occur in Texas. From FY07 to FY11, these species had 423 work tasks associated with them (177, 83, 138, 20, 3, and 1 for the Double-crested and Neotropic Cormorants, American White and Brown Pelicans, Pied-billed Grebe, and Anhinga) for a combined damage of about $240,000, mostly to aquaculture facilities.

Waterfowl. Waterfowl primarily refers to ducks, geese, and swans, but cranes, moorhens, and coots are often included in this group because these species have mostly been managed as migratory game birds and are similar in size and behavior. Ducks can be further subdivided into surface feeders and divers. Twelve species of surface feeding ducks, 16 species of diving ducks, 5 geese, 2 cranes, a gallinule, a moorhen, and a coot can be regularly found in Texas. Most are only common seasonally, with many migrating through or wintering in Texas. Of all of the species of waterfowl, 19 have been found in BBS surveys from 2007 to 2011 (USGS 2012). The most common year-round residents in Texas are the Black-bellied and Fulvous Whistling-Ducks, Canada Goose, Wood Duck, Mallard, Ruddy Duck, Common Moorhen, and American Coot. Several species such as the Snow Goose and Lesser Scaup are abundant during the winter migrating into Texas from northern breeding areas. Ducks, geese, and swans are aquatic birds with webbed feet, long necks, narrow pointed wings, and short legs. Cranes are tall birds with long legs, beak, and neck, and non-webbed feet. Coots and moorhens are black and the Purple Gallinule purple; all have short tails, stubby, rounded wings, lobed toes and short beaks. In addition to those given, Texas has also documented 13 other species of swans, ducks, and geese in Texas which are only infrequently found or accidental. Finally, several feral or escaped waterfowl can be found in Texas which was discussed above. From FY07 to FY11, waterfowl had an annual average of 1,249 work tasks associated with them valued at $76,000 (Table 2). From FY02 to FY11, waterfowl were responsible for 5% and 2% of the strikes in the United States and Texas with about 50% of these causing damage

(Appendix D: Table D1). Several BDM methods are used to manage damage caused by waterfowl (see Section 3.3.1.3) and are specifically discussed in Cleary (1994). Waterfowl are flocking from late summer through winter causing associated damage problems and BDM efforts can be focused on dispersing these birds from damage situations such as crop fields and airports (Booth 1994, Godin 1994).

Waterfowl, cranes, and coots are attracted to wetland habitats. Several species of ducks, geese, cranes, and coots are attracted to field crops such as wheat. Geese, swans, and to a lesser extent, wigeons and coots, frequent grass and winter wheat fields. Other species, especially the divers, are attracted to open water where they feed on fish and submerged aquatic vegetation and shellfish and some can be a problem at aquaculture facilities. Canada Geese and Mallards can be a nuisance in urban areas at parks and in residential areas where they cause property damage and fecal contamination of water and lawns. Additionally, nesting Canada Geese can be very aggressive and injure people nearing their nests. Waterfowl are particularly hazardous to aircraft because of their size and weight, flocking behavior, and relative abundance. Waterfowl, cranes, and coots are protected as migratory game birds by federal and state laws, but most can be hunted during the fall and winter. Shooting, including efforts by hunters, dramatically increases the effectiveness of hazing techniques. Permits are needed to take waterfowl, but hunters with the appropriate licensing can take waterfowl during open seasons. The Whooping Crane is federally listed as endangered with a small population that migrates to Aransas National Wildlife Refuge in Texas from Canada; this species in particular is avoided, but could potentially be hazed from an airport with the appropriate permit (this would be beneficial for the cranes because one has been killed by aircraft – Appendix D: Table D1). Because of the potential for waterfowl to be vectors and reservoirs for highly pathogenic avian influenza, some of these species may be shot by TWSP for disease surveillance and management. Such activities would require a permit from USFWS.

Grassland Species. Grassland species, for the sake of this EA, will be considered meadowlarks, Lark Buntings, kingbirds, Horned Larks, pipits, Dickcissels, Bobolinks, longspurs, orioles, field sparrows, and goldfinches because they are often found in grasslands or semi-open country and are common grassland species in Texas. Western and Eastern Meadowlarks are similar in size and appearance to starlings except they are light brown with black Vs on their breasts and yellow underparts. Dickcissels are somewhat smaller versions of meadowlarks. Kingbirds, phoebes, and flycatchers are somewhat small birds that are often found in somewhat open country using perches to hawk for insects. Horned Larks, pipits, Lark Buntings, longspurs, White-crowned Sparrows are slender, sparrow sized ground-dwellers. Orioles are similar to blackbirds in size and shape, but have bold orange or yellow with black colors. Orioles tend to stay near edge or riparian areas adjacent to grasslands and forage on primarily insects. Goldfinches are small birds with stout short beaks with black wings and yellow or green bodies (have breeding and winter plumages). Most field sparrows, embizerids, are small and many look similar to female House Sparrows. Most of these species feed on weed seeds in grasslands or edge areas. Many of these species such as meadowlarks, Horned Larks, and goldfinches form loose-knit flocks in winter. These species are attracted to short grass habitats and agricultural fields where seeds and insects are abundant. These species tend to stay near the ground; however, meadowlarks and kingbirds will use perches such as telephone wires. Orioles, many field sparrows, and goldfinches typically stay near edge areas. These species are often abundant at airports where they are struck by aircraft. In the United States and Texas, these species (all grassland species, flycatchers, goldfinches, and orioles from Appendix D: Table D1) were responsible for 16% (634/year) and 19% (63/year) of the bird strikes. Though most of these species are small which reduces damage to aircraft considerably, these species often will be in flocks of up to several hundred (Horned Larks, buntings, and longspurs) presenting a hazardous situation. Additionally, the Horned Lark is often referred to as a "feathered-bullet" because of its dense body mass relative to other species and cause significantly more damage than similar sized birds. These species may need to be controlled periodically at airports and to protect some agricultural crops. White-crowned Sparrows can cause damage to landscaping and crops, especially in those fields and gardens adjacent to river bottoms (Clark and Hygnstrom 1994d). All of these species are migratory nongame birds and managed by USFWS and TPWD. The Scissor-tailed Flycatcher, Sprague's Pipit, Lark Bunting, McCown's Longspur, and Dickcissel are birds of conservation concern (USFWS 2008). BBS data for 1966 to 2010 (Sauer et al. 2011) show significant declines for the Eastern Kingbird (-1.2%/year), Scissor-tailed Flycatcher (-0.7%/year), Horned Lark (-2.2%/year), Sprague's Pipit (-2.4%/year), Chestnut-collared Longspur (-4.4%/year), McCown's Longspur (-5.5%/year), Vesper Sparrow (-0.8%/year), Lark Sparrow (-1.0%/year), Lark Bunting (-2.4%/year), Savannah Sparrow (-1.1%/year), Grasshopper Sparrow (-2.5%/year), White-crowned Sparrow (-0.9%/year), Dickcissel (-0.4%/year), Bobolink (-2.2%/year), Eastern Meadowlark (-3.2%/year), Western Meadowlark (-1.0%/year), Bullock's Oriole (-0.4%/year), and Baltimore Oriole (-1.2%/year) with most declines determined to be loss of extensive grassland habitat. BDM methods for grassland birds are discussed in Section 3.3.1.3 and for Horned Larks, specifically, in Clark and Hygnstrom (1994a). These species were annually responsible for 637 work tasks with a value of about $220,000 with the meadowlarks and Horned Lark responsible for most (Table 2).

Native Pigeons and Doves. Red-billed and Band-tailed Pigeons, and White-winged, Mourning, Inca, Common Ground-, and White-tipped Doves are native to Texas and regularly occur (Appendix C: Table C1) with Mourning and White-winged Doves being the most numerous. Three other species have been documented in Texas, but outside their normal range (Appendix C: Table C3). From FY07 to FY11, pigeons and doves caused an annual average of 529 work tasks with damage documented at $660,000 from primarily Mourning and White-winged Doves (Table 2). Native doves and pigeons were responsible for 11% of the strikes in the United States and 29% of the strikes in Texas which is quite high at an annual average of 95 from FY02 to FY11 (Appendix D: Table D1). Several BDM methods are used to manage damage caused by pigeons and doves (see Section 3.3.1.3), especially dispersing birds from damage situations such as crop fields and airports (Booth 1994, Godin 1994).

Red-billed and Band-tailed Pigeons are mid-sized, stocky birds that look similar to feral Rock Pigeons. White-winged and Mourning Doves are smaller and more slender. Inca Doves and Common Ground-Doves are much smaller. All have robust bodies with small heads and short beaks. All are powerful fliers; Mourning Doves typically fly close to the ground near cover between feeding and roosting areas, while pigeons will fly at higher altitudes. Mourning, White-winged, and Inca Doves and Common Ground-Doves are common in a wide variety of habitats, but most common near wooded streams, in agricultural and weedy fields, and in urban areas. Band-tailed Pigeons are found in ponderosa pine and pinyon-juniper forests, and oak woodlands. Red-billed Pigeons and White-tipped Doves are found in native riparian forests and riparian areas of the lower Rio Grande Valley. These 2 species are not likely to be the focus of any TWSP BDM project because they are generally not associated with airport type habitat, though it is possible.

Pigeons and doves cause a wide variety of damage and are a threat to aviation due to size and flocking behavior, abundance, and medium size. Band-tailed Pigeons can cause crop damage, especially to fruits. Mourning and White-winged Doves can cause some damage to grain crops. Native doves and pigeons are migratory game birds and some such as the Mourning and White-winged Doves have established hunting seasons with bag limits. The estimated breeding populations of pigeons and doves in Texas using 2007 to 2011 BBS data (USGS 2012) and detectability factors from Rich et al. (2004) are 370 Red-billed Pigeons, 1,700,000 White-winged Doves, 13 million Mourning Doves, 390,000 Inca Doves, 620,000 Common Ground-Doves, and 100,000 White-tipped Doves. Texas BBS data has trends for 4 species that show a significant decreasing trend for Mourning Doves at -1.1%/year and significant increasing trends for White-winged Doves, Common Ground-Doves, and Inca Doves, and, additionally, surveywide BBS data shows a significant decreasing trend for Band-tailed Pigeons at -2.7%/year (Sauer et al. 2011).

Aerialists. Seven species of swallows, the Purple Martin, 2 swifts, 2 nighthawks, and 4 nightjars (Whip-poor-will, Poor-will, Chuck-will's-widow, and Buff-collared Nightjar) are found in Texas. Swallows and swifts are slender aerialists with long-pointed wings. Nighthawks are similar, but much larger and primarily nocturnal. Swifts are especially fast fliers. They all feed on insects caught on the wing with their wide, gaping mouths. Cliff and Barn Swallows build mud nests under eaves and bridges. The other swallows, and swifts, nest in cavities of rocks, banks, and trees. Nighthawks nest on the ground or large branches. These species are attracted to areas with an abundance of flying insects. They also are attracted to areas with suitable roosting or nesting habitat (barren to sparsely vegetated ground with large trees for nighthawks, dead snags in riparian areas for tree swallows, eaves or tunnels for mud-nest builders, crevices and cracks in buildings or rocks for the others). The nightjars are typically found in forested habitats and mostly nest on the ground; none of these is anticipated to cause damage concerns. The primary damage from the other species in this group is from the mud-nest builders, and especially the colonial nesting Cliff Swallow (Barn Swallows are usually tolerated because they nest singly). Mud-nest builders can cause damage from falling debris and droppings, especially in and around buildings, causing continual clean-up costs during the nesting season. Additionally, parasites (bugs such as mites and fleas) in the nest can cause problem for domestic animals and people. Chimney swifts can cause damage from their twig nests in chimneys and other structures. All of these species can be a problem at airports where colonies of them are found because they are commonly on the wing, like bats, searching for insects; nighthawks can cause more damage to aircraft than the other species because they are somewhat large. Swallows, swifts, and nighthawks are migratory nongame birds and protected by USFWS and TPWD. From FY07 to FY11, WS had an annual average of 252 work tasks associated with these species valued at about $39,000 (Table 2). From FY02 to FY11, aerialists were responsible for 11% and 8% of the bird strikes in the United States and Texas. BDM methods specifically for swallows are discussed in Gorenzel and Salmon (1994), and for all of these species, as appropriate, in Section 3.3.1.3.

Woodpeckers. Eleven species of woodpeckers regularly occur in Texas. An additional 5 species, including the potentially extinct Ivory-billed Woodpecker, have also been documented in the State. Woodpeckers are familiar birds because of their drumming and cavity building behavior. They are relatively small birds with short legs, two forward - two back, sharp clawed toes for climbing trees, stiff tail feathers for support, and a sharp, stout beak for drilling. These characteristics enable them to climb trees while probing for insects or making cavities. Woodpeckers are found near or in wooded areas. Their undulating flight is a characteristic trait. They are territorial and usually found alone or in pairs. Woodpeckers are primarily attracted to areas with trees, space, water, and a good food supply. Woodpeckers are primarily insectivorous, though they also eat fruits and nuts (sap for sapsuckers). Woodpeckers can damage structures such as buildings and telephone poles. They can also damage crops such as pecans. Since woodpeckers are fairly territorial damage is typically at low levels to orchard crops and uniform throughout orchards rather than focused in a particular area. Woodpeckers are protected as migratory nongame birds. The Ivory-billed Woodpecker was removed from the State list because it was believed to be extinct, but it remains on the federal list along with the Red-cockaded Woodpecker as an endangered species. The Lewis's Woodpecker and Red-headed Woodpecker are birds of conservation concern (USFWS 2008). From FY07 to FY11, WS annually averaged 76 work tasks associated with woodpeckers with a damage value of $6,900 and most all associated with damage to property. BDM methods for woodpeckers are discussed in Marsh (1994) and Section 3.3.1.3.

Gallinaceous Birds. The Plain Chachalaca (2,100), Ring-necked Pheasant (110,000), Lesser (26,000) and Greater Prairie-Chickens (unknown), Wild Turkey (340,000), Scaled (230,000), Gambel's (55,000) and Montezuma Quail (830), and Northern Bobwhite (940,000) are found in Texas with all having the potential to cause damage conflicts, except the Greater Prairie-Chicken and Montezuma Quail due to their isolated populations, and are collectively known as gallinaceous birds (population numbers estimated from BBS 2007 to 2011 data (USGS 2012) using detectability parameters from Rich et al. (2004)). Gallinaceous birds are primarily ground-dwellers with short, rounded wings and short strong bills. Flight is usually very brief for these species, as they prefer to walk. Males are typically very colorful and perform elaborate courting displays. Pheasants and quail can be found in several habitats ranging from riparian woodlands to agricultural fields, but primarily open areas with brushy cover. Quail are normally found close to permanent water. Turkeys are found in close association with wooded regions. The prairie-chickens are found in short- and long-grass prairies with interspersed agricultural areas. All are primarily grain and seed eaters. Of these, the turkey and pheasant are usually the only two that cause problems, primarily to agricultural crops. From FY07 to FY11, TWSP annually averaged conducting 9 work tasks associated with these 2 species with a value of $1,500 (Table 2). However, their damage is often tolerated because they are highly sought after game birds. These species are hazardous to aircraft when found on or around airports. Gallinaceous birds are protected as resident game birds by TPWD and most have hunting seasons. These birds are non-migratory and not protected by federal laws, except for the prairie-chickens. The Attwater's Greater Prairie-Chicken is a federally listed endangered species and the Lesser Prairie-Chicken is a candidate for the endangered species list. BDM methods for gallinaceous birds are discussed in Section 3.3.1.3.

Frugivorous Birds. Several fruit and seed eating birds are found in Texas that cause damage. The most notable of these, other than those discussed above such as starlings, are the American Robin, Cedar Waxwing, and House, Purple and Cassin's Finches. These birds are all mid-sized small birds, often forming large flocks. The robin is well-known with its red-breast and slate-black or grayish back. Waxwings are brownish and have crests, black masks, short tails with yellow tips; they get their name from wax-like red tips on the wing feathers of adults. The finches are small brownish sparrow-sized birds; males have a bright red forehead, breast, and rump. These species are attracted to trees that have fruits or nuts, grains, and areas with an abundance of insects. Earthworms are a major attractant for robins. Most prefer brushy to open areas with scattered trees, and sometimes dense forests. Robins use dense trees or thickets for roosting. Grapes and other fruits can be significantly damaged by these species. Other than agricultural damage, robins and House Finches can form nightly roosts in residential areas causing some nuisance problems. These species are migratory nongame birds and protected by USFWS and TPWD. BDM methods for frugivorous birds are discussed in Section 3.3.1.3. Clark and Hygnstrom (1994b) discuss methods specifically to address House Finch damages. These species generally are not a significant problem in Texas, generating only an annual average of 4 work tasks from FY07 to FY11 (Table 2).

Other Birds. A few other birds (Appendix C: Table C1) in Texas infrequently cause damage, or have the potential. The Northern Mockingbird is a very aggressive nester, often attacking people that come near the nest. This is especially a problem at the entrance to residences and businesses. Northern Cardinals often see their reflection in windows and incessantly attack the window, becoming a nuisance or sometimes damaging screens. Greater Roadrunners are common in much of Texas and prey on lizards and the eggs and nestlings of birds. These species had an annual average of 10 work tasks associated with alleviating damage from them from FY07 to FY11 (Table 2). Finally, a few other bird species could possibly be a problem at airports, though it is anticipated that this will be infrequent (parrots, anis, and grosbeaks). Several other birds are commonly found in Texas (Appendix C: Table C2), but few will ever cause damage, though they may be responsible for a request for assistance (e.g., injured bird picked up to be taken to a rehabilitator).

2.1.1.2 Bird Population Estimates. To determine impacts from TWSP BDM lethal activities, a reasonable quantitative estimate of a bird population provides the best reference for impacts from WS and others (Table 4). Bird populations generally are quite mobile and wide-ranging. Thus, a population estimate should be somewhat specific to the population potentially affected, but include all areas where the species may reside, even if for just a short duration in Texas. For example, TWSP conducts BDM year-round in Texas and winter projects often involve migratory birds migrating into Texas from northern breeding grounds such as the Brewer's Blackbird; thus, birds likely come from a larger area and impacts need to be considered for the overall population and not just for Texas because Brewer's Blackbirds only winter in Texas. For migratory birds, it is important to know when birds are present that cause damage and when the BDM projects will be conducted. It is especially important to have population numbers for those species that more than several individuals will be lethally taken. Those species lethally taken by TWSP with an average of 100 or more include several blackbirds, American Crows, Black and Turkey Vultures, Laughing Gulls, Upland Sandpipers, Double-crested Cormorants, Cattle Egrets, meadowlarks, and Mourning Doves. Other species that have been killed in limited numbers include other corvids, other raptors, other herons, egrets, vultures, hawks, crows, shorebirds, waterfowl, and swallows. Also, there may be concerns about potential adverse impacts from TWSP's harassment of nesting egrets in urban areas during spring. This analysis will address those impacts as well.

Bird populations that are affected by BDM are either migratory or resident with some bird species having populations that are both (e.g., Red-winged Blackbird). The majority of TWSP BDM projects involving migratory birds come from the Central Flyway, but some could come from the other flyways in North America (Figure 6). Several migratory species are found in Texas year round, but the population may actually shift during the year (Turkey Vulture). Additional birds may come into Texas for the winter while some that summer in Texas may leaver. Some species only nest in Texas and migrate out of the State from fall through spring (e.g., Cliff Swallow), though a few may linger in the area during winter months. Some only migrate through the State from northern breeding areas to southern wintering grounds (e.g., Franklin's Gull) and return passing through in spring. And finally, some species of migratory birds targeted in BDM may only winter in Texas (e.g., Rough-legged Hawk). Of the species that typically are involved in BDM such as blackbirds, introduced commensal birds, and raptors, most have resident populations with some migrating into the State in winter from northern states. Canada Geese have a "resident" population and have many more migrants that pass through or winter in the State. However, most lethal BDM for Canada Geese invariably involves nuisance "resident" geese as TWSP lethal BDM activities for Canada Geese have occurred from spring through summer with nesting geese (TWSP conducts mostly nonlethal harassment of migratory flocks to protect airplanes and crops during winter).

Current bird population estimates are unavailable for most species of birds and are estimated from the best available information for impacts analyses. The best information available for monitoring most bird populations, primarily land birds and not colonial waterbirds, is trend data from the Breeding Bird Survey (BBS). The BBS is a long-term (1966-2010), large-scale inventory of North American birds, coordinated by the USGS, Patuxent Wildlife Research Center, which combines a set of over 3,500 roadside survey routes primarily covering the continental United States and southern Canada (Sauer et al. 2011, USGS 2012). BBS routes are surveyed each May and June by experienced birders. The stated primary objective of the BBS has been to generate an estimate of population change, or index, for songbirds. Estimates of population trends from BBS data are derived primarily from route-regression analysis (Geissler and Sauer 1990) and are dependent upon a variety of assumptions (Link and Sauer 1998). The statistical significance of a trend for a given species is reflected in the calculated *P*-value (i.e., the probability of obtaining the observed data or more extreme data given that a hypothesis of no change is true) for a particular geographic area and is best calculated over a number of years and larger geographic areas. Positive and negative trends are considered significant if the 95% confidence interval range is wholly positive or negative and enough data is available to statistically be relatively certain that the observed data is increasing or declining. BBS trends are available for 1966 to 2010 and 2000 to 2010, or can be analyzed for any set of years desired. BBS data can be summarized for Texas, the Central or Pacific Flyways (the northern limit of the BBS is in central Alberta, British Columbia, and Saskatchewan, and southern limit Mexico), or surveywide for species breeding in the BBS survey area.

BBS data are intended for use in monitoring bird population trends, but has the potential for providing a general estimate of the size of bird populations from the average birds seen/survey route (Rich et al. 2004, RMBO 2007). The raw data is available from counts for individual routes, all routes combined in a particular geographic area such as a state, or all routes by a single year or multiple years (USGS 2012). If a population has been increasing or declining in the last 20 years, the best estimate of a population would come from recent data. The population estimates for land birds from RMBO (2007) were derived using BBS data from the 1990s and sometimes other bird population data, especially in areas with few or no BBS counts and for nocturnal or secretive species, to derive population estimates. RMBO (2007) looked at several factors to estimate bird populations.

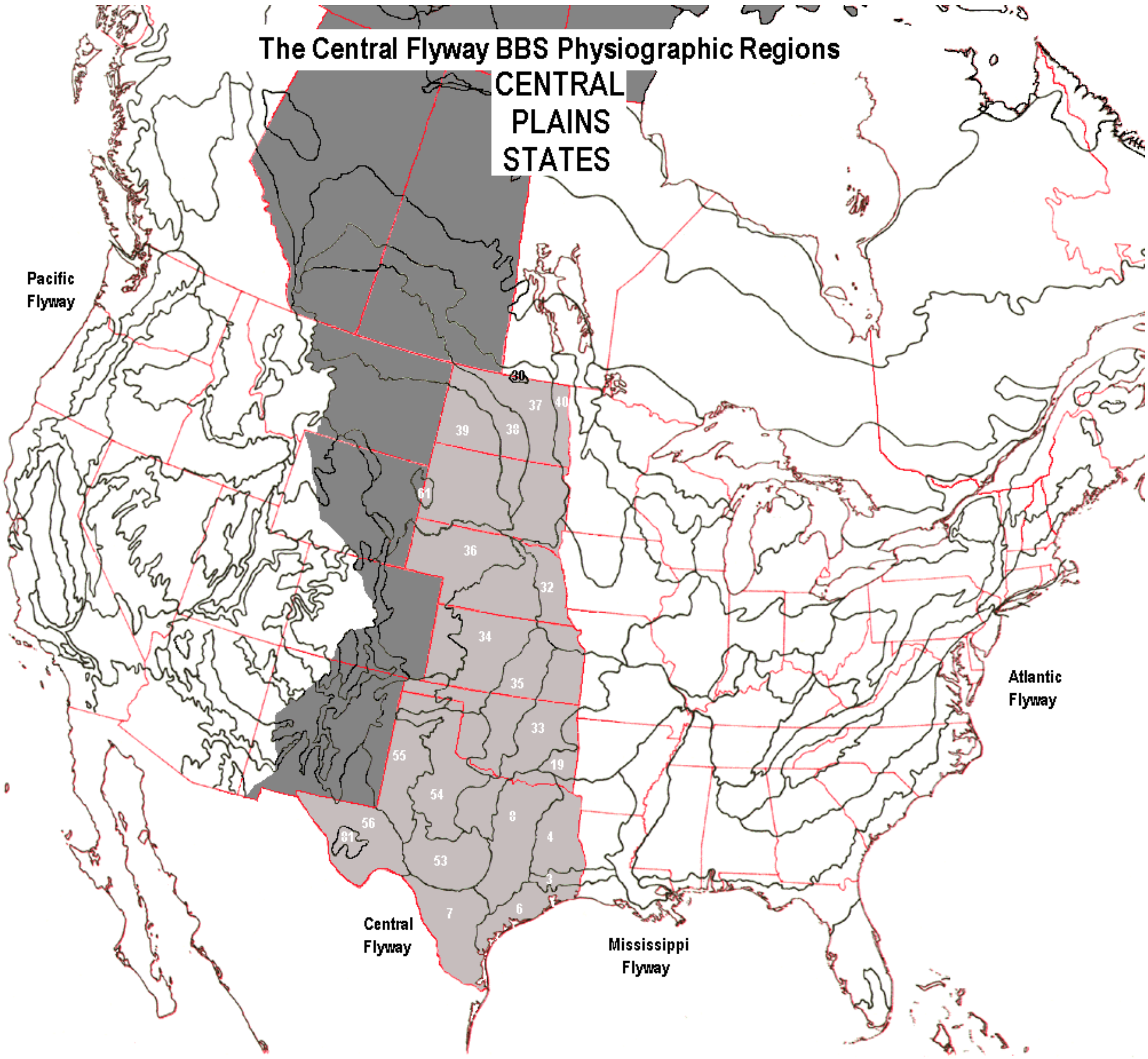

Figure 6. BDM conducted by TWSP for migratory birds is most likely to affect birds from the Central Flyway (area shaded gray). Due to limitations in data, data from the Central Plains States (CPS), migratory bird population estimates for the EA will be derived from the light gray shaded area or the Central Plains States (CPS) of Kansas, Nebraska, North Dakota, Oklahoma, South Dakota and Texas using BBS raw data for those states. The BBS physiographic regions in the CPS (shaded gray) that encompass the population of birds likely to be impacted by BDM in Texas, especially those during migration and winter. The shaded area includes BBS regions 3, 4, 6-8, 19, 30, 32-40, 53-56, 61, and 81. This area excludes the western portion of the Central Flyway in New Mexico, Colorado, Wyoming, and Montana – little BDM is conducted in this area except for feral introduced birds such as the starling and birds from the Canadian boreal forest and Arctic tundra which are mostly north of the BBS boundary limit.

However, some populations have changed since the 1990s (Table 4), the data used for RMBO (2007). Thus, a new estimate using current BBS data would provide a better impact analysis. For this EA, it was decided that populations from BBS raw data for different geographic areas would be averaged for the last 5 years for the geographic area of the majority of bird population involved in BDM (2007 to 2011) because 5 FYs are used to look at impacts and is equivalent to FY07 to FY11 because counts are surveyed from May to June. This estimate would lack some of the complicated formulas RMBO (2007) used to make their estimate. A population estimate will be calculated for the analysis using FY07-FY11 data, but mostly presented with the RMBO (2007) estimate because they also calculated other factors into the population estimate. The estimate made will focus on the population likely impacted from BDM. For example, feral pigeons, starlings, ravens, are some raptor populations are estimated at the statewide level since the majority of lethal BDM projects in Texas involve resident birds. For most other species, except the Rusty Blackbird, the states encompassed in Figure 6 in the Central Flyway population is estimated and used for analysis. However, the BBS physiographic areas shaded in Figure 6 would likely provide a better estimate for the population of migratory birds affected by BDM in Texas; the raw data, though, are available by states and provinces, and not the BBS physiographic regions. Additionally, impacts to the populations are known for WS, but less so by others, especially in Canada. Thus, only the Central Plain States (CPS) will be used.

Using methods adopted by Partners in Flight (PIF) to estimate population size with BBS data (Rich et al. 2004), the numbers of birds seen per route can be used to extrapolate a population estimate. The PIF system involves extrapolating the number of birds in the 50 quarter-mile circles (total area/route = 9.82 mi^2). It also makes assumptions on the detectability of birds, which *varies* for each species. For example, some species that are large such as ravens and vultures or vocalize frequently such as Mourning Doves and American Crows are much more easily detected during bird surveys than species that are small and inconspicuous such as owls and Horned Larks, or do not vocalize that often or loudly during surveys such as herons and shorebirds. Additionally, breeding males are often the most visible during surveys while females may be in cover or on a nest and not detected such as Red-winged Blackbirds. Given an idea about the detectability of a bird species, a population estimate can be obtained from the equation - # of birds/route seen/9.8 mi^2 x area of concern x detection parameters (distance, pair, and time). RMBO (2007) discusses the detectability parameters in detail. Detectability parameters were not made for colonial waterbirds because it has been determined that the BBS data would have limitations for estimating their populations.

TWSP will use BBS data (USGS 2012), averaging the relative abundance for geographic areas from FY07 to FY11 (equates to BBS routes run in May-July 2007 to 2011), to estimate populations (Table 4) that are impacted lethally by TWSP BDM (Table 8). TWSP conducts BDM for most all species that are either residents in Texas or primarily come from the Central Flyway which, for the purposes of this EA, includes the CPS or all or part of the BBS physiographic regions: 3, 4, 6-8, 19, 30, 32-40, 53-56, 61, and 81 (Figure 6). The CPS bird populations (Table 4, see Appendix A for details) will provide population estimate baselines to determine impact from WS BDM activities, including WS BDM in other states. Additionally, some birds come from areas of the Central Flyway not included in the CPS - the western area of the Central Flyway in Colorado, Montana, New Mexico, and Wyoming and areas north in Canada from the Central Flyway, but it is unlikely that any of the species considered in this EA will be impacted greatly in this area. To a lesser extent, birds could also come from areas in the Pacific, Mississippi, and Atlantic Flyways.

To determine impacts, all known take in the area used to estimate the population is analyzed in Section 4.1.1.1. TWSP records or estimates take of species killed in BDM. Estimates of other take are made for species hunted or those species that are permitted to be taken under permits issued by USFWS to resolve depredations. In many cases, undocumented take can occur for species that are not protected (starling, feral pigeon, and House Sparrow) or have a USFWS depredation order (blackbirds, magpies, and crows) which allows take without a permit. For these species, an estimate of other take can be made, but should only be considered a guess; to be conservative we believe we have greatly overestimated this take.

Table 4. Population estimates for those species that TWSP takes most frequently in BDM in Texas from BBS raw data (USGS 2012) (see Appendix A for details). Population estimates for Texas are included for landbirds in the 1990s (RMBO 2007) and for waterbirds (NAS 2012b).

Species	Detectability Parameter Factors			BBS Surveywide Pop. Estimate ^	Aver. TX Birds/Count 2007-2011^^	Texas Pop. Estimate ^^	Texas Landbird Pop. Est. 1990-99^	Pop. Est.^^ Central Plains. States (Fig 6)
	Dist.	Pair	Time					
Population Estimates for the Less Migratory/"Resident"/Local Species in Texas								
Canada Goose*	x	x	x	5,300,000	0.235	6,400	750#	
Laughing Gull	x	x	x	800,000	8.402	230,000	na	
Feral Rock Pigeon	4	2	1.19	26,000,000	2.550	880,000	1,100,000	
Eurasian Collared-Dove	4	2	1.32	400,000	3.839	1,100,000	3,000	
Common Raven**	0.5	2	1.30	2,000,000	0.425	7,600	4,800	
Chihuahuan Raven	1	2	1.40	370,000	0.802	62,000	92,000	
European Starling	4	2	1.06	120,000,000	7.101	1,800,000	2,000,000	
Boat-tailed Grackle	4	2	1.54	3,600,000	0.597	200,000	190,000	
Bronzed Cowbird	4	2	1.29	500,000	2.313	660,000	500,000	
House Sparrow	4	2	1.06	81,000,000	16.591	3,800,000	6,000,000	
Population Estimates of Migratory Birds in Texas with Little Take in BDM by WS								
Double-crested Cormorant	x	x	x	1,600,000	0.099	2,700	na	
Great Blue Heron	x	x	x	120,000	1.142	31,000	na	
Great Egret	x	x	x	270,000	2.287	63,000	na	
Cattle Egret	x	x	x	1,200,000	30.381	830,000	na	
Black Vulture**	0.5	2	2.50	260,000	5.801	200,000	100,000	
Turkey Vulture**	0.5	2	2.61	1,300,000	16.742	600,000	520,000	
Swainson's Hawk	1	2	1.26	460,000	0.903	62,000	63,000	
Crested Caracara	1	2	1.66	68,000	1.621	150,000	65,000	
Killdeer	x	x	x	1,000,000	3.730	100,000	na	
White-winged Dove	4	2	1.39	5,300,000	5.629	1,700,000	730,000	
Mourning Dove	4	2	1.31	110,000,000	46.755	13,000,000	16,000,000	
Lesser Nighthawk	1	2	7.15	1,500,000	1.555	610,000	670,000	
Common Nighthawk	1	2	6.73	10,000,000	6.680	2,500,000	3,100,000	
Western Kingbird	4	2	1.55	18,000,000	10.184	3,500,000	2,600,000	
Scissor-tailed Flycatcher	4	2	1.27	7,000,000	15.126	4,200,000	5,700,000	
Horned Lark	4	2	1.35	80,000,000	5.249	1,500,000	2,800,000	
Cliff Swallow	4	2	1.31	82,000,000	52.355	15,000,000	9,000,000	
Barn Swallow	4	2	1.19	52,000,000	16.360	4,300,000	4,000,000	
Lark Bunting	4	2	1.09	27,000,000	0.418	100,000	80,000	
Eastern Meadowlark	1	2	1.19	8,100,000	14.580	950,000	1,600,000	
Western Meadowlark	1	2	1.13	30,000,000	8.449	570,000	1,200,000	
Population Estimate for Migratory Species in Texas and the Central Plains States								
Upland Sandpiper	x	x	x	350,000	0.004	110	na	350,000
American Crow	1	2	1.55	31,000,000	15.051	1,300,000	1,500,000	2,700,000
Red-winged Blackbird	4	2	1.13	190,000,000	39.816	9,900,000	12,000,000	36,000,000
Yellow-headed Blackbird	4	2	1.18	20,000,000	0.071	23,000	500	7,900,000
Brewer's Blackbird	4	2	1.39	35,000,000	0.001	340	0	1,100,000
Common Grackle	4	2	1.23	97,000,000	7.273	2,200,000	4,300,000	19,000,000
Great-tailed Grackle	4	2	1.32	7,800,000	23.605	6,800,000	6,000,000	7,000,000
Brown-headed Cowbird	4	2	1.45	51,000,000	12.036	3,100,000	3,500,000	20,000,000
Closed Boreal Forest Physiographic Region Index (BBS Area 29 – 580,000 mi^2) – Migratory Species								
Rusty Blackbird	4	2	1.44	2,000,000	++	++	++	++

* PIF (Rich et al. 2003, RMBO 2007) provided estimates for land birds only. BBS data do not generally provide sufficient information to estimate waterbird populations; the estimate is provided uses a corrective factor of 1 (or no corrective factor) and the surveywide from NAS (2012a) (Cattle Egret, Killdeer, and Upland Sandpiper from Morrison et al. 2006).

** Distance detectability parameter was adjusted for these species because we believe the PIF parameters (Rich et al. 2003 and RMBO 2007) are overly conservative. PIF has twice the distance counted in the BBS point counts (800 meter radius instead of 400 meter radius set as BBS observer limit for counting) because these species may cover large distances flying during the 3 minute count or can be heard calling from long-range. However, this effectively increases the area counted or decreases the population estimated four-fold. While there is no doubt that some birds are detected from an area greater than quarter mile radius in the BBS point counts, the assumption that all birds of these species are counted in an area 4 times the size of the point count (after accounting for time and pair detectability parameters) would be an underestimate. In fact, limitations at survey stops that restrict vision such as trees, structures, and hills reduce the area surveyed at many point counts already, especially for species that are relatively quiet such as the Turkey Vulture, and many birds are not counted as a result. Therefore, we believe a more appropriate estimate, yet still believed to be conservative, would be acquired by using twice the size of the count area rather than 4 times which equates to a distance parameter of 0.5. We believe that the actual distance parameter for these species should be even closer to 1.

^ Estimates for landbirds from RMBO (2007) using BBS data from 1990-1999 and based on detectability parameters from (Rich et al. 2004 and RMBO 2007) for the United States and Canada to estimate population.

^^ Estimates from FY07-FY11 BBS raw data (USGS 2012) with point counts covering 9.82 mi^2 (the Canada Goose population will not be used for analysis).

+ Detectability parameters were estimated for the Eurasian-Collared Dove because this invasive species was not established in the 1990s, and, therefore, did not have these estimated by Rich et al. (2004) and RMBO (2007). It has now become established almost nationwide and the population is growing exponentially.

++ Does not breed in Central Plains States, but the northern boreal forests of Canada, mostly north of the BBS limits.

Spring 1999 population estimate from Resident Canada Goose EIS (USFWS 2005)

Many of the requests for assistance that TWSP receives occur during winter when migratory birds have come into Texas, thus changing bird population numbers. Birds from a larger geographic area are often involved in depredations, namely those that reside in the state and those that migrate into the state, mostly from northern areas. The National Audubon Society (NAS) conducts nationwide bird surveys within a few weeks of December 25th, the NAS Christmas Bird Counts (CBC). The CBC (NAS 2012a) reflects the number of birds in Texas during early winter that would occur after migrations are completed. The Christmas Counts are a volunteer effort conducted by all levels of birders and only provides the number seen in a 15 mile diameter circle (177 mi^2). The CBC data does not provide a population estimate (numbers can be extrapolated for the area of coverage giving a very rough population estimate over a larger area), but can be used as an indicator of trend in the population, used to determine winter species composition, or compared with other populations. CBC data often varies much more than BBS data due to variations in winter climate and observer ability.

2.1.1.3 BDM for T&E, and Sensitive Species. Of most concern to TWSP and others are BDM activities that need to be directed at T&E, and sensitive bird species which have limited populations. Texas has 168 species or subspecies considered T&E, or sensitive. Texas has 33 bird species or subspecies federally or state listed as T&E, including federal candidates (Table 5). Some federal and state listed species have the potential of being the target of a BDM project. Any activity involving a listed species would require a Section 10 or State permit under ESA, Texas laws, or other allowance to conduct that activity. Additionally, the species being targeted, its status throughout its range, and available techniques would be considered. In most all situations, nonlethal techniques would likely be used including trapping and relocation. In addition, Texas has 135 species considered sensitive species by USFWS (2008) and NAS (2007) which are not federally or state listed species.

Of the 33 listed avian species in Texas, 20 have the potential of being targeted by BDM (Table 5). Most of these species (19) would potentially be targeted at airports where they were deemed a strike hazard. Most would be frightened with hazing devices such as pyrotechnics and propane cannons. Some of the raptors such as the White-tailed and Zone-tailed Hawks, species that do not frighten well, could be trapped with raptor traps and relocated (see Section 3.1.3.3). Though this may seem to be a negative interaction with a listed species, it actually would be beneficial because the species would not be killed or injured by aircraft if hazed from an air operating area. Two of these species in particular, the Lesser Prairie-Chicken and Common Black-Hawk, would not likely cause problems because they inhabit areas where airports would be few and private, thus negating most potential. Similarly, 10 species could be hazed from an area impacted by an oil spill to reduce the potential for them to be killed. This, again, would be a beneficial impact on the species because hazing activities at an oil spill would reduce the likelihood of succumbing to the toxic effects of oil.

TWSP personnel may work to protect resources from T&E or sensitive species (Table 5). Aquaculture facilities could be impacted by 5 species. The Interior Least Tern and Whooping Crane would require a Section 10 permit to haze being federally listed species. Two species, the Reddish Egret and Red-cockaded Woodpecker, could cause damage to property (minimal potential for the woodpecker and a Section 10 permit from USFWS would be required to haze them from an area). The Reddish Egret will nest in colonies with other egrets/herons; nesting colonies may warrant a hazing effort to relocate them from areas where they are causing damage such as in a residential neighborhood. Finally, Bald Eagles will kill livestock such as lambs and may need to be hazed or relocated from the damage area (a USFWS permit is needed to haze eagles). From FY07 to FY11, of the 33 listed T&E or sensitive species, only the White-faced Ibis, Bald Eagle, and Least Tern had work tasks associated with them (aver. 1, 0.4, and 1, respectively). However, from FY94 to FY06, WS has also received complaints for Wood Storks at an aquaculture facility. Finally, it is possible that Reddish Egrets were in mixed heron and egret roosts that were hazed from different sites, but these were not documented to be present. Thus, in 18 years, WS has only documented working with 4 T&E or sensitive species, showing the minimal potential for damage that these species actually represent.

On the other hand, TWSP could conduct BDM to protect T&E or sensitive species. TWSP has conducted BDM to protect some avian species as well as other listed species from depredating bird species. WS has conducted avian predator control to reduce predation of Attwater's Greater Prairie-Chickens, adults and poults. Some BDM is conducted to alleviate nestling/egg depredation (corvids and gulls on terns, plovers, and prairie-chickens) or nest parasitism (cowbirds on flycatcher, vireo, and warbler nests). Additionally, other T&E species could be depredated (e.g., Texas wild rice (*Zizania texana*) and Texas tortoise (*Gopherus berlandieri*)) by birds and may need BDM to protect them. Where a bird(s) has been identified as a limiting factor for T&E or other sensitive species' population, BDM could be conducted to protect them, thus providing a beneficial impact on the T&E or sensitive species.

Table 5. Federal and stated listed avian T&E and candidate species in Texas and potential of them to be targeted in BDM or the potential impact as a nontarget species in BDM (TPWD 2003, 2012b, USFWS 2012a).

Specie	*Scientific Name*	Status	Locale	BDM Target	Protected by BDM	BDM Nontarget
Attwater's Greater Prairie-Chicken	*Tympanuchus cupido attwateri*	FE SE	Southeast	0	+ N P	0
Lesser Prairie-Chicken	*Tympanuchus pallidicinctus*	FC	Panhandle	0	+ N P	0
Reddish Egret	*Egretta rufescens*	ST	Coast	A/S Aq P	0	- F
White-faced Ibis	*Plegadis chihi*	ST	Statewide	A/S	0	- F
Wood Stork	*Mycteria americana*	ST	Coast, East	A/S Aq	0	- F
Swallow-tailed Kite	*Elanoides forficatus*	ST	Coast	A	0	- F
Bald Eagle	*Haliaeetus leucocephalus*	ST	Statewide	A/S Aq L	0	- F R
Common Black-Hawk	*Buteogallus anthracinus*	ST	Big Bend	A	0	- F
Northern Gray Hawk	*Buteo nitidus maximus*	ST	Extreme South	A	0	- F
White-tailed Hawk	*Buteo albicaudatus*	ST	South	A L	0	- F R
Zone-tailed Hawk	*Buteo albonotatus*	ST	South, West	A/S L	0	- F R
Northern Aplomado Falcon	*Falco femoralis septentrionalis*	FE SE	Extreme South	A	0	- F
American Peregrine Falcon	*Falco peregrinus anatum*	ST	Statewide	A L	0	- F
Whooping Crane	*Grus americana*	FE SE	Central, Coast	A/S Aq	0	- F T
Piping Plover	*Charadrius melodus*	FT ST	Statewide	A/S	+ N	- F M
Eskimo Curlew*	*Numenius borealis*	FE SE*	* (Central)	0	0	0
Red Knot	*Calidris canutus rufa*	FC	Statewide	A/S	0	- F M
Sooty Tern	*Lasiurus fucata*	ST	Coast	A/S	+ N	- F
Interior Least Tern	*Sterna antillarum athalassos*	FE SE	Statewide	A/S Aq	+ N	- F M
Red-crowned Parrot	*Amazona viridigenalis*	FC	Extreme South	A	0	0
Western Yellow-billed Cuckoo	*Coccyzus americanus*	FC	West	0	0	0
Cactus Ferruginous Pygmy-Owl	*Glaucidium brasilianum cactorum*	ST	Extreme South	0	0	0
Mexican Spotted Owl	*Strix occidentalis lucida*	FT ST	Extreme West	0	0	0
Red-cockaded Woodpecker	*Picoides borealis*	FE SE	Extreme East	P	0	0
Northern Beardless-Tyrannulet	*Camptostoma imberbe*	ST	Extreme South	0	0	0
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	FE SE	West	0	+ C	0
Rose-throated Becard	*Pachyramphus aglaiae*	ST	Extreme South	0	0	0
Black-capped Vireo	*Vireo atricapilla*	FE SE	Central	0	+ C	0
Sprague's Pipit	*Anthus spragueii*	FC	Statewide	A	0	- F
Tropical Parula	*Parula pitiayumi nigrilora*	ST	Extreme South	0	+ C	0
Golden-cheeked Warbler	*Dendroica chrysoparia*	FE SE	South, Central	0	+ C	0
Bachman's Sparrow	*Aimophila aestivalis*	ST	Extreme East	0	0	0
Texas/Arizona Botteri's Sparrow	*Aimophila botterii texana/arizonae*	ST	X South/West	0	0	0

STATUS	BDM Target	BDM to Protect	BDM - Nontarget
F - Federal	**A** – Airport	**C** – Cowbird Nest Parasitism	**F** –Frightening Devices
S - State	**Aq** – Aquaculture	**N** – Egg/Nestling Depredation	**M** – Mist Nets
E - Endangered	**L** – Livestock/Poultry	**P** – Predation Adults/Poults	**R** – Raptor Traps
T - Threatened	**P** – Property	**0** - none	**T** - Toxicants
C - Candidate	**S** – Toxic Spill (e.g., oil)	**(+)** - Positive	**0** – No Impact
***** Believed extirpated/extinct	**0** – Not Targeted		**(-)** - Negative

Similar to federal and state listed T&E species, some sensitive species could also be the focus of BDM projects. The USFWS (2008) and the National Audubon Society (NAS 2007) list species of management concern (SMC: USFWS lists "Birds of Conservation Concern" and NAS has a "Watch List") (Appendix C: Tables C1, C2, and C3 denote these species). These are species of birds considered sensitive because their populations have declined over the past several years, but not serious enough to be considered T&E species (NAS lists T&E species as well in "Watch List" (NAS 2007)). Most population declines have been attributed to habitat loss, but predation or other negative wildlife interactions have been noted as a contributing factor in the decline of some species. USFWS (2008) and NAS (2007) list 135 bird species documented to be in Texas that are not listed as federal or state T&E, or candidate species (Table 5). Of these, 107 are regularly occurring species in Texas (Appendix C: Tables C1 and C2); 53 of these could be the focus of a BDM project with 43 only at airports (Appendix C: Table C1). Of the accidental species that have been found in Texas (Appendix C: Table C3), 28 are listed as sensitive species by USFWS (2008) or NAS (2007); of these, 12 could be the focus of a BDM project with 4 only at airports. Most SMC species would only be hazed from the resource being protected. The SMC species taken by TWSP from FY07 to FY11 included the Mottled Duck, Little Blue Heron, Mississippi Kite, Swainson's Hawk, Upland Sandpiper, Long-billed Curlew, Scissor-tailed Flycatcher, and Lark Bunting. TWSP theoretically could have taken Rusty Blackbirds with DRC-1339, but none were noted to be present in areas where DRC-1339 was used. However, it would be easy to overlook these in flocks of blackbirds in the thousands. Three least terns were taken on the coast at a Corpus Christi airport, but were the subspecies *antillarum*, the coastal subspecies, and not *athalassos*, the Interior Least Tern which is federally endangered; it should be noted, though, that no genetic distinctions were found for populations analyzed, a great deal of overlap occurs in physical characteristics between subspecies, and a tern that was born on the coast of Texas nested in Kansas suggesting genetic exchange between subspecies, thus little credence is given to the subspecific determinations (Thompson et al. 1997). Finally, the *paulus* subspecies of the American Kestrel could have been taken by TWSP, but it is primarily found from Louisiana east. Most BDM conducted at airports where kestrels were targeted were likely from the subspecies *sparverius*. The take of these species will be analyzed in Section 4.1.1.1.

2.1.2 Effects of BDM on Nontarget Species Populations, Including T&E Species

A common concern among members of the public and wildlife professionals, including WS personnel, is the potential impacts of damage control methods and activities on nontarget species, particularly T&E species. TWSP's SOPs include measures intended to reduce the effects of BDM activities on nontarget species populations and are presented in Chapter 3. From FY07 to FY11, WS lethally took 7 Mourning Doves and 1 Crested Caracara averaging the lethal take of 2 nontargets. TWSP also released 2 Crested Caracaras from FY07 to FY11. Additionally from FY07 to FY11, 100 feral Rock Pigeons were taken at a feedlot where they were being targeted with other methods, but taken as nontargets under the DRC-1339 Feedlot label and 1 Mallard and 2 Canada Geese were targeted with A-C for relocation, but accidentally died during their captures (target species, unintentionally taken). The annual average was 21 unintentional targets. The total take of nontargets by TWSP annually averaged 22 from FY07 to FY11. From FY94-FY06, TWSP also lethally took other species with most being associated with a Brown-headed Cowbird trapping program to protect Golden-cheeked Warblers and Black-capped Vireos, but take has been very minimal and not impacted any species.

In contrast to adverse impacts on nontarget animals from direct take by BDM methods, some nontarget species may actually benefit from BDM, though this benefit would be unintentional unless it was the focus of the BDM project. Prime examples are the benefit to native cavity nesting bird species such as the bluebird that results from any reduction in starling populations. A number of other bird species, including some T&E species, could benefit from reductions in populations of Brown-headed Cowbirds which parasitize nests of other birds. Section 4.1.2.1 discusses this further.

2.1.2.1 Federally Listed T&E Species. Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects on them and the establishment of special restrictions or mitigation measures to reduce the potential. The Federal T&E, and candidate species list for Texas includes 9 mammals, 15 birds, 3 reptiles, 8 amphibians, 14 fishes, 28 invertebrates, and 31 plants, not including 3 and 5 marine mammals and reptiles (USFWS 2012a). TWSP BDM will have no effect on listed reptiles, amphibians, fish, invertebrates, and plants, or marine animals, and little potential to adversely affect T&E mammals or birds. Tables 5 and 6 list the federally listed birds and mammals and the potential for BDM to have an impact on them. In all, BDM has the potential to have a slight adverse impact on 6 federally listed avian (Table 5) and 6 federally listed mammalian species (Table 6). The Tables denote where a problem could occur, but the likelihood of occurrence would be nullified if the species distribution is outside areas where BDM is conducted. WS conducted a national Section 7 consultation with USFWS in 1992 on the potential for WDM, in general and including most BDM methods currently used, to impact the species listed nationwide. WS received a Programmatic BO in 1992 (USFWS 1992) from USFWS on the species that WS had the likelihood to adversely affect. However, USFWS concluded that WS would have no adverse effects on listed species (USFWS 1992) following the Reasonable and Prudent Measures and Alternatives and Terms and Conditions of the BO. TWSP will consult on all species that may be affected by conducting BDM.

USFWS (1992) had no concerns with BDM and the listed species of Texas in their 1992 BO, except for the Whooping Crane with toxicants and the Aplomado Falcon with prey-base removal. WS agreed not to use DRC-1339 and Avitrol in areas inhabited by the cranes and has never taken a crane. The USFWS (1992) believed that WS would not conduct a BDM project involving the removal of enough birds in the areas inhabited by the Aplomado Falcon to cause concern. TWSP has not conducted starling and blackbird projects in the vicinity of the falcon and believes it will have no effect on them. In addition, a toxicant that is no longer registered, the above-ground use of strychnine for pigeon control, was a concern for the delisted Peregrine Falcon and Bald Eagle. WS does not use this BDM method, as it has been banned. No species listed since that decision would be similarly affected.

Table 6. Federal and stated listed mammalian T&E and candidate species in Texas (TPWD 2003, 2012b, USFWS 2012a) and the potential impact as a nontarget species from TWSP BDM.

Specie	***Scientific Name***	**Status**	**Locale**	**BDM Impact**
Texas Kangaroo Rat	*Dipodomys elator*	ST	North Central	0
Palo Duro Mouse	*Peromyscus truei comanche*	ST	Panhandle	0
Coue's Rice Rat	*Orozomys couesi aquaticus*	ST	Extreme South	0
Mexican Long-nosed Bat	*Leptonycteris nivalis*	FE SE	Big Bend	- M
Southern Yellow Bat	*Lasiurus ega*	ST	Extreme South	- M
Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*	ST	Extreme East	- M
Spotted Bat	*Euderma maculatum*	ST	Big Bend	- M
Ocelot	*Leopardus pardalis*	FE SE	South	0
Margay*	*Leopardus wiedii*	ST	*Extreme South	0
Jaguarundi	*Herpailurus yagouaroundi cacomitli*	FE SE	Extreme South	0
Jaguar*	*Panthera onca*	FE SE	*South	0
Mexican-Gray/Red Wolf*	*Canis lupus baileyi/rufus*	FE SE	* West/East	0
Black Bear	*Ursus americanus*	FTA STA	East	- F
Louisiana Black Bear	*Ursus americanus luteolus*	FT ST	Extreme East	- F
Black-footed Ferret*	*Mustela nigripes*	FE SE	* Northwest	0
White-nosed Coati	*Nasua narica*	ST	Rio Grande Valley	0

STATUS
F - Federal
S - State
E - Endangered
T - Threatened
C – Candidate
A - Similarity of Appearance

BDM Nontarget Impact
F –Frightening Devices
M – Mist Nets
0 – No Impact
(-) – Negative

***** Believed extirpated

However, TWSP has the potential to impact a few species, albeit slight. TWSP believes that 2 BDM methods could affect federally listed T&E birds and mammals: frightening devices and mist nets, other than those already listed above. Of the federally listed mammalian and avian species, the Louisiana black bear, Lesser Prairie-Chicken, Northern Aplomado Falcon, Whooping Crane, Piping Plover, and Least Tern could potentially be affected by BDM where noise harassment is used to protect human health and safety (e.g., at airports), property such as aircraft and residences, livestock, crops, or aquaculture facilities from birds. These species could unintentionally be harassed by frightening devices used in the vicinity of them. This would be inconsequential to the species and typically go unnoticed by those implementing a BDM action near them. For example, an Interior Least Tern could be on a lake adjacent to a crop where birds are being hazed to reduce crop damage. The Least Tern could leave the lake because of the noise from pyrotechnics and propane cannons, though the noise was not directed at it. This would not cause harm to the species. USFWS (1992) determined that this would have no more than a temporary effect and did not consider this further. It should be noted that of the above species, TWSP anticipates that this would only have the potential of occurring with a few species as they could potentially be in the vicinity of a BDM program using hazing devices, primarily at airports and for toxic spills. TWSP will be cognizant of these species when conducting a frightening program and avoid the use of them where a T&E species could be adversely affected.

The Piping Plover, and potentially the Least Tern and Mexican long-nosed bat (the latter 2 are highly unlikely), could be accidentally caught in mist nets or noose mats used to capture shorebirds and potentially bats for disease monitoring. These devices are monitored closely and species taken in them are released unharmed. Where these methods are used with a potential to take T&E species, WS has consulted nationally with USFWS under Section 7 of the ESA. WS has developed SOPs to avoid impacts which include ensuring WS Specialists are trained in T&E species identification, not working in areas known to be inhabited by T&E species, monitoring mist nets and traps frequently, and pulling equipment if a T&E species is seen in the vicinity of the trapping operations. These SOPs ensure that T&E species are not likely to adversely be affected. The bat is found in the Big Bend area of Texas where TWSP does not anticipate conducting disease monitoring, thus it would be avoided.

On the other hand, some T&E species could unintentionally benefit from BDM. The Black-capped Vireo, Golden-cheeked Warbler, and Southwestern Willow Flycatcher could benefit from Brown-headed and Bronzed Cowbird control where their nests were significantly parasitized by the cowbirds. The Interior Least Tern would benefit from the control of predatory and scavenging birds such as gulls if they were nesting near an airport where gulls were being controlled. Additionally, if a species were accidentally hazed from an air operating area or a toxic spill such as oil where they could potentially be struck by aircraft or succumb to the effects of a toxic spill, they would benefit by moving away from that site. However, WS would consult with USFWS if it was known that there was a potential to impact a T&E species, even if the species would benefit from the activity.

2.1.2.2 State Listed T&E Species. TPWD (2012b) lists animals that are considered T&E species. This list contains most federally listed species. It also lists additional species considered threatened or endangered in Texas, but not their entire range as these are not listed federally. The TPWD list has, in addition to the federal list, 7 mammals, 11 marine mammals, 18 birds, 18 reptiles, 9 amphibians, 11 fish, and 16 invertebrates. As the same for federally listed species, BDM will have no effect on listed marine mammals, reptiles, amphibians, fish, and invertebrates. Of the 7 additional mammals (Table 6), the 3 species of bats could potentially be impacted with the use of mist nets. Mist nets used after dusk and before dawn during BDM in the range of these 3 species have the potential to capture a bat. However, WS has not used mist nets in the range of the 3 bats (east and south Texas, and the Big Bend area), uses them minimally, puts them up after dawn, and removes them before dusk. Thus, WS anticipates that none of these species will be taken.

TPWD (2012b) lists an additional 18 species of birds not on the federal list (Table 5). Of these, BDM will have no impact on 7 of them. The remaining 11 species could all be inadvertently impacted by the use of frightening devices. However, it is anticipated that the effect of frightening devices would be minimal, if at all, and temporary. The use of raptor traps, primarily used at airports to reduce raptor hazards to aircraft, could accidentally take 3 species on the list. However, even if a Bald Eagle, White-tailed Hawk, or Zone-tailed Hawk were taken accidentally, they would more likely be relocated, which as discussed would be to their benefit to reduce the likelihood of them being struck. Thus, WS believes that at most, any impact to Texas listed T&E species would be minimal and temporary.

2.1.2.3 Sensitive Species. WS also monitors potential impact to USFWS (2008) and NAS (2007) species of management concern (see Appendix C for list). Of the 135 additional species listed, some could have the potential of being taken lethally where they were nontargets. These species will be analyzed to determine the potential for impact on them in Section 4.1.3. However, most of these species, if not targeted, have minimal chance to be taken lethally.

2.1.3 Effects of BDM on Public and Pet Safety and the Environment

TWSP uses a variety of methods in BDM, but includes SOPs to reduce potential safety impacts to the public and the environment. TWSP relies on its Specialists to use their professional judgment to determine the most effective methods to use in a given bird damage situation, while having minimal, if any, impact to people, pets, and the environment. TWSP Specialists are professionally trained to use BDM techniques, especially with those techniques that have the potential to impact themselves, the public, and the environment. Several BDM methods have the potential to be hazardous including firearms, pyrotechnics, and avicides. Chapter 3 lists measures that TWSP implements to reduce potential problems.

Some individuals have expressed concerns that they believe that chemical BDM methods and pyrotechnics could adversely affect people and pets from direct exposure or indirectly from birds that have died from chemical use. Under the proposed alternatives in this EA, the avicides that TWSP could use are DRC-1339, an avicide used to remove damaging feral pigeons, starlings, crows, blackbirds, and gulls, and Avitrol for House Sparrows, blackbirds, and feral pigeons. TWSP would also use Sodium Lauryl Sulfate, a wetting agent, to manage starlings and blackbirds. SLS is a surfactant commonly used in soap products. Chemical repellents that could be used under the proposed action include methyl-anthranilate (MA), an artificial grape flavoring used in the food industry that repels many bird species and polybutene products which are bird repellents that have a tactile, sticky consistency to touch and are applied directly to problem locations to prevent birds such as feral pigeons from perching. Avicides and chemical repellents are regulated under FIFRA and Texas pesticide laws by EPA and TDA, and applied by WS under their management and in accordance with labeling and WS Directives. TWSP applicators are certified by the State and must complete a written examination and undergo recurrent training. Other chemical methods that could be used are the tranquilizer anesthetic A-C, used to capture waterfowl and a wide variety of other species, and euthanizing drugs such as Fatal Plus®. These drugs are regulated by FDA under the Food, Drug, and Cosmetic Act and WS policy. TWSP would also use pyrotechnic cartridges fired from 15mm pistols and 12 gauge shotguns. TWSP used an annual average of about 0.6 ounces of A-C, 3.4 pounds of DRC-1339, 3.9 pounds of Avitrol grain baits (0.1 pounds active ingredient – 4-amino-pyridine), 81 pounds of deltamethrin (an insecticide), and 8 gallons of sodium lauryl sulfate. Additionally, TWSP personnel fired an average of 2,622 pyrotechnics from FY07 to FY11 (Table 7). This is a minimal use of chemicals and pyrotechnics. A formal risk assessment of WS methods concluded low risks to humans (USDA 1997, Appendix P) including BDM methods used by TWSP such as toxicants, repellents, immobilization drugs, firearms, pyrotechnics, and traps.

Table 7. Chemicals and pyrotechnics used by TWSP in BDM from FY07 to FY11. Alpha-chloralose, an immobilization drug, was used and has been regulated under FDA (an average of 40 mg/tablet was used to calculate total where tablet size unknown – comes in 3 formulations of 20, 40, 60 mgs). . Two avian toxicants, DRC-1339 and Avitrol, were used by TWSP and are registered for use by EPA. An avian wetting agent, sodium laurel sulfate, was used at a starling/blackbird roost adjacent to an airfield. Finally, an insecticide was used at an airport to reduce available feed on the airfield. WS did not use any chemical repellents from FY07 to FY11

Chemical/Pyrotechnics	FY07	FY08	FY09	FY10	FY11	Aver.
Alpha-chloralose (oz.)	0.15	1.56	0.34	0.45	0.63	0.62
DRC-1339 (oz.)	64.2	30.5	57.3	75.1	46.8	54.8
Avitrol Grain Baits (oz.)	36	142	112	21.2	0	62
Deltamethrin (lbs.)	0	0	0	203	201	81
Sodium Laurel Sulfate (gal)	0	0	40	0	0	8
Pyrotechnics (ea.)	2,848	4,207	997	1862	3194	2,622

Some people may be concerned that TWSP's use of firearms and pyrotechnic bird scaring devices could cause injuries to people. TWSP personnel occasionally use small caliber firearms or air rifles and shotguns to remove feral domestic pigeons and other birds that are causing damage, and would continue to use such firearms in bird damage situations. WS policy has requirements for training, safe use, storage and transportation of firearms as prescribed by the WS Firearms Safety Training Manual (WS Directive

2.615). The required firearms training is conducted biennially by certified instructors. Hands-on firearms proficiency is evaluated in the field and candidates must pass a written exam. Therefore, firearms are handled in a safe manner with consideration given to the proper firearm to be utilized, the target density, backstop, and unique field conditions. Pyrotechnics often emit sparks when launched, creating some potential fire hazard to private property from field use. Prior to the implementation of formalized training standards, other states reported incidents where small fires were started from the use of pyrotechnics in the field. Pyrotechnics storage, transportation, and use are regulated by the Alcohol, Tobacco and Firearms Bureau, Department of Transportation, and WS policy respectively. WS requires adherence to all federal, state, and local laws. Pyrotechnics on-hand are less than 50 lbs. in total weight; that, along with industry approved packaging of the materials allow TWSP's pyrotechnics to be classified as Division 1.4 (formally known as Class C), the lowest classification of explosive materials as defined by the Alcohol, Tobacco and Firearms Bureau. Pyrotechnics are stored and transported in approved metal boxes. Training for pyrotechnics field use is also conducted and maintained under the WS Firearms Safety Training Manual guidelines.

On the other hand, public health and safety may be jeopardized by not having a full array of BDM methods for responding to complaints involving threats to human health and safety such as bird airstrike hazards and a disease outbreak. Many bird species such as raptors, gulls, and starlings represent a significant strike risk for aircraft at airports and are commonly struck (Dolbeer 2006). This can result in damage and injuries to people. Additionally disease, especially the potential for HP H5N1 AI, could be a significant threat to humans. Surveillance of this disease is being conducted in much of the United States in migratory birds to monitor for its presence. WS often uses several BDM methods to capture target animals, depending on the specifics of these types of situation. Firearms, traps, mist nets, chemical immobilization, or toxicants may be used to take a target bird. BDM methods that may pose a slight public safety risk may be used safely and effectively to eliminate or monitor for a recognized public safety risk.

One peripheral factor pertinent to assessing the risk of adverse effects of TWSP BDM activities is the potential for adverse effects from not having professional assistance from programs like TWSP available to private entities that express needs for such services. TWSP operates to assist individuals with damage from birds where a need exists. In the absence of a federal BDM program, or where restrictions prohibit the delivery of an effective program, it is most likely that BDM would be conducted by other entities such as private individuals. Private BDM activities are less likely to be as selective for target species, and less likely to be accountable. Additionally, private activities may include the use of unwise or illegal methods to control birds. For example, Great-tailed Grackles were illegally poisoned in Texas with dicrotophos (Mitchell et al. 1984) and a corporation in Kentucky was fined for illegally using carbofuran to destroy unwanted predators including raptors at a private hunting club (Porter 2004). Similarly, on a Georgia quail plantation, predatory birds were being killed by eggs that had been injected with carbofuran (the Federal Wildlife Officer 2000); in Oklahoma, Federal agents charged 31 individuals with illegally trapping and killing hawks and owls to protect fighting chickens (USFWS 2003b). TDA (2012) has a website and brochure devoted solely to preventing pesticide misuse in controlling agricultural pests. Similarly, the United Kingdom Department of Environment, Food, and Rural Affairs (2012) in Britain has a "Campaign against Illegally Poisoning of Animals." Therefore, TWSP believes that it is in the best interest of the public, pets, and the environment that a professional BDM program be available because private resource owners could elect to conduct their own control rather than use government services and simply out of frustration resort to inadvisable techniques (Treves and Naughton–Treves 2005).

2.1.4 Effects of BDM on Aesthetics

Some individual members or groups of wild and feral domestic bird species habituate and learn to live in close proximity to humans. Some people in these situations feed such birds or otherwise develop emotional attitudes toward such animals that result in aesthetic enjoyment. In addition, some people consider individual wild birds as “pets,” or exhibit affection toward these animals. Examples would be people who visit a city park to feed waterfowl or pigeons and homeowners who have bird feeders or bird houses. Other people do not develop emotional bonds with individual wild animals, but experience aesthetic enjoyment from observing them. Public reaction to BDM actions is variable because individual members of the public can have widely different attitudes toward wildlife. Some individuals that are negatively affected by wildlife support the removal or relocation of damaging wildlife. Other individuals affected by the same wildlife may oppose removal or relocation. Individuals unaffected by wildlife damage may be supportive, neutral, or opposed to wildlife removal depending on their individual personal views and attitudes.

Some people do not believe that birds such as nesting Canada Geese or nuisance egret, blackbird, or starling roosts should even be harassed to stop or reduce damage problems. They are concerned that their ability to view migratory birds is lessened by TWSP nonlethal harassment or relocation activities and lethal control projects. The public’s ability to view wild birds in a particular area may be more limited if the wildlife were removed or relocated from a specific site. However, if the program is successful and birds could no longer be found at a project site, the opportunity to view or feed wildlife is typically available at other parks or areas with adequate habitat and local populations of the species of interest.

Property owners that have pigeons roosting or nesting on their buildings or waterfowl grazing on turf areas are generally concerned about the negative aesthetic appearance of bird droppings and the damage to their buildings, turf, or other property. Business owners generally are particularly concerned because negative aesthetics can result in lost business. Costs associated with property damage include labor and disinfectants to clean and sanitize fecal droppings, implementation of nonlethal wildlife management methods, loss of property use, loss of aesthetic value of flowers, gardens, and lawns consumed by birds such as geese, loss of customers or visitors irritated by the odor of or having to walk on fecal droppings, repair of golf greens, replacing grazed turf, and loss of time contacting local health departments and wildlife management agencies on health and safety issues.

Wildlife biologists often find that domestic waterfowl will hybridize with wild waterfowl, thereby, diluting the wild strain genes. The hybrids are often looked at by wildlife biologists and others as aesthetically and biologically displeasing because they are not the wild form.

2.1.5 Issues that Were Analyzed in Prior WS EAs (WS 1998, 1999, 2001) that Will Not Receive Detailed Analysis under the Alternatives in This EA, but Some Background Information Will Be Discussed

In addition to the above issues, several other issues have been identified and analyzed thoroughly in the previous WS EAs (e.g., WS 1998, 1999, and 2001) and their analyses would be almost identical in this EA. These will not be considered further. The environmental consequences of these issues were found to have the least impacts under the current program alternative, the same in this EA except this EA is being considered at the statewide level for all bird species found in Texas. Even though these issues are not analyzed in this EA, the issue of humaneness will still be considered in determining SOPs to minimize potential impacts. Following are two issues that will not receive detailed analysis, except in the development of SOPs.

2.1.5.1 Selectivity and Humaneness of BDM Methods. Selectivity of BDM methods is related to the issue of humaneness in that greater selectivity results in less perceived suffering of nontarget animals.

The selectivity of each method is based, in part, on the skill and discretion of the TWSP Specialist in applying such methods and on specific measures and modifications designed to reduce or minimize nontarget captures. The humaneness of a given BDM method is based on the human perception of the pain or anxiety caused to the animal by the method. How each method is perceived often differs, depending on the person's familiarity and perception of the issue as discussed in Section 2.3.5. The selectivity and humaneness of each alternative are based on the methods employed and who employs them under the different alternatives. Schmidt and Brunson (1995) conducted a public attitude survey in which respondents were asked to rate a variety of WDM methods on humaneness (1=not humane, 5= humane) based on their individual perceptions of the methods. Their survey found that the public believes that nonlethal methods such as animal husbandry, fences, and scare devices were the most humane and the use of traps, snares, and aerial hunting was the least humane. The previous bird EA for Texas (WS 1998) and many other WS EAs (WS 1996, 2001, 2006, 2008, 2009) have discussed how selective each of the methods used in Texas to take target animals was and information on their humaneness.

In comparison, under the No Federal Program Alternative, the federal portion of TWSP would not employ methods viewed by some as inhumane and, thus, have no program effect on humaneness. TWPD, TDA, or other agency would probably still provide some level of hands on professional BDM assistance, but without federal supervision. They would continue to use the BDM methods considered inhumane by some, but likely at lower levels. The state personnel would not receive training from federal sources nor would the program benefit from federal research focused on improved humaneness, selectivity, and nonlethal methods. Private individuals that have experienced resource losses, but are no longer provided professional assistance from TWSP, could conduct lethal BDM on their own. Use of Avitrol, traps, and shooting by private individuals would probably increase. This could result in less experienced persons implementing BDM methods such as traps without appropriate modifications to reduce stress of the target animal and take of nontarget animals. Greater take or suffering of both nontarget and target wildlife would likely be the result. Therefore, it was concluded that the No Federal Program Alternative would result in the highest potential for negative effects from BDM (WS 1998, 1999, 2001). Additionally, it is hypothetically possible that frustration caused by the inability of resource owners to reduce losses could lead to the illegal use of chemical toxicants. The illegal use of toxicants could also result in increased animal suffering.

BDM conducted by private individuals would probably be less humane than BDM conducted under the auspices of a federal BDM program. TWSP is accountable to public input and humane interest groups that often focus their attention and opposition on BDM activities employed by TWSP. BDM methods used by private individuals may be more clandestine, and in particular, those that are used illegally. Members of the public that perceive some BDM methods as inhumane would be less aware of BDM activities being conducted by private individuals because private individuals would not be required to provide information under mandatory policies or regulations similar to those applied to TWSP. Thus, the perception of inhumane activities could be reduced, although the actual occurrence of BDM and associated inhumane activities may increase.

The No Federal Program Alternative would likely result in more negative impacts with regard to humaneness than the current program. The other alternatives analyzed in this EA were also analyzed in prior WS environmental documents (WS 1998, 1999, 2001) and found to lie between the Current Program and No Federal Program Alternatives. These will not be discussed further. However, humaneness is a concern of TWSP and is a criteria used to help determine the appropriate SOPs to maximize method selectivity and humaneness. The current program conducted by TWSP has taken minimal numbers of nontarget species from FY04 to FY08, with most of these being targeted, but unintentionally killed during the project (they were to be relocated). Thus, WS's SOPs have been very effective at minimizing the take of nontargets.

2.1.5.2 Effects of BDM on Water Quality and Wetlands. Two issues arose regarding water quality and wetlands in WS EAs (WS 1999, 2001) that were believed to be impacted by BDM targeting blackbirds at feedlots and other locations with avicides. Some discussion is provided here to ensure the reader that these issues have been considered.

Potential for BDM Chemicals to Affect Aquatic Organisms from Runoff. An issue that was raised during interagency discussions while working on previous WS EAs (WS 1999, 2001) that WS has the potential to affect water quality to the point that adverse effects on humans or aquatic organisms could occur from the use of DRC-1339. This issue overlaps with "effects on human health" identified in section 2.1.3. Under the current TWSP BDM program, TWSP would use DRC-1339 in accordance with EPA-approved label directions. USDA (1997, Appendix P) contains information pertinent for analyzing the potential for effects on water quality from use of this chemical and is incorporated by reference. This chemical is very soluble in water (one liter can dissolve 91 grams). Based on its solubility, the appearance is such that DRC-1339 has a high potential to be transported from sites where it is used. However, DRC-1339 degrades rapidly under both aerobic and anaerobic conditions in soils with a half-life of less than two days. This degradation process diminishes concentrations before the chemical migrates to groundwater or off-site surface water areas. Continued degradation would be more than 90% degraded within about one week based on a half-life of two days.

Available information suggests DRC-1339 has low potential for aquatic and invertebrate toxicity (USDA 1997, Appendix P). Aquatic toxicity of DRC-1339 to water fleas occurred at 1.6 mg/L (Marking and Chandler 1981, Blasberg and Herzog 1991). The majority of LC_{50} (lethal concentration of a chemical in water in mg/L that is expected to kill 50 percent of the test subjects of a given species) values ranged from 6 to 18 mg/L for such species as glass shrimp, snails, crayfish, and Asiatic clams (Marking and Chandler 1981). LC_{50} values for bluegill and catfish ranged from 21 to 38 mg/L (USDA 1997, Appendix P). The greatest quantity that might be used by TWSP at an individual site at any one time is expected to be 16 ounces (454g). If all of the 16 ounces of chemical was transported off site and made it to surface or ground water, the water supply would have to be no more than 75,000 gallons in size to present a 50% lethal hazard to water fleas, no more than 6,700 to 20,000 gallons in size to present such a hazard to other invertebrates, or no more than 3,200 to 5,700 gallons to present such a hazard to bluegills or catfish. Put in perspective, 75,000 gallons is equivalent to a pond that is about 65 feet across and averages only 3 feet deep. These water volumes are much smaller than are likely to be encountered in streams or lakes in the area, and, undoubtedly, only a tiny fraction of the ground-water supply in the area. Because treated bait material is not applied unless target birds are already taking a similar amount of untreated bait, it is highly unlikely that much, if any, of the chemical would be left on the ground where it would be subjected to off-site transport by rainfall. The risk is further mitigated by the fact that the chemical degrades rapidly as discussed above. USDA (1997, Appendix P) concluded no probable risk to aquatic organisms. This analysis further indicates that the low quantities used at any one site, rapid degradation, and dilution factors act together to virtually eliminate any potential for hazard to humans or aquatic organisms due to possible run-off or ground water. Therefore, WS concluded in a previous EA (WS 1999, 2001) that the use of DRC-1339 would not cause runoff problems or affect aquatic organisms. From FY07 to FY11, TWSP used an average of 3.4 pounds of DRC-1339 statewide which is a low use of the chemical and therefore, TWSP concludes that the current use of DRC-1339 is minimal and will not cause runoff problems or affect aquatic organisms.

The other primary chemical used by TWSP, Avitrol, is used minimally (aver. 0.1 pounds. active ingredient from FY07 to FY11) and, thus, would not likely cause problems under the current program, especially used according to label directions. Avitrol is available as a prepared grain bait mixture that is mixed in with clean bait at a no greater than 1:9 treated to untreated mixture of bait kernels or particles. Several factors virtually eliminate health risks to members of the public or to water quality from the use of this product as an avicide:

- It is readily broken down or metabolized into removable compounds that are excreted in urine in the target species (Extension Toxicology Network 1996). Therefore, little of the chemical remains in killed birds to pose contamination risks to water supplies.

- Although Avitrol has not been specifically tested as a cancer-causing agent, the chemical was not found to be mutagenic in bacterial organisms (EPA 2012). Therefore, the best scientific information available indicates it is not a carcinogen. Regardless, however, the controlled and limited circumstances in which Avitrol is used would prevent exposure of members of the public to this chemical or contamination of water supplies.

- Since Avitrol is commercially available, it has already undergone extensive governmental environmental review for potential water quality impacts.

However, this chemical would likely be used much more by private individuals under the other alternatives because it would be the only legal avicide available. Therefore, it can be concluded that the current program would have the least risk. Additionally, TWSP uses Avitrol according to the label, and therefore, concludes that its use poses no or minimal risks, at most, to aquatic sites and organisms.

Potential to Cause Accelerated Eutrophication of Wetland Areas. This latter concern is based on the possibility that carcasses of birds killed by lethal control with DRC-1339 might significantly increase nutrients in marsh roosting areas, resulting in accelerated eutrophication. Eutrophication is the natural process by which lakes and ponds become more productive in terms of the amount of life (i.e., "biomass') they can support. If this process is accelerated by man-caused activities that increase nutrients in an aquatic ecosystem, the increased amount of plant material that is produced as a result may lead to increases in decomposition of organic material which can reduce oxygen content in the water and lead to loss of certain species in the area or changes in species composition. Major nutrients that contribute to plant production (and thus, potentially, eutrophication) in freshwater ecosystems are nitrogen, carbon, phosphorus, and potassium (Cole 1975). Thus, the amount of these nutrients was compared under no control with droppings from birds being deposited in the marshes where birds roosted and control with carcasses falling into the marshes. WS (2001) analyzed the differences in nutrients for the potential take of up to 3 million starlings and 1 million blackbirds. It was determined that there would be little difference in the amount of nutrient deposited in wetlands from bird droppings under no control to weight of birds with control using DRC-1339, except that nitrogen would likely be much more under no control. TWSP in Texas anticipates that up to 4,000,000 starlings and blackbirds could be killed by use of DRC-1339 (currently the take is less than 1 million). WS (2001) determined that accelerated eutrophication would not be expected to occur from BDM activities at this level. Thus, this issue will not be considered further.

2.2 CONSIDERATIONS USED TO DEVELOP WS SOPs FOR BDM

2.2.1 Effects on Target Bird Species Populations

TWSP take is analyzed in Section 4.1.1.1 and would annually monitor target bird take in BDM to determine if take remains within the range analyzed by this EA. Thus far, TWSP has not exceeded a significant level of take for any bird species which was analyzed for blackbirds and starlings as analyzed in the prior EA (WS 1998). Actually, take has not exceeded the level of take analyzed in the EA (WS 1998). However, all bird species taken in BDM are being considered in this EA and bird populations and abundance can change, and, therefore, their populations along with applicable sport harvest, considering cumulative impacts, would be considered and monitored annually. TWSP SOPs, discussed in Section 3.4, ensure that the take of birds remains below a sustainable harvest, unless the managing agency has different management goals.

2.2.2 Effects on Nontarget Species Populations, Including T&E Species

Special efforts are made to avoid taking nontargets during BDM or jeopardizing T&E species. The selectivity of BDM methods has been improving through the years, and much credit goes to WS' National Wildlife Research Center (NWRC). Improved cage traps, baits, hazing techniques, and other BDM tools and the development of new methods such as lasers have helped TWSP Specialists be more efficient and effective at focusing efforts on target species while minimizing take of nontarget species. T&E species are avoided by conducting biological evaluations of the potential effects and the establishment of special restrictions or measures to reduce the potential for take, and consultation with USFWS and TDWP biologists. TWSP SOPs include measures intended to reduce the effects of BDM on nontarget species populations, especially T&E species, and are presented in Section 3.4.

2.2.3 Effects on Public and Pet Safety and the Environment

TWSP Specialists have SOPs to reduce potential safety impacts from BDM to the public, pets, and the environment. TWSP relies on its Specialists to use their professional judgment to determine the most effective methods to use in a given bird damage situation, while having minimal, if any, impact to people, pets, and the environment. TWSP Specialists are professionally trained to use BDM techniques, especially those that could have the potential to impact themselves, the public, and the environment. Several BDM methods have the potential to be hazardous including firearms, pyrotechnics, and avicides. Measures to reduce potential problems are given in Chapter 3. TWSP has not had any known impacts from BDM on the public, pets, or the environment from FY04 to FY08.

As discussed in Section 2.1.3, a peripheral factor pertinent to assessing the risk of adverse effects of TWSP BDM activities is the potential for adverse effects from not having professional assistance from programs like TWSP available to private entities that express needs for such services. TWSP operates to assist individuals with damage from birds where a need exists. In the absence of a program, or where restrictions prohibit the delivery of an effective program, it is most likely that BDM would be conducted by other entities such as State agencies and private individuals. Private BDM activities are less likely to be as selective for target species, and less likely to be accountable. Additionally, private activities may include the use of unwise or illegal methods to control birds. Therefore, TWSP believes that it is in the best interest of the public, pets, and the environment that a professional BDM program be available because private resource owners could elect to conduct their own control rather than use government services and simply out of frustration resort to inadvisable techniques (Treves and Naughton-Treves 2005).

2.2.4 Effects of BDM on Aesthetics

Under the proposed action, TWSP would kill what some people would perceive to be a large number of birds. Some people enjoy seeing birds, and, if so, might feel their interests were being harmed. However, the population impacts analysis in Section 4.1.1 indicates the overall populations of birds are not being significantly affected, which means opportunities to view these species would continue to exist.

TWSP's experience has generally been that, whereas many people perceive some pleasure or enjoyment at seeing relatively small concentrations of birds, most people directly affected by birds, especially large wintering concentrations, perceive them as an annoyance or a health hazard. Reductions in large wintering concentrations of birds such as starlings or local populations of feral pigeons would be viewed by those people as an aesthetic improvement. Concentrations of roosting birds have resulted in calls to the TWSP office in Texas concerning nuisance noise, odor, and fecal contamination. Some towns in Texas have had active harassment programs in order to move birds from urban areas.

It is possible that some birds killed with DRC-1339, due to its slow action, would die in nighttime roost sites in trees or wooded areas near to or in urban or suburban areas. This has been known to happen. Also, some birds might die en route to nighttime roost sites with DRC-1339 use, despite the tendency for most birds to die at their nighttime roost sites, and be visible to passersby. This would be particularly noticeable if they fall onto snow covered areas where the black bodies would contrast sharply with the white snow. If this occurs, some people might perceive these numbers of dead birds to be aesthetically displeasing. TWSP would plan to mitigate this effect by retrieving visible dead birds following baiting operations, or by requiring facility managers to provide personnel to pick up visible dead birds as a condition of receiving TWSP operational service. However, this depends on receiving permission to trespass by property owners.

Measures and policies are in place to help minimize the effects of TWSP activities on aesthetics as much as possible. TWSP personnel post signs in prominent places to alert the public that BDM tools are set in an area and this would allow the public offended by BDM activities to avoid these areas. On private lands, the cooperators or landowners are aware that BDM methods are set and can alert guests using the property of their presence. Landowners determine the areas and timing of equipment placement, thereby avoiding conflicts with the public, especially those that would find BDM aesthetically displeasing. For public lands, TWSP abides by all applicable laws and regulations regarding the use of different BDM methods. TWSP coordinates with the different land management agencies to determine high-use public areas and times of the year. TWSP limits conducting BDM in high-use public areas or limits the BDM methods used to minimize potential problems with those people that find BDM aesthetically displeasing.

2.2.5 Humaneness of Methods Used by TWSP

The issue of humaneness and animal welfare as it relates to killing or capturing wildlife is an important and very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate pest damage management for societal benefits could be compatible with animal welfare concerns if "*. . . the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process.*" Suffering is described as a "*. . . highly unpleasant emotional response usually associated with pain and distress.*" However, suffering "*. . . can occur without pain . . .*" and "*. . . pain can occur without suffering . . .*" (American Veterinary Medical Association 1987). Because suffering carries with it the implication of a time frame, a case could be made for "*. . . little or no suffering where death comes immediately . . .*" (California Department of Fish and Game 1991), such as with shooting. Defining pain as a component of humaneness and animal welfare in BDM methods used by TWSP appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain, and identifying the causes that elicit pain responses in humans would "*. . . probably be causes for pain in other animals . . .*" (American Veterinary Medical Association 1987). However, pain experienced by individual animals probably ranges from little or no pain to significant pain (California Department of Fish and Game 1991). Pain and suffering, as it relates to damage management methods, has both a professional and lay point of arbitration. Wildlife managers and the public would be better served to recognize the complexity of defining suffering since "*. . . neither medical nor veterinary curricula explicitly address suffering or its relief*" (California Department of Fish and Game 1991).

The American Veterinary Medical Association states, "*... euthanasia is the act of inducing humane death in an animal*" and "*... the technique should minimize any stress and anxiety experienced by the animal prior to unconsciousness.*" (Beaver et al. 2001). Some people would prefer accepted methods of euthanasia to be used when killing all animals, including wild and feral animals. The American Veterinary Medical Association states, "*For wild and feral animals, many of the recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but use terms such as killing, collecting or harvesting, recognizing that a distress-free death may not be possible.*" (Beaver et al. 2001).

Some individuals and groups are opposed to some management actions of TWSP. TWSP personnel are experienced and professional in their use of management methods. This experience and professionalism allows TWSP personnel to use equipment and techniques that are as humane as possible within the constraints of current technology. Professional BDM activities are often more humane than nature itself (i.e., death from starvation) because these activities can produce quicker deaths that cause less suffering. Research suggests that with some methods, such as restraint in leghold traps, changes in the blood chemistry of trapped animals indicate "stress." Blood measurements indicated similar changes in foxes that had been chased by dogs for about five minutes as those restrained in traps. However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness. People concerned with animal welfare often express that they would like to see animal suffering minimized as much as possible and that unnecessary suffering be eliminated. The interpretation of what is unnecessary suffering is the point to debate (Schmidt 1989).

Humaneness, as perceived by the livestock industry and pet owners, requires that domestic animals be protected from predatory birds because humans have bred many of the natural defense capabilities out of domestic animals. It has been argued that man has a moral obligation to protect these animals from all predators. Predators frequently do not kill larger prey animals quickly, and will often begin feeding on them while they are still alive and conscious (Wade and Bowns 1982). The suffering apparently endured by livestock and pets damaged in this manner is unacceptable to many people.

Thus, the decision-making process involves tradeoffs between the above aspects of pain and humaneness. Objective SOPs to minimize impacts from this issue must consider not only the welfare of wild animals, but also the welfare of humans and domestic animals if damage management methods were not used. Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal. People may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering within the constraints imposed by current technology and funding.

WS has improved the selectivity of management devices through research and development for the use of padded jaw pole traps with pan-tension devices and other modifications, lights for deterring birds from airplanes while in flight, immunocontraception drugs to reduce fertility of overabundant species, and chemical immobilization/euthanasia procedures that minimize pain. Research continues to improve selectivity, practicality, and humaneness of management devices. Until new findings and products are found to be practical, a certain amount of animal suffering will occur if BDM objectives are to be met in those situations where nonlethal BDM methods are ineffective or impractical. Furthermore, if it were possible to quantify suffering, it is possible that the actual net amount of animal suffering would be less under the proposed action (or any other alternative involving the use of lethal methods) than under the No Federal BDM Alternative since suffering experienced by domestic animals preyed upon by predators is reduced if BDM is successful in abating predation. Measures to reduce pain and stress in animals and SOPs used to maximize humaneness are listed in Chapter 3.

2.3 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

In addition to the above issues, several other issues have been raised that warrant discussion, but not consideration in the analysis. Several of these issues have been discussed in other WS environmental documents (WS 1998, 1999, 2001) and found that they would not have an effect on the decision, as rationalized. These issues would have the same discussion in this EA. No new information has arisen that would change the analysis provided in these other EAs or suggest a need for their inclusion here in the issues considered in the comparison of alternatives. Below is a synopsis of issues that have been considered and rationale for why they are not included in the analyses in Chapter 4.

2.3.1 Appropriateness of Preparing an EA (Instead of an EIS) For Such a Large Area.

Some individuals might question whether preparing an EA for an area as large as Texas would meet the NEPA requirements for site specificity. WS' mission is to manage damage caused by wildlife, not overall wildlife populations. As an agency that exists to manage specific types of damage, TWSP can predict the types of locations or situations where damage is likely to occur. However, due to any number of variable circumstances, TWSP has no absolute control over when a request for BDM assistance will be received nor can TWSP predict specific individual times and locations of most bird damage situations. Therefore, TWSP must be ready and able to provide assistance on short notice about anywhere in Texas to protect any resource. The missions of other federal and state wildlife management agencies generally concentrate on management for wildlife abundance and are not equipped or prepared to prevent bird damage problems without resorting to extreme and extensive population management strategies that, in most cases, would be neither prudent nor affordable. Given the numbers of birds, past experiences, and program activity monitoring, TWSP believes this EA addresses most potential needs and issues associated with providing BDM at any given location in Texas. It should be noted that MIS data shows that WS works on less than 5% of the analysis area, thus the majority of the state has no BDM. This is reflective of the need and the requests for assistance involving birds, and available manpower to conduct operational BDM.

If a determination is made through this EA that the proposed action would have a significant environmental impact, then an EIS would be prepared. In terms of considering cumulative impacts, one EA analyzing impacts for the entire State may provide a better analysis than multiple EA's covering smaller zones, especially considering the mobility of birds and impacts on their populations.

2.3.2 Effects from the Use of Lead in Ammunition

TWSP uses nontoxic shot (e.g., steel and bismuth) and lead shot, bullets, and pellets for ground-based shooting. TWSP uses nontoxic shot for all migratory birds shot under the authority of a permit issued by USFWS and in areas where there is a potential risk to T&E or sensitive species such as Bald Eagles. In general, sport hunting using rifles or shotguns, which would be similar in nature to ground-based shooting by TWSP with regard to dispersal of lead shot, tends to spread lead over wide areas and at low concentrations (Craig et al. 1999). The primary concerns raised thus far about sport hunting and lead shot contamination have been focused on aquatic areas where waterfowl hunting occurs, and the feeding habits of many species of waterfowl that result in them picking up and ingesting shot from the bottoms of ponds, lakes, and marshes. Shooting of lead shot in dry land upland areas has not raised similar levels of concern except where such activities are more intensively concentrated such as those which can occur with dove hunting at harvested crop fields and with game bird hunting at "shooting preserves" (Kendall et al. 1996). In an ecological risk assessment of lead shot exposure in non-waterfowl bird species, ingestion of lead shot was identified as the exposure mode of concern rather than just contact with lead shot or lead leaching from lead shot distributed in the environment (Kendall et al. 1996). Shots fired during WDM activities in Texas are scattered in distribution over relatively wide areas in mostly uninhabited locations where contact with humans or ingestion by birds picking up grit to aid in digestion of food are highly unlikely.

The amount of lead deposited on the landscape from the firing of shotguns and rifles during WDM is very small since the amount of land area involved is huge. WS conducted WDM on an annual average of 19.8 million acres from FY06 to FY08[6] (total acres worked from FY06 to FY08 = 28.1 million acres) which includes all wildlife. TWSP uses firearms for many WDM activities in Texas including ground-based, aerial, and harassment shooting, and shooting to euthanize animals caught in traps. TWSP uses steel shot

[6] TWSP had already analyzed the impact of lead for FY06 to FY08 so this data was used. The use of lead by TWSP was found to be an insignificant impact on the environment. Use of ammunition has remained similar, though less lead has been used because accurate nontoxic ammunition has become available.

or pellets to take birds listed on a migratory bird permit from USFWS, but the MIS does not track the type of shot or bullets used, lead or not lead. For the sake of analysis, we will look at the amount of lead from firearms as if all the bullets and shot were lead, even though we know that much of them are not. Additionally, the MIS does not track the number of shots fired. For the sake of analysis, we will calculate the amount of lead used by assuming that 3 shotgun shells are shot (1.2 oz. lead each) for every bird shot (most pigeons and other small birds are taken with pellets from air rifles which would be much less lead) and every mammal killed in aerial hunting, that 2 bullets (0.25 oz. lead ea. (110 grain bullet aver.)) are fired for every mammal killed by ground-shooting, that one .22 caliber round (0.1 oz.) is shot to euthanize animals in cage and leghold traps and snares (snares are most often lethal), and 5 shotgun shells are fired for every harassment shooting work task. From FY 06 to FY08, TWSP averaged 17,147 mammals taken in aerial hunting and birds taken with firearms, 5,770 mammals taken with ground-based shooting, 11,435 animals taken in traps and snares, and 350 work tasks involving harassment shooting. With the above information, it could be estimated that TWSP deposits 4,200 pounds of lead annually over 19.8 million acres, but again this is considered conservative for many reasons. TWSP personnel do not likely shoot as many times as suggested, the bullets used are likely smaller number of grains, nontoxic shot is used for most all bird work, and most carcasses shot are retrieved and disposed of according to WS Policy in areas where they are not available for avian scavengers, the species of most concern with lead use. However, even considering the conservative nature of the estimation, this would amount to 2.2 ounces of lead deposited per square mile.

The estimated lead use by TWSP, 2.2 ounces of lead over one square mile (97 mg/acre), is considered very minimal. TWSP shooting for all wildlife species taken (including mammals and a few reptiles) or hazed (harassment shooting) in WDM occurs on small proportion of the land area in Texas. The average (FY06-FY08) area worked by TWSP was about 11.5% of the land area of Texas. The land area of exposure to shots fired is still relatively large in relation to the amount of shot distributed. Even though this is a small amount, to address even the most extremely unrealistic concerns raised regarding this issue, we have looked at the following detailed scientific facts and data related to any potential exposure of lead resulting from the lead shot used by TWSP in all WDM activities. It should be noted that hunting is not allowed on much of lands under agreement where TWSP conducts WDM (e.g., airports and feedlots), thus cumulative impacts on these lands would not include upland game hunting (nontoxic shot is required for waterfowl hunting). In comparison, and cumulatively, TPWD estimated that hunters harvested about 500,000 big game (white-tailed and mule deer, and javelina) and 9 million upland game (doves, quail, pheasant, and turkey) (TPWD 2012a and c). Using the same formulas, hunters used 7.6 million pounds of lead for upland game and 16,000 pounds for big game. This equates to about 7.6 pounds per square mile in Texas.

The hazard standard set by EPA for lead concentrations in residential soils is 400 ppm (1 part per million is equivalent to 1 mg/kg or 0.0064 oz./lb.) in children's play areas, and 1,200 ppm on average for the rest of a residential yard[7]. We are unaware of any established standards for lead contamination of soil in remote rural areas of the kind where TWSP conducts much of its WDM activities in Texas, but it is reasonable to assume the guideline for residential areas would be more stringent than any such standard that might ever be established for rural areas. Laidlaw et al. (2005) reported that, because of the low mobility of lead in soil, all of the lead that accumulates on the surface layer of the soil is generally retained within the top 20 cm (about 8 inches). A representative average weight of soil is in the range of 110 lbs. (49.9 kg) per cubic foot (Environmental Working Group 2001). The number of cubic feet of soil in the top 8 inches of soil in one acre is about 29,000. Therefore, a reasonable estimate of the total weight of the top layer of soil per acre where spent lead shot should remain would be 3.2 million lbs. (110 x 29,000) or 1.5 million kg. If considered over the amount of land area involved in WDM in the State during a typical year, the amount of lead distributed from TWSP WDM activities would constitute an

[7] The EPA soil-lead hazard is bare soil on residential real property or on the property of a child occupied facility that contains total lead equal to or exceeding 400 parts per million (mg/g) in a play area or average of 1,200 parts per million of bare soil in the rest of the yard based on soil samples (40 CFR 745.65(c)).

average of about 1 mg/15,000 kg of soil. This is a small fraction, about 6 million times less than the concentration in the EPA hazard standards for children play area soils shown above. Soil uncontaminated by human activities generally contains lead levels up to about 50 ppm (or 50 mg/kg) (Agency for Toxic Substances and Disease Registry 2012). Assuming that the soils in the areas where TWSP conducts WDM have the upper limit of this baseline level, it would take an additional 350 mg/kg to reach the EPA hazard standard for children's playgrounds, and 1,150 mg/kg to reach the standard for other residential yard areas. It would take millions of years for enough lead to accumulate from shooting by TWSP to reach the EPA hazard standard for children's playgrounds. Cumulatively, hunters shooting 7.6 pounds of lead per acre equates to 2.3 mg/kg of soil or 170 times less than the hazard level set for playgrounds or 510 times less than the hazard set for residential areas. Thus, even cumulatively, the level of lead, assuming all shot and bullets are lead and nontoxic varieties, it would take hundreds of years of shooting to reach the standard set by EPA for hazardous.

A remaining question is whether lead shot deposited in remote areas by TWSP might lead to contamination of water, either ground water or surface water via runoff that occurs during or following rainfall or melting snow cover. Stansley et al. (1992) found that lead did not appear to "transport" readily in surface water when soils are neutral or slightly alkaline in pH (i.e., not acidic), but that it will transport more readily under slightly acidic conditions. In their study, they looked at lead levels in water that was subjected directly to high concentrations of lead shot accumulation because of intensive target shooting at several shooting ranges. Although they detected elevated lead levels in water in a stream and a marsh that were in the shot "fall zones", they did not find higher lead levels in a lake into which the stream drained, except for one sample collected near a parking lot where it was believed the lead contamination was due to water runoff from the parking lot, and not from the shooting range areas. Their study indicated that even when lead shot is highly accumulated in areas with permanent water bodies present, the lead does not necessarily cause elevated lead contamination of water further downstream. They also reported that muscle samples from two species of fish collected in the water bodies with high lead shot accumulations had lead levels that were well below the accepted threshold standard of safety for human consumption (Stansley et al. 1992). Craig et al. (1999) reported that lead levels in water draining away from a shooting range with high accumulations of lead bullets in the soil of the impact areas were far below the EPA's "action level" (i.e., requiring action to treat the water to remove lead) of 15 ppb ("parts per billion"). They reported that the dissolution (i.e., capability of dissolving in water) of lead declines when lead oxides form on the surface areas of the spent bullets and fragments in the impact areas. This means "transport" of lead from bullets or shot distributed across the landscape is reduced once the bullets and shot from these crusty lead oxide deposits on their surfaces, which serves to naturally further reduce the potential for ground or surface water contamination. These studies suggest that, given the very low and highly scattered shot concentrations that occur from TWSP's WDM shooting activities, as well as most other forms of dry land small game hunting in general, lead contamination of water from such sources would be minimal to nonexistent. Based on the above analysis, we conclude that the amount of lead deposited by TWSP WDM operations is far below any level that would pose any risk to public health or of significant contamination of water supplies.

In a review of lead toxicity threats to the California Condor (*Gymnogyps californianus*), a species not found in Texas, the Center for Biological Diversity et al. (2004) concluded that lead deposits in soils, including those caused by target shooting by the military at shooting ranges on military reservations used by condors, did not pose significant threats to the condor. The concern was that lead might bio-accumulate in herbivores that fed on plants that might uptake the lead from the soil where the target ranges were located. However, Center for Biological Diversity et al. (2004) reported blood samples from condors that foraged at the military reservation where the target shooting occurred did not show elevated lead levels, and, in fact showed lower lead levels than samples from condors using other areas. Because lead deposited by TWSP's WDM activities is widely scattered in comparison to military shooting ranges, it is clear that, despite valid concerns about other sources of lead toxicity in the environment, lead deposited onto the landscape by TWSP should not cause any significant impacts on wildlife, nor should it contribute in any significant way to cumulative impacts from other sources of lead shot deposited by sport hunting. However, there appears to be a growing body of evidence that lead bullets and shot remaining in carcasses of animals that are shot but not removed from the landscape can pose lead toxicity problems for scavenging California Condors (Center for Biological Diversity et al. 2004). These concerns have also arisen regarding lead poisoning from Bald Eagles scavenging predators that have been shot. TWSP has tried various nontoxic (non-lead) shot loads to reduce the concern of lead poisoning, and continues to move in this direction as new nontoxic ammunition is developed that is effective for WDM. However, some evidence has shown that the threat of lead toxicity to eagles is not as severe as previously thought. Hayes (1993) reviewed literature and analyzed the hazard of lead shot to raptors, in particular eagles from aerial hunting by WS. Key findings of that review were:

- Eagles are known to scavenge on bird and mammal carcasses, particularly when other food sources are scarce or when food demands are increased.

- In studies that documented lead shot consumption by eagles (i.e., based on examining the contents of regurgitated pellets), the shot was associated with waterfowl, upland game bird, or rabbit remains, and was smaller than BB or #4 buckshot used in aerial hunting. Lead levels have been detected in eagle blood samples, but the source of the exposure was unknown. Lead residues have been documented in jackrabbits, voles (*Microtus sp.*), and ground squirrels which can explain how eagles could ingest lead from sources other than lead shot. In one study (Pattee et al. 1981), four of five captive Bald Eagles force fed uncoated lead shot died and the fifth went blind. Frenzel and Anthony (1989) suggested, however, that eagles usually reduce the amount of time that lead shot stays in their digestive systems by casting most of the shot along with other indigestible material. It appears that healthy eagles usually regurgitate lead shot in pellet castings which reduces the potential for lead to be absorbed into the blood stream (Pattee et al. 1981; Frenzel and Anthony 1989).

- WS personnel examined nine coyotes (*Canis latrans*) shot with copper plated BB shot to determine the numbers of shot retained by the carcasses. A total of 59 BBs was recovered, averaging 6.5 pellets per coyote. Of the 59 recovered pellets, 84% was amassed just under the surface of the hide opposite the side of the coyote that the shot entered, many exhibited minute cracks of the copper plating, and two shot pellets were split. The fired shot was weighed, compared with unfired shot, and found to have retained 96% of its original weight. Eagles generally peel back the hide from carcasses to consume muscle tissue. Because most shot retained by coyotes tends to end up just under the hide, it would most likely be discarded with the hide. Any shot consumed would most likely still have the nontoxic copper plating largely intact, reducing the exposure of the lead to the digestive system. These factors combined with the usual behavior of regurgitation of ingested lead shot indicate a low potential for toxic absorption of lead from feeding on coyotes killed by aerial hunting.

The above analysis indicates adverse effects on eagles from scavenging on animals killed in WDM are unlikely. The USFWS did not identify this as a concern in the 1992 BO (USFWS 1992) which covered potential adverse effects on Bald Eagles from all WS used WDM methods, including shooting. Bald Eagle populations appear to be increasing in the contiguous 48 states and have met or exceeded recovery goals in several states. Golden Eagle populations appear to be somewhat healthy, but show nonsignificant trends in the Breeding Bird Survey (BBS trend estimates for raptors are not as reliable because of small sample sizes). Breeding Bird Survey data indicate a general increasing trend in breeding populations of both Golden Eagles (nonsignificant at 0.1%/year) and Bald Eagles (significant at +5.5%/year) in North America from 1966 to 2010 (Sauer et al. 2011). However, researchers have suggested that the population may be declining in the West (Kochert et al. 2002, Good et al. 2007). Good et al. (2007) estimated the population of Golden Eagles in 4 Bird Conservation Regions including the northern half of Texas from aerial transects at 27,000 and hope to continue the surveys to determine the trend in the population (preliminary estimates suggest a decline). Thus, Bald Eagle populations do not appear to be adversely affected by lead toxicity problems. Some portion of the Golden Eagle population dies from lead poisoning which is believed to occur from eating hunter shot carcasses which were not retrieved. However, one study found that found that eagles were exposed to lead in the environment from unknown sources in the environment over extended periods of time (Kochert et al. 2002). To minimize exposure, TWSP retrieves shot carcasses where practical and disposes of them in areas where eagles and other scavengers such as hawks are not able to scavenge on them. In addition, TWSP uses nontoxic shot where eagles have been documented recently. In addition, no evidence has been brought forth to indicate that any animals killed during WDM by TWSP have resulted in any indirect lead poisoning of scavenging eagles or other animals.

2.3.3 Impacts of Hazing Programs on Livestock

Some individuals have raised concerns that noise from pyrotechnics used to harass birds could startle livestock and cause problems such as injuring themselves running through fences. Some dairy operators have voiced concerns that startling effects from sound-scare devices could adversely affect milk production. TWSP personnel, trained and experienced in using pyrotechnics, have noted that in their experience most animals habituate relatively easily and rapidly to noises from the pyrotechnics. However, personnel avoid shooting pyrotechnics near identified livestock facilities where operators have expressed concerns.

2.3.4 National Historic Preservation Act, American Indian, and Cultural Resource Concerns

NHPA requires federal agencies to evaluate the effects of any federal undertaking on cultural resources and determine whether they have concerns for cultural properties in these areas. In most cases as discussed in Section 1.7.2, WDM activities have little potential to cause adverse effects to sensitive historical and cultural resources. If a BDM activity with the potential to affect historic resources is planned under the selected alternative in the decision for this EA, then an individual site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary. The proposed action would not cause major ground disturbance, does not cause any physical destruction or damage to property, wildlife habitat, or landscapes, and does not involve the sale, lease, or transfer of ownership of any property. In general, the proposed methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. Harassment techniques that involve noise-making could have a primary effect that would be beneficial at the damage site. The use of these devices is usually short term and could be discontinued if a conflict arose with the use of historic property. Therefore, the BDM methods that TWSP would use under the proposed action are not the types of activities that would have the potential to affect historic properties.

The Native American Graves and Repatriation Act of 1990 provides protection of American Indian burial sites and establishes procedures for notifying Tribes of any new discoveries. Senate Bill 61, signed in 1992, sets similar requirements for burial protection and Tribal notification with respect to American Indian burials discovered on state and private lands. If a TWSP employee locates a burial site, the employee would notify the appropriate Tribe or official. TWSP only conducts BDM activities at the request of a Tribe or their lessee and, therefore, the Tribe should have ample opportunity to discuss cultural and archeological concerns with TWSP. However, in consideration of Texas' Native Americans, TWSP has included all of the recognized Tribes in Texas on the mailing list for this EA to solicit their comments.

2.3.5 Concerns that Killing Wildlife Represents "Irreparable Harm"

Public comments have raised the concern that the killing of any wildlife represents irreparable harm. Although an individual bird or multiple birds in a specific area may be killed by TWSP BDM activities, this does not in any way irreparably harm the continued existence of these species. Wildlife populations experience mortality from a variety of causes, including human harvest and depredation control, and have evolved reproductive capabilities to withstand considerable mortality by replacing lost individuals. Texas's historic and current populations of big game animals, game birds, furbearers and unprotected birds, which annually sustain harvests of thousands of animals as part of the existing human environment, are obvious testimony to the fact that the killing of wildlife does not cause irreparable harm. Populations of some of these species are in fact much higher today than they were several decades ago (e.g., Snow Geese, Canada Geese), in spite of liberal hunting seasons and the killing of hundreds or thousands of these animals annually. The legislated mission of USFWS and TPWD is to preserve, protect, and perpetuate all the wildlife in the United States and Texas. Therefore, USFWS and TPWD would be expected to regulate killing of protected wildlife species in the State to avoid irreparable harm. Our analysis, herein, shows that the native species TWSP takes in BDM will continue to sustain viable populations. Thus, losses due to human-caused mortality are not "irreparable."

2.3.6 Concerns that the Proposed Action May Be "Highly Controversial" and Its Effects May Be "Highly Uncertain," Both of Which Would Require That an EIS Be Prepared

The failure of any particular special interest group to agree with every act of a Federal agency does not create controversy and NEPA does not require the courts to resolve disagreements among various scientists as to the methodology used by an agency to carry out its mission (*Marsh vs. Oregon Natural Resource Council*, 490 U.S. 360, 378 (1989)[8]). As was noted in the previous Finding of No Significant Impact and Record of Decision for the prior EA (WS 1998), "*The effects on the quality of the human environment are not highly controversial.*" Although there is some opposition to BDM, this action is not highly controversial in terms of size, nature, or effect. If in fact a determination is made through this EA that the proposed action would have a significant environmental impact, then an EIS would be prepared.

2.3.7 Potential for Avian Cholera and Botulism to Result from Killing Starlings and Blackbirds

Concern has been expressed that if WS personnel kill blackbirds with DRC-1339 and the blackbirds subsequently die in wetland roosting areas, there would be an increased risk of avian botulism and avian cholera.

Avian Botulism. Avian botulism is a paralytic disease of birds resulting from ingestion of toxin produced by the bacterium, *Clostridium botulinum* (Rosen 1971, Locke and Friend 1987). Seven distinct types of botulism toxins, designated by the letters A through G, have been identified; waterfowl die-offs from botulism are usually caused by Type C toxin (Locke and Friend 1987). Many species of birds and some mammals are affected by Type C botulism in the wild. Waterfowl, shorebirds and gulls are most commonly affected and songbirds are only infrequently affected (Locke and Friend 1987). However, not enough is known about avian botulism to precisely identify the factors leading to an outbreak (Locke and Friend 1987). Many botulism outbreaks occur on the same wetland year after year, and within a wetland there may be localized "*hot spots*." Also, outbreaks often follow a fairly consistent and predictable time frame (Locke and Friend 1987).

Most outbreaks occur west of the Mississippi River usually during late summer from July through September. The *C. botulinum* bacterium persists in wetlands in a spore form that can persist for many seasons since it is resistant to heat and drying (Locke and Friend 1987). The primary factors that

[8] Court cases not given in Literature Cited section.

contribute to the onset and maintenance of avian botulism outbreaks include water quality, depth and fluctuations, rotting vegetation, presence of invertebrate and vertebrate carcasses, high fly populations, and high ambient temperatures (above 77F^{o}) (Rosen 1971, Locke and Friend 1987). Onset usually occurs following fluctuating water levels during the hot summer months which can produce high mortality in the invertebrate fauna and this in turn could initiate rapid bacterial growth and toxin production within the wetland. Once animals begin to die of the toxins, their carcasses are the source of further amplification in fly maggot-bird transmission cycles (Reed and Rocke 1992); a single waterfowl carcass can produce several thousand infected maggots. Consumption of just a few of these maggots can intoxicate a duck. Outbreaks generally occur from July through September. Management of the environmental conditions in the wetlands, especially water levels, and early and continuous clean-up and incineration of botulism-killed waterfowl carcasses are recommended to prevent and/or control avian botulism outbreaks (Locke and Friend 1987). In addition, the occurrence of carcass-maggot cycles of botulism is dependent on a number of factors in addition to the presence of carcasses with botulism spores, including: fly density, and environmental conditions that facilitate fly egg-laying, maggot development, and maggot dispersal from carcasses (Reed and Rocke 1992).

There is little information available on infection or mortality of songbirds, including blackbirds, from avian botulism, but songbirds are generally infrequently affected by this bacterial toxin (Locke and Friend 1987). If numbers of blackbird carcasses were added to a wetland in the winter as a result of BDM activities, it is unlikely that it would result in increased risk of avian botulism to the waterfowl present in the same wetlands in spring and summer. This is mainly because of the cold ambient temperatures and lack of sufficient flies to produce a bird-maggot amplification cycle during winter (Locke and Friend 1987). Most carcasses would be eliminated within a few days through consumption by scavengers or, when temperatures rose above freezing, by decomposition in a few days or a week. This should occur long before summer temperatures rise to levels needed for botulism outbreaks. Also, most of the blackbird carcasses would be located in the dense cattail stands where a nighttime roost is located which means that, even if they were still present by July, they and any associated maggots, would generally not be available to expose feeding waterfowl and contribute to increased botulism risk. There is no evidence to suggest that the blackbird carcasses themselves could initiate rapid bacterial growth and amplification of bird-maggot transmission. Thus, it is unlikely that increased risk of avian botulism would result from any type of BDM activity anticipated to occur at livestock feeding facilities.

Avian Cholera. The following information was provided by R. McLean, Director, National Wildlife Health Center, Madison, WI, and is based on information summarized from Friend (1999).

> *Most species of birds and mammals can become infected with the bacteria, Pasteurella multocida, that causes avian cholera. The majority of the bird species are susceptible to the clinical disease when exposed to virulent strains of this bacterium. Avian cholera commonly occurs in waterfowl and major die-offs occur almost yearly, whereas, it occurs less frequently with only occasional die-offs in coots and scavenging gulls and crows. There are only a small number of reports in shorebirds, cranes and songbirds. Losses can occur any time of year, but predictable seasonal patterns exist in areas where avian cholera has become well established as a disease of wild waterfowl, particularly in waterfowl movement corridors west of the Mississippi River. Transmission occurs by direct bird-to-bird contact or by ingestion of contaminated food or water and possibly by aerosols. Transmission is enhanced by the gregarious nature of most waterfowl species and by dense concentrations of migratory waterbirds. The bacteria can persist in water for several weeks, in soil for up to 4 months and in decaying bird carcasses for at least 3 months. Acute infections in birds can result in rapid death 6 to 12 hours after exposure; therefore, early detection of outbreaks is crucial in stopping the disease. Rigorous and careful collection, removal, and incineration of waterfowl carcasses is recommended to control the outbreaks and to reduce exposure of scavenging birds.*

Preliminary results from studies conducted by the National Wildlife Health Center (1998) indicate that wetlands are probably not an important reservoir for maintaining the bacteria that causes avian cholera. Little evidence of infection of blackbirds with *P. multocida* bacteria has been found or evidence to suggest they are involved in avian cholera outbreaks. The risk of exposing waterfowl to avian cholera from the presence of blackbird carcasses in the dense cattail marsh habitat where most are likely to occur is considered low.

2.3.8 WS's Impact on Biodiversity. No TWSP wildlife management program is conducted to eradicate a native wildlife population. TWSP operates in accordance with international, federal, and state laws and regulations enacted to ensure species viability. Any reduction of a local population or group would be temporary because immigration from adjacent areas or reproduction would soon replace the animals removed. The impacts of the current TWSP BDM programs on biodiversity are not significant in Texas. WS operates on a relatively small percentage of the land area in Texas and TWSP take is a small proportion of the total population of the species analyzed in Chapter 4.

2.3.9 Wildlife Damage Should Be an Accepted Loss -- a Threshold of Loss Should Be Reached Before Providing BDM Services. TWSP is aware of concerns that federal WDM should not be allowed until economic losses become unacceptable. Although some loss of resources to wildlife can be expected and tolerated, WS has the legal direction to respond to requests for WDM, and it is Program policy to aid each requester to minimize losses. WS uses the Decision Model discussed in Chapter 3 to determine an appropriate strategy.

In a ruling for *Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie NF, et al.* the United States District Court of Utah upheld the determination that a WDM program may be established based on threatened damage. In part, the court found that a forest supervisor need only show that damage (from predators) is threatened to establish a need for WDM (Civil No. 92-C-0052A January 20, 1993). Thus, there is precedent for conducting BDM when damage has not yet occurred but is only threatened.

2.3.10 Wildlife Damage Management Should Be Fee Based and Not a Taxpayer Expense. TWSP is aware of concerns that WDM should not be provided at the expense of the taxpayer or that it should be fee based. TWSP was established by Congress as the agency responsible for providing WDM to the people of the United States. Funding for TWSP BDM comes from a variety of sources in addition to Federal appropriations. Such non-Federal sources include local government funds (state, county or city), producer associations, and individual private citizens which are all applied toward program operations. Federal, state, and local officials have decided that WDM needs to be conducted and have allocated funds for these activities. Additionally, WDM is an appropriate sphere of activity for government programs, since wildlife management is a government responsibility. A commonly voiced argument for publicly funded WDM is that the public should bear the responsibility for damage to private property caused by "publicly-owned" wildlife.

2.3.11 Environmental Justice and Executive Order 12898

Environmental Justice is a movement promoting the fair treatment of people of all races, income levels, and cultures with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Environmental Justice, also known as Environmental Equity, has been defined as the pursuit of equal justice and equal protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status.

Environmental Justice is a priority both within APHIS and WS. Executive Order 12898 requires Federal agencies to make Environmental Justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies and activities on minority and low-income persons or populations. APHIS implements Executive Order 12898 principally through its compliance with the provisions of NEPA.

All WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898 to insure Environmental Justice. TWSP personnel use wildlife damage management methods as selectively and environmentally conscientiously as possible. It is not anticipated that the proposed action or any alternative would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations.

2.3.12 Lethal Starling and Blackbird Control Is Futile Because 50-60% Die Annually Anyway

Because natural mortality in blackbird populations is 50 - 65% per year (see section 4.1.1.1), some persons argue that this shows lethal BDM actions are futile. However, the rate of natural mortality has little or no relationship to the effectiveness of lethal BDM because natural mortality generally occurs randomly throughout a population and throughout the course of a year. Natural mortality is too gradual in individual concentrations of depredating birds to adequately reduce the damage that such concentrations are causing. It is probable that mortality caused by BDM actions is not "additive" to natural mortality but merely displaces it, otherwise known as "compensatory" mortality. In any event, it is apparent that the rate of mortality from BDM is well below the extent of any natural fluctuations in overall annual mortality and is, therefore, insignificant to regional populations. The objective of lethal BDM in the alternatives analyzed in this EA is not to necessarily add to overall blackbird or starling mortality, which would be futile under current funding limitations, but to redirect mortality to a segment of the population that is causing damage in order to realize benefits during the current production season. The resiliency of these bird populations does not mean individual BDM actions are not successful in reducing damage, but that periodic and recurring BDM actions are necessary in many situations.

2.3.13 Cost Effectiveness of BDM

Perhaps a better way to state this issue is by the question "Does the value of damage avoided equal or exceed the cost of providing BDM?" The Council on Environmental Quality (CEQ) regulations (40 CFR 1502.23) does not require a formal, monetized benefit:cost analysis to comply with NEPA. Consideration of this issue is not essential to making a reasoned choice among the alternatives being considered. USDA (1997, pp. 2-32 to 2-33) determined that cost effectiveness is not, nor should it be, the primary goal of the WS program. Additional constraints, such as environmental protection, land management goals, and others, are considered whenever a request for assistance is received. These constraints increase the cost of the program while not necessarily increasing its effectiveness, yet they are a vital part of the WS program.

An analysis of cost-effectiveness in many BDM situations is exceedingly difficult, if not impossible to perform, because the value of benefits is not readily determined. For example, the potential benefit of eliminating feral domestic pigeons from roosting and nesting around heating and cooling structures on a school or hospital could be reduced incidence of illness among an unknown number of building users. Since some of the bird-borne diseases described in Chapter 1 are potentially fatal or severely debilitating, the value of the benefit may be high. However, no studies of disease problems with and without BDM have been conducted, and, therefore, the number of cases *prevented* by effective BDM is not possible to estimate. Also, it is rarely possible to conclusively prove that birds are responsible for individual disease cases or outbreaks.

The WS programs in Arizona (WS 1996), Idaho (WS 1998), and Nevada (WS 2006) prepared an analysis of cost versus avoided losses for feedlot and dairy operations that received BDM service. The analyses in these EAs indicated that the benefit:cost of providing BDM and the feed saved from starling and blackbird damage was 3:1, 4:1 and 5:1, respectively. These analyses did not consider other benefits such as prevention of disease transmission, restored weight gain performance of livestock, and milk yields. Thus, these analyses showed that the BDM programs were beneficial and TWSP anticipates the same.

An agency reviewer suggested that a rigorous benefit:cost analysis of all possible combinations of nonlethal and lethal alternatives would demonstrate that costs of lethal BDM are greater than of implementing most if not all nonlethal BDM. TWSP does not currently have the resources to conduct such a benefit:cost analysis, but believes that it would even be greater because Texas CAFOs have had diseases outbreaks which would increase the benefits greatly. An important benefit:cost consideration of implementing scaring programs is whether the birds would be expected to simply relocate to other facilities (Johnson and Glahn 1994), requiring more facility managers to resort to the costs of scaring or other control programs. Thus, the overall cost of BDM at multiple facilities within broader localized areas could be expected to be greater with purely nonlethal strategies than under strategies in which the damaging birds could be removed.

2.3.14 Protection of Children from Environmental Health and Safety Risks (Executive Order 13045)

Children may suffer disproportionately from environmental health and safety risks for many reasons. Bird damage management at livestock feeding facilities as proposed in this EA would only involve legally available and approved damage management methods in situations or under circumstances where it is highly unlikely that children would be adversely affected. Therefore, implementation of the proposed action or other alternatives involving direct assistance by WS would not increase environmental health or safety risks to children.

2.3.15 Impacts on the Natural Environment Not Considered

USDA (1997, pg. 3-84) evaluated many TWSP BDM activities for their impacts on several other natural environmental factors not discussed above. USDA (1997, pg. 3-84) concluded that WS would have negligible impacts on air quality from the use of WDM methods. In addition, the proposed action does not include construction or discharge of pollutants into waterways and, therefore, would not impact water quality or require compliance with related regulations or Executive Orders. The proposed action would cause only very minimal or no ground disturbance and, therefore, would impact soils and vegetation insignificantly. TWSP uses very little fossil fuels and contributes negligible greenhouse gases that could impact global warming.

2.3.16 Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable commitments of resources are expected, other than the minor use of fuels for motor vehicles and other equipment, and similar materials. These will not be discussed further.

CHAPTER 3: ALTERNATIVES INCLUDING THE PROPOSED ACTION

3.1 ALTERNATIVES ANALYZED IN DETAIL

Four alternatives will be analyzed in detail in this EA:

1) **Alternative 1 - Continue the Current Federal BDM Program (No Action/Proposed Action).** This is the Proposed Action as described in Chapter 1 and is the No Action Alternative as defined by the Council on Environmental Quality (40 CFR 1500-1508) for analysis of ongoing programs or activities. Under the proposed action, TWSP will continue to provide an integrated BDM program.

2) **Alternative 2 – Nonlethal BDM by TWSP Only.** Under this alternative, WS would use only nonlethal methods in BDM. TWSP could still recommend the use of lethal methods, but would not partake in implementing them.

3) **Alternative 3 – TWSP Provides Technical Assistance Only for BDM.** Under this alternative, TWSP would not conduct direct operational BDM activities in Texas. If requested, TWSP would provide affected resource owners with technical assistance information only.

4) **Alternative 4 - No Federal TWSP BDM.** This alternative consists of no federal BDM program by TWSP or other federal agency.

3.2 DESCRIPTION OF THE ALTERNATIVES

3.2.1 Alternative 1 – Continue the Current Federal BDM Program

The No Action Alternative, the Proposed Action Alternative in this EA, a procedural NEPA requirement (40 CFR 1502), is a viable and reasonable alternative that could be selected. The No Action Alternative provides a baseline to compare with the other alternatives. The proposed action is to continue the current portion of TWSP that responds to requests for BDM to protect human health and safety, agricultural and natural resources, and property as discussed in Section 1.3, and conduct surveillance projects involving birds as needed. A major component of the current program is to protect rice crops from blackbird depredation and livestock feed and health from starlings. Another major component is providing BDM at airports to reduce wildlife hazards and bird strikes. Additionally, TWSP protects livestock, especially newborns, from vulture predation. The program also provides protection of human health and safety and property from feral Rock Pigeon damage. Finally, TWSP would also operate to reduce or minimize invasive species (several identified in Appendix C: Table C4) such as starlings and Rock Pigeons.

To meet these goals TWSP would have the objective of responding to all requests for assistance with, at a minimum, technical assistance or self-help advice, or, where appropriate and when cooperative or congressional funding is available, direct damage management assistance in which professional TWSP Specialists or Biologists conduct BDM. An IWDM approach would be implemented which would allow use of any legal technique or method, used singly or in combination, to meet requestor needs for resolving conflicts with birds. Agricultural producers and others requesting assistance would be provided with information regarding the use of effective nonlethal and lethal techniques as available and appropriate. Lethal methods used by TWSP would include shooting, trapping, egg addling/destruction, DRC- 1339, Avitrol, and euthanasia following live capture with trapping, hand capture, nets, or the use of A-C. Nonlethal methods used by WS may include harassment with pyrotechnics, scare crows, propane exploders, and other noises or visual stimuli to frighten birds away from an impacted area, porcupine wire deterrents, wire barriers, the tranquilizer A-C, and chemical repellents (e.g., methyl anthranilate, polybutene tactile repellents, etc.). In many situations, the implementation of nonlethal methods such as exclusion-type barriers would be the responsibility of the requestor to implement which means that, in those situations, TWSP's only function would be to implement lethal methods, if any were determined to be necessary to resolve a damage problem.

Under this alternative, BDM by TWSP would be allowed in Texas when requested to conduct such activities to protect resources on private and public property where a need has been documented following the completion of a Work Initiation Document or similar conveyance (e.g., *Annual Work Plan*). All management actions would comply with applicable federal, state, and local laws which include obtaining the necessary permits to take birds. A detailed description of the methods that could be used in BDM is given in Section 3.3.1.3. NWRC would continue to conduct research on BDM methods with more than 75% of the budget being spent on nonlethal control methods.

3.2.2 Alternative 2 - Nonlethal BDM by TWSP Only

This alternative would require TWSP to use only nonlethal methods to resolve bird damage problems. Persons receiving BDM assistance could still resort to lethal methods that were available to them. DRC-1339 and A-C are currently only available for use by TWSP employees and could not be used by private individuals. Section 3.3.1.3 describes nonlethal methods available for use by TWSP under this alternative and the lethal techniques that could potentially be used by State agency personnel and private individuals. NWRC would continue to conduct research on nonlethal methods to resolve bird damage problems.

3.2.3 Alternative 3 - TWSP Provides Technical Assistance Only for BDM

This alternative would not allow for TWSP operational BDM in Texas. TWSP would only provide technical assistance and make recommendations when requested. Producers, property owners, State and local agency personnel, or others could conduct BDM using traps, shooting, Avitrol, or any nonlethal method that is legal. Avitrol could only be used by State certified pesticide applicators. Currently, DRC-1339 and A-C are only available for use by TWSP employees and could not be used by private individuals. Section 3.3.1.3 describes BDM methods that could be employed by private individuals or other agencies after receiving technical assistance advice under this alternative. NWRC would continue to conduct research on nonlethal methods to resolve bird damage problems for incorporation into WS personnel's "tool box" of BDM methods.

3.2.4 Alternative 4 - No Federal TWSP BDM

This alternative would eliminate federal involvement in BDM in Texas. TWSP would not provide direct operational or technical assistance and requestors of TWSP services would have to conduct their own BDM without TWSP input. Section 3.3.1.3 describes BDM methods that could be employed by private individuals or other agencies under this alternative, except that DRC-1339 and A-C would not be available for use. Avitrol could be used by State certified restricted-use pesticide applicators. Information on future developments in nonlethal and lethal management techniques that culminate from NWRC would also not be available to producers or resource owners.

3.3 BDM STRATEGIES AVAILABLE TO TWSP UNDER THE ALTERNATIVES

The strategies and methodologies described below include those that could be used or recommended under Alternatives 1, 2 and 3 described above. Alternative 4 would terminate both TWSP technical assistance and operational BDM by TWSP.

3.3.1 Alternative 1 – Continue the Current Federal BDM Program

TWSP currently uses many of the BDM methods available for use. Some BDM methods are widely used, while others are used infrequently. TWSP recommends the use of many BDM methods, but does not implement them. The BDM methods available for use are described in Section 3.1.3.3.

The most effective approach to resolving wildlife damage is through IWDM, the integration of one or more damage management methods, used alone, simultaneously, or sequentially, to achieve the desired effect. The philosophy behind IWDM is to implement the best combination of effective management methods in a cost-effective manner while minimizing the potentially harmful effects on humans, target and nontarget species, and the environment. IWDM may incorporate cultural practices (i.e., animal husbandry), habitat modification (i.e., exclusion), animal behavior modification (i.e., scaring), removal of the individual offending animal, suppression or removal of a local population, complete removal of an invasive species, or any combination of these, depending on the circumstances of the specific damage problem and the species targeted. IWDM is being implemented by TWSP under the current BDM program.

3.3.1.1 The IWDM Strategies That TWSP Employs.

<u>Technical Assistance Recommendations</u>

"Technical assistance" as used herein is information, demonstrations, and advice on available and appropriate WDM methods. The implementation of damage management actions is the responsibility of the requestor. In some cases, TWSP provides supplies or materials that are of limited availability for non-TWSP entities to use. Technical assistance may be provided following a personal or telephone consultation, or during an on-site visit with the requestor. Generally, several management strategies are described to the requestor for short and long-term solutions to damage problems; these strategies are based on the level of risk, need, and the practicality of their application by the requestor.

Under APHIS NEPA Implementing Regulations and specific guidance for the WS program, WS technical assistance is categorically excluded from the need to prepare an EA or EIS. However, it is discussed in this EA because it is an important component of the IWDM approach to resolving bird damage problems.

<u>Direct Damage Management Assistance</u>

Direct BDM assistance is given when technical assistance alone is not sufficient to resolve a problem and landowners are unable to resolve the problem by themselves. Direct damage management assistance may be an initiated *Work Initiation Document* or other comparable instruments that provide for WS direct damage management. The initial investigation defines the nature, history, extent of the problem, species responsible for the damage, and methods that would be available to resolve the problem. Professional skills of TWSP personnel are often required to effectively resolve problems, especially if restricted use pesticides are necessary, or if the problem is complex. WS direct BDM assistance involves the implementation of lethal control or nonlethal capture or harassment methods.

3.3.1.2 TWSP Decision Making. TWSP personnel are frequently contacted after requestors have tried or considered both nonlethal and lethal methods and found them to be ineffective for any number of reasons. Misapplied or inappropriate methods are often impractical, too costly, time consuming, or inadequate for reducing damage to an acceptable level. TWSP personnel assess the problem and evaluate the legal and administrative appropriateness and availability of potential strategies and methods based on biological, economic and social considerations. Following this evaluation, the methods deemed practical for the situation are developed into a management strategy. After the management strategy has been implemented, monitoring and evaluation are conducted to assess the effectiveness of the strategy. This conscious thought process for evaluating and responding to damage complaints are the steps involved in the WS Decision Model (Slate et al. 1992) (Figure 5 in Section 1.6.4). In the model, most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The Decision Model is not a documented process, but a mental problem-solving process common to most, if not all, professions. As depicted in the Decision Model, consideration is given to the following factors before selecting or recommending control methods and techniques:

- Species responsible for damage
- Magnitude, geographic extent, frequency, and duration of the problem
- Status of target and nontarget species, including T&E species
- Local environmental conditions
- Potential biological, physical, economic, and social impacts
- Potential legal restrictions
- Costs of control options
- Prevention of future damage (lethal and nonlethal techniques)

WS recognizes that the decision to implement lethal bird damage reduction activities is a serious professional responsibility. Treves and Naughton-Treves (2005) stated that lethal control can foster the coexistence between people and wildlife and has a legitimate role in wildlife management, but it must be undertaken with care. They stated further that the BDM methods to be used in an operation must be considered carefully and should most often be implemented by a government agency. The authors described a decision-making process for determining the methods and approach (lethal or nonlethal) that the applicator should consider in conducting wildlife damage management, similar to the Decision Model (Slate et al. 1992) used by APHIS-WS personnel. An example of TWSP decision making in selecting BDM methods is given for a common problem species in Texas, the feral domestic pigeon.

Feral Domestic Pigeon Problems. Feral domestic pigeons are responsible for many nuisance bird damage requests for assistance in Texas. Feral domestic pigeons are an invasive species whose feeding activity and diseases may negatively affect native species. However, the most common complaint with this species involves pigeons roosting and nesting on buildings and structures in both urban and rural areas. The main nuisance problem is from the droppings which are most frequently addressed by recommending exclusion devices/barriers (such as netting, hardware cloth, screen, porcupine wire) or habitat modification and local population reduction. With feral pigeons, the population using a structure typically must be removed before exclusion and other techniques will work effectively because the resident population will diligently remain at the site and continue to cause damage. Methods that could be used for population reduction include shooting with pellet rifles, .22 caliber rifles with low velocity rounds, shotguns (mostly in rural or semi-rural situations), live capture with cage traps followed by euthanasia, and DRC-1339 or Avitrol applications. Once a population at a particular site is removed, cleanup of droppings and feathers (an attractant to new pigeons), the use of exclusion techniques, especially from nesting sites (new pigeons looking for nesting sites are less likely to take up residence), and potentially building modifications such as replacing broken windows, covering open doorways with doors or plastic strips, and other methods are effective in minimizing the potential for a problem to recur. All of these options are available to TWSP Specialists determining what the best strategy would be to resolve a particular damage situation. In addition, depending on the particular situation, the TWSP Specialist must determine if the problem should be resolved by the requestor or if assistance is needed.

3.3.1.3 BDM Methods Available for Use. WS has been conducting WDM in the United States for more than 90 years. WS has modified WDM activities to reflect societal values and minimize impacts to people, wildlife, and the environment. The efforts have involved research and development of new field methods and the implementation of effective strategies to resolve wildlife damage. TWSP personnel use a wide range of methods in BDM and strategies are based on applied IWDM principles. Some techniques suggested for use by resource owners, by other entities or individuals, to stop bird damage may not be considered by TWSP if they are biologically unsound, legally questionable, or ineffective such as ultrasonic devices to repel birds and the use of illegal chemicals.

Resource Management

Resource management includes a variety of practices that may be used by agriculture producers and other resource owners to reduce their exposure to potential wildlife depredation losses. Implementation of these practices is appropriate when the potential for depredation can be reduced without significantly increasing the cost of production or diminishing the resource owner's ability to achieve land management and production goals. Changes in resource management are usually not conducted operationally by TWSP, but TWSP could assist producers in implementing changes to reduce problems.

Animal Husbandry. This category includes modifications in the level of care and attention given to livestock, shifts in the timing of breeding and births, selection of less vulnerable livestock species to be produced, and the introduction of human custodians to protect livestock. The level of attention given to livestock may range from daily to seasonally. Generally, when the frequency and intensity of livestock handling increases, so does the degree of protection especially during calving and lambing when young livestock are vulnerable to species such as Black Vultures. The use of human custodians, such as sheep herders, may reduce damage levels, but can be very costly.

The risk of predation to poultry and small livestock, primarily newborns, can be reduced when operations monitor their livestock during the hours when predatory birds are most active. The risk of predation is usually greatest with immature livestock, and this risk can be reduced by holding pregnant females in pens or sheds to protect newborn livestock and keeping newborn livestock in pens for their first 2 weeks. The risk of predation to livestock diminishes with age and the increase in size. For example, Black Vultures, Turkey Vultures, and Common Ravens kill calves within a short time after they are born and keeping cows gathered during calving can reduce the opportunity for this, if custodians are present to scare away the birds. Shifts in breeding schedules can also reduce the risk of predation by altering the timing of births to coincide with the greatest availability of natural food items for predators or to avoid seasonal concentrations of migrating predators such as ravens and vultures.

Altering animal husbandry to reduce wildlife damage has many limitations though. Gathering may not be possible where livestock are in many fenced pastures and where grazing conditions require livestock to scatter. Hiring extra herders, building secure holding pens, and adjusting the timing of births is usually expensive. The timing of births may be related to weather or seasonal marketing of livestock. The expense associated with a change in husbandry practice may exceed the savings. TWSP encourages resource owners to use these strategies where they may be beneficial, but does not conduct these techniques operationally.

Guard Animals. Guard animals are used in WDM to protect a variety of resources and can provide significant protection at times. Guard animals (i.e., dogs, burros, and llamas) have proven successful in many sheep and goat operations. The effectiveness of guarding animals may not be sufficient in areas where there is a high density of wildlife to be deterred, where the resource, such as sheep foraging on open range, is widely scattered, or where the guard animal to resource ratios are less than recommended. TWSP often recommends the use of guard animals, but has not had an operational guard animal program.

Several breeds of dogs such as the Great Pyrenees and Komondor have been used to protect sheep and goats. However, the supply and longevity of proven guard dogs is generally quite limited. Resource owners typically must purchase and rear their own guarding dog. Therefore, a 4 to 8 month lag-time is necessary to raise a guarding dog before it becomes an effective deterrent to wildlife such as vultures and geese. Since 25% to 30% of dogs are unsuccessful, the first dog raised as a protector may not be useful.

Guard dogs may be ineffective for a number of reasons, but usually because they kill the livestock they are protecting or because they do not stay with the livestock or resource they are intended to guard. Guard dogs can harass and kill nontarget wildlife while protecting resources (Timm and Schmidt 1986). They do have the potential for capturing any of the mammalian and avian T&E predators if they tried to depredate on the resource being protected (e.g., lambs).

Crop Selection/Scheduling. In areas where damage to crops from wildlife is expected, different crops can be planted that are less attractive to the wildlife causing damage or crops can be planted at an earlier or later date to avoid damage. This practice depends on the species causing damage (e.g., resident vs. migrant), the availability of alternate food sources, and the market for alternative crops. Research has been conducted on damage resistant crop varieties with little success.

Lure Crops. If depredations are not avoided by careful crop selection or a modified planting schedule, lure crops can sometimes be used to mitigate the potential loss (Cummings et al. 1987). Lure crops are planted or left for consumption by wildlife as an alternate food source. To improve the efficacy of this technique, it is recommended that frightening devices should be used in nearby non-lure crop fields and wildlife should not be disturbed in the lure crop fields. This approach provides relief for critical crops by sacrificing less important or specifically planted fields. Establishing lure crops is sometimes expensive, requires considerable time and planning to implement, and may attract other unwanted species to the area. Lure crops have been used successfully to reduce damage by cranes and geese in the Middle Rio Grande Valley of New Mexico for many years (WS 2009).

Habitat Management. Localized habitat management is often an integral part of WDM. The type, quality, and quantity of habitat are directly related to the wildlife produced or attracted to an area. Habitat can be managed to not produce or attract certain wildlife species. For example, vegetation can be planted that is unpalatable to certain wildlife species or trees and shrubs can be pruned or cleared (Figure 7) to make an area unattractive for roosting birds. Ponds or other water sources can be eliminated to reduce certain wildlife species. Habitat management is typically aimed at eliminating nesting, roosting, loafing, or feeding sites used by particular species. Limitations of habitat management as a method of reducing wildlife damage are determined by the characteristics of the species involved, the nature of the damage, economic feasibility, and other factors. Legal constraints may also exist which preclude altering particular habitats. Most habitat management recommended by TWSP is aimed at reducing wildlife aircraft strike hazards at airports, eliminating bird winter roosts, or managing field rodent populations at airports so not to attract raptors.

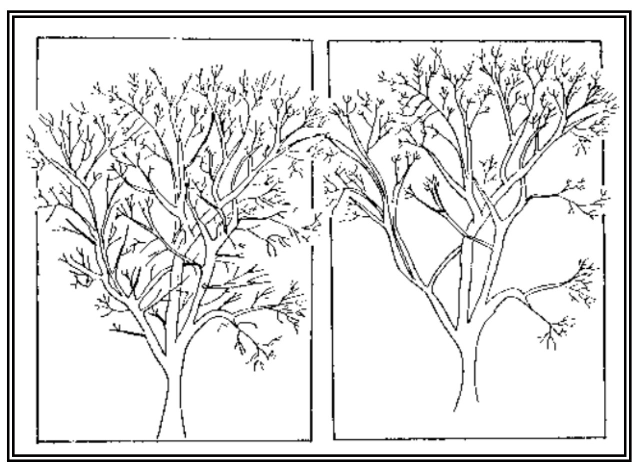

Figure 7. Tree pruning is an example of habitat management.

Change in the architectural design of a building or a public space can often help to avoid potential wildlife damage. For example, selecting species of trees and shrubs that are not attractive to wildlife can reduce the likelihood of potential wildlife damage to parks, public spaces, or residential areas. Similarly, incorporating spaces or open areas into landscape designs that expose wildlife can significantly reduce potential problems. Modifying public spaces to remove the potential for wildlife conflicts is often impractical because of economics or the presence of other nearby habitat features that attract wildlife. Some forms of habitat management may also be incompatible with the aesthetic or recreational features of the site.

Birds use trees and poles for roosting, perching and nesting, and the removal or modification of these items will often reduce the attractiveness of the area. Large winter bird roosts can be greatly reduced at roost sites by removing all the trees or selectively thinning the stand or branches in used trees. Roosts often will re-form at traditional sites, and substantial habitat alteration is the only way to permanently stop such activity. Poles can also be used to attract raptors to sites where reductions in rodent populations are desired.

Habitat management does have the potential to have an effect on all T&E species if present in an area, especially where a T&E species is present that uses the habitat to be modified. If TWSP determines habitat management would be appropriate to reduce wildlife damage or the threat of damage at a site, such as an airport where wetlands often should be removed, TWSP will ensure that the cooperator is aware for the need to address T&E species impacts. Habitat management instigated by TWSP will only be conducted following a consultation with USFWS on a site-specific basis where T&E species are present. Any efforts to mitigate identified effects will be the responsibility of the landowner, but must be agreed upon before TWSP will commence WDM activities. This will ensure that TWSP habitat management activities will not have an adverse impact on T&E species and their habitat.

Glyphosate, such as Glypro® Specialty Herbicide and AguaNeat® Aquatic Herbicide**,** is used by WS to reduce cattail (*Typhus spp*.) choked marshes in the Dakotas that are used by blackbirds for roosts and nesting habitat. Glyphosate treatments are conducted to reduce the density of cattails from a wetland for a period of 3-5 years, depending on weather conditions (i.e., moisture levels). Invasive nonnative and hybrid cattail stands have recently invaded the wetlands of the Plains and are a comparatively new habitat type which has changed the species composition of the area to some degree. The marshes, where they are present, easily become inundated with the hybrid cattails and the stands become dense or "choked" with cattails (i.e., little open water exists). A few species of wildlife favor this habitat type, especially for cover, while others, do not such as waterfowl and those that become more vulnerable to predation. Toxicity studies have shown that the glyphosate is non-toxic to all wildlife and safe for use. It is commonly used on many of the National Wildlife Refuges where marsh habitat becomes choked and makes waterfowl habitat relatively unavailable. Although this method is not currently used by TWSP in Texas, it could be, especially to disperse blackbird roosts near crop fields.

Prey-base Control with Insecticides and Rodenticides is conducted primarily at airports to reduce the attractiveness of an area to insectivores and predators of insects and small mammals including raptors such as Western Kingbirds, Scissor-tailed Flycatchers, Swainson's Hawks, Red-tailed Hawks, American Kestrels, and Great Blue Herons that are attracted to insects and rodents. All pesticides used by WS are registered for use by EPA and TDA and are not expected to have more than minimal effects on nontarget species, people, pets, or the environment. A reduction in insects at an airfield by TWSP in Texas was shown to reduce the number of bird strikes as well as bird abundance on the airfield. TWSP has used deltamethrin, an insecticide moderately toxic to mammals, slightly to not toxic to birds, but highly toxic to a broad spectrum of insects and, in laboratories, to fish. However, in the field, fish were found not to be as highly effected. TWSP used 40 pounds in one year (aver. 8 pounds/year) at an airfield to significantly reduce bird strikes, primarily species attracted to insects.

Deltamethrin is a member of one of the safest classes of pesticides: synthetic pyrethroid. The following information was taken from Extension Toxicology Network (1995). This pesticide is highly toxic to aquatic life, particularly fish, and therefore must be used with extreme caution around water. It is neurotoxic to humans, but requires a fairly high or intravenous dose. Deltamethrin is a pyrethroid insecticide that kills insects on contact and through digestion. It is popularly used to control crop (e.g., corn, fruits, tomatoes, cucumbers, and peppers), potted plant, and ornamental insect pests. Formulations include emulsifiable concentrates, wettable powders, ultra-low volume sprayables, and flowable formulations and granules. Deltamethrin rapidly paralyzes an insect's nervous system giving a quick knockdown effect. Deltamethrin has a rapidly disabling effect on feeding insects and is thought to mainly affect higher nerve centers of the brain. Death of insects seems to be due to irreversible damage to the nervous system occurring when poisoning lasts more than a few hours. The susceptibility of insects is dependent on a variety of factors and can vary, as with many insecticides, according to the environmental conditions. For example, flies are most susceptible to pyrethroid poisoning shortly before dawn, dropping by the factor of 2 as compared to daytime. The signs of poisoning produced in rats by deltamethrin are not the same as those produced by other pyrethroids. Especially characteristic are rolling convulsions. The site of action is considered to be central with little or none of the peripheral component demonstrated for other pyrethroids. The sequence of signs is clearly defined, progressing from chewing, salivation, and pawing to rolling convulsions, tonic seizures, and death. Blood pressure begins to drop promptly, but slowly; it tends to normalize about the time choreoathetosis (abnormal movements of the body of a combined choreic and athetoid pattern) begins but falls precipitously prior to death. The early signs are reversible, but rats that exhibit a tonic seizure and shock almost always die promptly. Acute exposure effects in humans include ataxia, convulsions leading to muscle fibrillation and paralysis, dermatitis, edema, diarrhea, dyspnea, headache, hepatic microsomal enzyme induction, irritability, peripheral vascular collapse, rhinorrhea, serum alkaline phosphatase elevation, tinnitus, tremors, vomiting and death due to respiratory failure. Studies have shown many cases of dermal deltamethrin poisoning after agricultural use with inadequate handling precautions and many cases of accidental or suicidal poisoning by the oral route at doses estimated to be 2-250 mg/kg. Oral ingestion caused epigastric pain, nausea, vomiting and coarse muscular fasciculations. With doses of 100-250 mg/kg, coma was caused within 15-20 minutes. Deltamethrin is rapidly lost from the body (2-4 days) of animals ingesting sublethal doses. It has a rating of moderately toxic, suggesting with proper precautions it is a safe chemical to use. TWSP used deltamethrin to control insect at an airfield with no known primary or secondary incidents involving nontarget organisms and found it highly effective at reducing airstrikes with birds.

Modification of Human Behavior. TWSP often tries to alter human behavior to resolve potential conflicts between humans and wildlife. For example, TWSP may talk with residents of an area to eliminate the feeding of wildlife that occurs in parks, recreational sites, or residential areas to reduce damage by certain species of wildlife, such as Rock Pigeons, Canada Geese, and gulls. This includes inadvertent feeding allowed by improper disposal of garbage or leaving pet food outdoors where wildlife can feed on it, especially near fast food restaurants. Many wildlife species adapt well to human settlements and activities, but their proximity to humans may result in damage to structures or threats to public health and safety. Eliminating wildlife feeding and handling can reduce potential problems, but many people who are not directly affected by problems caused by wildlife enjoy wild animals and engage in activities that encourage their presence. It is difficult to consistently enforce no-feeding regulations and to effectively educate all people concerning the potential liabilities of feeding wildlife.

Physical Exclusion

Physical exclusion methods restrict the access of birds to resources. These methods can provide effective prevention of bird damage in many situations. Bird proof barriers can be effective but are often cost-prohibitive, particularly because of the aerial mobility of birds which requires overhead barriers as well as peripheral fencing or netting. Exclusion adequate to stop bird movements can also restrict movements of livestock, people, and other wildlife (Fuller-Perrine and Tobin 1993). Exclusionary devices are often more costly than the value of the resource being protected, especially for large areas, and, therefore, are uneconomical and not used often. In addition, some exclusionary devices are labor intensive which can further reduce their cost-effectiveness. Exclusionary devices can potentially injure, maim, and kill nontarget wildlife, particularly birds. Netting can entangle birds and needs to be checked frequently to release birds that have been trapped. Wire grids can inadvertently injure or kill nontarget wildlife species, including T&E species, from impact at high speeds.

Fencing. Fences are widely used to prevent damage from wildlife. Exclusionary fences constructed of woven wire or multiple strands of electrified wire can be effective in keeping wading birds from some areas such as an aquaculture facility or molting Canada Geese out of crop fields. The size of the wire grid must be small enough and the height of the fence high enough to keep the birds from entering the area. For ponds, fencing at least 3 feet high should be erected in water 2 to 3 feet deep. If fences are built in shallow water, birds can easily feed on the pond side of the fence. Raceway fences should be high enough to prevent feeding from the wall. Occasionally, blackbirds will cling to fencing or screening near the water and feed on small fish. A slippery surface created by draping plastic over the fence or screen can be used to eliminate this problem. Electric fences or wires have also been used with limited success. This type of exclusion can make routine work around ponds and hatcheries difficult or impossible. Fencing does have limitations. Even an electrified fence is not always bird-proof and the expense of the fencing can often exceed the benefit. In addition, if large areas are fenced, the wildlife being excluded has to be removed from the enclosed area to make it useful.

Overhead Barriers. Overhead barriers such as netting and wire grids are mostly used to prevent access to areas such as gardens, fish ponds and raceways, dwellings, and livestock and poultry pens. Selection of a barrier system depends on the bird species being excluded, expected duration of damage, size of the area or facility to be excluded, compatibility of the barrier with other operations (e.g., feeding, cleaning, harvesting, etc.), possible damage from severe weather, and the effect of on-site aesthetics. The barrier system also depends on the resource being protected and its value. Overhead barrier systems can initially be very costly and expensive to maintain.

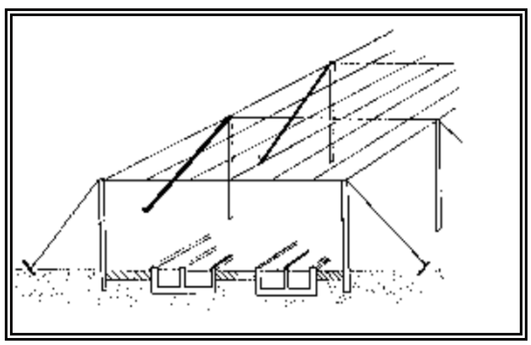

Figure 8. Overhead wire grid to exclude birds.

Netting consists of placing plastic or wire nets around or over resources in a small area, likely to be damaged or that have a high value. Netting is typically used to protect areas such as poultry pens, fish ponds and raceways, and high value crops. Complete enclosure of ponds and raceways to exclude all fish-eating birds requires 1.5- to 2-inch mesh netting secured to frames or supported by overhead wires (Figure 8). Gates and other openings must also be covered. Some hatchery operators use mesh panels placed directly on raceways to effectively exclude predatory birds. Small mesh netting or wire with less than 1-inch openings, secured to wood or pipe frames, prevents feeding through the panels. Because the panels may interfere with feeding, cleaning, or harvesting, they are most appropriate for seasonal or temporary protection. It is also used to prevent wildlife access to settling ponds that contain poisons which could kill them. Small mesh can also be used in ponds to prevent fish from entering shallow water where they would be easy prey for wading birds. Complete enclosure of areas with netting can be very effective at reducing damage by excluding all problem species, but can be costly.

Ponds, raceways, buildings, and other areas can be protected with overhead wires or braided or monofilament lines suspended horizontally in one direction or in a crossing pattern. Monofilament wires can effectively deter gull use of specific areas where they are causing a nuisance (Blokpoel 1976, Blokpoel and Tessier 1984, Belant and Ickes 1996). The birds apparently fear colliding with the wires and thus avoid flying into areas where the method has been employed. The WS program in Washington has effectively utilized steel wires to deter gulls from preying on salmon fingerlings, including T&E species, at the base of dams. Spacing between wires or lines should be based on the species and habits of the birds causing damage. Where the wire grids need to be suspended up high to allow for maintenance, perimeter fencing or wire around ponds and raceways provides some protection from wading birds and is most effective for herons. Partial enclosures, such as overhead lines, cost less but may not exclude all bird species such as terns. Additionally, some areas in need of protection are too large to be protected with netting or overhead wires.

Other Exclusionary Methods. Entrance barricades of various kinds are used to exclude several bird species such as starlings, pigeons, and House Sparrows from dwellings, storage areas, gardens, or other areas. Heavy plastic strips hung vertically in open doorways (Figure 9) have been successful in some situations in excluding birds from buildings used for indoor feeding or housing of livestock (Johnson and Glahn 1994). Plastic strips, however, can prevent or substantially hinder the filling of feed troughs or feed platforms at livestock feeding facilities. Such strips can also be covered up when the feed is poured into the trough by the feed truck. They are not practical for open-air feedlot operations that are not housed in buildings. Metal flashing or hardware cloth may be used to prevent entry of wildlife into buildings or roosting areas. Floating plastic balls called Euro-Matic Bird Balls™ have successfully been used at airports and settling ponds to keep birds from landing on ponds. Porcupine wire (Figure 10) such as Nixalite™ and Catclaw™ is a mechanical repellent method that can be used to exclude pigeons and other birds from ledges and other roosting surfaces (Williams and Corrigan 1994). The sharp points inflict temporary discomfort on the birds as they try to land which deters them from roosting. Drawbacks of this method are that some pigeons will build nests on top of porcupine wire and it can be expensive to implement when large areas are involved. Electric shock bird control systems are available from commercial sources and, although expensive, can be effective in deterring pigeons and other birds from roosting on ledges, window sills and other similar portions of structures (Williams and Corrigan 1994). There are many more examples of these types of exclusionary devices to keep wildlife from entering or landing on areas where they are unwanted.

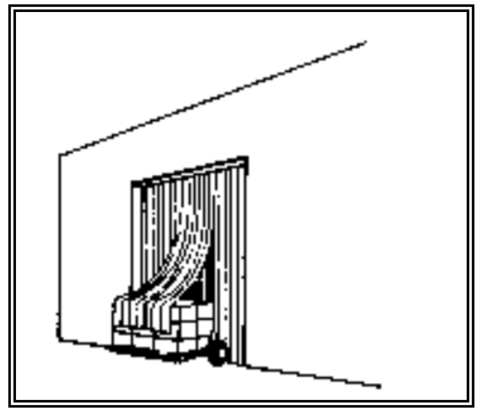

Figure 9. Entrance barricade to deter birds.

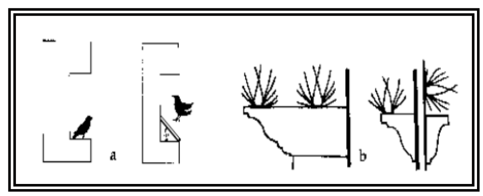

Figure 10. Porcupine wire on ledge to deter birds.

Wildlife Management

Reducing wildlife damage through wildlife management is achieved using a myriad of techniques. The objective of this approach is to alter the behavior of or repel the target species, remove specific individuals from the population, reduce local population densities, or suppress/extirpate exotic species populations to eliminate or reduce the potential for loss or damage to property and natural resources.

Frightening Devices. Frightening devices are used to repel wildlife from an area where they are a damage risk (i.e., airport, crops) or at risk of being contaminated (e.g., oil spill, settling ponds). The success of frightening methods depends on an animal's fear of, and subsequent aversion to, offensive stimuli (Shivik and Martin 2001). A persistent effort is usually required to effectively apply frightening techniques and the techniques must be sufficiently varied to prolong their effectiveness. Over time, animals often habituate to commonly used scare tactics and ignore them (Arhart 1972, Rossbach 1975, Pfeifer and Goos 1982, Conover 1982 Shirota et al. 1983, Schmidt and Johnson 1984, Mott 1985, Dolbeer et al. 1986, Graves and Andelt 1987, Tobin et al. 1988, Bomford 1990). In addition, in many cases birds frightened from one location become a problem at another. Scaring devices, for the most part, are directed at specific target species by specialists working in the field. However, several of these devices, such as scarecrows and propane exploders can be automated and work without the presence of an operator.

Harassment and other scaring devices and techniques to frighten birds are probably the oldest methods of combating wildlife damage. These devices may be either auditory or visual and generally only provide short-term relief from damage. However, a number of sophisticated techniques have been developed to scare or harass birds from an area. The use of noise-making devices is the most popular and commonly used. Other methods include harassment with visual stimuli (e.g., scarecrows, human effigies, balloons, Mylar® tape, and wind socks), vehicles, lasers, people, falcons, or dogs. These are used to frighten mammals or birds from the immediate vicinity of the damage prone area. As with other WDM efforts, these techniques tend to be more effective when used collectively in a varied regime rather than individually. However, the continued success of these methods frequently requires reinforcement by limited shooting (see Shooting). These techniques are generally only practical for small areas. Finally, it must be noted that sound-scare devices can also scare livestock when they are used in their vicinity.

Visual scaring techniques such as use of Mylar® tape (highly reflective surface produces flashes of light that startles birds), eye-spot balloons (the large eyes supposedly give birds a visual cue that a large predator is present), flags, effigies (scarecrows), sometimes are effective in reducing bird damage. Mylar tape has produced mixed results in its effectiveness to frighten birds (Dolbeer et al. 1986, Tobin et al. 1988). Birds quickly learn to ignore visual and other scaring devices if the birds' fear of the methods is not reinforced with shooting or other tactics.

Electronic distress sounds and alarm calls of various animals have been used singly and in conjunction with other scaring devices to successfully scare or harass animals. Many of these sounds are available on compact discs and tapes. Distress calls are broadcast to the target animals from either fixed or mobile equipment in the immediate or surrounding area of the problem. Animals react differently to distress calls; their use depends on the species and the problem. Calls may be played for short (e.g., few second) bursts, for longer periods, or even continually, depending on the severity of damage and relative effectiveness of different treatment or "playing" times. Some artificially created sounds also repel wildlife in the same manner as recorded "natural" distress calls.

Propane exploders (Figure 11) operate on propane gas and designed to produce loud explosions at controllable intervals. They are strategically located (i.e., elevated above the vegetation, if possible) in areas of high wildlife use to frighten wildlife from the problem site. Because animals are known to habituate to sounds, exploders must be moved frequently and used in conjunction with other scare devices.

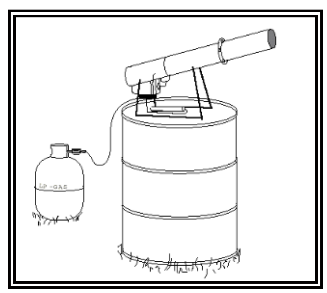

Figure 11. Propane exploder.

Pyrotechnics, shell-crackers and scare cartridges are commonly used to repel wildlife. Shell-crackers are 12-gauge shotgun shells containing firecrackers that are projected up to 75 yards in the air before exploding. They can be used to frighten birds or mammals, and are most often used to prevent crop depredation by birds or to discourage birds from undesirable roost locations. The shells should be fired so they explode in front of, or underneath, flocks of birds attempting to enter crop fields or roosts, or the air operating area at an airport. The purpose is to produce an explosion between the birds and their objective. Birds already in a crop field can be frightened from the field; however, it is extremely difficult to disperse birds that have already settled in a roost.

Noise, whistle, racket and rocket bombs are fired from 15 millimeter flare pistols. They are used similarly to shell-crackers but are projected for shorter distances. Noise bombs (also called bird bombs) are firecrackers that travel about 25 yards before exploding. Whistle bombs are similar to noise bombs, but whistle in flight rather than exploding. They produce a noticeable response because of the trail of smoke and fire, as well as the whistling sound. Racket bombs make a screaming noise in flight and do not explode. Rocket bombs are similar to noise bombs but may travel up to 150 yards before exploding.

A variety of other pyrotechnic devices, including firecrackers, rockets, and Roman candles, are used for dispersing wildlife. Firecrackers can be inserted in slow-burning fuse ropes to control the timing of each explosion. The interval between explosions is determined by the rate at which the rope burns and the spacing between firecrackers.

Lights, such as strobe, barricade, and revolving units, are used with mixed results to frighten waterfowl. Brilliant lights, similar to those used on aircraft, are most effective in frightening night-feeding birds. These extremely bright-flashing lights have a blinding effect, causing confusion that reduces the bird’s ability to see. Flashing amber barricade lights, like those used at construction sites, and revolving or moving lights may also frighten birds when these units are placed on raceway walls, fish pond banks, or ingress corridors. However, most birds rapidly become accustomed to such lights and their long-term effectiveness is questionable. In general, the type of light, the number of units, and their location are determined by the size of the area to be protected and by the power source available.

Lasers (the term of “laser” is an acronym for Light Amplification by Simulated Emission of Radiation) to alter bird behavior was first introduced nearly 35 years ago (Lustick 1973), but are a relatively new technique used to frighten and disperse birds from their roosts. The laser received very little attention, until recently, when it had been tested by NWRC. Results have shown that several bird species, such as Double-crested Cormorants, Canada Geese, other waterfowl, gulls, vultures, and American Crows have all exhibited avoidance of laser beams during field trails (Glahn et al. 2001, Blackwell et al. 2002). The repellent or dispersal effect of a laser is due to the intense and coherent mono-wavelength light that, when targeted at birds, can have substantial effects on behavior and may illicit changes in physiological processes (APHIS 2001). Best results are achieved under low-light conditions (i.e., sunset through dawn) and by targeting structures or trees in proximity to roosting birds, thereby reflecting the beam. In field situations, habituation to lasers has not been observed (APHIS 2001). Lasers are directional by the user and, therefore, will have little effect on nontarget species.

Water spray devices from rotating sprinklers placed at strategic locations in or around ponds or raceways will repel certain birds. However, individual animals may become accustomed to the spray and feed among the sprinklers. Best results are obtained when high water pressure is used and the sprinklers are operated with an on-off cycle. The sudden startup noise also helps frighten birds from an area.

Physical harassment with radio controlled airplanes is effective in several situations for dispersing damage-causing birds. This tool is effective in removing raptors from areas that are not accessible by other means. Radio controlled airplanes allow for up close and personal harassment of birds, while combining visual (e.g., eyespots painted on the wings) and auditory (e.g., engine noise and whistles attached to the aircraft) scare devices. Disadvantages of method are birds in large flocks do not respond well to the plane, much training is required to become efficient, a good working relationship is required by the operator and air traffic controllers at airports where they are most commonly used, weather conditions may restrict the usefulness of the plane, and the planes require frequent mechanical up-keep.

Avitrol® (Avitrol Corporation, Tulsa, OK), 4-aminopyridine, is primarily used as a chemical frightening agent (repellent) for blackbirds in corn and sunflower fields and can be effective in a single dose when mixed with untreated baits. However, Avitrol is not completely a frightening agent because most birds that consume the bait die (Johnson and Glahn 1994). Avitrol comes preformulated with treated baits mixed with untreated baits (1:99) and applied to crop fields for birds to ingest. After ingesting the bait, the bird becomes ill, flies erratically, emits distress calls, and then dies. This behavior is intended to frighten the remaining blackbirds from the treated fields. NWRC research and producers have had mixed and inconsistent results with the technique's effectiveness. As a result, this formulation of Avitrol has not been used widely. Avitrol is more often used as a toxicant for other species of birds such as pigeons and it will be discussed further under chemical toxicants. Avitrol is a restricted-use pesticide that can only be sold to certified applicators. It is available in several bait formulations with only a small portion of the individual grains carrying the chemical. It can be used during anytime of the year, but is used most often during fall and winter just prior to harvest of a crop. Any granivorous bird associated with the target species could be affected by Avitrol. Avitrol is water soluble, but laboratory studies demonstrated that Avitrol is strongly absorbed onto soil colloids and has moderately low mobility. Biodegradation is expected to be slow in soil and water, with a half-life ranging from three to 22 months. However, Avitrol may form covalent bonds with humic materials, which may serve to reduce its bioavailability in aqueous media, is non-accumulative in tissues, and is rapidly metabolized by many species (Schafer 1991). Avitrol is acutely toxic to avian and mammalian species; however, blackbirds are more sensitive to the chemical with little evidence of chronic toxicity for many species. Laboratory studies with predator and scavenger species have shown minimal potential for secondary poisoning, and during field use only magpies and crows appeared to have been affected (Schafer 1991). However, a laboratory study by Schafer et al. (1974) showed that magpies exposed to two to 3.2 times the published LD_{50} (Lethal Dose required to kill 50% of the test subjects of a given species) in contaminated prey for 20 days were not adversely affected and three American Kestrels were fed contaminated blackbirds for seven to 45 days were not adversely affected. Therefore, no probable risk is expected, based on low concentrations and low hazards quotient value for nontarget indicator species tested on this compound. No probable risk is expected for pets and the public, based on low concentrations and low hazards quotient value for nontarget indicator species tested on this compound.

Relocation. Translocation may be appropriate in some situations (i.e., if the problem species' population is at very low levels, a suitable relocation site is known, and the additional dollars required for relocation can be obtained.) However, those species that often cause damage problems (e.g., blackbirds, Canada Geese) are relatively abundant and relocation is not necessary for the maintenance of viable populations. Relocation may also result in future depredations if the relocated animal encounters protected resources again and, in some cases, could require payment of damage compensation claims. Any decisions on relocation of wildlife are coordinated with USFWS or TPWD, and, in many instances, State laws require consultation with appropriate land management agencies/manager before relocating wildlife to these lands. Finally, some state agencies require veterinary examinations and disease tests prior to relocation.

The American Veterinary Medical Association, The National Association of State Public Health Veterinarians, and the Council of State and Territorial Epidemiologists all oppose the relocation of mammals because of the risk of disease transmission (Centers for Disease Control 1990). Although relocation is not necessarily precluded in all cases, it would in many cases be logistically impractical and biologically unwise. Relocation to other areas following live capture would not generally be effective or cost –effective because problem bird species are highly mobile and can easily return to damage sites from long distances, habitats in other areas are generally already occupied, and relocation would most likely result in bird damage problems at the new location. Relocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of stress to the relocated animal, poor survival rates, and difficulties in adapting to new locations or habitats. However, there may be exceptions for relocating certain bird species. Relocation of damaging birds might be a viable solution and acceptable to the public when the birds were considered to have high value such as migratory waterfowl, raptors, or T&E species. In these cases, TWSP would consult with the USFWS or TPWD to coordinate capture, transportation, and selection of suitable relocation sites.

Chemical Repellents. Chemical repellents are nonlethal chemical formulations used to discourage or disrupt particular behaviors of wildlife. There are three main types of chemical repellents: olfactory, taste, and tactile. Olfactory repellents must be inhaled to be effective. These are normally liquids, gases or granules, and require application to areas or surfaces needing protecting. Taste repellents are compounds (i.e., liquids, dusts, granules) that are normally applied to trees, shrubs and other materials that are likely to be ingested or gnawed by the target species. Tactile repellents are normally thick, liquid-based substances which are applied to areas or surfaces to discourage travel of wildlife by irritating the feet or making the area undesirable for travel. Most repellents are ineffective or short-lived in reducing or eliminating damage caused by wildlife, therefore, are not used very often by TWSP.

Effective and practical chemical repellents should be nonhazardous to wildlife; nontoxic to plants, seeds, and humans; resistant to weathering; easily applied; reasonably priced; and capable of providing good repellent qualities. The reaction of different animals to a single chemical formulation varies and this variation in repellency may be different from one habitat to the next. Development of chemical repellents is expensive and cost prohibitive in many situations. Chemical repellents are strictly regulated, and suitable repellents are not available for many wildlife species or wildlife damage situations. Chemical repellents are commercially available for birds and include active ingredients such as methyl anthranilate which is grape soda flavoring (i.e., Rejex-it®), anthraquinone (Flight Control®Plus, Avipel®), or polybutenes (i.e., Tanglefoot® - Tanglefoot Co., Grand Rapids, MI). These compounds are relatively nontoxic to the environment with the amount of active ingredient used in the different formulations, especially following label instructions (some problems have been brought forth regarding anthraquinone, but it should be relatively safe if used according to label). The active ingredients in many repellents are listed on the EPA's 25b exempt list and, as such, are considered to have relatively low risk to the environment. Registration requirements for these chemicals are reduced because they are relatively nontoxic. Most repellents have only "Caution" on the labels because they are relatively nontoxic. These can typically be purchased by the public. Applied in accordance with label directions, none of the other repellents discussed are expected to have an effect on nontarget species.

> **Methyl anthranilate (MA),** an artificial grape flavoring used in foods and soft drinks for human consumption, could be used or recommended by TWSP as a bird repellent. MA has been shown to be an effective repellent for many bird species, including waterfowl (Dolbeer et al. 1993). It is equivalent in birds as capsaicin (hot peppers) is to mammals. It is registered under the brand name Rejex-it® (Natural Forces LLC, Davidson, NC) or applications to turf or to surface water areas used by unwanted birds. The material has been shown to be nontoxic to bees (LD_{50} > 25 micrograms/bee[9]), nontoxic to rats in an inhalation study (LC_{50} > 2.8 mg/L[10]), and of relatively low toxicity to fish and other invertebrates. MA is a naturally occurring chemical in concord grapes and the blossoms of several species of flowers which is used as a food additive and perfume ingredient (Dolbeer et al. 1992). It has been listed as "Generally Recognized as Safe" by the FDA (Dolbeer et al. 1992). Water surface and turf applications of MA are generally considered expensive. For example, the least intensive application rate required by label directions is 20 lbs. of product (8 lbs. active ingredient) per acre of surface water at a cost of about $64/lb. with retreatment required every 3-4 weeks; a golf course in Rio Rancho, New Mexico estimated that treating four watercourse areas would cost in excess of $25,000 per

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[9] An LD_{50} is the dosage in milligrams of material per kilogram of body weight, or, in this case in micrograms per individual bee, required to cause death in 50% of a test population of a species.

[10] An LC_{50} is the dosage in milligrams of material per liter of air required to cause death in 50% of a test population of a species through inhalation.

treatment for material alone (WS 2009). MA completely degrades in about 3 days when applied to water which indicates the repellent effect is short-lived. Cost of treating turf areas would be similar on a per acre basis.

Another, potentially more cost-effective, MA application is with the use of a fog-producing machine (Vogt 1997). The fog drifts over the area to be treated and is irritating to the birds while being nonirritating to any humans that might be exposed. Fogging applications must generally be repeated 3-5 times after the initial treatment before the birds abandon a treatment site. Applied at a rate of about .25 lb./ acre of water surface, the cost is considerably less than when using the turf or water treatment methods. However, TWSP would ensure that these methods were currently registered for use in Texas as these or any chemical registration could be canceled.

Capture or Take Methods. Several methods are available to capture or take offending animals. The appropriateness and efficacy of any technique will depend on a variety of factors.

Leghold traps are versatile and widely used by TWSP for capturing many species. These traps can be utilized to live-capture a variety of animals but are most often used by TWSP to capture mammals. Birds are rarely targeted with leghold traps, except padded jaw leghold pole traps (discussed below). Traps are effectively used in both terrestrial and shallow aquatic environments. Traps placed in the travel lanes of the targeted animal, using location to determine trap placement rather than attractants, are known as *"blind sets."* Three advantages of the leghold trap are: 1) they can be set under a wide variety of conditions, 2) nontarget captures can be released or relocated, and 3) pan-tension devices can be used to reduce the probability of capturing smaller nontarget animals (Turkowski et al. 1984, Phillips and Gruver 1996). Disadvantages of using leghold traps include: 1) the difficulty of keeping them in operation during rain, snow, or freezing weather, 2) the lack of selectivity where nontarget species are of a similar or heavier weight as the target species, and 3) the additional time and labor necessary over other methods to keep them functional.

Cage traps come in a variety of styles for WDM to target different species. The most commonly known cage traps used in the current program are box traps. Box traps are usually rectangular, made from wood or heavy gauge wire mesh. These traps are used to capture animals alive and can often be used where many lethal or more dangerous tools would be too hazardous. Box traps are well suited for use in residential areas.

Cage traps usually work best when baited with foods attractive to the target animal. They are used to capture birds ranging in size from sparrows to vultures. Cage traps do have a few drawbacks. Some individual target animals avoid cage traps. Some nontarget animals become “trap happy” and purposely get captured to eat the bait, making the trap unavailable to catch target animals. These behaviors can make a cage trap less effective. Cage traps must be checked frequently to ensure that captured animals are not subjected to extreme environmental conditions. For example, an animal may die quickly if the cage trap is placed in direct summertime sunlight. Another potential problem with the use of cage traps is that some animals fight to escape and injure themselves in the process. TWSP SOPs when conducting bird trapping operations is to ensure that an adequate supply of food and water is in the trap to sustain decoy and captured birds for several days. Active traps are checked regularly to replenish bait and water and to remove captured birds. Nontarget species are released during trap checks. The 1992 BO (USFWS 1992) had no concerns with impacts to T&E species from the use of these traps.

Decoy traps, modeled after the Australian crow trap, are used to capture several species of birds, including crows, starlings, sparrows, magpies, gulls, and vultures. They are large screen enclosures with the access modified to suit the target species. A few live birds are maintained in the baited trap to attract birds of the same species and, as such, act as decoys. Non-target species are mostly released unharmed (as discussed above birds can injure themselves lethally or birds may be killed by a predator that gains access into the trap).

Nest box traps are used for a variety of damage situations to capture birds (DeHaven and Guarino 1969, Knittle and Guarino 1976). Traps are made of nylon netting, hardware cloth, and wood, and come in many different sizes and designs, depending on the species of birds being captured. The entrances of traps also vary greatly from swinging-door, one-way door, funnel entrance, to tip-top sliding doors. Traps can be baited with grains or other feed, but mainly need to appear to be ideal nesting sites to attract the target birds.

Clover, funnel, and pigeon traps are enclosure traps made of nylon netting or hardware cloth and come in many different sizes and designs, depending on the species of birds being captured. The entrance of the traps also vary greatly from swinging-door, one-way door, funnel entrance, to tip-top sliding doors. Traps are baited with grains or other feed which attract the target birds. TWSP standard procedure when conducting trapping operations is to ensure that an adequate supply of food and water is in the trap to sustain captured birds for several days. Active traps are checked daily, every other day, or as appropriate, to replenish bait and water and to remove captured birds.

Cannon and rocket nets are normally used for larger birds such as waterfowl, but can be used to capture a wide variety of avian species. Cannons use mortar projectiles to propel a net up and over birds which have been baited to a particular site. Birds are taken from the net and disposed of appropriately.

Net guns have occasionally been used by WS to catch target waterfowl. These shoot from a “rifle with prongs,” go about 20 yards, and wrap around the target animal.

Mist nets are very fine mesh netting used to capture several species of birds. Birds cannot see the netting when it is in place because the mesh is very fine and overlapping “pockets” in the net assure birds will become entangled. They typically become entangled after striking the net. Net mesh size determines the birds that can be caught (Day et al. 1980). These nets can be used for capturing small-sized birds such as House Sparrows and finches entrapped in warehouses and other structures. They can also be used to capture some larger birds such as blackbirds and starlings when they are going to a roost or feeding area. Mist nets are monitored closely, typically watched from a discreet location. Mist nets when used outdoors are often monitored at least hourly to ensure that any captured nontarget species, especially T&E species, can be released quickly and unharmed. Mist nets are more often used in buildings to catch birds such as sparrows and finches, but have been used recently by TWSP to capture birds to be sampled for disease and released.

Bow nets are small circular net traps used for capturing birds and small mammals. The nets are hinged and spring loaded so that when the trap is set it resembles a half moon. The net is set over a food source and triggered by an observer using a pull cord.

Hand nets are used to catch birds and small mammals in confined areas such as homes and businesses. These nets resemble fishing dip nets with the exception that they are larger and have long handles. A variant on the hand net is a round throw-net with weights at the edges of the net, similar to that used for fishing. This net is also used for capturing birds in urban areas.

Drive traps are used to herd some animals into pens where they are captured. Drive traps have been used for species such as Canada Geese, domestic waterfowl, jackrabbits (*Lepus* spp.), and ungulates. A drive-trap consists typically of wire panels that are erected into a 15 ft^2 to 100 ft^2 pen, depending on the number of geese or other target species, with two wings made of 2-3 ft. high plastic fencing extending 60-200 ft. in a 'V' from the pen. Target species are herded to the pen at each site with people on foot or in boats, depending on the target species and the existing conditions. TWSP uses the standard "drive-trap" (Addy 1956) to capture Canada Geese or domestic waterfowl during the molt when they are flightless (May-July) for relocation or euthanasia.

Raptor traps come in a variety of styles such as the bal-chatri, Swedish goshawk trap, and purse traps. These have been used by WS at airports to capture raptors to remove them from the airfield. Most raptors captured in these have been banded and relocated. Raptor traps are also used to remove birds from areas around nesting T&E shorebirds. Disposition of captured raptors is determined after consultation with the local USFWS office.

Padded-jaw pole traps (Figure 12) are modified No. 0 or 1 coil spring leghold traps used to capture specific target birds such as raptors, magpies and crows. These are placed on top of poles or typical roosting spots frequented by targeted birds. These traps are monitored frequently and nontarget species can be released unharmed. Target species can be relocated or euthanized, mostly depending on the species to be captured and the desires of TPWD and USFWS.

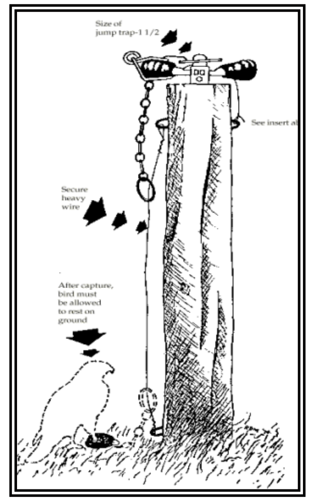

Figure 12. Padded-jaw pole trap.

Snap traps are modified rat snap traps used to remove individual woodpeckers, starlings, and other cavity use birds. The trap treadle is baited with peanut butter or other taste attractants and attached near the damage area, such as on the exterior wall of a home that is being damaged by a species such as a woodpecker. These traps pose no imminent danger to pets or the public.

Shooting is used selectively for target species, but may be relatively expensive because of the staff hours sometimes required. Nevertheless, shooting is an essential WDM method. Removal of feral pigeons may be achieved by night shooting with an air rifle and be quite effective in a short period. Shooting can also be a good method to target individual birds. However, shooting is mostly ineffective for flocking birds.

Lethal reinforcement through shooting is often necessary to ensure the continued success in bird scaring and harassment efforts (see the discussion on shooting under Frightening Devices). This is especially important where predatory birds are drawn by birthing activities, aquiculture facilities, sanitary landfills, and other locations where food is available. In situations where the feeding instinct is strong, most birds quickly adapt to scaring and harassment efforts unless the WDM program is periodically supplemented by shooting.

The risk of lead poisoning to birds was analyzed in Section 2.3.2. TWSP personnel use lead based ammunition in rifles and sometimes shotguns. TWSP personnel retrieve carcasses where possible to reduce the risk of lead poisoning. This has been discussed with the USFWS. Because of the recognized potential hazard associated with lead, TWSP often uses steel or other non-toxic shot as necessary to minimize the risk of lead poisoning to scavengers.

Sport hunting is sometimes recommended by TWSP as a viable BDM method when the target species can be legally hunted. A valid hunting license and other licenses or permits may be required by TPWD and USFWS for certain species. This method provides sport and food for hunters and requires no cost to the landowner. Sport hunting is occasionally recommended if it can be conducted safely for pigeon damage management around feedlots and dairies and for Sandhill Cranes, Canada Geese, Snow Geese, and other damage causing waterfowl.

Egg, nest, and hatchling removal and destruction can be a means of maintaining populations of a damaging avian species at a static level. Nesting populations of Canada Geese and gulls, especially if located near airports, may pose a threat to public health and safety, as well as equipment. Pigeons and starlings can also cause extensive damage to public facilities. Egg and nest destruction is used mainly to control or limit the growth of a nesting population in a specific area through limiting reproduction of offspring or removal of nest to other locations. Egg and nest destruction is practiced by manual removal of the eggs or nest.

Some species frequently attack people to guard their nests. In Texas, species that will actually hit people are Canada Geese and Mississippi Kites. This causes concern when the nest is located near a door or exit to a residential house or business. Of greatest concern is the threat to elderly people or bicyclist who may fall in response to the attack. Where these are creating a significant nuisance, TWSP may remove the nest, eggs, or hatchlings.

Egg addling or oiling is the practice of destroying the embryo prior to hatching. Egg addling is conducted by vigorously shaking an egg numerous times which causes detachment of the embryo from the egg sac. Egg oiling (a liquid spray) does not allow an egg to breathe or get oxygen, which prohibits the embryo from developing. Eggs are oiled and addled so that birds do not renest at least for an extended period; for example, Canada Geese will set on eggs an average of 14.2 days beyond the expected hatch date for addled eggs. Egg destruction can be accomplished in several different ways, but the most commonly used methods are manually gathering eggs and breaking them. This method is practical only during a relatively short time interval and requires skill to properly identify the eggs and hatchlings of target species. Some species may persist in nesting and the laying of eggs, making this method ineffective.

Chemical immobilizing and euthanizing drugs are important tools for managing wildlife. Under certain circumstances, TWSP personnel are involved in the capture of animals where the safety of the animal, personnel, or the public are compromised and chemical immobilization provides a good solution to reduce these risks. For example, chemical immobilization has often been used to capture aggressive Canada Geese in residential areas where public safety is at risk. It is also used to take nuisance waterfowl that cannot be easily captured with other methods. TWSP employees that use immobilizing drugs are certified to use these following the guidelines established in the WS Field Operational Manual under "Use of Immobilization and Euthanasia Drugs." A-C is an immobilizing agent used by TWSP to capture and remove waterfowl, coots, pigeons, and gulls. These are typically used in urban, recreational, and residential areas where the safe removal of a problem animal is most easily accomplished with a drug delivery system, hand-fed baits. Immobilization is usually followed by relocation when appropriate (i.e., mainly waterfowl) or euthanasia. Euthanasia is usually performed with drugs such as Beuthanasia-D® or Fatal-Plus® which contain forms of sodium phenobarbital. Euthanized animals are disposed of by incineration or deep burial to avoid secondary hazards. Drugs are monitored closely and stored in locked boxes or cabinets according to WS policies, and Department of Justice, Drug Enforcement Administration or FDA guidelines. Most drugs fall under restricted-use categories and must be used under the appropriate license from the U.S. Department of Justice, Drug Enforcement Administration which TWSP does hold. A-C is currently regulated by FDA.

Alpha-chloralose is an immobilizing agent used to capture and remove nuisance birds. The drug is currently approved for use by WS as an FDA Investigational New Animal Drug (Registration

#6602) rather than a pesticide. A-C has been typically used in industrial and residential areas. Single bread or corn baits are fed directly to target birds and those treated are monitored until the drug takes effect. TWSP personnel remain at the application site until the immobilized birds are retrieved. Unconsumed baits are removed from the site following each treatment. A-C may be used only by TWSP personnel who have been trained and certified in its use. Pursuant to FDA restrictions, pigeons and waterfowl (during the hunting season) captured with A-C for subsequent euthanasia must be killed and buried or incinerated, or be held in captivity for at least 30 days, at which time the birds may be killed and processed for human consumption. If a bird is going to be relocated, it can be released once the effects of the drug wears off (about 10 hours) or after it is held 30 days if take will overlap with a hunting season. Use of this drug is labor intensive and, therefore, not always cost effective (Wright 1973, Feare et al. 1981). A-C is typically delivered in small quantities contained in baits with minimal hazards to pets and humans because the single bread or corn baits are fed directly to the target birds.

A-C was eliminated from more detailed analysis in USDA (1997, Appendix P) based on critical element screening; therefore, environmental fate properties of this compound were not rigorously assessed. However, the solubility and mobility are believed to be moderate and environmental persistence is believed to be low. Bioaccumulation in plants and animal tissue is believed to be low. A-C is used in other countries as an avian and mammalian toxicant. The compound is slowly metabolized, with recovery occurring a few hours after administration (Schafer 1991). The dose used for immobilization is designed to be about 2 to 30 times lower than the LD_{50}. LD_{50} values are typically much higher for mammals than birds. Toxicity to aquatic organisms is unknown (Woronecki et al. 1990), but the compound is not generally soluble in water and, therefore, probably remains unavailable to aquatic organisms. Since A-C is monitored at the application site, fed directly to target species, and uneaten baits are retrieved, the potential effect to nontarget species is low. Factors supporting the determination of this low potential impact included the lack of exposure to pets, non-target species and the public, and the low toxicity of the active ingredient. In addition, most A-C projects are conducted in urban-type environments. Other supporting rationale for this determination included relatively low total annual use by TWSP and a limited number of potential exposure pathways. However, because A-C is given in baits that the target species could drop or exposed in a free-feeding condition, rather than injected into the animal, a nontarget species could be exposed to its sedative affects. TWSP Specialists monitor areas for nontargets and tries to avoid them as possible.

Euthanasia can be accomplished with several methods. Several drugs and methods are available to euthanize captured animals. Euthanasia methods include registered drugs such as Beuthanasia-D®, Fatal Plus®, cervical dislocation, decapitation, a shot to the brain, or asphyxiation with CO or CO_2. These methods are completely target species-specific and animals euthanized with drugs are buried or incinerated.

Chemical pesticides have been developed to reduce or prevent wildlife damage and are widely used because of their efficiency. Although some pesticides are fairly group specific to certain of species (e.g., birds vs. mammals), pesticides are typically not species specific and their use may be hazardous unless used with care by knowledgeable personnel. The proper placement, size, type of bait, and time of year are keys to selectivity and successful use of pesticides for WDM. When a pesticide is used according to its EPA registered label, it poses minimal risk to people, the environment, and non-target species. Neither EPA nor TDA would register a chemical that had not undergone rigorous environmental testing to determine its potential effects on humans and the environment including risks to nontarget species. Since the tests required by EPA to register a chemical, development of appropriate pesticides is expensive, and the path to a suitable end product is filled with legal and administrative hurdles. Few private companies are inclined to undertake such a venture. Most pesticides are aimed at a specific target species, yet suitable pesticides are not available for most animals. Available delivery systems make the use of pesticides unsuitable in many wildlife damage situations. This section describes the pesticides used by TWSP in BDM.

DRC-1339 (EPA. Reg. Nos. 56228-10, 56228-17, 56228-28, 56228-29, and 56228-30), and Texas 24c Label Nos. TX-890001. TX-020003, TX-060016 and TX-090010), 3-chloro-4-methylbenenamine hydrochloride, is an avian pesticide registered with EPA. For more than 30 years, DRC-1339 has proven to be an effective method of starling, blackbird, gull, crow, raven, magpie, and pigeon damage management (West et al. 1967, West and Besser 1976, Besser et al. 1967, and DeCino et al. 1966). DRC-1339 is a slow acting avicide that is rapidly metabolized into nontoxic metabolites and excreted after ingestion. This chemical is one of the most extensively studied and evaluated pesticides ever developed. Because of its rapid metabolism, DRC-1339 poses little risk of secondary poisoning to non-target animals, including avian scavengers (Cunningham et al. 1979, Schafer 1984, Knittle et al. 1990). This compound is also unique because of its relatively high toxicity to many pest birds, but low-to-moderate toxicity to most raptors with almost no toxicity to mammals (DeCino et al. 1966, Palmore 1978, Schafer 1981). For example, starlings, a highly sensitive species, require a dose of only 0.3 mg/ bird to cause death (Royall et al. 1967); many other bird species such as raptors, House Sparrows, and eagles are classified as non-sensitive (USDA 1997, Appendix P) requiring a much higher dose (Oral LD_{50}s doses for Golden Eagles = 450 mg, Northern Harrier = 45 mg, and House Sparrow = 99 mg), usually at least a 10-fold increase in dose over sensitive species. Numerous studies have shown that DRC-1339 poses minimal risk of primary poisoning to non-target and T&E species (USDA 1997, Appendix P). Secondary poisoning has not been observed with DRC-1339 treated baits. During research studies, carcasses of birds which died from DRC-1339 were fed to raptors and scavenger mammals for 30 to 200 days with no symptoms of secondary poisoning observed (Cunningham et al. 1979). This can be attributed to relatively low toxicity to species that might scavenge on birds killed by DRC-1339 and its tendency to be almost completely metabolized in target birds leaving little residue for scavengers to ingest. Secondary hazards of DRC-1339 are almost non-existent. DRC-1339 acts in a humane manner producing a quiet, painless death. Prior to the application of DRC-1339, pre-baiting is required to monitor for non-target species that may consume the bait. If non-target species are observed, then the use of DRC-1339 would be postponed or not applied. Research studies and field observations suggest that DRC-1339 treatments kill about 75% of the blackbirds and starlings at treated feedlots (Besser et al. 1967). The inherent safety features of DRC-1339 help avoid negative impacts to T&E species as well as preclude hazards to most species other than the target species listed.

DRC-1339 is unstable in the environment and degrades rapidly when exposed to sunlight, heat, or ultra violet radiation. DRC-1339 is highly soluble in water but does not hydrolyze and degradation occurs rapidly in water. DRC-1339 tightly binds to soil and has low mobility. The half-life is about 25 hours, which means it is nearly 100% broken down within a week, and identified metabolites (i.e., degradation chemicals) have low toxicity. Aquatic and invertebrate toxicity is low (USDA 1997, Appendix P). USDA (1997, Appendix P) contains a thorough risk assessment of DRC-1339 and that assessment concluded that no adverse effects to T&E species are expected from use of DRC-1339.

DRC-1339 concentrate is used effectively under five EPA registered labels to reduce damage by specific bird species. Hard-boiled eggs and meat baits are injected with DRC-1339 and used to reduce raven, crow, and magpie damage for the protection of newborn livestock, the young or eggs of threatened, endangered, or sensitive species, human health and safety, and silage and fodder bags. DRC-1339 is also registered for application on grain, poultry pellets, raisins, and cull French fries to reduce damage caused by blackbirds and starlings at livestock and poultry feedlots. A similar label allows DRC-1339 to be used at blackbird and starling staging areas associated with nighttime roosts with similar baits. Another label allows DRC-1339 to be used on whole kernel corn to reduce health, nuisance, or economic problems caused by pigeons in and around structures in non-crop areas. A fifth label allows the use of DRC-1339 on bread cube baits to reduce damage caused by several species of gulls that, during their breeding season, prey on other colonially nesting bird species, or damage property and crops. The specified gull species can be managed to reduce damage or damage threats on their breeding grounds or several other areas including airports and landfills and for T&E species and human health and safety protection. Additionally, Texas has a few Special Local Need (SLN) labels approved through TDA under FIFRA 24c. One SLN label allows the use of DRC-1339 to be used for sensitive wildlife species depredation by other species such as Great-tailed Grackles. Another Texas SLN label allows mechanical bait placement at CAFOs. Another SLN label in Texas allows the use of DRC-1339 to be used to reduce crow and raven damage to pecan and peanut growing areas.

The use of DRC-1339 as per label instructions will have little effect on nontarget species in Texas. DRC-1339 baits cannot be used in areas where potential consumption of treated baits by T&E species could occur. Observation of sites to be treated with or without prebaiting is necessary to determine the presence of nontarget species. DRC-1339 baits cannot be used directly in water or areas where runoff is likely.

Avitrol® (Avitrol Corp., Tulsa, OK), 4-aminopyridine, discussed as a chemical frightening agent (repellent) for blackbirds and starlings above, is often used as a toxicant at a 1 treated:9 untreated ratio for pigeons, House Sparrows, and other commensal birds (the ratio can be reduced to 1:5 for House Sparrows). Avitrol treated baits are placed in an area where the targeted birds are feeding and most all birds that consume treated baits normally die (Johnson and Glahn 1994). Birds display abnormal flying behavior after ingesting treated baits and emit distress vocalization (pigeons do not). This chemical is not normally used at airports because the abnormal flying behavior could cause affected birds to fly into the path of aircraft. Avitrol is a restricted use pesticide that can only be sold to certified applicators and is available in several bait formulations with only a small portion of the individual grains carrying the chemical. Any granivorous bird associated with the target species could be affected by Avitrol which none of the T&E species in the United States are. Blackbirds and corvids are slightly more sensitive to the chemical than other species of mammals and birds. In addition, chronic toxicity has not been demonstrated (Schafer 1991). Laboratory studies with predator and scavenger species have shown minimal potential for secondary poisoning. However, in a field study, magpies and crows may have been affected secondarily (Schafer 1991). A laboratory study showed, though, that magpies which fed for 20 days on birds killed with 2 to 3.2 times the lethal dose of active ingredient were not affected (Schafer et al. 1974). Similarly, American Kestrels that fed on blackbirds for 7 to 45 days which had died from a lethal dose of Avitrol were not adversely affected (Schafer 1991). Therefore, no probable secondary risk is expected with use of this compound, even for pets and the public. Avitrol is water soluble, but laboratory studies demonstrated that Avitrol is strongly absorbed onto soil colloids and has moderately low mobility. Biodegradation is expected to be slow in soil and water, with a half-life ranging from 3 to 22 months. Avitrol may form covalent bonds with humic materials, which may serve to reduce its bioavailability in aqueous media. Avitrol is non-accumulative in tissues and rapidly metabolized by many species (Schafer 1991). TWSP has used Avitrol in the last 5 FYs (FY07 – FY11) for urban bird damage situations. Use of Avitrol by TWSP is not likely to have an adverse effect on T&E species, especially because it will be used according to label restrictions and primarily in urban environments by TWSP.

Sodium Lauryl Sulfate **(SLS)** (Stephan Co., Northfield, IL), is a wetting agent in managing European starling; red-winged, yellow-headed, and Brewer's blackbird; cowbird; grackle; American Crow; common raven and magpie roosts. SLS is a surfactant commonly used in soap products. Application of SLS and water is through a ground-based sprinkler-head spray system in areas of the target roost where it will be most effective in bird coverage. When applied to birds, SLS allows water to penetrate and saturate the feathers so that with low temperatures (<41°F) and sufficient water, birds die of hypothermia. During 2004-2007, WS' NWRC and Missouri State Office conducted field tests to investigate the effectiveness of SLS in removing urban blackbird roosts. Results document that SLS causes mortality in starlings and blackbirds and may be useful as part of IWDM programs designed to reduce local blackbird populations. Birds died as soon as 30 minutes after exposure to SLS. In 1996, the EPA exempted 31 minimum-risk pesticides from requirements of FIFRA if the pesticides satisfy certain conditions. In general, conditions claiming that a pesticide should be exempt from registration under FIFRA Section 25(b) are that claims cannot be made regarding control of public-health pests, and the product cannot be used on food or feed crops. SLS (Chemical Abstract Service No. 151-21-3) was included on the list of 31 exempt compounds. TWSP anticipates using this method in the future, especially to disperse blackbird roosts in urban areas.

Chemosterilants and Contraception. Contraceptive measures can be grouped into four categories: surgical sterilization, oral contraception, hormone implantation, and immunocontraception (i.e., the use of contraceptive vaccines). These techniques require that each individual animal receive either single, multiple, or possibly daily treatment to successfully prevent conception. The use of oral contraception, hormone implantation, or immunocontraception is subject to approval by Federal and State regulatory agencies. Surgical sterilization and hormone implantation are generally impractical because it requires that each animal be captured, sterilization conducted by licensed veterinarians, and, thus, would be extremely labor intensive and expensive. As alternative methods of delivering sterility are developed, sterilization may prove to be a more practical tool in some circumstances (DeLiberto et al. 1998). Reduction of local populations could conceivably be achieved through natural mortality combined with reduced fecundity. No animals would necessarily be killed directly with this sterilization, however, and sterilized animals could continue to cause damage. Thus, sometimes culling the population to the desired level and then implementing a sterilization program would be the optimal solution to overabundant bird populations. Populations of dispersing animals would probably be unaffected. Potential environmental concerns with chemical sterilization would still need to be addressed, including safety of genetically engineered vaccines to humans and other wildlife. Several formulations of drugs have been and are being tested by NWRC and other researchers including nicarbazin, diazacon, and immunocontraceptives. These would have to be registered for use in Texas before TWSP would use them. The only EPA approved contraceptive available is OvoControl™ G for Canada Geese in urban areas (population greater than 50,000) and FAA certificated airport environments. The active ingredient in OvoControl™ G is nicarbazin which was developed by WS NWRC researchers (WS 2004). Nicarbazin, a drug approved by FDA for use to control coccidiosis in chickens for the last 45 years, reduces the hatchability of eggs. This reduction only occurs while the bait is being consumed and, thus, primary and secondary hazards to other bird species and mammals are minimized or nullified. Following label directions further minimizes nontarget hazards. In Texas, the use of this bait would have no effect on T&E or sensitive species, people, pets, or the environment. TWSP has not used OvoControl™ G, but could if registered with TDA. It is expected that this chemical would have minimal effect on the resident Canada Goose population in Texas in the short-term because geese are long-lived. However, combined with culling, it would be effective at keeping local populations at manageable numbers.

3.3.2 Alternative 2 - Nonlethal BDM by TWSP Only

This alternative would require that TWSP use only nonlethal methods in addressing bird damage problems. For lethal BDM activities, producers, state agency personnel, or others could conduct BDM activities including the use of trapping, shooting, avicides, and any other lethal method. The basis of method selection may not be biologically sound or prudent. The chemicals DRC- 1339 and A-C are currently only available for use by WS employees. Therefore, the use of these chemical by private individuals would not be available. The only avian toxicants registered are Avitrol and Starlicide Complete® (PM Resources, Bridgeton, MO) which contains formulated DRC-1339 and these could be used to resolve some bird damage problems.

3.3.3 Alternative 3 - TWSP Provides Technical Assistance Only for BDM

Under this alternative, TWSP would only provide technical assistance and make recommendations when requested to resolve bird damage problems. This alternative would not allow TWSP operational BDM. Producers, state agency personnel, or others could conduct BDM activities including the use of traps, shooting, avicides, and any lethal or nonlethal methods they wish. The chemicals DRC- 1339 and A-C are currently only available for use by TWSP employees and could be the optimal method to resolve a bird damage situation. However, these chemical could not be used by private individuals or State personnel, but Avitrol and Starlicide Complete could be.

3.3.4 Alternative 4 - No Federal TWSP BDM

This alternative would consist of no federal involvement in BDM in the State -- neither direct operational management assistance nor technical assistance to provide information on nonlethal or lethal management techniques would be available from WS. Information on future developments in nonlethal and lethal management techniques that culminate from research efforts by WS' research branch would not be as accessible to affected resource owners or managers, as TWSP would not be a direct source of such information. Producers, state agency personnel, or others would be left with the option to conduct BDM activities including the use of trapping, shooting, and any lethal or nonlethal methods. The basis of method selection may not be biologically sound or prudent. The chemicals DRC-1339 and A-C are currently only available for use by WS employees. Therefore use of these chemicals by private individuals would be illegal, and private and commercial applicators would be left only with using an extremely narrow choice of legal or effective alternatives if chemical control was needed, (i.e. Avitrol, etc.).

3.4 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

Several alternatives have been considered in other EAs for BDM such as WS (2001), but not analyzed in detail. The discussion of these alternatives in this EA would be the same. The reader is referred to WS (2001) for a detailed discussion of these alternatives; these will only be listed here.

- Compensation for Bird Damage Losses
- Short Term Eradication and Long Term Population Suppression
- Use of Bird-Proof Feeders in Lieu of Lethal Control at Dairies and Cattle Feeding Facilities

Additionally a few other alternatives will not be analyzed in detail and are given with a discussion of why they were not considered for detailed analysis in Chapter 4.

3.4.1 Lethal BDM Only By WS

Under this alternative, TWSP would not conduct any nonlethal control of birds for BDM purposes in the State, but would only conduct lethal BDM. This alternative was eliminated from further analysis because many situations can be resolved effectively through nonlethal means. For example, for blackbird roosts in urban areas, TWSP has used nonlethal methods exclusively as an effective means to resolving damage. Lethal BDM Only does not interface with the overall concept of IWDM, where multiple methods can achieve a desired cumulative effect. Restricting that portion of the program to lethal methods only would likely not be socially acceptable to various agencies, groups and individuals.

3.4.2 Relocation Rather Than Killing Problem Wildlife

Translocation may be appropriate in some situations (i.e., if the problem species' population is at very low levels such as the Ferruginous Hawk, suitable relocation sites are available, and the additional dollars required for relocation can be obtained). However, those species that often cause damage problems (e.g., Canada Geese and Great-tailed Grackles) are relatively abundant or are not native (e.g., starlings) and relocation is not necessary for the maintenance of viable populations. Relocation may also result in future depredations if the relocated animal encounters protected resources, and in some cases could require payment of damage compensation claims. Any decisions on relocation of wildlife by TWSP are coordinated with TPWD or USFWS and consultation with the appropriate land management agency(ies) or manager associated with proposed release sites. Additionally, animals that are relocated become stressed and there is a potential for disease transmission into healthy populations. WS considers translocation for some species and conducts such, but does not relocate all damaging species.

3.4.3 Biological Control

The introduction of a species or disease to control another species has occurred throughout the world. Unfortunately, many of the introduced species become pests themselves. For example, in Hawaii, the Indian mongoose (*Herpestes auropunctatus*) was brought in to control rats (*Rattus* spp.), but wound up causing declines in many native Hawaiian bird species. Though many people think that this is a good idea for small flocking birds, TWSP dismissed it from further consideration because technology has not advanced to the point that biological control, even for non-native species such as the starling, is feasible and safe.

3.5 TWSP SOPs INCORPORATED INTO BDM TECHNIQUES

An SOP is any aspect of an action that serves to prevent, reduce, or compensate for negative impacts that otherwise might result from that action. The current program, nationwide and in Texas, uses many such SOPs. The key SOPs are incorporated into all alternatives as applicable, except the no federal program alternative (Alternative 4). Most SOPs are instituted to abate specific issues while some are more general and relate to the overall program. SOPs include those recommended or required by regulatory agencies such as EPA and these are listed where appropriate. Additionally, specific measures to protect resources such as T&E species that are managed by TWSP's cooperating agencies (USFWS and TPWD) are included in the lists below.

3.5.1 General SOPs Used by TWSP in BDM

- TWSP complies with all applicable laws and regulations that pertain to conducting BDM on private and public lands.

- TWSP coordinates with agency officials for work on public lands to identify and resolve any issues of concern with BDM.

- TWSP coordinates with tribal officials for work on tribal lands to identify and resolve any issues of concern with BDM.

- The use of BDM methods such as traps and avicides conform to applicable rules and regulations administered by the State.

- TWSP personnel adhere to all label requirements for toxicants. EPA approved labels provide information on preventing exposure to people, pets, and T&E species along with environmental considerations that must be followed. TWSP personnel abide by these. These restrictions invariably preclude or reduce exposure to nontarget species, the public, pets, and the environment.

- The WS Decision Model (Slate et al. 1992) thought process as discussed in Section 1.6.5 which is designed to identify effective WDM and their impacts, is consistently used.

3.5.2 TWSP SOPs Specific to the Issues

The following is a summary of the SOPs used by TWSP that are specific to the issues listed in Chapter 2 of this document.

3.5.2.1 Effects on Target Bird Species Populations.

- BDM is directed toward localized populations or individual offending animals, depending on the species and magnitude of the problem, and not an attempt to eradicate any native wildlife population in a large area or region. In the case of invasive species, the goal may be to eradicate them (this is rarely feasible for established populations).

- TWSP Specialists use specific trap types, lures, and placements that are most conducive for capturing the target animal.

- TWSP BDM kill is monitored. Both "Total Harvest" and estimated population numbers of key species are used to assess cumulative effects of harvest. TWSP BDM is designed to maintain the level of harvest below that which would impact the viability of populations of native species (see Chapter 4) as determined by WS in consult with USFWS and TPWD, as appropriate. TWSP provides data on total take of target animal numbers to other agencies (i.e., USFWS, TPWD) as appropriate.

- TWSP currently has agreements for BDM on less than 5% of the land area in Texas. This could be increased several-fold, but target bird take would be monitored to ensure that harvest remains below a level that would impact viability of a species. However, TWSP will not impact bird species populations on more than 95% of the lands in Texas.

- TWSP will relocate birds, as appropriate, primarily for less abundant species such as Golden Eagles and other raptors. Nonnative species will not be relocated, but can be transferred to various facilities at the direction of USFWS or TPWD.

3.5.2.2 Effects on Nontarget Species Populations, Including T&E Species.

- TWSP personnel are highly experienced and trained to select the most appropriate BDM method(s) for taking problem birds with little impact on nontarget species.

- TWSP personnel work with research programs such as NWRC to continually improve and refine the selectivity of management devices, thereby reducing nontarget take.

- Nontarget animals captured in traps or with any other BDM method are released at the capture site unless it is determined by TWSP Specialists that the animal is not capable of self-maintenance.

- When working in an area that has T&E or sensitive species or has the potential for T&E species to be exposed to BDM methods, TWSP personnel will know how to identify the target and T&E species (e.g., Turkey Vulture vs. juvenile Bald Eagle), and apply BDM methods accordingly. However, BDM in Texas has little potential to impact T&E species.

- Avian predators of T&E or sensitive species such as the Attwater's Greater Prairie-Chicken (endangered) and Lesser Prairie-Chicken (candidate) could be captured, moved, or euthanized to enhance recruitment of the sensitive species. These actions would be conducted where they would provide a positive benefit to sensitive species with no significant negative impacts to target or nontarget populations.

- ***Measures to Reduce the Potential Take of Specific T&E or Sensitive Species***

  The Piping Plover and Least Tern. These species could be accidentally caught in mist nets or noose mats used to capture shorebirds for disease monitoring. These devices are monitored closely and species taken in them are released unharmed. Where these methods are used with the potential to take T&E species, WS has consulted nationally with USFWS under Section 7 of the ESA. WS SOPs to avoid impacts include ensuring WS Specialists are trained in plover and tern species identification, not working in areas known to be inhabited by these T&E species, monitoring mist nets and traps frequently, and pulling equipment if either species is seen in the vicinity of the trapping operations.

  Whooping Crane. TWSP employees will not use avicides in areas where Whooping Cranes could potentially be found as discussed in the 1992 BO (USFWS 1992).

  Aplomado Falcon. TWSP will not conduct lethal blackbird projects with DRC-1339 in the immediate area of the falcon where it would impact their prey-base as discussed in the 1992 BO (UFWS 1992).

  Bald Eagle. Even though the Bald Eagle was delisted in 2007, WS continues to implement BDM consistent with the recommendations addressed by the 1992 BO (USFWS 1992). TWSP has adopted and implemented all reasonable and prudent alternatives and measures and their terms and conditions to protect Bald Eagles as identified by USFWS in their 1992 BO (USFWS 1992). Most of these were directed toward other facets of WDM and not BDM.

3.5.2.3 Impacts on Public Safety, Pets, and the Environment.

- A formal risk assessment (USDA 1997, Appendix P) concluded that hazards to the public from BDM devices and activities are low.

- All pesticides are registered with EPA and TDA. TWSP employees will comply with each pesticide's directions and labeling and any additional EPA and TDA rules and regulations.

- TWSP Specialists that use restricted use chemicals (i.e., pesticides or drugs) are trained and certified by program personnel or other experts in the safe and effective use of these materials under EPA and TDA approved programs. TWSP employees who use chemicals participate in continuing education programs to keep abreast of developments and to maintain their certifications.

- TWSP Specialists who use firearms and pyrotechnics are trained and certified by experts in the safe and effective use of these materials. WS policy has requirements for training, safe use, storage and transportation of firearms as prescribed by the WS Firearms Safety Training Manual (WS Directive 2.615). WS Policy also has the same for pyrotechnics.

- Conspicuous, bilingual warning signs, alerting people to the presence of traps, avicides, and other BDM methods, are placed at major access points when they are set in the field.

3.5.2.4 Effects of BDM on Aesthetics

- TWSP take is minimal compared with overall bird species populations, and, thus, does not impact the opportunity of the public to enjoy wild bird species.

- TWSP could conduct BDM projects that protect T&E and sensitive species which could offer the public the potential opportunity to view these rarer species.

- TWSP conducts most BDM projects in areas where the public has little access, and therefore, that portion of the public that finds certain BDM methods as objectionable will not be upset by visually viewing that action.

3.5.2.5 Humaneness of Methods Used by WS

- Chemical immobilization and euthanasia procedures that do not cause pain or undue stress are used by certified TWSP personnel when practical and where safe.

- TWSP personnel attempt to kill captured target animals that are slated for lethal removal as quickly and humanely as possible. In most field situations, cervical dislocation is performed which causes rapid unconsciousness followed by cessation of heart function and respiration which is in concert with the American Veterinary Medical Association's (1987) definition of euthanasia (Beaver et al. 2001). In some situations, accepted chemical immobilization and euthanasia methods are used.

- Cage and padded-jaw leghold pole traps are set and inspected according to WS policy. Water and food are replenished as necessary in decoy traps.

- Research continues with the goal of improving the humaneness of BDM devices.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides information needed for making informed decisions in selecting the appropriate alternative for meeting the purpose and need of the proposed action. This chapter analyzes the environmental consequences of each alternative discussed in Chapter 3 in relation to the issues identified for detailed analysis in Chapter 2. The environmental consequences of each alternative are compared with the current program, the no Action Alternative, to determine if the real or potential impacts would be greater, lesser, or the same. Therefore, the current program, the Proposed Action Alternative, serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The background and baseline information presented in the analysis of the current program alternative, therefore, may also apply to the analysis of each of the alternatives.

4.1 ISSUES ANALYZED IN DETAIL

NEPA requires federal agencies to determine whether their actions have a "*significant impact on the quality of the human environment*." The environmental consequences of the 4 alternatives are discussed below with emphasis on the issues presented in Chapter 2. The comparison of alternatives will be used to make a selection of the most appropriate alternative for TWSP BDM activities. The alternatives selected for detailed assessment provide the best range of alternatives that could potentially meet the purpose and the need of BDM in Texas as identified in Chapter 1 as discussed in Chapter 3.

4.1.1 Effects of BDM on Target Bird Species Populations

To adequately determine the magnitude of impacts in relation to birds and their populations, TWSP data and known cumulative or "other" take (sportsmen harvest and permitted depredation take) will be analyzed. The authority for management of migratory birds is USFWS and of resident bird species is TPWD. TPWD regulates hunting of migratory game species under the direction of USFWS and monitors migratory nongame.

An aspect, perhaps overriding, that is germane to the determination of "significance" under NEPA is the effect of a federal action on the *status quo* for the environment. States have the authority to manage populations of wildlife species as they see fit, but for migratory and T&E bird species with oversight from USFWS. However, management direction for a given species can vary among states, and state management actions are not subject to NEPA compliance. Therefore, the *status quo* for the environment with respect to state-managed wildlife species is the management direction established by the States. Federal actions that are in accordance with state management have no effect on the *status quo*. Wildlife populations are typically dynamic and can fluctuate without harvest or control by humans. Therefore, the *status quo* for wildlife populations is fluctuation, both within and among years, which complicates determining the significance of human impact on such populations.

4.1.1.1 Alternative 1 - Continue the Current Federal BDM Program. Under the Current Federal Program Alternative, TWSP conducts BDM on bird species in Texas causing problems or concerns with lethal and nonlethal BDM methods. Lethal take by TWSP and others will be considered regionally or statewide to provide a more comprehensive picture of impacts to bird populations. The prior EA (WS 1998) determined that BDM had no significant impacts to blackbird populations in Texas from projects to protect sprouting rice. This EA has been expanded to include all bird species in Texas to determine the magnitude of impacts for other species as well. Analyzing impacts of bird species at the statewide and Central Plains States (CPS) region level provides a more comprehensive and statistically sound look at cumulative impacts because population estimates and take is statistically more credible on a statewide or regional scale, and impacts of BDM often involve a regional population because most birds are migratory.

BDM targets specific species and cumulative effects on those species populations from BDM and other actions are analyzed to determine the relative significance of impacts. In addition, management direction from the responsible agency (USFWS and TPWD) is a determining factor. From a NEPA standpoint, justification for a finding of "*no significant impact on the quality of the human environment*" with respect to TWSP's take of most birds in Texas is the fact that TWSP's involvement has no adverse effect on the *status quo* because, if TWSP was not available, under USFWS or TPWD authority, virtually the same birds that are killed by TWSP could be taken by other agency or private actions. This suggests that, if TWSP stopped its involvement in most bird management, there would be virtually no change in environmental effects or in cumulative environmental effects. Additionally, landowners that are given assistance with damage problems are much more likely to have a favorable view of wildlife (International Association of Fish and Wildlife Agencies 2004, Treves and Naughton-Treves 2005).

A "viable" wildlife population can exist at many levels between one that is at carrying capacity (the maximum number of a species that a particular habitat can support) and one that is at only a fraction of carrying capacity. Because rates of increase are density dependent (i.e., the population grows at a faster rate as the population is reduced in relation to carrying capacity), bird populations have the ability to recover from declines that might result from mistakes in management. History has born this out by the fact that efforts in the early half of the 20th century to eradicate some of the larger mammalian predator species (i.e., coyotes, black bears, and mountain lions) failed to do so. However, the larger predators' numbers were most likely reduced substantially (Evans 1983). Density dependent rates of increase are a built-in mechanism of most wildlife populations that serve to reduce effects of population reductions whether by harvest, localized control, or non-man-induced mortality. This provides additional assurance that a viable population of a target species would be maintained in Texas, even if a sustainable harvest rate is exceeded in the short term in areas where the objective is to maintain the population.

The methods used by TWSP to take target bird species under the current program are the same as those that have been used in recent years and were described in Section 3.3.1.3. The methods used in each damage situation depend on the species causing damage and other factors including location (public *vs.* private lands), weather, and time of year as discussed in Section 3.2. The methods include physical exclusion, frightening devices, shooting, cage traps, padded-jaw pole traps, and avicides. Many BDM methods, especially those that can be safely implemented by the public, may only be recommended by TWSP personnel and incorporated by the resource owner.

TWSP uses lethal and nonlethal methods as needed for appropriate biologically sound, effective BDM. Analysis of this issue is limited primarily to those species most often killed during TWSP BDM; however, nonlethal BDM will be analyzed for potential impacts as well. The analysis for magnitude of impact generally follows the process described in USDA (1997, Chapt. 4 pp. 4-9 to 4-16). Magnitude is described in USDA (1997, Chapt. 4 pp. 4-11) as ". . . *a measure of the number of animals killed in relation to their abundance*." Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest data, when available. In general, TWSP conducts most BDM on species whose population densities are high and usually only after they have caused damage. WS conducts both lethal and nonlethal BDM for birds. Lethal and nonlethal take will be given and then a discussion will follow regarding the impacts to species.

Impacts on Bird Populations from Lethal Take in BDM

TWSP conducted lethal BDM from FY07 to FY11 for a total of 90 bird species in Texas with 4 of these only theoretically taken (Brewer's Blackbird, Yellow-headed Blackbirds, Bronzed Cowbird, and Lesser Nighthawk) (Table 8) in response to damage caused by birds (129 species noted in Table 2). The average annual number of species taken lethally was 58 from FY07 to FY11 with a high of 73 species in FY07 (most nighthawks taken were likely Common Nighthawks – the number taken could be reduced if only

Common Nighthawks were taken annually). Take was high in FY07 as a result of conducting disease monitoring for HP H5N1 AI and increased BDM at airports. Two species were only taken for disease monitoring purposes (Greater and Lesser Yellowlegs). TWSP conducted most lethal BDM annually from FY07 to FY11 for 9 bird species in Texas with an average annual take greater than or equal to 1,000. Nine species had a take of 100 or greater, but less than 1,000 and 21 had a take from 10 to 99. The majority of species (51), theoretically including the Lesser Nighthawk, taken lethally by TWSP had an annual take of less than 10. The primary target species were Red-winged Blackbirds, Brown-headed Cowbirds, Common and Great-tailed Grackles, European Starlings, feral pigeons, American Crows, and Black Vultures. Of the annual take of birds from FY07 to FY11, 98.5% of the take were 6 species: Red-winged Blackbirds (46%), Brown-headed Cowbirds (39%), European Starlings (7%), Great-tailed Grackles (3%), Common Grackles (2%), and feral pigeons (2%). The remaining 85 species combined accounted for about 1.5% of TWSP's lethal take. From FY94 to FY06[11], additional species taken lethally have included the Rusty Blackbird theoretically (0.5/year), Monk Parakeet (0.1/year), Fish Crow (15.7/year), Eastern Screech-Owl (0.1/year), Black Skimmer (0.1/year), Solitary Sandpiper (0.2/year), Pectoral Sandpiper (0.1/year), Canvasback (0.1/year), Bufflehead (0.1/year), Northern Flicker (0.1/year), Ladder-backed Woodpecker (0.1), and other woodpeckers (0.2/year) (total of 103 species over 18 years).

Table 8. Birds killed by TWSP in BDM from FY07 to FY11. Take was estimated for species taken with DRC-1339 and Avitrol. Population estimates for the CPS region and North America are included for landbirds in the 1990s (RMBO 2007) and for waterbirds (NAS 2012b), unless otherwise noted, and from FY07 to FY11 BBS data for Texas from USGS (2012).

Species	FY07	FY08	FY09	FY10	FY11	Ave	Estimated Breeding Population		
							Texas	CPS	N. Amer.
Blackbirds									
Red-winged Blackbird*	485,754	347,370	361,845	75,170	265,080	307,044	9,900,000	47,000,000	190,000,000
Brown-headed Cowbird*	185,057	133,285	309,127	357,499	330,133	263,020	3,100,000	19,000,000	51,000,000
Common Grackle*	16,490	12,294	26,474	16,375	14,110	17,149	2,200,000	23,000,000	97,000,000
Great-tailed Grackle*	14,013	24,688	6,150	27,793	3,720	15,273	6,800,000	6,300,000	7,800,000
Boat-tailed Grackle*	4,873	3,595	0	0	42	1,702	200,000	190,000	4,000,000
Brewer's Blackbird*	2,729	1,957	0	0	0	937	nb	88,000	35,000,000
Bronzed Cowbird	26	22	0	0	0	10	660,000	500,000	500,000
Yellow-headed Blackbird*	2	0	1	0	0	1	23,000	9,100,000	20,000,000
Introduced Commensal Birds									
European Starling*	51,769	7,650	35,510	111,603	42,914	49,889	1,800,000	7,700,000	120,000,000
Feral (Rock) Pigeon*	7,251	5,711	7,024	2,270	3,132	5,078	880,000	2,600,000	26,000,000
House Sparrow*	1,702	0	0	1,037	44	557	3,800,000	18,000,000	82,000,000
Feral Domestic Mallard/Muscovy	0	97	0	107	21	45	na	na	na
Eurasian Collared-Dove	0	0	0	0	23	5	1,100,000	3,000	
Feral Geese	0	0	0	0	11	2	na	na	na
Feral Chicken	0	0	9	0	0	2	na	na	na
Corvids									
American Crow*	6,319	700	2,632	44	694	2,078	1,300,000	3,500,000	31,000,000
Common Raven*	69	26	80	117	203	99	7,600	4,900	4,000,000
Chihuahuan Raven*	13	0	0	0	0	3	62,000	92,000	400,000
Raptors									
Black Vulture	1,858	1,315	1,468	2,548	1,963	1,830	200,000	100,000	250,000
Turkey Vulture	320	321	213	228	242	265	600,000	610,000	1,300,000
Swainson's Hawk	54	30	7	58	3	30	62,000	140,000	460,000
American Kestrel	6	8	26	49	12	20	57,000	340,000	4,300,000
Crested Caracara	17	17	31	22	14	20	150,000	65,000	70,000
Mississippi Kite	15	2	5	36	0	12	79,000	146,000	190,000
Red-tailed Hawk	12	8	6	2	9	7	120,000	330,000	2,000,000
Sharp-shinned Hawk	11	1	0	0	0	2	2,600	15,000	600,000
Broad-winged Hawk	10	0	0	0	0	2	49,000	86,000	1,700,000
Cooper's Hawk	1	0	0	0	4	1	51,000	59,000	500,000
Northern Harrier	4	0	0	0	0	1	3,300	60,000	400,000
Osprey	1	1	0	0	0	0.4	110	480	200,000
Red-shouldered Hawk	0	0	0	0	2	0.4	170,000	120,000	800,000
Great Horned Owl	1	0	0	0	1	0.4	220,000	610,000	2,000,000
Native Doves and Pigeons									
Mourning Dove	305	698	305	743	666	543	13,000,000	42,000,000	110,000,000
White-winged Dove	192	12	31	120	89	89	1,700,000	730,000	4,800,000
Grassland Passerines									

[11] Averages given are for FY94 to FY11 (18 years), except for Rusty Blackbird which was estimated DRC-1339 take using CBC numbers for only FY04-FY11 (8 years).

Species	FY07	FY08	FY09	FY10	FY11	Ave	Estimated Breeding Population		
							Texas	CPS	N. Amer.
Eastern Meadowlark	289	675	243	384	296	377	950,000	3,100,000	8,100,000
Western Meadowlark	298	92	7	83	225	141	570,000	4,000,000	30,000,000
Western Kingbird	10	14	15	173	1	43	3,500,000	5,600,000	18,000,000
Scissor-tailed Flycatcher	27	26	31	58	60	40	4,200,000	6,900,000	7,100,000
Horned Lark	36	24	15	36	52	33	1,500,000	17,000,000	99,000,000
Lark Bunting	0	50	20	0	16	17	100,000	10,000,000	27,000,000
Gulls/Terns									
Laughing Gull	527	528	109	175	162	300	230,000^	230,000^	800,000
Ring-billed Gull	1	4	0	0	31	7	nb	96,000^	2,600,000
Franklin's Gull	6	6	2	0	0	3	nb	74,000^	320,000[12]
Herring Gull	2	0	0	8	0	2	nb	nb	370,000
Bonaparte's Gull	5	0	0	0	0	1	nb	nb	390,000
Least Tern	0	0	0	3	0	1	2,800^	3,600^	67,000
Forster's Tern	3	0	0	0	0	1	7,200^	12,000^	47,000[13]
Shorebirds									
Upland Sandpiper	181	294	47	175	109	161	110^	350,000^	350,000[1]
Killdeer	36	64	21	69	63	51	100,000^	610,000^	1,000,000[1]
Lesser Yellowlegs[D]	61	0	0	0	0	12	nb	nb	400,000[1]
Greater Yellowlegs	5	0	0	0	0	1	nb	nb	100,000
Long-billed Curlew	0	0	0	4	0	1	7,300^	26,000^	55,000
Long-billed Dowitcher	2	0	1	0	0	1	nb	nb	500,000[1]
Wading Birds									
Cattle Egret	15	356	3	43	100	103	830,000^	970,000	1,200,000[1,4]
Great Blue Heron	29	36	24	31	12	26	31,000^	67,000	120,000
Great Egret	16	29	1	3	1	10	63,000^	110,000	270,000
Yellow-crowned Night-Heron	12	6	2	4	6	6	3,600^	3,900	na
Snowy Egret	15	0	0	1	0	3	37,000^	40,000	1,400,000
Little Blue Heron	2	5	0	0	0	1	28,000^	36,000	150,000
Green Heron	2	0	1	0	0	1	17,000^	26,000	na
Tricolored Heron	1	0	0	0	0	0.2	15,000^	11,000	290,000
Waterbirds									
Double-crested Cormorant	151	3	11	2	8	35	2,700^	74,000^	1,600,000
Eared Grebe	0	0	0	1	0	0.2	nb	24,000^	3,700,000
Waterfowl									
Canada Goose	14	21	7	5	44	18	6,400^	1,200,000	5,300,000
Northern Pintail	7	6	17	15	2	9	840^	1,800,000	3,600,000
Black-bellied Whistling-Duck	2	7	2	5	21	7	96,000^	96,000^	550,000
Gadwall	17	3	4	0	10	7	730^	2,700,000	3,900,000
Mallard	15	0	6	5	3	6	23,000^	6,300,000	13,000,000
Northern Shoveler	8	7	0	0	15	6	2,600^	3,100,000	4,400,000[5]
American Wigeon	14	3	0	8	0	5	nb	1,300,000	2,500,000[5]
Mottled Duck	0	15	5	4	2	5	15,000^	15,000^	660,000
Ring-necked Duck	12	11	0	1	0	5	nb	620,000	2,000,000
Sandhill Crane	23	1	0	0	0	5	nb	452,000	520,000
Snow Goose	0	1	0	7	9	3	nb	3,900,000	3,900,000
Blue-winged Teal	10	2	3	0	2	3	9,300^	5,500,000	7,400,000[5]
American Coot	9	0	0	0	8	3	56,000^	2,400,000	6,000,000[6]
Lesser Scaup	0	9	0	0	0	2	nb	2,300,000	3,700,000
Ruddy Duck	4	0	0	5	0	2	4,100^	630,000	~500,000
Green-winged Teal	6	0	0	0	0	1	1,400^	1,700,000	3,000,000[5]
Cinnamon Teal	0	1	0	0	0	0.2	1,200^	1,200^	na
Redhead	0	1	0	0	0	0.2	1,400^	830,000	1,200,000
Common Gallinule	1	0	0	0	0	0.2	4,300^	4,300^	1,300,000[6]
Nighthawks, Swifts, and Swallows									
Cliff Swallow	10	12	1	2	216	48	15,000,000	19,000,000	80,000,000
Barn Swallow	35	87	39	19	25	41	4,200,000	12,000,000	51,000,000
Common/Lesser Nighthawks	30	38	11	25	7	22	3,100,000	5,200,000	12,000,000
Chimney Swift	0	0	0	0	1	0.2	480,000	1,900,000	15,000,000
Woodpeckers									
Golden-fronted Woodpecker	0	5	1	2	6	3	840,000	840,000	840,000
Gallinaceous Birds									
Wild Turkey	1	0	0	1	0	0.4	340,000	520,000	1,200,000
Frugivorous Birds									
American Robin	0	1	0	0	0	0.2	170,000	13,000,000	310,000,000

*Take was estimated for DRC-1339 and Avitrol use – see Appendix B. **nb**=non-breeder **na**=not available
D – Disease monitoring only – no damage per se ^ - Pop. estimate from 2007-2011 BBS (USGS 2012) with no detectability parameters
[1]Population estimate from Donaldson et al. 2000 [2]Range 320,000-990,000 breeders [3]Range 47,000-52,000 breeders
[4]Estimate for Texas Only [5]USFWS 2009 [6]Waterbird Conservation 2009

TWSP uses several BDM methods that result in the lethal take of birds. The greatest number of birds is lethally taken with chemical methods. TWSP used 4 chemicals on birds from FY07 to FY11, DRC-1339, Avitrol, SLS, and A-C. Table 7 (Section 2.1.3) gives the amount of chemical used by TWSP. Take with

DRC-1339 and Avitrol was estimated by Specialists in the field for most projects, but to be conservative, were estimated because only dead birds found were sometimes recorded in the MIS (Appendix B). The MIS does not record wastage which could be from: chemical baits disposed of by deep burial because birds did not take all of the bait or the project failed due to birds not being present; the shelf-life of DRC-1339, once a bait is mixed, is about 3 to 7 days depending on environmental factors such as heat and humidity and baits from projects not completed in this time are remade, and thus, the baits disposed; and finally, precipitation and harsh weather conditions can decrease a project's effectiveness because bait loses its effectiveness more quickly. Thus, bird take estimates with DRC-1339 and Avitrol from Appendix B are estimated mostly at an "ideal" level and are likely high because many factors can reduce the success of projects, especially DRC-1339.

Take with DRC-1339 can conservatively be estimated for each species based on daily consumption and the bait applied by TWSP; this is discussed thoroughly in Appendix B. When a species was specified, the chemical take was estimated for that species. Blackbird take, including starlings, is often combined as blackbird (mixed species) in the MIS. Projects involving mixed blackbirds at feedlots have been estimated to be 95% starlings and 5% other blackbirds by TWSP Specialists. The other blackbirds were divided to species by the typical composition of birds found in Texas during the time of year the project took place. Other than starlings, TWSP Specialists see mostly Red-winged and Brewer's Blackbirds, Brown-headed Cowbirds, and Great-tailed and Common Grackles during BDM projects at CAFOs. On the other hand, projects to protect sprouting rice involve mostly Red-winged Blackbirds and Brown-headed Cowbirds with virtually no starlings. To analyze impacts for mixed blackbird projects, species composition for blackbirds other than starlings was estimated. For projects conducted from April 1 to November 30, species composition was averaged from BBS (USGS 2012) and CBC (NAS 2012a) data for the blackbird species found in Texas. For mixed blackbird projects from December 1 to March 31, an estimate of species composition was derived from CBC data (NAS 2012a). These percentages are used to estimate take for the different species. The estimated take (Appendix B) is added to other take to determine impacts to the species taken in BDM. It should be noted that the take of Rusty Blackbirds, though minimal in the CPS region, is likely a high estimate because this species mostly forages in wet woodlands away from other blackbirds and not in feedlots, open rice fields, and urban areas where most BDM projects occur.

To analyze impacts, blackbird take was estimated for all WS projects in the CPS region. The take for mixed blackbird projects is estimated by the species composition found in BBS and CBC data for each of the core states, the CPS region, in the Central Flyway (Figure 6) where BDM is conducted by WS, including TWSP, for analysis purposes. It should be noted that DRC-1339 treated baits are often greased to enhance consumption by starlings which are prevalent at feedlots during winter throughout the United States and especially in the CPS when insects are relatively unavailable; starlings, requiring a high protein diet, favor the greased treated baits over the other blackbirds found in feedlots, and will seek them out, whereas the other blackbirds will eat what is available searching more for grain (Twedt 1985). Thus, fewer blackbirds, but more starlings are likely taken by WS than estimated as discussed in Appendix B. Overall, it was estimated that starlings make up at least 95% of the flocks found at feedlots in Texas and the other states in the CPS. For other projects, blackbird take was estimated by the species and their composition found in a given area.

In addition to WS take, private landowners and others can take birds to resolve damage problems. This take is needed for a cumulative impact analysis. Nonnative species such as the feral pigeon, starling, and House Sparrow and those under a USFWS Depredation Order such as blackbirds, magpies, and crows can be taken without a permit. Thus, take for these species can only be estimated. However, most other migratory birds require a USFWS permit with reporting requirements and resident birds require a TPWD permit. USFWS provided permitted take for calendar years 2006 to 2010 for Texas and Oklahoma in Region 2 (Katie Wade, Migratory Bird Permit Office, Albuquerque, NM, *unpubl. data*, 2011) and for Kansas, Nebraska, South Dakota, and North Dakota in Region 6 (Kelly Gonzales, Region 6, Migratory

Bird Permit Office, Lakewood, CO, *unpubl. data*, 2010). Permits were issued for few species and take is included in the analysis for each species. Table 9 provides USFWS permitted from 2006 to 2010 (2011 data had not been compiled for both regions when writing the EA was near completion so unable to use calendar year 2011 information). In all, private individuals took 49 known species in Texas and 62 in the CPS region under USFWS permits. Private take will be considered with TWSP take to determine cumulative impacts on species.

Table 9. USFWS permitted take in Texas and the CPS region from 2006 to 2010.

Species	2006		2007		2008		2009		2010		Ave	
Area	**TX**	**CPS**	**TX**	**CPS**	**TX**	**CPS**	**TX**	**CPS**	**TX**	**CPS**	**TX**	**CPS**
Raptors												
Black Vulture	134	134	202	202	559	561	5	5	18	19	184	184
Turkey Vulture	-	-	30	30	226	240	127	157	8	64	78	98
Crested Caracara	-	-	6	6	12	12	-	-	-	-	4	4
Osprey	-	-	-	-	1	1	-	-	-	-	0.2	0.2
Red-tailed Hawk	-	-	0	2	12	12	3	40	4	53	4	21
Swainson's Hawk	-	-	-	-	9	9	5	10	1	3	3	4
Rough-legged Hawk	-	-	-	-	-	-	-	-	0	1	0	0.2
Red-shouldered Hawk	-	-	-	-	-	-	-	-	1	1	0.2	0.2
Cooper's Hawk	-	-	0	2	0	9	0	17	0	4	0	6
Sharp-shinned Hawk	-	-	-	-	-	-	-	-	0	3	0	1
Northern Harrier	-	-	-	-	-	-	0	3	0	5	0	3
Mississippi Kite	-	-	-	-	0	2	-	-	0	2	0	1
American Kestrel	-	-	-	-	3	4	22	37	3	12	6	11
Great Horned Owl	-	-	-	-	0	3	0	3	0	45	0	10
Barn Owl	-	-	-	-	-	-	-	-	1	3	0.2	1
Barred Owl	-	-	-	-	-	-	-	-	0	3	0	1
Short-eared Owl	-	-	-	-	-	-	0	1	0	2	0	1
Shorebirds												
Upland Sandpiper	-	-	-	-	2	70	-	-	0	3	0.4	14.6
Killdeer	-	-	-	-	74	147	14	151	6	61	19	72
Long-billed Dowitcher	-	-	-	-	2	2	-	-	-	-	0.4	0.4
Baird's Sandpiper	-	-	-	-	-	-	0	1	0	7	0	2
Least Sandpiper	-	-	-	-	-	-	-	-	0	4	0	1
White-faced Ibis	-	-	-	-	-	-	-	-	1	1	0.2	0.2
Gulls/Terns												
Gull spp.	-	-	-	-	5	48	-	-	2	3	1	10
Laughing Gull	-	-	-	-	201	201	-	-	2	2	41	41
Ring-billed Gull	0	480	0	325	0	584	0	534	2	1,410	0.4	667
Franklin's Gull	0	180	0	44	2	324	0	594	0	481	0.4	325
Herring Gull	0	76	0	16	2	183	0	223	0	103	0.4	120
Bonaparte's Gull	-	-	0	28	-	-	0	81	0	51	0	32
California Gull	-	-	-	-	-	-	0	160	0	464	0	125
Caspian Tern	-	-	-	-	10	10	-	-	1	1	2	2
Forster's Tern	-	-	-	-	19	19	-	-	1	1	4	4
Royal Tern	-	-	-	-	19	19	-	-	1	1	4	4
Wading Birds												
Cattle Egret	-	-	-	-	29	34	0	511	6	10	7	111
Great Blue Heron	23	119	0	92	335	418	1	108	5	81	73	164
Great Egret	-	-	-	-	210	211	-	-	5	7	43	44
Snowy Egret	-	-	-	-	126	126	-	-	5	7	26	27
Little Blue Heron	-	-	-	-	7	7	0	300	1	3	2	62
Green Heron	-	-	-	-	23	23	-	-	1	1	5	5
Blk-crowned Night-Heron	-	-	-	-	25	25	-	-	1	2	5	5
Yel-crowned Night-Heron	-	-	-	-	6	6	10	10	2	2	4	4
Waterbirds												
Dbl-crested Cormorant	0	301	100	529	51	235	0	523	3	209	31	359
American White Pelican	0	28	0	27	32	82	0	51	2	16	7	41
Pied-billed Grebe	-	-	-	-	25	25	-	-	2	2	5	5
Waterfowl												
Black-bellied Whistl-Duck	-	-	-	-	-	-	-	-	1	1	0.2	0.2
Canada Goose	-	-	0	5	1,648	1,674	0	2,178	2	2,472	330	1,266
Snow Goose	-	-	-	-	-	-	0	3	0	7	0	2
Great White-fronted Goose	-	-	-	-	-	-	-	-	0	2	0	0.4
Mallard	-	-	-	-	5	26	1	89	0	91	1	41
Gadwall	-	-	-	-	0	4	0	7	0	2	0	3
Northern Pintail	-	-	-	-	6	6	-	-	-	-	1	1
American Wigeon	-	-	-	-	2	2	0	4	0	2	0.4	2
Northern Shoveler	-	-	-	-	-	-	-	-	0	10	0	2
Blue-winged Teal	-	-	-	-	-	-	-	-	0	48	0	10
Green-winged Teal	-	-	-	-	0	4	0	4	0	6	0	3
Lesser Scaup	-	-	0	23	-	-	0	20	-	-	0	9
Ring-necked Duck	-	-	-	-	0	12	0	1	0	1	0	3

Redhead	-	-	-	-	1	1	-	-	0	8	0.2	2
Common Merganser	-	-	-	-	-	-	0	41	-	-	0	8
Hooded Merganser	-	-	-	-	1	1	-	-	-	-	0.2	0.2
American Coot	-	-	-	-	278	280	0	91	1	108	56	96
Sandhill Crane	-	-	-	-	-	-	-	-	1	1	0.2	0.2
Native Doves												
Mourning Dove	-	-	-	-	266	963	340	1,777	7	843	123	717
White-winged Dove	-	-	-	-	42	42	-	-	1	1	7	7
Aerialists												
Common/Lesser Nighthawk	-	-	-	-	2	30	0	36	4	6	1	14
Cliff Swallow	-	-	-	-	7	7	0	152	1	141	2	60
Barn Swallow	-	-	-	-	24	24	25	94	2	133	10	50
Bank Swallow	-	-	-	-	-	-	-	-	1	1	0.2	0.2
Grassland Birds												
Horned Lark	-	-	-	-	16	97	0	79	0	6	3	36
Western Kingbird	-	-	-	-	0	16	0	21	1	2	0.2	8
Eastern Kingbird	-	-	-	-	0	20	0	14	0	1	0	7
Scissor-tailed Flycatcher	-	-	-	-	13	13	20	20	3	5	7	8
Meadowlark spp.	-	-	-	-	0	383	1	374	4	7	1	153
Eastern Meadowlark	-	-	-	-	204	204	37	44	9	11	50	52
Western Meadowlark	-	-	-	-	2	2	0	4	0	18	0.4	5
Miscellaneous Birds												
Northern Flicker	-	-	0	1	-	-	-	-	-	-	0	0.2
Blue Jay	-	-	-	-	-	-	-	-	0	1	0	0.2
Northern Mockingbird	-	-	-	-	5	5	-	-	1	1	1	1
American Robin	-	-	-	-	-	-	0	10	-		0	2
Northern Cardinal	-	-	-	-	1	1	-	-	-	-	0.2	0.2
House Finch	-	-	-	-	-	-	-	-	1	2	0.2	0.4

Impacts on Bird Populations from Nonlethal Methods in BDM

TWSP hazed, or captured and released (disease monitoring) or relocated at least 99 species (some species were in mixed flocks and all the species present were not recorded) that had the potential to cause or were causing damage, or were involved in disease monitoring from FY07 to FY11. WS could potentially conduct nonlethal BDM for many more species (Appendix C: Tables C1 and C3). Operationally, WS conducts most all hazing activities for projects on airports or in urban areas where birds are an aviation strike hazard or a threat to human health and safety and property. The bird species that caused damage in Texas are listed in Section 1.2 with general information about them in Section 2.1.1 and the agency, USFWS, TPWD, or TWSP, with primary responsibility to assist with damage complaints from these species.

TWSP annually averaged hazing about 141,000 birds of at least 54 species from FY07 to FY11 (Table 10); it should be noted that many birds that are hazed may have to be hazed several times before they are successfully moved. WS conducted most hazing in conjunction with projects on airports. Additional hazing efforts were concentrated on reducing property damage and human health concerns for roosting vultures, herons, starlings and Great-tailed Grackles. The primary target species hazed by TWSP annually were blackbirds (35%), swallows (28%), and doves (13%), primarily at airports. The remaining 87 species combined accounted for 24% of the nonlethal hazing conducted by WS. Hazing birds by TWSP employees may negatively impact birds in the short term, especially if weather is particularly cold, because the birds are expending energy that they would otherwise not normally expend to search for food elsewhere. However, it is likely that the energy spent is minimal and not enough to cause impacts. For example, birds hazed from an area such as a crop field or an airport typically find alternate feeding, roosting, or loafing areas close by and actually benefit from being hazed. Birds hazed from an air operating area benefit from being less likely to be killed by aircraft and birds hazed to protect crops or other resources likely benefit because removing them from damage situations probably increases the tolerance of agricultural producers and other resource owners to their presence elsewhere (International Association of Fish and Wildlife Agencies 2004, Treves and Naughton-Treves 2005). This means that they should be less inclined to seek political help in reducing populations through increased sport hunting or direct population management.

Capture with relocation or release is done for some birds and mostly involved waterfowl (aver. 130/year), domestic waterfowl (aver. 51/year), shorebirds (aver. 35/year), raptors (aver. 20/year), and House Finches (aver. 3/year) from FY07 to FY11. Some waterfowl are relocated from damage situations. Domestic waterfowl are almost always given to an organization or individual that will take them. Barn Owls, Cooper's Hawks, and Sharp-shinned Hawks trapped inside a warehouse, often by chasing prey through an open doorway, were captured and relocated back outdoors. Several raptors were trapped at airports and relocated at least 50 miles away. Species that would most likely be involved in relocation would be rarer species and any species at the request of TPWD and USFWS.

TWSP conducted disease surveillance on birds from FY07 to FY11. The primary focus of the disease surveillance work was to monitor for the presence of H5N1 AI from FY07 to FY09. TWSP collected 2,613 samples in FY07, 1,981 in FY08, 1,778 in FY09, 790 in FY10, and 327 in FY11 for testing from fecal droppings, and cloacal and oral swabs from birds being monitored, primarily waterfowl and shorebirds. WS collected bird samples from a few birds taken lethally during BDM projects and at waterfowl hunter check stations. Several samples were collected from birds captured and released with rocket/cannon nets, mist nets, and cage traps, or from birds observed to collect fecal droppings (Table 10).

TWSP concludes that the nonlethal BDM activities have been beneficial in reducing damage or monitoring for disease and not created environmental concerns. However, nonlethal efforts do have a minimal potential to result in the take of a target bird, primarily when hazing is conducted with shooting, when a chemical such as A-C is used and an individual succumbs to the tranquilizer, or the incidental take of wildlife (e.g., captured in netting).

Table 10. Birds hazed (scared with frightening devices or other nonlethal method) from damage situations from or captured (in parentheses) and released (disease monitoring) or relocated from FY07 to FY11 by TWSP.

Species	FY07	FY08	FY09	FY10	FY11	Ave
Blackbirds						
Blackbirds – Mixed Species	5,585	10,495	115,600	32,735	0	32,883
Great-tailed Grackle*	7,910	20,625	290	1,900	6,935	7,532
Brown-headed Cowbird*	20	15,830	5,445	520	5,413	5,446
Red-winged Blackbird*	439	250	500	4,104	5,753	2,209
Common Grackle	0	0	120	1,198	4,718	1,207
Boat-tailed Grackle	0	0	474	580	0	211
Introduced Commensal Birds						
European Starling*	376	3,543	423	1,698	9,393	3,087
Feral (Rock) Pigeon*	154	82	252	40	6,860	1,478
House Sparrow*	60	0	0	0	0	12
Eurasian Collared-Dove	0	0	0	0	40	8
Feral Domestic Duck	0 (10)	0 (205)	0 (11)	0	0 (7)	0 (48)
Feral Geese	0 (7)	0 (8)	0	0	0	0 (3)
Corvids						
American Crow*	0	6	0	0	859	173
Raptors						
Turkey Vulture	3,054	5,384 (2)	3,311	3,469 (1)	4,252 (4)	3,894 (1)
Black Vulture	4,486	2,859	3,214	841	2,431	2,766
Swainson's Hawk	257	220	76 (1)	1,383 (2)	67	401 (1)
American Kestrel	23	51	196	636	341 (22)	249 (4)
Broad-winged Hawk	250	225	0	0	50	105
Crested Caracara	113	67	41	36	73	66
Red-tailed Hawk	24 (6)	22 (16)	41 (1)	31	110 (13)	46 (7)
Osprey	62	28	9	11 (1)	2	22 (0.2)
Northern Harrier	30	29	5	8	63 (1)	17 (0.2)
Mississippi Kite	0	50	0	0	0	10
Sharp-shined Hawk	12	2 (1)	0	0	0 (1)	3 (0.4)
Cooper's Hawk	1 (2)	1 (6)	0	1	0 (2)	1 (2)
Great Horned Owl	0 (3)	1 (2)	0	0	0 (2)	0.2 (1)
Red-shouldered Hawk	0	0	0	0	1	0.2
Common Barn Owl	0 (7)	0 (6)	0	0	0	0 (3)
Gulls/Terns						
Laughing Gull	8,908	7,418	2,825	5,519	6,081	6,150
Ring-billed Gull	0	5	0	30	3,275	662
Franklin's Gull	198	54	98	215	0	113
Black Skimmer	425	0	0	0	0	85
Least Tern	0	0	0	200	25	45
Herring Gull	180	0	0	0	0	36

Forster's Tern	40	0	50	0	0	18
Bonaparte's Gull	32	0	0	0	0	6
Waterbirds						
Double-crested Cormorant	122	291	107	50	3,657	845
American White Pelican	0	1	0	0	570	114
Shorebirds						
Upland Sandpiper	51	131	7	144	462	159
Killdeer	37	42	13	39	518	130
Long-billed Curlew	0	0	0	99	15	23
Wilson's Snipe	37	0	0	0	0	7
Long-billed Dowitcher	4 (9)	10	10	0	0	5 (2)
Least Sandpiper[D]	0 (50)	0	0	0	0	0 (10)
Dunlin[D]	0 (47)	0	0	0	0	0 (9)
White-rumped Sandpiper[D]	0 (23)	0	0	0	0	0 (5)
Semipalmated Sandpiper[D]	0 (18)	0	0	0	0	0 (4)
Spotted Sandpiper[D]	0 (2)	0	0	0	0	0 (0.4)
Lesser Yellowlegs[D]	0 (6)	0	0	0	0	0 (1)
Stilt Sandpiper[D]	0 (4)	0	0	0	0	0 (1)
Western Sandpiper[D]	0 (4)	0	0	0	0	0 (1)
Semipalmated Plover[D]	0 (3)	0	0	0	0	0 (1)
Pectoral Sandpiper[D]	0 (2)	0	0	0	0	0 (0.4)
Ruddy Turnstone[D]	0 (1)	0	0	0	0	0 (0.2)
Wading Birds						
Cattle Egret	95	1,355	105	382	2,078	803
Great Blue Heron	627	336	405	415	487	454
Great Egret	50	73	9	18	113	53
Snowy Egret	24	0	83	20	0	25
White Ibis	0	0	0	125	0	25
Little Blue Heron	0	42	0	0	0	8
Green Heron	0	0	16	0	0	3
Yellow-crowned Night-Heron	2	0	0	0	0	0.4
Tricolored Heron	2	0	0	0	0	0.4
Waterfowl						
Northern Pintail	1,572 (34)	435	2,375	3,610	1,049	1,808 (7)
Sandhill Crane	308	844	3,867	157	196	1,074
Black-bellied Whistling-Duck	2	252	81	5	1,321	332
Northern Shoveler	16 (5)	31	32	341	1,182	320 (1)
Gadwall	226 (5)	145	15	99 (11)	701	237 (3)
American Wigeon	72 (7)	115	253	239	320	200 (1)
Blue-winged Teal	45 (61)	16	482 (1)	10 (18)	303	171 (16)
Lesser Scaup	0	75	80	80	470	141
Snow Goose	0	585	0	0	90	135
Ring-necked Duck	66	38	0	10	390	101
Mallard	140 (49)	73 (66)	10	41	15 (19)	56 (27)
Mottled Duck	0	93	36	0	2	26
Greater White-fronted Goose			0	0	120	24
Ruddy Duck	0	0	0	60	40	20
Canada Goose	25 (14)	30 (30)	3 (68)	0 (38)	0 (17)	12 (33)
Redhead	0	0	0	0	44	9
Bufflehead	0	0	0	18	20	8
Green-winged Teal	12 (135)	15	0 (31)	0 (22)	4	6 (38)
Canvasback	0	0	0	0	12	2
American Coot	10	0	0	0	0	2
Grassland Species						
Western Meadowlark	987	447	104	747	11,600	2,777
Eastern Meadowlark	99	3,238	226	1,373	4785	1,944
Horned Lark	0	2,310	105	924	1,164	901
Lark Bunting	90	710	1,050	0	295	429
Scissor-tailed Flycatcher	0	1	102	179	463	149
Savannah Sparrow	0	0	0	0	140	28
Western Kingbird	9	0	5	0	0	3
Native Doves and Pigeons						
White-winged Dove	3,536	40,586	17,504	14,006	9,392	17,005
Mourning Dove	635	742	135	2,882	5,264	1,932
Nighthawks, Swifts, and Swallows						
Barn Swallow	0	10,566	6,115	4,025	125,670	29,275
Cliff Swallow	3,250	8,295	3,000	2,360	33,510	10,083
Common/Lesser Nighthawks	0	2	30	0	4	7
Purple Martin	0	8	0	0	0	2
Gallinaceous Birds						
Wild Turkey	2	1	0	6	2	2
Frugivorous Birds						
Cedar Waxwing	0	75	0	0	0	15
House Finch	0	0	0 (14)	0	0	0 (3)
Unidentified Passerine	1	0	0	0	0	0.2

[D] – Disease monitoring only – no damage per se=

Impacts of BDM on Bird Species in Texas

Blackbirds

Texas has nine species of blackbirds that are present at some time of the year. Precise counts of blackbird populations do not exist but the winter population of starlings and blackbirds has been estimated at over 500 million (Meanley and Royal 1976, Royall 1977). The majority of wintering blackbirds and starlings occur in southeastern United States roosts where their numbers were estimated to be 350 million (Bookhout and White 1981). The northwest and southwest regional population of the blackbird group was estimated at 111 million (Meanley and Royall 1976). An intensive study from 1996 to 1998 in the Northern Prairie-Pothole Region (Peer et al. 2003) including areas in North and South Dakota, Minnesota, Saskatchewan, and Alberta (Figure 13) found 61 million breeding Red-winged and Yellow-headed Blackbirds, and Common Grackles (Table 11) indicating the potential numbers breeding in a relatively small area. Data from BBS indicate that the blackbird population surveywide is about 400 million (Table 8) with about 94 million in the CPS region (Figure 6). This EA will use the population estimated for CPS from Table 4 and Appendix A to determine impacts relative to recent population estimates.

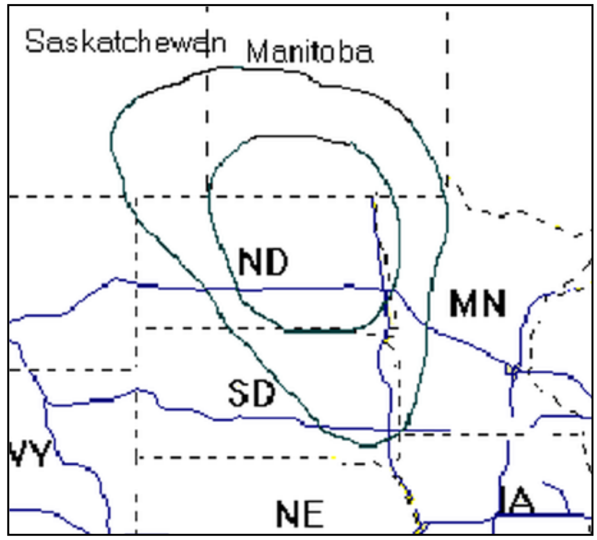

Figure 13. The Northern Prairie-Pothole region used by Peer et al. (2003) to make an estimate of the population of 3 blackbird species.

Meanley (1971) analyzed band return data which showed that blackbirds wintering in Arkansas, Mississippi, and Louisiana in the Mississippi Flyway, and Texas in the Central Flyway came from 13, 16, 14, and 15 different states and provinces, respectively, ranging east to west from Alberta to New England and Quebec. Knittle et al. (1987) documented 86% of marked Red-winged Blackbirds dispersing from spring roosts in Missouri and southeastern South Dakota migrated to breeding sites in western Minnesota, North Dakota, and eastern South Dakota, and provided evidence that some Red-winged Blackbirds coming from spring roosts in the central United States breed in Canada. As part of an ongoing NWRC research project, Red-winged Blackbirds which were color marked in North Dakota in early fall were collected around Cheyenne Bottoms in Kansas later in the year. Thus, it is probable that blackbirds wintering in Texas come from a much broader area than just CPS which comprises 6 states. This means that the mortality of blackbirds at Texas rice fields and CAFOs during winter months would not just be focused on the CPS population of blackbirds, but would be distributed across much of the northern part of the United States and Canada. This factor would serve to lessen the effects of BDM-induced mortality in Texas on the breeding population of blackbirds. It would also mean population impacts, including cumulative impacts, as discussed herein, would be distributed across a broad segment of the North American population of blackbirds. However, population estimates from the CPS area will be used to determine impacts to the various populations of blackbirds because it is likely that the majority of birds wintering in Texas come from the CPS north into Canada.

Table 11. Estimate of the breeding and fall blackbird population sizes in the Northern Prairie-Pothole region (Peer et al. 2003), an area that includes parts of Canada outside the CPS in the Central Flyway, but is much smaller than the CPS region.

	Red-winged Blackbird	Common Grackle	Yellow-headed Blackbird
Breeding Population	27,076,061	13,069,332	11,610,860
Fall Population	39,260,288	18,950,531	16,835,747

Based on observations of TWSP personnel at several affected Texas feedlots where TWSP starling and blackbird damage management operations are concentrated, the species composition of the birds causing damage has been estimated to be about 95% starlings and 5% blackbirds. On the other hand, birds in the rice fields of southeastern Texas have been blackbirds with a predominance of Red-winged Blackbirds and Brown-headed Cowbirds. However, blackbird populations have been estimated as discussed in Appendix A using BBS and CBC data for the regions where the damage occurs. USFWS established a standing depredation order for use by the public to take blackbirds causing or about to cause damage. This suggests that USFWS believes that native blackbird populations are healthy enough, and the problems they cause great enough, to allow such activities. Under this “order” (50 CFR 21.43), no federal permit is required by anyone to remove blackbirds if they are committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance. Thus, it appears that previous human-caused mortality or other factors have not resulted in major declines in the blackbird populations. It must be noted that USFWS took the Rusty Blackbird off the list of species that can be taken under the Depredation Order. In all likelihood, TWSP has taken relatively few Rusty Blackbirds, if any, and does not anticipate the take of more than a few at most. Further information is discussed in this Section.

TWSP averaged the take of about 600,000 (Table 8) and hazed about 50,000 (Table 10) blackbirds from FY07 to FY11. WS in the CPS, excluding Texas, took an additional 50,000 blackbirds in BDM. The lethal take of these species will be discussed, but hazing had no more than a minor effect on blackbirds and will not be discussed further.

Red-winged Blackbirds. Red-winged Blackbirds are one of the most abundant breeding birds in North America only followed by Brown-headed Cowbirds, and equal to Mourning Doves, in the number of routes where it was recorded, but its relative abundance was much higher than the other 2 species (Sauer et al. 2011). BBS data show a significant downward trend in the Red-winged Blackbirds population of -0.9%/year and -2.2%/year from 1966 to 2010 surveywide and in Texas. The decline mirrors the loss of wetland nesting habitat, primarily from changing agricultural practices and development (Dolbeer 2003). The combined United States and Canadian population of Red-winged Blackbirds has been estimated at nearly 190 million birds, based on winter roost surveys (Meanley and Royall 1976) and BBS data in the 1990s (Rich et al. 2004, RMBO 2007). The CPS population (Figure 6) was estimated at about 36 million with Texas having 2.6 million breeders (Table 4).

Female Red-winged Blackbirds breed as yearlings (second year); males do not breed until their third year. For the sake of estimating the population for this EA, it is assumed that 75% of the female Red-winged Blackbirds breed, the sex ratio is 1:1 males to females, females lay 3-5 eggs with the average of 3.3, and they have an average of 1.7 nests annually (Yasukawa and Searcy 1995). Fledgling success was found to range from 40% to 88% for the first clutch varying with climatic conditions; for the analysis of population impacts it will be assumed, to be conservative, that only 40% fledge. Far fewer nestlings were found to be successfully fledged from a second clutch, 4%, which will be used in this analysis (Yasukawa and Searcy 1995). Using these parameters, the estimated CPS breeding population of 36 million would have about 13.5 million breeding females that successfully fledge about 19 million nestlings, raising the post-fledgling population to about 55 million Red-winged Blackbirds. This would be an increase in the population by a factor of 1.53. Peer et al. (2003) used a factor of 1.45 to estimate the fall population (Table 12). Thus, about 8% of the population would die from fledging to fall, presumably mostly juveniles, which would be expected.

Natural mortality in blackbird populations is between 50% and 65% of the population each year, regardless of human-caused control operations (USDA 1997, pg. 4-64). Based on population modeling, Dolbeer (1998) showed that the effect of reducing survival of two blackbird species by 50% (additional loss following natural mortality prior to breeding) was only a 41% reduction in the population by the end of three years. For a population of 190 million Red-winged Blackbirds with an assumed average annual survival of 50%, cutting the survival in half would require the mortality of an additional 47 million per year over the natural mortality level. Assuming that human-induced mortality is mostly compensatory, instead of additive, to natural mortality, this level of impact is well within the extent of normal mortality levels and thus well within the ability of the population to withstand. To further illustrate the minor degree of impact, Sawin et al. (2003) found that the removal of all males over a large area that did not breed during a given year because they were unsuccessful in establishing a territory (floaters) did not have any effect on the population or the number of floaters the following year. This suggests that recruitment and immigration replaced those blackbirds lost to the population and the population remains stable for the available habitat.

TWSP conducts few BDM projects for Red-winged Blackbirds specifically, except at rice fields where they are mixed mostly with Brown-headed Cowbirds, and at CAFOs where a small percentage of blackbirds are sometimes mixed with mostly starlings. The take of Red-winged Blackbirds by TWSP was estimated to be about 307,000 annually from FY07 to FY11 with a high of 496,000 in FY07 (Table 12). The WS Program cumulatively in the CPS region took an average of 332,000 Red-winged Blackbirds from FY07 to FY11, about 2% of the expected annual mortality (Table 12). Because the public is permitted to take Red-winged Blackbirds that are causing depredations or are a health nuisance under a depredation order by USFWS, depredation permits are not required to be obtained by private individuals or agencies to take them. The public conducts control of Red-winged Blackbirds to protect crops such as sunflower, rice, corn, and wheat and livestock feed and health at CAFOs in the CPS region and much of this is done with trapping, shooting, and the use of Avitrol. However, TWSP has no way of determining how many blackbirds were taken by private efforts. It is expected that this effort occurred, especially to protect crops such as sunflowers, rice, and corn, but the numbers actually taken are probably minimal. However, for the purposes of this analysis, it is estimated that up to 1 million Red-winged Blackbirds would be taken by private efforts (this would be a high number of blackbirds taken by private individuals using the available methods and believed to be grossly exaggerated, to be conservative). With this information, Table 12 provides a cumulative impact analysis for Red-winged Blackbird take by TWSP, other Central Plains WS Programs, and private individuals and entities. A recent EA (WS 2009) for New Mexico analyzed take in the Rocky Mountain States with similar levels of take. The cumulative impact to the Red-winged Blackbird population from FY07 to FY11 averaged about 2% of the post-breeding population and up to 7% of their expected annual mortality. This would not be enough to cause the population to decline. Doubling the percentage of blackbirds other than starlings taken in DRC-1339 projects at feedlots did not appreciably elevate take percentages. In fact, take would have to be in the millions before an impact would likely start to occur. Under the Proposed Action (Alternative 1), potentially up to 3 million Red-winged Blackbirds could be taken by WS in the CPS which would be 16% of the expected annual mortality and up to 21% cumulative impact. Even at this level, which WS does not anticipate taking, it would not impact the population with more than 75% of the expected mortality to occur above that taken by WS. It would be expected that the mortality would be considered compensatory and not additive. Habitat loss, primarily a decline in breeding habitat, over the last 60 years has been the primary contributor to their decline (Dolbeer 2003).

The take of Red-winged Blackbirds by TWSP and the WS Program in the CPS region is not anticipated to have more than a temporary minor effect on the population. Even if WS increased take significantly (nine-fold) in the CPS region, WS's take would increase from 2% to 16% of the expected annual mortality and the cumulative impact to 21%, a low level of impact. Thus, WS believes that BDM has only had a relatively minor effect, if any, on the Red-winged Blackbird population in Texas and the CPS region and that, even under the highest take scenario (a nine-fold increase in the Red-winged Blackbirds taken); take would not rise to a level of significance. TWSP and WS do not expect that take will ever go above this threshold.

Table 12. Cumulative impact analysis for Red-winged Blackbirds killed in Texas by TWSP, other WS Programs in the CPS region, and private individuals and entities (estimated) from FY07 to FY11.

RED-WINGED BLACKBIRD IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated CPS Breeding Population	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000
% Breeding Females in Population	37.5%	37.5%	37.5%	37.5%	37.5%	37.5%
Estimated Number Breeding Females	13,500,000	13,500,000	13,500,000	13,500,000	13,500,000	13,500,000
Aver. Clutch	3.3	3.3	3.3	3.3	3.3	3.3
Aver. Nests	1.7	1.7	1.7	1.7	1.7	1.7
% Fledge 1st Nest/2nd Nest	40%/4%	40%./4%	40%/4%	40%/4%	40%./4%	40%/4%
Young Produced/ Stable Pop. Ann. Mort.	19,000,000	19,000,000	19,000,000	19,000,000	19,000,000	19,000,000
Total CPS Population	55,000,000	55,000,000	55,000,000	65,000,000	65,000,000	65,000,000
TX TWSP Take	485,754	347,370	361,845	75,170	265,080	307,044
Other CPS WS Take	1,003	33,332	56,529	25,052	11,897	25,563
WS Take % of CPS Ann. Mort.	2.6%	2.0%	2.2%	0.5%	1.5%	1.8%
Private Take in CPS	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Total Take	1,486,757	1,380,703	1,418,374	1,100,222	1,276,977	1,332,607
% CPS Post-breeding Pop.	3%	3%	3%	2%	2%	2%
% of CPS Ann. Mortality	8%	7%	7%	6%	7%	7%

Brown-headed Cowbirds. Brown-headed Cowbirds are an abundant species that have been estimated to have a population of more than 90 million nationwide (Meanley and Royall 1976). RMBO (2007) estimated a continental population is 51 million. The CPS population (Figure 6) was estimated at about 20 million with Texas having 3.1 million breeders (Table 4). BBS data from 1966 to 2010 shows significant declining trends for Brown-headed Cowbirds surveywide and in Texas of -0.6%/year and -1.9%/year (Sauer et al. 2011). The decline is thought to have occurred because of habitat loss that has affected host species (being a parasitic nester – lays eggs in other bird species' nests). However, during the settlement of North America, the cowbird greatly expanded its range from where buffalo (*Bison bison*) roamed in the central Great Plains eastward as the deciduous forests were opened for agriculture (Mayfield 1965). Birds that had previously not been exposed to parasitic nesting became more vulnerable as forest fragmentation increased (Brittingham and Temple 1983). This pattern occurred similarly in the West (Verner and Ritter 1983, Airola 1986). Thus, this species abundance increased greatly during this period, but has become regulated by host numbers.

Brown-headed Cowbirds breed as yearlings (second year). For the sake of estimating the population for this EA, it is assumed that 75% of the cowbird females breed, the sex ratio is 1:1 males to females, females lay an average of 41 eggs/season, and an average of 13% fledge with 3 (7%) cowbirds developing to maturity from other species rearing them (Lowther 1993). Using these parameters, a breeding population of 20 million in the CPS region would have about 7.5 million breeding females that successfully fledge about 22 million nestlings, raising the post-fledgling population to about 42 million Brown-headed Cowbirds. This would be an increase in the population by a factor of 2.1. It would be expected that the mortality rate through the course of a year for Brown-headed Cowbirds would be higher than other species of blackbirds because of the higher population increase factor as well as smaller body size.

TWSP took an average of 260,000 Brown-headed Cowbirds from FY07 to FY11, with a high of 360,000 in FY10 (Table 13). Under the proposed action (Alternative 1), it is estimated that up to 1,000,000 might be taken by TWSP and 500,000 by other CPS region WS programs. WS in a few other states took an average of 17,000 with a high of 71,000 in FY06 (Table 13). The cumulative impact from all CPS WS Programs averaged 1.3% of the annual mortality of Brown-headed Cowbirds with a high of 1.6% in FY10. It is anticipated that the cumulative take of Brown-headed Cowbirds in the CPS region, including Texas, could take up to 1.5 million for the protection of a variety of resources, but primarily to protect rice and livestock feed from damage and the protection of other song birds from nest parasitism. This level of take is about 7% of the estimated annual mortality for Brown-headed Cowbirds in the CPS region which is well within the ability of the overall population to withstand. Additionally, private individuals and other agencies take Brown-headed Cowbirds and it is estimated that these entities could possibly take an additional 750,000 cowbirds, especially because several agencies and organizations have programs to protect T&E bird species from Brown-headed Cowbirds (this, though, like the Red-winged Blackbird, is likely a gross over exaggeration to ensure a conservative analysis). It should be noted that few cowbirds would be taken for the protection of crops with the exception of rice. With this information, Table 13 provides a cumulative impact analysis for Brown-headed Cowbird take by TWSP, other CPS WS Programs, and private individuals and entities in the CPS region. The cumulative impact from all sources from FY07 to FY11 has averaged about 2% of the post-breeding population or about 5% of the expected annual mortality. Thus, this level of take would have little, if any, impact on the population. If the WS programs in the CPS region increased the level of take to 1,500,000 and private take was 1 million, the cumulative impact would be 10% of the expected annual mortality, well within compensatory mortality which would be absorbed by the population. Thus, TWSP concludes that the current and potential level of take is not expected to have an effect on the Brown-headed Cowbird population.

Table 13. Cumulative impact analysis for Brown-headed Cowbirds killed in Texas by TWSP, other CPS WS Programs, and private individuals and entities (estimated) from FY07 to FY11.

BROWN-HEADED COWBIRD IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated CPS Breeding Population	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000
% Breeding Females in Population	37.5%	37.5%	37.5%	37.5%	37.5%	37.5%
Estimated Number Breeding Females	7,500,000	7,500,000	7,500,000	7,500,000	7,500,000	7,500,000
Aver. Clutch	41	41	41	41	41	41
% Fledge	7%	7%	7%	7%	7%	7%
Young Produced/ Stable Pop. Ann. Mort.	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000
Total CPS Population	42,000,000	42,000,000	42,000,000	42,000,000	42,000,000	42,000,000
TX TWSP Take	185,057	133,285	309,127	357,499	330,133	263,020
Other CPS WS Take	70,510	7,891	2,076	3,820	1,626	17,185
WS Take % of CPS Ann. Mort.	1.2%	0.6%	1.4%	1.6%	1.5%	1.3%
Private Take in CPS	750,000	750,000	750,000	750,000	750,000	750,000
Total Take	1,005,567	891,176	1,061,203	1,111,319	1,081,759	1,030,205
% CPS Post-breeding Pop.	2%	2%	3%	3%	3%	2%
% of CPS Ann. Mortality	5%	4%	5%	5%	5%	5%

Great-tailed Grackles. The Great-tailed Grackle population has expanded its range in recent history, especially north and west of their historic boundaries, and has increased in abundance over its new range. Estimated BBS trends from 1966 to 2010 have been significantly positive surveywide and in Texas at 2.8%/year and 2.4%/year (Sauer et al. 2011). Their range expansion has been credited to their adaptability to altered habitats such as urban and agricultural landscapes with irrigation (Johnson and Peer 2001). The United States population of Great-tailed Grackles has been estimated at 7.8 million birds, based on BBS data from the 1990s (RMBO 2007). Recent BBS data (FY07-FY11) (USGS 2012) for just the CPS population rendered a population estimate of 7.0 million (Table 4).

Great-tailed Grackles breed as yearlings (second year). For the sake of estimating the population for this EA, it is assumed that 75% of the Great-tailed Grackle females breed, the sex ratio is 1:1 males to females, females lay 1-5 eggs with an average eggs/nest of 3.2, and an average nests/season of 1.37 (Johnson and Peer 2001). About 75% of the eggs hatch, but fledgling success was high and found to be 93% in Texas, once hatched, for a rate from egg to fledgling of 70% (Johnson and Peer 2001). Using these parameters, the CPS breeding population of 7.0 million would have about 2,600,000 breeding females that successfully fledge about 8.0 million nestlings, raising the post-fledgling population to about 15 million Great-tailed Grackles. This would be an increase in the population by a factor of 2.2. Of the population, natural mortality in blackbird populations is between 50% and 65% of the population each year, regardless of human-caused control operations (USDA 1997, pg. 4-64) and a stable population of Great-tailed Grackles would have a 54% mortality rate under the current assumptions.

TWSP took an average of about 15,000 Great-tailed Grackles from FY07 to FY11, with a high of 28,000 in FY10 (Table 14). Under the proposed action (Alternative 1), it is estimated that up to 200,000 might be taken by TWSP and 20,000 by other CPS region WS programs. WS in a few other states took an average of 990 with a high of 1,700 in FY08 (Table 14). The cumulative impact from all CPS WS Programs averaged 0.2% of the annual mortality of Great-tailed Grackles with a high of 0.4% in FY10. It is anticipated that the cumulative take in the CPS region by WS, including TWSP, could take up to 220,000 for the protection of a variety of resources, but primarily to protect citrus crops and human health and safety at airports. This level of take is about 3% of the estimated annual mortality for Great-tailed Grackles in the CPS region which is well within the ability of the overall population to withstand. Additionally, private individuals and other agencies take Great-tailed Grackles and it is estimated that these entities could possibly take an additional 100,000, especially to protect citrus crops (this, though, like the Red-winged Blackbird, is likely a gross over exaggeration to ensure a conservative analysis). With this information, Table 14 provides a cumulative impact analysis for Great-tailed Grackle take by TWSP, other CPS WS Programs, and private individuals and entities in the CPS region. The cumulative impact from all sources from FY07 to FY11 has averaged about 1% of the post-breeding population and the expected annual mortality, with a high of 2% in FY10. Thus, this level of take would have little impact on the population. If the WS programs in the CPS region increased its level of take to 220,000, including estimated private take of 100,000, the cumulative impact would be 4% of the expected annual mortality, well within compensatory mortality which would be absorbed by the population. Thus, TWSP concludes that the current and potential level of take is not expected to have an effect on the Great-tailed Grackle population.

Table 14. Cumulative impact analysis for Great-tailed Grackles killed in Texas by TWSP, other CPS WS Programs, and private individuals and entities (estimated) from FY07 to FY11.

GREAT-TAILED GRACKLE IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated CPS Breeding Population	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000
% Breeding Females in Population	37.5%	37.5%	37.5%	37.5%	37.5%	37.5%
Breeding Females	2,600,000	2,600,000	2,600,000	2,600,000	2,600,000	2,600,000
Aver. Clutch	3.2	3.2	3.2	3.2	3.2	3.2
Aver. Nests	1.37	1.37	1.37	1.37	1.37	1.37
% Fledge	70%	70%	70%	70%	70%	70%
Young Fledged/ Stable Pop. Ann. Mort.	8,000,000	8,000,000	8,000,000	8,000,000	8,000,000	8,000,000
Total CPS Population	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000
TWSP Take	14,013	24,688	6,150	27,793	3,720	15,273
Other CPS WS Take	465	1,735	829	1,673	247	990
TWSP Take % of CPS Ann. Mort.	0.2%	0.3%	0.1%	0.4%	0.0%	0.2%
Private Take in CPS Region	100,000	100,000	100,000	100,000	100,000	100,000
Total Take	114,478	126,424	106,979	129,467	103,967	116,263
% CPS Post-breeding Pop.	1%	1%	1%	1%	1%	1%
% of CPS Ann. Mortality	1%	2%	1%	2%	1%	1%

Common Grackles. Common Grackles are abundant in central and eastern North America which is reflected in their high estimated population of 97 million surveywide (RMBO 2007). Trend data for 1966 to 2010 shows a significant decline surveywide of -1.6%/year, but Texas has had an insignificant increase of 0.7%/year. The national downward trend is almost identical to the Brown-headed Cowbird trends. The decline of Common Grackles is thought to have occurred to habitat loss and, in some areas, the spread of Great-tailed Grackles. Control efforts, especially in eastern United States, have been also theorized as a reason for decline (Peer and Bollinger 1997). The North American population of Common Grackles has been estimated at 97 million based on BBS data (RMBO 2007). BBS data for the CPS region from FY07-FY11 (USGS 2012) provided an estimate of 19 million with 2.2 million in Texas (Table 4).

Common Grackles breed as yearlings (second year). For the sake of estimating the population for this EA, it is assumed that the Common Grackle sex ratio is 1:1 males to females, 75% of the females breed laying 3-7 eggs with the average of 4.8, and have an average of 1 nest/season (Peer and Bollinger 1997). Grackles renest if their initial attempt fails. Fledgling success was found to be 49%. Using these parameters, a CPS breeding population of 19 million would have about 7.1 million breeding females that successfully fledge about 17 million nestlings, raising the post-fledgling population to about 36 million Common Grackles. This would be an increase in the population by a factor of 1.9. Peer et al. (2003) used a factor of 1.45 to estimate the fall population of three blackbird species (Table 11). Thus, about

25% of the population would die from fledging to fall, presumably mostly juveniles. This would be a likely mortality rate from early summer to fall for juveniles with less dying the longer they survived. Natural mortality in blackbird populations is between 50% and 65% of the population each year, regardless of human-caused control operations (USDA 1997, pg. 4-64). Under the current assumptions, the Common Grackle population would have a 47% mortality rate, slightly lower than USDA (1997, pg. 4-64).

TWSP took an average of 17,000 Common Grackles from FY07 to FY11, with a high of 26,000 in FY09 (Table 15). WS in the other CPS states took an average of 2,600 with a high of 6,800 in FY10 (Table 15). The cumulative impact from all CPS WS Programs averaged less than 1% of the annual mortality of Common Grackles with a high of 0.2% in FY05. It is anticipated that the cumulative take of Common Grackles in the CPS region by WS, including Texas, could be 1 million, 500,000 by TWSP and 500,000 by the other WS CPS Programs, for the protection of a variety of resources, but primarily to protect sunflowers, corn, and livestock feed from damage. This level of take is about 6% of the estimated annual mortality for Common Grackles in the CPS region which is well within the ability of the overall population to withstand. Additionally, private individuals and other agencies may take Common Grackles, especially for the protection of sunflowers and it is estimated that these entities could possibly take an additional 500,000 grackles (this, though, like the Red-winged Blackbird, is likely a gross over exaggeration to ensure a conservative analysis). With this information, Table 15 provides a cumulative impact analysis for Common Grackle take by TWSP, other CPS WS Programs, and private individuals and entities in the CPS region. The cumulative impact from all sources from FY07 to FY11 averaged about 1% of the post-breeding population or about 3% of the expected annual mortality. Thus, this level of take would have little impact on the population. If the WS programs in the CPS region increased its level of take to 1,000,000, the cumulative impact would be 9% of the expected annual mortality, well within compensatory mortality which would be absorbed by the population. Thus, TWSP concludes that the current and potential level of take is not expected to have an effect on the Common Grackle population and BDM is not being conducted at a level as described by Peer and Bollinger (1997).

Table 15. Cumulative impact analysis for Common Grackles killed in Texas by TWSP, other WS Programs in the CPS region, and private individuals and entities (estimated) from FY07 to FY11.

COMMON GRACKLE IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated CPS Breeding Population	19,000,000	19,000,000	19,000,000	19,000,000	19,000,000	19,000,000
% Breeding Females in Population	37.5%	37.5%	37.5%	37.5%	37.5%	37.5%
Estimated Number Breeding Females	7,100,000	7,100,000	7,100,000	7,100,000	7,100,000	7,100,000
Aver. Clutch	4.8	4.8	4.8	4.8	4.8	4.8
Aver. Nests	1	1	1	1	1	1
% Fledge	49%	49%	49%	49%	49%	49%
Young Produced/ Stable Pop. Ann. Mort.	17,000,000	17,000,000	17,000,000	17,000,000	17,000,000	17,000,000
Total CPS Population	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000
TX TWSP Take	16,490	12,294	26,474	16,375	14,110	17,149
Other CPS WS Take	1,878	2,425	1,310	6,832	424	2,574
WS Take % of CPS Ann. Mort.	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%
Private Take in CPS	500,000	500,000	500,000	500,000	500,000	500,000
Total Take	518,368	514,719	527,785	523,207	514,534	519,722
% CPS Post-breeding Pop.	1%	1%	1%	1%	1%	1%
% of CPS Ann. Mortality	3%	3%	3%	3%	3%	3%

Boat-tailed Grackles. The Boat-tailed Grackle population has increased in abundance over the last few decades along coastal areas of Texas. Estimated BBS trends from 1966 to 2010 have been negative surveywide and positive in Texas, but not significant at -0.8%/year and 1.5%/year (Sauer et al. 2011). Nesting areas, especially in the East, have been lost to commercial coastal developments which could explain the downward trend surveywide (Post et al. 1996). The United States population of Boat-tailed Grackles has been estimated at 3.6 million birds, based on BBS data from the 1990s (Rich et al. 2004, RMBO 2007). BBS data for FY07-FY11 (Sauer et al. 2011) for just Texas, the only CPS State with a population, rendered a population estimate of 200,000 (Appendix A: Table A10), up from 190,000 in the 1990s (RMBO 2007).

Boat-tailed Grackles breed as yearlings (second year). For the sake of estimating the population for this EA, it is assumed that 75% of the females breed, the sex ratio is 1:1 males to females, females lay 1-5 eggs with an average eggs/nest of 2.7 for marshes and 2.9 for trees, and 1 nest/season (Post et al. 1996). The fledgling success was found to be about 46% in South Carolina and Florida (Post et al. 1996). Using these parameters, the Texas breeding population of 200,000 would have about 75,000 breeding females that successfully fledge about 97,000 nestlings, raising the post-fledgling population to about 300,000 Boat-tailed Grackles. This would be an increase in the population by a factor of 1.5, much lower than other blackbirds (Table 16). Natural mortality in blackbird population would be about 32% of the post-breeding population, about half that of other blackbirds.

Table 16. Cumulative impact analysis for Boat-tailed Grackles killed in Texas by TWSP and private individuals and entities (estimated) from FY07 to FY11.

BOAT-TAILED GRACKLE IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated Texas Breeding Population	200,000	200,000	200,000	200,000	200,000	200,000
% Breeding Females in Population	37.5%	37.5%	37.5%	37.5%	37.5%	37.5%
Breeding Females	75,000	75,000	75,000	75,000	75,000	75,000
Aver. Clutch	2.8	2.8	2.8	2.8	2.8	2.8
Aver. Nests	1	1	1	1	1	1
% Fledge	46%	46%	46%	46%	46%	46%
Young Fledged/ Stable Pop. Ann. Mort.	97,000	97,000	97,000	97,000	97,000	97,000
Total Texas Population	300,000	300,000	300,000	300,000	300,000	300,000
TWSP Take	4,873	3,595	0	0	42	1,702
TWSP Take % of Texas Ann. Mort.	5%	4%	0%	0%	0%	2%
Private Take in Texas Region	10,000	10,000	10,000	10,000	10,000	10,000
Total Take	14,873	13,595	10,000	10,000	10,042	11,702
% Texas Post-breeding Pop.	5%	5%	3%	3%	3%	4%
% of Texas Ann. Mortality	15%	14%	10%	10%	10%	12%

TWSP took an estimated average of 3,700 Boat-tailed Grackles from FY07 to FY11, with a high of 4,900 in FY07 (Table 16). Under the proposed action (Alternative 1), it is estimated that up to 20,000 might be taken by TWSP, 21% of the expected annual mortality. However, it is doubtful whether TWSP takes this many Boat-tailed grackles. They will damage rice, primarily when it is sprouting (Red-winged Blackbirds damage rice when it is ripening). However, new rice production techniques have reduced their damage and now it is only minor. For the sake of the analysis, though, Boat-tailed Grackles were estimated to take rice treated DRC-1339 baits, and therefore, we provided take for them. TWSP take was estimated to average about 2% of the expected annual mortality, with a high of 5% in FY07, which is a low level of take. Additionally, private individuals and other agencies may take some Boat-tailed Grackles, though this is probably very minimal, and it is estimated that these entities could possibly take an additional 10,000, especially to protect rice (this, though, like the Red-winged Blackbird, is likely a gross over exaggeration to ensure a conservative analysis). With this information, Table 16 provides a cumulative impact analysis for Boat-tailed Grackle take by TWSP and private individuals and entities in Texas. The cumulative impact from all sources from FY07 to FY11 has averaged about 4% of the post-breeding population and 12% of the expected annual mortality, with a high of 15% in FY07. Thus, this level of take would have little impact on the population. If TWSP increased the level of take to 20,000, the cumulative impact would be 31% of the expected annual mortality, well within compensatory mortality which would be absorbed by the population, but probably at the low end where an impact could be possible depending on other mortality factors. However, TWSP does not anticipate much take of this species, primarily from its location in Texas where few BDM activities occur. Thus, TWSP concludes that the current and potential level of take is not expected to have an effect on the Boat-tailed Grackle population.

Brewer's Blackbirds. The Brewer's Blackbird breeds in western and northern North America, mostly south of the Rusty Blackbird. Its population's range expanded in the early 1900s eastward and northward facilitated by human habitat modifications, principally forest clearing for farming, logging, and railroad and highway development (Martin 2002). However, its population increase has been followed by a decrease. Its breeding range includes the northern CPS region and the winter range includes the southern CPS region, including Texas. The estimated surveywide trend from 1966 to 2010, does not breed in Texas, was significantly negative at -2.1%/year (Sauer et al. 2011). The population of Brewer's Blackbirds was estimated at 35 million based on BBS data from the 1990s (RMBO 2007). The estimated population for the CPS region from BBS data (FY07-FY11) is 1.1 million (Appendix A: Table A5). Brewer's Blackbirds typically do not cause as many problems as other blackbird species, but can cause damage at feedlots where they are often separate or in loose flocks with other blackbirds.

Brewer's Blackbirds breed as yearlings (second year). For the sake of estimating the population for this EA, it is assumed that 75% of the blackbird females breed, the sex ratio is 1:1 males to females, females lay 1-8 eggs with an average eggs/nest of 5.0, and an average nests/season of 1 (Martin 2002). About 63% of the eggs hatch with subsequent fledgling success 63%, for an egg to fledgling success of 40%. Using these parameters, a breeding population of 1.1 million in the CPS region would have about 410,000 breeding females that successfully fledge about 830,000 nestlings, raising the post-fledgling population to about 1.9 million Brewer's Blackbirds. This would be an increase in the population by a factor of 1.75, similar to other blackbirds.

Table 17. Cumulative impact analysis for Brewer's Blackbirds killed in Texas by TWSP, other CPS WS Programs, and private individuals and entities (estimated) from FY07 to FY11.

BREWER'S BLACKBIRD IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated CPS Breeding Population	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000
% Breeding Females in Population	37.5%	37.5%	37.5%	37.5%	37.5%	37.5%
Breeding Females	410,000	410,000	410,000	410,000	410,000	410,000
Aver. Clutch	5.0	5.0	5.0	5.0	5.0	5.0
Aver. Nests	1	1	1	1	1	1
% Fledge	40%	40%	40%	40%	40%	40%
Young Fledged/Stable Pop. Ann. Mort.	830,000	830,000	830,000	830,000	830,000	830,000
Total CPS Population	1,900,000	1,900,000	1,900,000	1,900,000	1,900,000	1,900,000
TX TWSP Take	2,729	1,957	0	0	0	937
Other CPS WS Take	19	63	37	166	19	61
WS Take % of CPS Annual Mortality	0.1%	0.2%	0.2%	0.2%	0.1%	0.2%
Private Take in CPS Region	20,000	20,000	20,000	20,000	20,000	20,000
Total Take	22,748	22,020	20,037	20,166	20,019	20,998
% CPS Post-breeding Pop.	1%	1%	1%	1%	1%	1%
% of CPS Annual Mortality	3%	3%	2%	2%	2%	3%

Natural mortality in blackbird populations is between 50% and 65% of the population each year, regardless of human-caused control operations (USDA 1997, pg. 4-64) and a stable population of Brewer's Blackbirds would have a 75% mortality rate under the current assumptions (includes nestlings that die before fledging). The numbers that might be taken by TWSP under the proposed action or Alternative 1 have been negligible averaging 940 annually from FY07 to FY11 (potentially up to 50,000 might be taken by WS in the CPS region in any one year, about 6% of the annual mortality - Table 17). These numbers are very minor and well within normal mortality levels for this species. Other WS mortality averaged almost 60 from FY07 to FY11. Additional human-induced mortality of this species occurs from private individuals and could potentially be 25,000 annually (Brewer's Blackbirds are not as much the focus of large-scale projects and likely to even be less taken). However, WS has no way of knowing what the level of take is by private individuals since permits are not required. With this information, Table 17 provides a cumulative impact analysis for Brewer's Blackbird take by TWSP, other CPS WS Programs, and private individuals and entities in the CPS region. This would bring the total take in the CPS region to 26,000, about 1% of the CPS total population or 3% of the estimated annual mortality (Table 17). If the WS programs in the CPS region increased their level of take to 50,000, the cumulative impact would be 9% of the expected annual mortality, well within compensatory mortality which would be absorbed by the population. WS concludes that this is a minor level of take and would not impact the population.

It should be noted that Brewer's Blackbirds are not as likely to be taken when insects are available because they prefer feeding on them over waste grain, when available (Martin 2002). Thus, it is likely that the estimates of take are highly conservative, that is, higher than they are in actuality.

Bronzed Cowbirds. The Bronzed Cowbird, like other cowbirds, is a brood parasite that breeds in southern portions of Arizona, New Mexico, and Texas. It prefers open habitats and human settlements, which favored its range expansion northward into the United States in the 1950s (Ellison and Lowther 2009). However, the BBS surveywide and Texas trends for 1966 to 2010 are negative to stable, but not significant at -0.3%/year and 0.0%/year. Recent national declines possibly could have occurred because habitat loss has affected host species giving them less nesting opportunity (being a parasitic nester – lays eggs in other bird species' nests). This species is most abundant in southern Texas in its range and has an estimated population of 660,000 (a species not found in the other CPS States) (Appendix A: Table A10).

Not much is known about the reproduction parameters for Bronzed Cowbirds (Ellison and Lowther 2009). They breed as yearlings (second year). For the sake of estimating the population for this EA, it is assumed that 75% of the cowbird females breed and the sex ratio is 1:1 males to females. Assuming that they are similar to Brown-headed Cowbirds, females would lay an average of 41 eggs/season, and an average of 13% fledge with about 3 (7%) cowbirds developing to maturity from other species rearing them (Lowther 1993). Using these parameters, a breeding population of 660,000 in Texas would have about 250,000 breeding females that successfully fledge about 720,000 nestlings (about 3 that reach adult per female), raising the post-fledgling population to about 1,400,000 Bronzed Cowbirds. This would be an increase in the population by a factor of 2.1. It would be expected that the mortality rate through the course of a year for Bronzed Cowbirds would be higher than other species of blackbirds because of the higher population increase factor.

TWSP possibly took an average of 10 Bronzed Cowbirds from FY07 to FY11 (Table 8). This estimated take would be unnoticeable at the population level. It should be noted that the Bronzed Cowbird is primarily found in south Texas and have not been seen during rice baiting operations where they have been estimated to be taken. However, for the sake of being conservative, they have been believed to be in the area of baiting operations and could have been taken. Under the proposed action (Alternative 1), it is estimated that up to 20,000 might be taken by TWSP; Bronzed Cowbirds are not likely to be the focus of a large BDM project unless WS works with other agencies to protect other bird species from nest parasitism since they are believed to be responsible for decreases in native bird populations such as the Audubon's and Altamira Orioles of southern Texas (Ellison and Lowther 2009). This would amount to 3% of the estimated annual mortality which would a negligible impact. Additional human-induced mortality of this species occurs from private individuals and could potentially be a conservatively estimated 10,000 annually. TWSP has no way of knowing what the level of take is by private individuals since permits are not required. With this information, a current cumulative impact analysis for Bronzed Cowbird take by TWSP, and private individuals and entities in Texas with an average of 10,010 taken from FY07 to FY11, or 1% of the estimated annual mortality. Even if TWSP expanded operations into areas with high densities of bronzed cowbirds and took 20,000, the level of take cumulatively would rise to 4% which is still a low level of take. TWSP concludes that this is a minor level of take and would not impact the population.

Rusty Blackbirds. Rusty Blackbirds breed in Alaska and Canada, and winter in the southeastern United States. Rusty Blackbirds do not breed in the CPS region and, therefore, do not have an estimated population in this area. Their migratory and winter range, though, includes all the CPS area along with southeastern states from eastern portions of South Dakota south through the CPS region and east. Very few Rusty Blackbirds winter in western States, including west Texas, but have been documented in NAS

(2012) Christmas Counts. East Texas is the primary area where a few Rusty Blackbirds are found during winter months, but they are at relatively low densities, but get higher traveling east and north. To illustrate this, Texas CBC data for FY07 to FY11 show an average number of birds/party hour of 0.19 Rusty Blackbirds, increasing to 0.85 in Louisiana and to 2.60 in Mississippi travelling east. Going north, Rusty Blackbirds/party hour in Oklahoma[12] was 2.60 and in Kansas 1.321. Thus, it can be seen that many more wintering Rusty Blackbirds are further east and north of Texas.

Rusty Blackbirds primarily feed on invertebrates in wet woodlands and near streams throughout the year. Even though they roost with other blackbirds, Rusty Blackbirds usually will not feed with them. It should be noted that Rusty Blackbirds are a species not likely to be taken protecting crops because during winter they mostly feed in wet woodland bottoms on acorns, pine seeds, fruits, and animal matter, but sometimes will be found in feedlots (Avery 1995). Thus, few are likely ever taken by TWSP during BDM. Even so, we will analyze take for the species composition found in Texas.

Estimated trends from 1966 to 2010 surveywide show a significant decline of -6.2%/year and a nonsignificant increase of +9.8%/year in the Central BBS Region (Sauer et al. 2011). NAS (2012) CBC data show a steady decline of the Rusty Blackbird from 1966 to 2006. Declines of the overall population have been linked to a loss of wet woodland breeding habitat (Avery 1995). The population of Rusty Blackbirds was estimated at 2.0 million based on BBS data from the 1990s (Rich et al. 2004, RMBO 2007). FY07 to FY11 BBS data (USGS 2012) rendered a population estimate of 1.7 million (Appendix A: Table A10). The Rusty Blackbird is a species on the Audubon Watchlist (NAS 2007) and was removed from the USFWS Blackbird Depredation Order. Take of this species has been estimated to be minimal, if any were actually taken at all. As such, estimated take will be analyzed, but at a maximum, would be minimal.

To determine impacts, Rusty Blackbirds breed as yearlings (second year). For the sake of estimating the population in this EA, it is assumed that 75% of the blackbird females breed, the sex ratio is 1:1 males to females, and females lay an average of 4.5 eggs/nest with 1 nest/season (Avery 1995). No other data is available, but it assumed that from egg to fledgling, success is 40% (using Brewer's Blackbird parameters). Using these parameters, a breeding population of 1.7 million would have about 640,000 breeding females that successfully fledge about 1.1 million nestlings, raising the post-fledgling population to about 2.8 million Rusty Blackbirds. This would be an increase in the population by a factor of 1.7, similar to other blackbirds.

Natural mortality in blackbird populations is between 50% and 65% of the population each year, regardless of human-caused control operations (USDA 1997, pg. 4-64) and a stable population of Rusty Blackbirds would have a 53% mortality rate under the current assumptions and an assumption that 67% of the eggs in a nest hatch (the mortality rate includes nestlings that die before fledging). TWSP did not take any Rusty Blackbirds from FY07 to FY11 as estimated (Appendix B: Table B3), but 9 were projected to be taken in the CPS States. It is likely that private take is also few, if any (feeding behavior would likely preclude the take of many). It should be noted that USFWS permits were not needed for the years accounted for in Table 9, but permits are now needed to take Rusty Blackbirds. However, for the sake of estimating impact, it is assumed that 100 are killed by individuals or other organizations. The cumulative take would be <0.1% of the estimated annual mortality. If TWSP and other CPS states increased take to 500, the cumulative impact would be 0.05% of the estimated annual mortality, a very minimal take that would cause an imperceptible impact on the population. It should be noted that cumulative take should actually encompass the entire area where Rusty Blackbirds are taken because the entire population is being used. However, the take of so few would preclude an impact even at the national level. TWSP concludes that current levels of take in the Texas and the CPS region are very low to nonexistent and at a

[12] CBC FY08 data (NAS 2012) in Oklahoma recorded a record 50,504 birds for a 99.56 Rusty Blackbirds/party hour which was quite high and much higher than the next highest, 4,433 birds for 7.06 Rusty Blackbirds/party hour in FY09. This skewed the data at 22.65 birds/part hour. Using data from FY02 to FY11 without FY08 gives an average of 2.60 birds/party hour which seems more reasonable, the number given above.

potential level of take that would not impact the population. The loss of wetland nesting habitat, especially in the breeding area, is attributed to their decline (Avery 1995).

Yellow-headed Blackbirds. The Yellow-headed Blackbird breeds in north central western states including the northern states in the CPS region, and to a lesser degree in southern States of the CPS region. It requires emergent wetland habitat for breeding and is limited by its distribution. The Yellow-headed Blackbird begins migration to its wintering grounds in southern Arizona, New Mexico and southwest Texas south into Mexico starting in July and finishes by mid-September, mostly coinciding with the completion of its pre-basic molt (their migration is missed by both CBC and BBS). Yellow-headed Blackbirds mostly miss BDM activities conducted by WS in the CPS region, except for those that linger prior to heading for their wintering grounds. However, its migration coincides with the ripening of some sunflowers and other crops, and therefore, it may be involved in some BDM activities. Estimated trends from 1966 to 2010 have been slightly negative surveywide (-0.4%/year), and positive in the Central BBS Region (0.5%/year) and Texas (10.5%/year), but not significant (Sauer et al. 2011). Reductions in breeding populations for this species have primarily been attributed to the loss of nesting habitat from drought and development (Twedt and Crawford 1995). The population of Yellow-headed Blackbirds was estimated at 23 million based on BBS data from the 1990s (Rich et al. 2004, RMBO 2007). A detailed study in the northern prairie pothole region (Peer et al. 2003) estimated 11.6 million Yellow-headed Blackbirds in that area (the study included parts of Canada). Recent BBS data (FY07-FY11) estimated the CPS area population at 7.9 million (Table 4). This will be the population estimate used for this EA.

Yellow-headed Blackbirds breed as yearlings (second year). For the sake of estimating the population for this EA, it is assumed that 75% of the blackbird females breed, the sex ratio is 1:1 males to females, females lay 1-5 eggs with an average of 3.2-4.0 eggs/nest (3.2 will be used for the EA), and average 3 nests/season (Twedt and Crawford 1995). Averages of 2.1 nestlings fledge the first nest, 1.0 from the second, and 0.9 from the third for an egg to fledgling success of 42%. Using these parameters, a breeding population of 7.9 million in the CPS region would have about 3 million breeding females that successfully fledge about 12 million nestlings, raising the post-fledgling population to about 20 million Yellow-headed Blackbirds. This would be an increase in the population by a factor of 2.5, somewhat higher than other blackbirds.

Natural mortality in blackbird populations is between 50% and 65% of the population each year, regardless of human-caused control operations (USDA 1997, pg. 4-64) and a stable population of Yellow-headed Blackbirds would have a 77% mortality rate under the current assumptions (includes nestlings that die before fledging) or a 59% mortality from fledging to breeding. This is a fairly high annual mortality rate. It would be highly likely that the population of Yellow-headed Blackbirds is limited by the available nesting habitat which would determine the number nesting and the number of floaters that did not breed.

TWSP has not taken large numbers of Yellow-headed Blackbirds, but they have been seen on occasions. Estimated take by TWSP has been 1 per year from FY07 to FY11. The other WS Programs in the CPS area have an estimated annual take of 94. This level of take would be imperceptible at the population level. Private take may be much higher, especially in North Dakota through Kansas where large acreages of sunflowers are grown. WS has not conducted BDM with DRC-1339 for sunflower protection, but possibly could. Additionally, large numbers of Yellow-headed Blackbirds may also stage longer in areas before completing migration, though doubtful, and may get taken during BDM at a CAFO. Thus, TWSP estimates that up to 50,000 could be taken by TWSP in Texas and possibly 150,000 in other CPS States. It is possible that agricultural producers in the CPS region take up to 100,000 bring a potential total to 300,000 cumulatively in the CPS region. This would equate to 3% of the estimated annual mortality which would be a very low level impact on the population. Thus, TWSP concludes that current impacts are negligible, and even at a high level of take, impacts would be minor.

Introduced/Invasive Commensal Birds

Texas hosts several species of introduced birds and most are considered invasive species. The goal of BDM for these species may be eradication from the "wild," but this would be difficult for the overabundant species such as starlings and Rock Pigeons. TWSP took 4 invasive species and 4 feral species of poultry (chickens, domestic Mallards and Muscovy Ducks, and possibly an unknown number of different species of domestic geese) from FY07 to FY11 (Table 8). Texas took its first Eurasian Collared-Dove in FY11, as their population has expanded rapidly across the United States over the last 10 years and they are becoming a problem at CAFOs. Most damage problems from these species are associated with protecting agriculture and human health and safety. The take of these species by TWSP is considered to be of no significant impact on the human environment since they are not native components of ecosystems in Texas. Most of these species are unprotected by federal and state laws, except for domestic strays.

Starlings. The nationwide European Starling population was estimated at 140 million (Johnson and Glahn 1994). Feare (1984) estimated the starling population in North America at 200 million. Recent data from RMBO (2007) estimate the population to be about 122 million breeding starlings BBS-wide. BBS data show a significant decreasing population trend of -1.2%/year from 1966 to 2010 (Sauer et al. 2011), but a nonsignificant of 0.6%/year in Texas. USGS (2012) data (FY07-FY11) indicate a large population in Texas. However, it must be noted that large numbers of starlings are located in urban areas and BBS routes often do not account for these populations because most BBS routes are more often run in areas that are rural. Thus, BBS data are more likely to reflect the number of starlings in rural areas and not include the urban populations which would likely be the higher number. The breeding starling population in Texas estimated from BBS data (USGS 2012) using corrective parameters (Rich et al. 2004) at 1.8 million.

With a population of 1.8 million breeding starlings (Table 4), the population would increase following the nesting season. Not all starlings may breed their first year, but it was estimated that at least 66% of females did. In many populations of starlings, the males outnumber the females 2:1. Starlings lay an average of 4-6 eggs with the average being 4.28 in the Midwest and have two clutches each year below 48° latitude (Cabe 1993). Fledgling success was found to average 76.1% in New York (higher in Ontario) for both clutches with the first being about 10% more successful (Cabe 1993). Using these parameters, a breeding population of 1.8 million in Texas would have about 460,000 breeding females that fledge 3.0 million starlings, raising the post-fledgling population to about 4.8 million starlings in Texas (Table 18). Additionally, during winter months, when the majority of BDM projects are conducted, an influx of starlings is seen in Texas with birds migrating into the State from northern areas. Some starlings may leave the state, but it is likely that Texas actually has two or three times as many starlings coming into the state during winter from migration. However, not considering the migrant population, TWSP and others would have to take close to 1.5 million starlings, about 50% of the expected annual mortality, or more annually to begin to have an effect on the population, the borderline between moderate and high magnitude of take depending on other mortality factors. TWSP and other agencies have no idea how many starlings are taken by private efforts to reduce damage by starlings because they are unprotected and private individuals and others can take them without a permit. Thus, resource owners suffering damage can take starlings with available BDM methods. TWSP believes that other individuals or agencies might possibly take up to 250,000 starlings in control projects in Texas, primarily with shooting and Avitrol and Starlicide Complete, commercially available products for certified pesticide applicators. With this information, Table 18 provides a cumulative impact analysis of TWSP and other starling take in Texas from FY07 to FY11.

TWSP annually took 36,000 starlings or 2% of the estimated population with a high of 4% in FY10. This would not be enough to cause the population to decline and would be a low magnitude of take. Barring emigration into the state, take would have to increase at least 50 times the current rate before the population would likely begin to decline which may be the goal to reduce starling damage over the long term in Texas. TWSP believes that, at most, 1 million starlings would be taken in BDM in Texas. Cumulatively, TWSP, and individual and entities, this would be 42% of the expected annual mortality. This would be a moderate level of impact, likely not enough to cause the population to decline. Thus, TWSP currently has a minimal impact on the starling population.

Table 18. Cumulative impact analysis for European Starlings killed in Texas by TWSP and private individuals and entities (estimated) from FY07 to FY11.

EUROPEAN STARLING IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated Texas Breeding Population	1,800,000	1,800,000	1,800,000	2,000,000	2,000,000	2,000,000
Females to Males	50:100	50:100	50:100	50:100	50:100	50:100
% Breeding Females in Population	23%	23%	23%	23%	23%	23%
Estimated Number Breeding Females	460,000	460,000	460,000	460,000	460,000	460,000
Aver. Clutch	4.3	4.3	4.3	4.3	4.3	4.3
Aver. Nests	2	2	2	2	2	2
% Fledge	76%	76%	76%	76%	76%	76%
Young Produced/ Stable Pop. Ann. Mort.	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
Total Texas Population	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000
TX TWSP Take	51,769	7,650	35,510	111,603	42,914	49,889
TWSP Take % of CPS Ann. Mort.	1.7%	0.3%	1.2%	3.7%	1.4%	1.7%
Private Take in CPS	200,000	200,000	200,000	200,000	200,000	200,000
Total Take	251,769	207,650	235,510	311,603	242,914	249,889
% CPS Post-breeding Pop.	5%	4%	5%	6%	5%	5%
% of CPS Ann. Mortality	8%	7%	8%	10%	8%	8%

In addition to the above analysis, it must be reiterated that starlings are not indigenous to North America and are not protected by federal or state law. Therefore, the take of starlings by the TWSP program is considered to be of no significant impact on the human environment since starlings are not an indigenous component of ecosystems in Texas. In fact, the removal of starlings could be beneficial for many native species such as the Eastern Bluebird that declined significantly earlier this century with the spread of European Starlings across the United States as discussed in Section 1.3.7.

Feral Pigeon. The feral domestic pigeon, also known as the Rock Pigeon, is an introduced (nonnative) species in North America not protected by federal or state law. BBS data indicate that they have experienced a significant decreasing trend surveywide at -0.9%/year, but a nonsignificant increase in Texas at 1.2%/year from 1966 to 2011 (Sauer et al. 2011). The breeding feral pigeon population in Texas could be estimated from USGS (2012) data using corrective parameters (Rich et al. 2004) at 890,000 (Table 4). As with starlings, most BBS routes are conducted in rural areas, and, thus, BBS data most likely represent rural numbers of feral pigeons. Larger urban areas have significant numbers of feral pigeons that would not be counted. Even so, an impact analysis can be conducted with the above information, but is likely to be conservative.

Most pigeons breed their first year where habitat is available. For the purposes of impacts, it is assumed that 75% of females breed in a given year and that the sex ratio is 1:1 males to females. Pigeons usually lay 2 eggs per nest, and average 6.5 clutches per year. Fledgling success was found to average 43% (Johnston 1992). Using these parameters, a breeding population of 890,000 in Texas would have about 330,000 breeding females that fledge 1,800,000 pigeons annually, raising the post-fledgling population to about 2,700,000 feral pigeons in Texas (Table 19). TWSP's impact to feral pigeons can then be calculated annually averaging less than 1% from FY07 to FY11 of the annual mortality with the highest impact in FY07 at 0.4% (Table 8). WS cannot determine the number of feral pigeons cumulatively taken because no data is available. However, WS can make a conservative estimate (estimating a higher number taken than believed to be taken). Of the commensal species, the pigeon is probably taken more than any other species because many pest control operators are available to handle requests for feral pigeon control, people hunt them, and private individuals may take them. It is assumed for the purposes of this analysis that local pest control operators, private individuals, and hunters take about 200,000 pigeons annually. WS takes minimal numbers of pigeons averaging about 5,100 annually from FY07 to FY11. With this information, Table 19 provides a cumulative impact analysis of WS and other feral pigeon take. The average cumulative impact from FY07 to FY11 was 8% of the post-breeding population or 11% of the estimated annual mortality. This would be a low magnitude of impact on the population. As an invasive species that causes significant damage statewide, the goal of BDM may be to eliminate populations around the state. At the current level of take, the Texas pigeon population is not likely to see any reduction, except potentially locally. TWSP would have to increase its take over a hundred-fold to begin to impact the population.

For the most part, any BDM involving lethal control actions by TWSP for this species would be restricted to isolated individual sites or communities. In those cases where feral pigeons are causing damage or are a nuisance, complete removal of the local population could be achieved. This would be considered a beneficial impact on the human environment because the affected property owner or administrator would request the action to stop or reduce damage at their site. Regional population impacts would be minor and most likely unnoticeable. Even if significant regional or nationwide reductions could be achieved, this would not be considered an adverse impact on the human environment because the species is not part of native ecosystems. However, some individuals who experience aesthetic enjoyment from watching or feeding pigeons may consider a widespread reduction in the population as a negative impact. Thus far, though, impacts from FY07 to FY11 were minimal from TWSP BDM and cumulative impacts would have amounted to, at most, 11% of their annual mortality (Table 19).

Table 19. Cumulative impact analysis for Rock Pigeon killed in Texas by TWSP and private individuals and entities (estimated) from FY07 to FY11.

ROCK PIGEON IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated Texas Breeding Population	890,000	890,000	890,000	890,000	890,000	890,000
% Breeding Females in Population	37.5%	37.5%	37.5%	37.5%	37.5%	37.5%
Breeding Females	330,000	330,000	330,000	330,000	330,000	330,000
Aver. Clutch	2	2	2	2	2	2
Aver. Nests	6.5	6.5	6.5	6.5	6.5	6.5
% Fledge	43%	43%	43%	43%	43%	43%
Young Fledged/ Stable Pop. Ann. Mort.	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000
Total Texas Population	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000
TWSP Take	7,251	5,711	7,024	2,270	3,132	5,078
TWSP Take % of Texas Ann. Mort.	0.4%	0.3%	0.4%	0.1%	0.2%	0.3%
Private Take in Texas Region	200,000	200,000	200,000	200,000	200,000	200,000
Total Take	207,251	205,711	207,024	202,270	203,132	205,078
% Texas Post-breeding Pop.	8%	8%	8%	7%	8%	8%
% of Texas Ann. Mortality	12%	11%	12%	11%	11%	11%

House Sparrow. House Sparrows are found in nearly every habitat in Texas except dense forest and desert environments. It prefers human-altered habitats, and is abundant on farms and in cities and suburbs. Like starlings and pigeons, House Sparrows are considered by many wildlife biologists, ornithologists, and naturalists to be an undesirable component of North American native ecosystems because they can have many negative impacts on resources and compete with native bird species. Thus, any reduction in their population would likely be considered beneficial on the human environment. BBS data indicate that the species has seen a significant decrease surveywide and in Texas from 1966 to 2010 at -3.7%/year and -3.6%/year (Sauer et al. 2011). The decrease in the House Sparrow population is likely due to a number of factors that have reduced their feed supply – reduced seeds form the replacement of horses with internal combustion engines (House Sparrows pick seeds from horse manure), reduced insects in urban areas and on farms from the use of insecticides, reduced grain from spillage from more efficient harvesters, and reduced weed seeds from weed control (Lowther and Cink 2006). The breeding population in Texas is abundant and was estimated using FY07 to FY11 USGS (2012) to be 3.8 million using corrective parameters from Rich et al. (2004) (Table 4). RMBO (2007) estimated the population at 6 million in Texas during the 1990s, reflecting the negative trend.

Most House Sparrows breed their first year with available habitat. For the purposes of impacts, it is assumed that 75% of females breed in a given year and that the sex ratio is 1:1 males to females. House Sparrows lay an average of 5.1 eggs per nest and average 1.6 clutches per year, with fledgling success averaging 40% (Lowther and Cink 2006). Using these parameters, the breeding population of 3.8 million in Texas would have about 4.6 million fledglings, raising the post-fledgling population to about 8.4 million in Texas. Thus, a stable House Sparrow population more than doubles following the nesting season, but is reduced back to this number by the next nesting season and the annual mortality rate would equal 4.6 million (Table 20).

TWSP conducts minimal BDM for House Sparrows in Texas, averaging 557 taken from FY07 to FY11 (Table 8) which is less than 0.1% of the expected annual mortality (Table 20). Because House Sparrows are not afforded protection by federal or state laws, depredation permits are not required for private individuals to take them. It is expected that the public conducts some control for House Sparrows, but much less than starlings and pigeons. House Sparrow control is probably conducted at a few CAFOs such as dairies and possibly for some urban damage situations by private pest control operators. These individuals and entities may conservatively take up to 50,000 House Sparrows annually, mostly with Avitrol. A cumulative impact analysis, combining all WS take, would show that this would possibly take just over 1% of the expected annual mortality (Table 20). Thus, this would be a minor impact on the population and not enough to cause the population to decline. In fact, take would have to be in the millions in Texas before an impact would likely start to occur. However, an impact to this species may be desired in some areas because the House Sparrow is an invasive species and not a native component of the ecosystem. But as can be seen, TWSP take would have to increase several thousand times before and impact would occur. TWSP, though, has had only a minimal, low magnitude impact on this species.

Table 20. Cumulative impact analysis for House Sparrow killed in Texas by TWSP and private individuals and entities (estimated) from FY07 to FY11.

HOUSE SPARROW IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated Texas Breeding Population	3,800,000	3,800,000	3,800,000	3,800,000	3,800,000	3,800,000
% Breeding Females in Population	37.5%	37.5%	37.5%	37.5%	37.5%	37.5%
Breeding Females	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000
Aver. Clutch	5.1	5.1	5.1	5.1	5.1	5.1
Aver. Nests	1.6	1.6	1.6	1.6	1.6	1.6
% Fledge	40%	40%	40%	40%	40%	40%
Young Fledged/ Stable Pop. Ann. Mort.	4,600,000	4,600,000	4,600,000	4,600,000	4,600,000	4,600,000
Total Texas Population	8,400,000	8,400,000	8,400,000	8,400,000	8,400,000	8,400,000
TWSP Take	1,702	0	0	1,037	44	557
TWSP Take % of Texas Ann. Mort.	0.04%	0.00%	0.00%	0.02%	0.00%	0.01%
Private Take in Texas Region	50,000	50,000	50,000	50,000	50,000	50,000
Total Take	51,702	50,000	50,000	51,037	50,044	50,557
% Texas Post-breeding Pop.	1%	1%	1%	1%	1%	1%
% of Texas Ann. Mortality	1%	1%	1%	1%	1%	1%

Eurasian Collared-Doves. The Eurasian Collared-Dove, a recent invasive species, is becoming abundant in Texas and WS has already been requested to conduct BDM for them in many states and in Texas in FY11 (Table 8). Doves are smaller than pigeons, but they possess many of the same physical characteristics. They are fast-flying grayish-brown birds with a whitish tail band. Eurasian Collared-Doves were introduced to the Bahamas in the 1970s and, following self-introduction into Florida, their population rapidly expanded throughout the Southeast and further. BBS observers first recorded the doves in Texas in 1996 and have documented increased numbers since. The 5 year average population increased from 1997-2001 at 0.14 birds/route, 1.33 in 2002-2006, and 3.84 birds/route for 2007-2011, a 2700% increase. In that short time, RMBO (2007) estimated the population in Texas at 3,000 1990s which has increased to 1.1 million for Texas (Table 4). The doves have become frequent problems at CAFOs where they feed on and contaminate livestock feed. TWSP expects that the take of this species will continue to increase as their population expands even more. Like starlings, feral pigeons, and House Sparrows, Eurasian Collared-Doves are considered by many wildlife biologists, ornithologists, and naturalists to be an undesirable component of North American native ecosystems because they could potentially have negative impacts on resources and compete with native bird species, though thus far, anecdotally, this does not seem to be the case. However, any reduction in their population would likely be considered beneficial on the human environment. Even so, WS has had minimal impact on the doves.

Eurasian Collared-Doves are not protected by USFWS. It is unknown how many collared-doves were harvested by sport hunters during prior hunting seasons, but it was likely not a significant amount. The sport hunting season is very liberal with no bag limit because the collared-doves are invasive. Sport harvest by hunters was not monitored. Most collared-dove mortality from TWSP BDM activities takes place at airports and CAFOs. TWSP could take hundreds of these doves, though this take would have a very minor impact on their population. It is anticipated that the population of this species will eventually level out, but that may take several years. The anticipated number of Eurasian Collared-Doves that will be killed by TWSP will likely be extremely low in comparison to sport hunter harvest that TWSP take will be insignificant in their overall mortality, though it is anticipated that it could be in the tens of thousands considering their population number.

Feral Poultry. Several species of domestic waterfowl are common in parks and lakes in Texas (Appendix C: Table C4) as well as chickens and other gallinaceous birds. These species are often released at parks and other areas intentionally by owners as ornamentals or by people who can no longer keep them (they are often received as gifts for different holidays by people who cannot raise them fully). They are often released without landowner permission. Their numbers can grow and often surpass the carrying capacity of the area. The various species of waterfowl can create severe problems including damage to landscaping and grass, water contamination, disease, and hybridizing with wild waterfowl. The chickens and other poultry are more of a nuisance and typically do not cause as much damage as waterfowl. TWSP lethally took an average of 48 ducks, 2 geese, and 2 chickens from FY07 to FY11 (Table 8) and no other feral domestic poultry, but has in the past (guineas and peacocks). Additionally, TWSP captured an average of 48 feral ducks and 3 feral geese from FY07 to FY11 and gave them to people that raised them (e.g., farmers). The effect of feral poultry removals is likely positive, with the exception of at parks where people feed them because these people could see control as negative as they often enjoy feeding them. However, opportunities to feed feral ducks and geese are abundant and probably close to areas of removal. It should be noted that many parks have "No Feeding" policies, but these are often disregarded and not enforced. However, the take of feral poultry by TWSP is considered to be of no significant impact on the human environment since feral ducks, geese, chickens, peacocks, and guineas are not indigenous components of ecosystems in Texas.

Exotic Birds. Texas has many exotic birds that have escaped captivity or intentionally released. Some can damage different resources and TWSP may be contacted to conduct BDM for them. TWSP did not lethally take any exotic birds from FY07 to FY11, but did take 1 (a Monk Parakeet) from FY94 to FY06. Thus, only one exotic bird, other than those discussed above, has been taken by TWSP. The take of these species has no effect on the human environment because they are not indigenous components of ecosystems in Texas. In fact, for most species, it would be seen as beneficial for their removal so a population does not get started, as with the Monk Parakeet, which has caused thousands of dollars damage to the power industry. TWSP expects that the take of exotics will remain fairly low because most do not have established populations.

<u>Corvids</u>

All species of corvids (crows, ravens, magpies, and jays) have the potential to cause damage to resources, but only a few species do routinely in Texas, crows and ravens. The American Crow, and Common and Chihuahuan Ravens are commonly found in Texas and the species most likely to cause damage resulting in requests for assistance from TWSP for damage to agriculture and protection of human health safety at airports. American Crows have been the focus of BDM projects in Texas because they often damage crops such as pecans and congregate in large numbers that are a nuisance or cause damage at feedlots. Periodically, crows are also responsible for livestock predation. Large numbers can be taken during a single BDM project, primarily during winter when large flocks form. Common and Chihuahuan Ravens cause the most consistent problems (mostly livestock predation, but also crop damage) and have been the focus of several BDM projects. Blue Jays have also caused consistent low level problems from FY07 to FY11, but have not been lethally taken during BDM. The only other corvid lethally targeted by TWSP from FY94 to FY03 was the Fish Crow of east Texas. During this time, Western Scrub-Jays and Green Jays also caused some damage, but TWSP only provided technical assistance for these species. TWSP does not anticipate that lethal take for these species will change and would only expect to take a few individuals of the different species if BDM were conducted for them. However, many corvid populations are increasing with increasing urbanization (Marzluff et al. 2001), and damage and subsequent BDM actions could increase. TWSP anticipates that it could take any of the corvids given in Appendix C: Table C1, but BDM will likely only be for the 3 species typically taken.

American Crows. The American Crow population has increased throughout its range, especially in more urbanized environments and western states (Marzluff et al. 2001). American Crows are year-round residents in Texas, but migration into the State during fall and winter raises the local populations each year as historical winter roosts are re-occupied or new roost sites are established. They are most common in north and eastern Texas, being absent or scarce in west and south Texas (Figure 14). Wintering numbers are variable from year to year which is reflected in the CBCs (NAS 2012a). Winter numbers likely are affected by climatic conditions such as colder winters in states further north. Estimates on historical roosts showed millions of crows concentrated in communal roosts throughout the southern tier of states (Johnson 1994). The arrival of wintering crows in Texas coincides with the harvest of several important agricultural commodities (e.g., pecans and peanuts) that are damaged by crows. Efforts to control depredation to these commodities include a variety of nonlethal and lethal methods. Lethal methods employed by TWSP include shooting, DRC-1339, and cage traps with euthanasia. Lethal strategies are intended to reduce the population of crows feeding on these valuable commodities that have not or would not be successfully been deterred by nonlethal measures. The damage threat from crows, along with their abundance, was significant enough that a Depredation Order was issued by the USFWS to allow the take of crows "*when found committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance*" with no Federal permit (50 CFR 21.43).

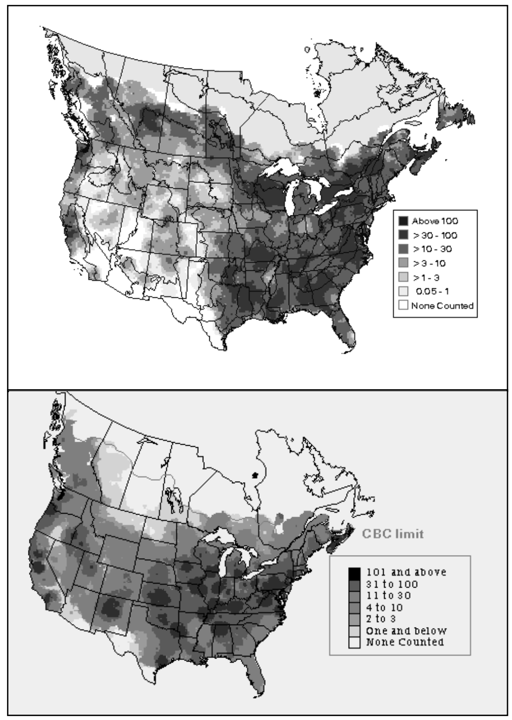

Figure 14. Breeding (Sauer et al. 2011) and winter CBC (Sauer et al. 2006) range maps for the American Crow based on data collected from 2006 to 2010 (above) and 1966 to 1989 (below), respectively.

In addition to TWSP's take, crows are taken by the public under the authority of the standing Depredation Order to protect resources. However, TWSP has no measure of the number of crows taken for such actions, similar to blackbirds, because reporting of take is not required. It is expected that some are taken, but not likely a substantial number because the public likely uses shooting as the primary method for control. Another cause of mortality for crows is hunting. Texas, though, does not have an open hunting season for crows, but all of the other states in the CPS region do such as Oklahoma. However, not all states collect harvest information for crows. In spite of these pressures from sport hunting and for resource protection, estimated trends from 1966 to 2010 have been positive with significant increases surveywide at 0.3%/year and in Texas at 1.0%/year (Sauer et al. 2011). Their range expansion has been credited to their adaptability to altered habitats such as urban and agricultural landscapes (Verbeek and Caffrey 2002). The BBS surveywide population of American Crows has been estimated at 31 million based on BBS data from the 1990s (Rich et al. 2004, RMBO 2007). Recent data (FY07-FY11) suggests the CPS population to be estimated at 2.7 million with 1.3 million in Texas (Table 4).

American Crows breed when they are two years old (third year). A population has been found to consist of 34% juveniles, many that form flocks with other nonbreeders or assist adults in raising nestlings (Verbeek and Caffrey 2002). For the sake of estimating the population for this EA, it is assumed that 66% of the estimated population are adults, that 90% of the adult females breed (breeding is expected to be higher for birds breeding after first year), the sex ratio is 1:1 males to females, females lay 3-7 eggs with an average eggs/nest of 4.5, and the average nests/season is 1 (Verbeek and Caffrey 2002)). About 67% of the eggs hatch and fledge averaging about 1.62 fledglings per nest. Using these parameters, the Texas breeding population of 2.7 million would have about 680,000 breeding females that successfully fledge about 2.1 million nestlings, raising the post-fledgling population to about 4.8 million American Crows. This would be an increase in the population by a factor of 1.8.

The numbers that might be taken by WS under the proposed action or Alternative 1 in Texas could be 50,000 with potentially up to an estimated 200,000 by WS in the CPS area annually. However, the take between FY07 and FY11 would likely be more realistic which averaged less than 30,000 with a high of 52,000 in FY09 or 3% of the expected annual mortality (Table 21). Additional human-induced mortality of this species in the CPS region occurs from hunters, and private individuals and others conducting control. TWSP has no way of knowing what the level of take is by private individuals. Some hunter harvests are available. All States except Texas in the CPS area have a designated hunting season for crows. Harvest in Oklahoma from the 2001 to 2005 averaged about 300,000, but a lot of these crows are taken in winter when they migrate into the state from northern areas, including areas from outside the CPS. Oklahoma and Kansas would be expected to have the highest hunting harvest with higher crow densities than the other CPS states (Figure 14). Oklahoma harvest, though, likely is the highest of the CPS and it is possible that up to 500,000 crows are harvested in the CPS. Kansas may take up to 150,000 crows, half that of Oklahoma, and the 3 northern states combined likely take 50,000. For example, Colorado, which has collected information on crow harvest, took an estimated 1,700 crows annually from the 2002 to 2004 hunting seasons which is likely a more reflective harvest of the states in the northern CPS region. Hunting harvest would be higher in Texas if crows had a designated hunting season. Private depredation take in the CPS area is likely moderate, especially in Texas which does not have a hunting season. It is expected that 250,000 crows are taken annually. Thus, cumulatively, hunters and private depredation take could possibly reach 750,000 representing about 36% of the expected annual mortality; however, as suggested, many crows winter in the southern tier of states that come from a wide area including areas outside the CPS. The cumulative impact overall from FY07 to FY11 averaged 16% of the post breeding population or 37% of the expected average mortality estimate. If WS in the CPS area took 250,000, the estimated cumulative take would be 48% of the estimated annual mortality. These numbers are within the annual mortality levels for this species, but would be a moderate estimated impact. BBS trend data for the area corresponds to less of an impact. Thus, the parameters for the population estimate may be too low or the detectability factor may be too low. However, we believe that these are highly overestimated numbers to be conservative and that take is likely lower.

It should be noted that West Nile virus has been documented in the CPS area since 2002 and probably and was a primary mortality factor of the corvid population. Since it has been in the state for a few years, it is expected that corvids will develop some resistance to the disease. WS has no way to determine the level of impact this disease has had, but looking at BBS trend data, it is believed that it could have been a primary mortality factor, but with the significant increasing trend (Sauer et al. 2011), it cannot have been a significant limiting factor.

Table 21. Cumulative impact analysis for American Crows killed in Texas by TWSP, other CPS WS Programs, and private individuals and entities (estimated) from FY07 to FY11.

AMERICAN CROW IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated CPS Breeding Population	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000
% Breeding Females in Population	25%	25%	25%	25%	25%	25%
Breeding Females	680,000	680,000	680,000	680,000	680,000	680,000
Aver. Clutch	4.5	4.5	4.5	4.5	4.5	4.5
Aver. Nests	1	1	1	1	1	1
% Fledge	69%	69%	69%	69%	69%	69%
Young Fledged/ Stable Pop. Ann. Mort.	2,100,000	2,100,000	2,100,000	2,100,000	2,100,000	2,100,000
Total CPS Population	4,800,000	4,800,000	4,800,000	4,800,000	4,800,000	4,800,000
TWSP Take	6,891	9,401	6,648	6,319	700	5,992
Other CPS WS Take	27,742	24,060	52,007	8,995	31,479	28,857
TWSP Take % of CPS Ann. Mort.	3.1%	3.0%	5.3%	1.4%	2.9%	3.2%
Private Take in CPS Region	750,000	750,000	750,000	750,000	750,000	750,000
Total Take	784,061	774,760	804,639	759,039	782,173	780,934
% CPS Post-breeding Pop.	16%	16%	17%	16%	16%	16%
% of CPS Ann. Mortality	37%	37%	38%	36%	37%	37%

American Crows can experience substantial reductions to their populations and show no effect at the population level. From 1934 to 1945, in an organized effort by the Oklahoma Game and Fish Commission, 127 crow roosts were removed in Oklahoma during winter. Almost 4 million crows were killed, but no evidence was obtained indicating an influence on total population levels during the period (Dolbeer 1986). In addition to this campaign, the hunting seasons for crows continued. Despite the attitudes of early in the 20th century that encouraged the complete extirpation of the American Crow, the birds continued to thrive.

Common Ravens. The Common Raven, the largest bodied of the passerines, is widely distributed throughout the Holarctic Regions of the world including Europe, Asia, and North America (Goodwin 1986, Boarman and Heinrich 1999). In Texas, Common Ravens are most common in west (Big Bend area) and central Texas (San Angelo to Del Rio) with some found in the far north area of the panhandle. In some parts of its range, the Common Raven population is rapidly expanding along with a dramatic increase in raven damage, and programs have been implemented to reduce population size. In other parts of its range, populations declined so drastically (Appalachians) in the past that reintroduction programs were implemented. The raven is an omnivorous species known to feed on carrion, crops, eggs and birds, small mammals, amphibians, reptiles, fish, and insects. Ravens are attracted to and concentrate around livestock birthing grounds. Ravens will attack young lambs, calves, and goats, and even adult ewes, nannies, and cattle in certain situations, by pecking the eyes and other vulnerable spots such as the anus, nose, or umbilical cord which results in the animal going into shock and dying (Larsen and Dietrich 1970, Wade and Bowns 1982). Other agriculturally related raven complaints received by WS have included eating livestock feed and feeding on grains, pecans, and other crops. Non-agricultural property damage complaints received by TWSP have included damage to electrical lines, power outages, buildings, landscaping, and other structures. Health related complaints have included turning garbage containers over and strewing its trash, and carrying trash from landfills into nearby residential areas. Additionally, high raven numbers potentially represent a threat to nesting waterfowl, upland gamebirds, Neotropical songbirds, and T&E species or other sensitive wildlife. The raven has been implicated as a causative factor in the declines of several T&E species, including desert tortoise (*Gopherus agassizi*), California Condor, Marbled Murrelet (*Brachyramphus marmoratus*), and Least Tern (Boarman and Heinrich 1999, Liebezeit and George 2002). Thus, a reduction of ravens in some areas of the country is seen as desirable to protect the T&E species such as the desert tortoise.

In many areas of the West, the Common Raven is seen as an indicator of human disturbance, being closely associated with garbage dumps, sewage ponds, highways, agricultural fields, urbanization, and other human-altered landscapes (Boarman 1993, Restani and Marzluff 2001). Adaptability, predacious habits, and ability to use resources provided by human activities have benefitted the raven population. Supplemental feeding sources such as garbage, crops, and road-killed animals have afforded ravens an advantage over other not-so-opportunistic feeders and has allowed the raven population to increase precipitously in some areas (Liebezeit and George 2002). In some areas of the West, the raven population has increased as much as 7000%. As a result, WS West-wide has seen an increase in raven complaints over the last several decades.

In most areas, ravens are year-round residents with little evidence of migration from radio-tagged or marked populations in North America (Goodwin 1986, Boarman and Heinrich 1999). However, the species has been known to move into areas just outside its range during non-breeding season. Further, there is some question as to whether some of the birds in flocks of floaters may be migrants (Boarman and Heinrich 1999). Floaters are primarily immature and non-breeding birds (i.e., fledgling, 1 and 2 year old birds) that typically will band together in flocks of 50 or more. These flocks tend to be loose-knit and wide-ranging (Goodwin 1986). Ravens do not breed until their third year, though some unsuccessful attempts to nest have been documented for 2-year old birds (Boarman and Heinrich 1999). Common Ravens have one nest per year, renesting if the first attempt fails, with a typical clutch size of 3 to 7, averaging 5.3 (Boarman and Heinrich 1999). Age structure in raven populations is unknown, but it is assumed for this analysis that “floaters” or subadult birds make up 34% of the population as with crows. Fledgling success (number fledged/egg) varied, but the lowest in a Wyoming study was found to be 31% (Boarman and Heinrich 1999). Using these parameters, an estimated breeding population of 9,800 in Texas (Table 4) would annually fledge about 4,100 ravens (Table 22).

Table 22. Cumulative impact analysis for Common Ravens killed in Texas by WS, and private individuals and entities (estimated) from FY07 to FY11.

COMMON RAVEN IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated TX Breeding Population	7,600	7,600	7,600	7,600	7,600	7,600
% Breeding Females in Population	25%	25%	25%	25%	25%	25%
Breeding Females	1,900	1,900	1,900	1,900	1,900	1,900
Aver. Clutch	5.3	5.3	5.3	5.3	5.3	5.3
Aver. Nests	1	1	1	1	1	1
% Fledge	31%	31%	31%	31%	31%	31%
Young Fledged/Stable Pop. Ann. Mort.	3,100	3,100	3,100	3,100	3,100	3,100
Total TX Population	11,000	11,000	11,000	11,000	11,000	11,000
TWSP Take	69	26	80	117	203	99
TWSP Take % of TX Ann. Mort.	2.2%	0.8%	2.6%	3.8%	6.5%	3.2%
Private Take in TX	0	0	0	0	0	0
Total Take	69	26	80	117	203	99
% TX Post-breeding Pop.	0.6%	0.2%	0.7%	1.1%	1.8%	0.3%
% of TX Ann. Mortality	2.2%	0.8%	2.6%	3.8%	6.5%	3.2%

The numbers that might be taken by TWSP under the proposed action or Alternative 1 are relatively minor. WS anticipates that it could potentially take up to an estimated 500 annually (about 12% of the expected annual mortality) especially because the population has increased, but the take between FY07 and FY11 would likely be more realistic which averaged 99 with a high of 203 or 3.2% of the expected annual mortality (Table 22). Cumulatively, WS anticipates that private individuals would take potentially up to 500, but USFWS recorded an average of 0 between 2006 and 2010 (no take recorded for ravens). In total, potential cumulative take would represent about 1% of the expected annual mortality. These numbers are well within normal mortality levels for this species. It should be noted, as with crows, that West Nile virus has been documented in Texas and probably caused additional mortality on the corvid population. Now that it has been in the state for a few years, it is expected that corvids will develop some resistance to the disease. TWSP has no way to determine the level of impact this disease has had, but looking at BBS trend data, it is believed that it has not been a significant limiting factor because the population has been increasing nonsignificantly in Texas from 1966 to 2010 at 1.8%/year and at significantly at 3.9%/year 2000 to 2010 in Texas (Sauer et al. 2011). TWSP believes that the Common Raven population has not been impacted at the population level by TWSP BDM in Texas and that take will continue to be very minor portion of their expected annual mortality. Additionally, TWSP believes that the estimated population for ravens is well below the actual number that resides in Texas because Rich et al. (2004) provided a very conservative detectability parameter equaling 0.65 (see Appendix A comment on Common Raven population estimation and why this detectability factor is believed to be well below the actual detectability factor). Thus, we believe that the actual impact in Texas is even lower than the minimal current take. Therefore, we believe that BDM has had, at most, a minimal impact on the Common Raven in Texas.

Chihuahuan Ravens. Chihuahuan Ravens tend to be more widely distributed and gregarious, even during the breeding season, and inhabit lower elevations than Common Ravens. They can be found from the panhandle to south Texas along the Rio Grande Valley and west. Ravens are considered migratory birds and managed under the Migratory Bird Treaty Act by USFWS. TWSP responds to requests from livestock operators, airports, and others who experience depredation problems from ravens and work with USFWS to resolve damage complaints. TWSP took an average of 3 Chihuahuan Ravens from FY06 to FY11 with a high of 13 (all ravens taken) in FY06 (Table 8). USFWS did not report any take of Chihuahuan Ravens from FY07-FY11. These ravens are often taken for similar reasons as Common Ravens. It is anticipated that TWSP will continue to take them in the future in BDM activities from time to time, but probably somewhat less or equal to that of the Common Ravens.

Similar to Common Ravens, Chihuahuan Ravens are abundant in those areas that they occupy in Texas. The estimated trend from 1966 to 2010 was positive BBS surveywide at 0.3%/year and negative in Texas at –0.8%/year, but not significant (Sauer et al. 2011). The BBS surveywide population of Chihuahuan Ravens has been estimated at 370,000 based on BBS data from the 1990s (RMBO 2007). Recent data (FY07-FY11) for the Texas population rendered an estimate of 62,000 (Table 4). Since populations are decreasing in Texas, but not surveywide, but not significantly, it is harder to judge what has impacted them. Bednarz and Raitt (2002) discuss how populations fluctuate dramatically in New Mexico appearing to be regulated by insect availability; the droughts that occurred in Texas during 2000 and 2007 to 2009 may have impacted their populations as these likely reduced grasshopper and pother insect populations significantly.

Much is unknown about the Chihuahuan Raven natural history (Bednarz and Raitt 2002). Looking at the population data, though, we can estimate the annual mortality. Chihuahuan Ravens have one nest per year, renesting if the first attempt fails, with a typical clutch size of 3 to 7, averaging 4.9 (Bednarz and Raitt 2002). Age structure in raven populations is unknown, but it is assumed for this analysis that "floaters" or subadult birds make up 34% of the population as with crows and Common Ravens. Fledgling success (number fledged/egg) varied, but was found to be about 30% of the average clutch (Bednarz and Raitt 2002). Using these parameters, an estimated breeding population of 62,000 in Texas would annually fledge about 23,000 nestlings, the estimated annual mortality rate. TWSP took less than 0.1% of the estimated annual mortality rate in FY07, the only year they were taken. The cumulative total was the same as TWSP take because the USFWS did not record any take for Chihuahuan Ravens from 2006 to 2010. TWSP could take several thousand Chihuahuan Ravens before a moderate magnitude impact would be reached. TWSP anticipates that it will not exceed the take 10% of the estimated annual mortality. TWSP concludes, that even with implementation of lethal control for these ravens, TWSP will have a minor impact on them, at most.

Fish Crows. These crows are distributed in far eastern Texas. They typically do not cause as many problems as the American Crow, but can, especially in pecan orchards and to other birds from depredating nests. Fish crows are omnivorous with a diet that primarily consists of carrion, marine invertebrates, insects, eggs, nestlings, fruits, and refuse. They are becoming quite common in urban areas and in some areas expanding their range. In Texas, their population is increasing at a rate of 16.8%/year and, while not considered significant due to a lack of data, the standard error range is wholly positive (Sauer et al. 2011). Surveywide their population is increasing at a significant rate of 0.3%/year. It is believed that habitat changes have accounted for the increase (McGowan 2001). RMBO (2007) estimated their population to be 8,000 in Texas which reflects its limited distribution. More recent data from FY07 to FY11 (USGS 2012) gives an estimate of 11,000 in Texas, reflecting the increasing trend.

Similar to the sympatric American Crows, Fish Crows are abundant in those areas that they occupy in Texas. Much is unknown about the Fish Crow's natural history (McGowan 2001). However, they nest once per year, renesting if the first attempt fails, with a typical clutch size of 2 to 6, averaging 4.5 (McGowan 2001). Age structure in Fish Crow populations is unknown, but it is assumed for this analysis that "floaters" or subadult birds make up 34% of the population as with American Crows. Fledgling success and other parameters were unknown, but assumed to be similar to American Crows. For the sake of estimating the population for this EA, it is assumed that 66% are breeding adults, that 75% of the adult females breed, the sex ratio is 1:1 males to females, and about 37% of the eggs hatch and fledge. Using these parameters, the Texas breeding population of 11,000 would have about 2,700 breeding females that successfully fledge about 4,500 nestlings, raising the post-fledgling population to about 16,000 Fish Crows. This would be an increase in the population by a factor of 1.45. TWSP did not take any Fish Crows from FY07 to FY11. However, from FY94 to FY06, TWSP averaged taking 15 per year or less than 1% of the estimated annual mortality. Fish Crows can be taken by private individuals under the USFWS Depredation Order and TWSP has no way of knowing how many are taken. It could be possible that as many as 500 are taken by private individuals and entities or 11% of the estimated annual mortality cumulatively. It is estimated that as many as 500 could be taken by TWSP, but given that none were taken from FY07 to FY11, it is unlikely. The cumulative total under this scenario would equate to 22% of the estimated annual mortality, still within a level that would not impact the Fish Crow population. Given the fact that the Fish Crow population in Texas has increased at almost 17% per year from 1966 to 2010, the cumulative take by TWSP and private persons did not impact the population.

Jays. Texas hosts 6 species of jays that are fairly common at some point in the year, which have the potential to cause damage. Of these, the Blue Jay in eastern Texas, Western Scrub-Jay in western Texas, and Green Jay in south Texas have estimated breeding populations of 1.1 million, 52,000, and 170,000, respectively, using data from FY07 to FY11 (USGS 2012). The Steller's Jay is a winter migrant in west Texas, the Pinyon Jay an erratic visitor to the panhandle and western Texas, and the Mexican Jay a resident along the upper Rio Grande Valley, estimated population is 4,400. These 3 species are uncommon in Texas because they all have very limited ranges in Texas. Of these, the Blue Jay and Pinyon Jay have been declining significantly surveywide from 1966 to 2010 at -0.7%/year and -4.0%/year, respectively (Sauer et al. 2011). The Pinyon Jay is listed by NAS (2007) as a species of concern. These species are thought to be declining mostly to habitat modifications and losses (Tarvin and Woolfenden 1999, Curry et al. 2002, Balda 2002) and possibly impacts from predators such as ravens (Balda 2002). More recently, West Nile virus impacted corvids including jays to some degree.

The most likely species to be the focus of a BDM project would be Blue Jays to protect crops such as pecans. TWSP anticipates that it could take as many as 1,000, but this would have minimal impact on the population (<0.1% of the breeding population). TWSP could also possibly take up to 100 Western Scrub-Jays, but this would only be 0.2% of the breeding population. However, TWSP has not taken either Blue Jays or Western Scrub-Jays, but anticipates that a request could occur because they can cause damage, especially to crops such as pecans. TWSP did receive requests for assistance for the Blue Jay from FY07 to FY11 or the others in the past TWSP could potentially be requested to assist with the other species, especially at airports where they are a strike hazard. However, it is anticipated that TWSP would take less than 10 of any of these species, but could easily go to the maximums given above. Even at high levels, TWSP does not believe it will have more than a minimal impact on any of these species.

Black-billed Magpies. Magpies frequently invoke requests for assistance from WS in states with large magpie populations, similar to complaints caused by ravens, including predation of livestock and poultry. Magpies are rarely found in northern and west Texas. Of the species that accidentally occur in Texas, primarily during winter, this species has the potential to create a request for assistance. TWSP anticipates that this would be a rare occurrence and take would be minimal, possibly 1 or 2 birds. USFWS has established a Depredation Order for magpies and they can be taken without a permit if they are committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance. TWSP anticipates that none will be taken, but the possibility exists.

Raptors

Texas has many species of raptors (vultures, buteos (hawks with broad wings), falcons, kites, accipiters (forest falcons), harriers (marsh hawk), eagles, owls, and shrikes). Most species rarely cause damage with the primary exception that most are a strike risk at airports and others take livestock and poultry (see Appendix C: Table C1 for a list of species and those that cause damage). The most common problem species with the highest number of work tasks associated with them (> 100 from FY07 to FY11) have involved the Black and Turkey Vultures, Crested Caracara, American Kestrel, Red-tailed and Swainson's Hawks, Northern Harrier, and Osprey (Table 2). In addition to these, 15 other raptors have had work tasks associated with them from FY07 to FY11 including eagles, hawks, and owls (Table 2). It should be noted that some species such as screech-owls may have work tasks associated with them, but may not have had actual damage associated with them. Some work tasks involve receiving a call of an injured owl which is picked up by a Wildlife Specialist and transferred to a rehabilitator (owls are frequently struck by passing cars while they are hunting, struck, and injured). "Damage" for this type of activity is often recorded as human health and safety because of the distress it causes for persons seeing the injured owl, but there was no damage per se.

Raptors are the most difficult birds to haze from air operating areas because most pay little attention to pyrotechnics and other sound-scare devices. Often, they must be trapped and relocated or killed to minimize strike risks. Raptors are a leading hazard at airports and cause significant damage to aircraft with most raptor strikes occurring at heights less than 500 feet above the ground (Dolbeer 2006), often at or near the airfield. Raptors caused 331 reported strikes from FY02 to FY11 at airfields in Texas with 38% of those causing damage (Appendix D: Table D1).

Of the species that occur in the BBS survey area and reside in Texas during some part of the year, the species that declined significantly from 1966-2011 are the Northern Harrier (-0.8%/year), Harris's Hawk (-1.7%/year), American Kestrel (-1.1%/year), Short-eared Owl (-2.5%/year), Great Horned Owl (-0.8%/year), and Loggerhead Shrike (-3.2%/year) (Sauer et al. 2011). The other species common in Texas that have exhibited downward trends, that are not significant are the White-tailed Kite (-0.2%/year), Eastern (-1.2%/year) and Western (-1.8%/year) Screech-Owls, and Burrowing Owl (-0.8%/year). On the other hand, 10 species exhibited significant positive trends. TWSP responds to requests for assistance mostly with just a few species and on a minimal basis. Declines, especially in the mid-1900s, in many species or raptors caused concern among biologists and most species became protected under state and federal laws. WS anticipates taking few raptors to abate damage situations, but will discuss those with the highest probability.

Vultures. Two species of vultures inhabit Texas and are abundant. TWSP receives most requests for assistance for these species. In fact, TWSP completed more work tasks associated with these 2 species than the other 20 species of raptors that TWSP received requests for assistance. Thus, BDM activity associated with the vultures is typically much higher than for the other species.

Black Vultures. Black Vultures are common throughout the southeastern United States with populations expanding northward, especially along the East coast. They are found year-round throughout much of Texas, excluding the panhandle and some of west Texas. Black Vultures are common in most habitats of the State including open plains, woodlands, agricultural settings, and human settlements. They are very good at detecting carrion, not so much by smell, but rather by monitoring Turkey Vulture feeding when soaring. They often kill injured or newborn livestock. Much of the BDM conducted for Black Vultures is for livestock predation. Some BDM is conducted to reduce hazards at airports and protect property where their roost is in undesirable location such as at an electrical substation or in a residential neighborhood. BBS data indicates that the Black Vulture population from 1966 to 2010 increased significantly at 4.5% and 7.3%/year BBS surveywide and in Texas. This suggests that habitat conditions benefit the Black Vulture allowing their population to expand in the United States. This alone also suggests that Black Vulture damage management and other mortality over the past several years throughout the United States did not have an impact on their population, especially considering that the increase was 2% greater from 2000-2010.

However, to further consider the impacts of TWSP, the population in Texas has been estimated at 190,000 (Table 4). New data (Runge et al. 2009) suggests that the detectability factor developed by Rich et al. (2004), 1.249, was substantially lower, 10.788, than it should be, in fact by a factor of 8. Using the Rich et al. (2004) detectability factor would render a population for Virginia of 11,000 in 2006 whereas, with detailed study, they determined the population was estimated to be 91,000. This would increase the current population estimate of 190,000 in Texas to 1.6 million, which is likely closer to the actual population. However, for the sake of this EA, we will continue to use the estimated population from using the detectability factor from Rich et al. (2004).

Table 23. Cumulative impact analysis for Black Vultures killed by TWSP and USFWS permitted private individuals and entities from FY07 to FY11.

BLACK VULTURE IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated TX Breeding Population	200,000	200,000	200,000	200,000	200,000	200,000
% Breeding Females in Population	16%	16%	16%	16%	16%	16%
Breeding Females	32,000	32,000	32,000	32,000	32,000	32,000
Aver. Clutch	2	2	2	2	2	2
Aver. Nests	1	1	1	1	1	1
% Fledge	71%	71%	71%	71%	71%	71%
Young Fledged/Stable Pop. Ann. Mort.	45,000	45,000	45,000	45,000	45,000	45,000
Total TX Population	250,000	250,000	250,000	250,000	250,000	250,000
TWSP Take	1,858	1,315	1,468	2,548	1,963	1,830
TWSP Take % of TX Ann. Mort.	4.1%	2.9%	3.3%	5.7%	4.4%	4.1%
Private Take in TX	134	202	559	5	18	184
Total Take	1,992	1,507	2,027	2,553	1,981	2,014
% TX Post-breeding Pop.	0.8%	0.6%	0.8%	1.0%	0.8%	0.8%
% of TX Ann. Mortality	4.4%	3.3%	4.5%	5.7%	4.4%	4.5%

To determine impacts, if 60% of the population were subadult (vultures exhibit delayed-onset breeding and first breed at age 4 to 8) and 80% of the estimated adult Black Vulture population bred (32,000 breeding females) with females averaging 2.0 eggs and fledgling 1.42 chicks (Buckley 2001[13]), annual production could be conservatively estimated at 45,000. TWSP took an average of 1,830 Black Vultures annually from FY07 to FY11 with a high of 2,548 in FY10, or 4% and 6% of the expected annual mortality (Table 23), the same number as their annual production. This level of take would have no noticeable impact on the population as suggested by the BBS trend. TWSP could take several thousand (at least 20,000 before any possible impact would likely begin to occur, but TWSP only anticipates taking as many 10,000). Cumulatively, USFWS issued permits to individuals that reported taking an average of

[13] Buckley (2001) cites 3 studies with fledgling success rates 0f 0.73, 1.29, 1.88 from attempted nests (*n*= 98, 20, and 58, respectively) and these averaged 1.42 fledglings per nest. The one study in Texas for two types of habitat found 1.88 fledglings per attempted nest.

184 from 2006 to 2010. This was a cumulative impact of 2,014 from FY07 to FY11 or less than 5% of the post-fledgling population. Thus, TWSP take, estimated maximum take (10,000), and cumulative take including USFWS permitted take is not expected to impact the Black Vulture population in Texas. In fact, we believe that the impact was less than 1% with the new data from Runge et al. (2009) and that many more could be taken without an impact to the population.

Turkey Vultures. Turkey Vultures are common throughout the continental United States. They are found throughout much of Texas in the summer, and east, central, and south Texas during winter. Their population can increase during migration and winter, but many birds, including those from the panhandle and west Texas winter in Central America. Turkey Vultures are common in most habitats of the State including open plains, desert, woodlands, and human settlements. Turkey Vultures are very good at detecting carrion by smell when soaring. They periodically will kill injured or newborn livestock, but are a much lesser target of control than Black Vultures where the two species are found together because the latter often kills livestock (Kirk and Mossman 1998). Much of the BDM conducted for Turkey Vultures is for property protection because roosts are in undesirable locations such as at an electrical substation or residential neighborhood.

BBS data indicates that the Turkey Vulture population from 1966 to 2010 increased significantly at 2.3%/year surveywide and 1.3%/year in Texas (Sauer et al. 2011). This suggests that habitat conditions benefit the Turkey Vulture allowing their population to expand in the United States and in Texas. This alone also suggests that Turkey Vulture control and other mortality over the past several years throughout the United States and in Texas have not had more than a minimal impact on their population. However, to further consider the impacts of TWSP, the population in Texas has been estimated at 600,000 (Table 4). If 60% of the population were subadult (vultures exhibit delayed-onset breeding) and 80% of the estimated adult Turkey Vulture population bred (96,000 breeding females) with the average number of eggs at 1.9 and fledglings at 0.95/nest (Kirk and Mossman 1998). With these population parameters, annual production could be conservatively estimated at 91,000 (Table 24). Of this, TWSP from FY07 to FY11 took an annual average of 265 Turkey Vultures which equates to 0.3% of the expected annual mortality. Private take was minimal, except in 2008 (FY09) when it was 226 and combined with TWSP take was the highest cumulative take of 439 less than 1% of the expected annual mortality (Table 24). This level of cumulative take would have no noticeable impact on the population. TWSP would have to take tens of thousands before a moderate impact would occur, but does not anticipate ever taking over 5% of their annual mortality. Thus, TWSP has not had an impact on the Turkey Vulture population and does not anticipate taking more than 5,000 which will not have an impact on the population. Finally, similar to the Black Vulture, the detectability used by Rich et al. (2004) is likely very low and the actual population is much greater, in the millions, and impacts are minor, if any.

Table 24. Cumulative impact analysis for Turkey Vultures killed by TWSP and USFWS permitted private individuals and entities from FY07 to FY11.

TURKEY VULTURE IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated TX Breeding Population	600,000	600,000	600,000	600,000	600,000	600,000
% Breeding Females in Population	16%	16%	16%	16%	16%	16%
Breeding Females	96,000	96,000	96,000	96,000	96,000	96,000
Aver. Clutch	1.9	1.9	1.9	1.9	1.9	1.9
Aver. Nests	1	1	1	1	1	1
% Fledge	50%	50%	50%	50%	50%	50%
Young Fledged/Stable Pop. Ann. Mort.	91,000	91,000	91,000	91,000	91,000	91,000
Total TX Population	690,000	690,000	690,000	690,000	690,000	690,000
TWSP Take	320	321	213	228	242	265
TWSP Take % of TX Ann. Mort.	0.4%	0.4%	0.2%	0.3%	0.3%	0.3%
Private Take in TX	0	30	226	127	8	78
Total Take	320	351	439	355	250	343
% TX Post-breeding Pop.	0.0%	0.1%	0.1%	0.1%	0.0%	0.0%
% of TX Ann. Mortality	0.4%	0.4%	0.5%	0.4%	0.3%	0.4%

Crested Caracara. Crested Caracaras are similar to the vultures in feeding behaviors, often scavenging with them, but are more closely related to the falcons. They scavenge frequently, but spend a lot of time hunting for insects, other invertebrates, and small vertebrates especially when they walk along the ground. As with other raptors, they will take livestock, primarily newborns with several documented cases from FY07 to FY11. They are hazardous at airports and have been struck 5 times at Texas airports from FY02 to FY11 (Appendix D: Table D-1). They are common in south Texas and range northeast. They can be found in a variety of habitats, but especially grassland, rangeland, desert, and pastures with scattered taller trees or cactus. BBS data indicate that they are significantly increasing surveywide and in Texas at 6.6%/year and 6.3%/year from 1966 to 2010 (Sauer et al. 2011). Their population has likely increased as a result of habitat modifications such as land-clearing (Morrison and Dwyer 2012). Their population in Texas has been estimated at 150,000 for FY07 to FY11 using BBS data (USGS 2012), an increase from the 65,000 they were estimated to be in the 1990s (RMBO 2007) which reflects their high increasing trend (Table 4). Caracaras nest when they are 3 years old, fledge 1.6 young, and 37% of the population are subadults (Morrison and Dwyer 2012); assuming 80% of the adult females breed, these parameters would result in 60,000 fledglings produced. TWSP takes relatively few and took an average of 20 from FY07 to FY11 with a high of 31 in FY09, < 0.1% of the breeding population and estimated annual mortality (Table 8). USFWS permitted the take of an average of 4 bringing the cumulative total to 24 (Table 9). TWSP could increase take easily to 2,000, 3% of the estimated annual mortality. It is doubtful that TWSP will surpass this number. Thus, TWSP has had no impact on the population of this species and does not anticipate such.

Buteos (Hawks with Broad Wings). Some buteos kill poultry and are problems for some T&E and sensitive species such as the Attwater's Greater Prairie-Chicken. However, most work tasks for buteos are related to reducing wildlife hazards at airports. Texas has 9 regularly occurring buteos or buteo-like hawks and 4 that are rare or accidental. Of these, 7 are species of concern (Appendix C: Tables C1 and C3). TWSP lethally took 4 buteos from FY07 to FY11 and conducted nonlethal hazing or trapping with relocation for the same 4 species. The Swainson's Hawk and Red-tailed Hawk consistently cause most problems. The Swainson's Hawk and Red-tailed Hawk provide good examples of an impact analysis for most buteos as well as other raptors with minimal take.

Swainson's Hawk. The Swainson's Hawk, once abundant in the western United States, declined from shooting and other problems. In recent times, habitat degradation, the loss of their summertime prey in many areas, the Richardson's ground squirrel (*Spermophilus richardsonii*), and deaths associated with organophosphate insecticide use in Argentina have been cited as the primary cause of mortality (Bechard et al. 2010). As a result of these findings and its overall negative trend in BBS data, the Swainson's Hawk was listed by USFWS (2008) as a Bird of Conservation Concern. Swainson's Hawks are common in Texas during the breeding season, but winter in South America. They are common in grass-dominated habitat with sparse shrubs or trees, including cultivated lands. During the nesting season, Swainson's Hawks hunt for field rodents, reptiles, and some birds, but are primarily insectivorous at most other times of the year (Bechard et al. 2010). Almost all work tasks conducted by TWSP have been associated with Swainson's Hawks on airports and reducing their hazards. BBS data indicates that the Swainson's Hawk population from 1966 to 2010 increased at 0.6%/year and 1.2%/year surveywide and in Texas.

To consider the impacts of TWSP, the Swainson's Hawk population in Texas has been estimated at 62,000 (Table 4). Reproduction has been found to be highly variable, greatly influenced by prey availability. Females were not found to breed until they were usually 3 years old, with some 2 year olds breeding (Bechard et al. 2010). If 37% of the population were subadults, similar to Caracaras which also breed at 3 years old, and 80% of the estimated adults bred (16,000 breeding females) with females averaging 2.5 eggs, with 30% of the nests failing and successful nests having 1.6 chicks fledge, or 1.1 fledglings/nest (Bechard et al. 2010), annual production could be conservatively estimated at 18,000. Of this, TWSP took an average of 30 Swainson's Hawks annually from FY07 to FY11 with a high of 58 in FY10, or less than 1% of the expected annual mortality (Table 25). This level of take would have no noticeable impact on the population. TWSP could take hundreds to a few thousand before a noticeable impact would likely begin to occur, but TWSP only anticipates taking as many 300 or 2% of the expected annual mortality. USFWS permitted take (Table 9) averaged 3 in Texas from FY07-FY11 with 9 taken in 2008, giving the highest cumulative take of 59 (Table 25). Thus, the cumulative impact is the same as TWSP take which was less than 1% of the expected annual mortality. Cumulative impact is anticipated to be no more than 5% of the expected annual mortality. However, take levels from FY07 to FY11 reveal the levels of take that are likely to occur and this would have an imperceptible impact on the Swainson's Hawk population in Texas.

Table 25. Cumulative impact analysis for Swainson's Hawks killed by TWSP and USFWS permitted private individuals and entities from FY07 to FY11.

SWAINSON'S HAWK IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated TX Breeding Population	62,000	62,000	62,000	62,000	62,000	62,000
% Breeding Females in Population	25%	25%	25%	25%	25%	25%
Breeding Females	16,000	16,000	16,000	16,000	16,000	16,000
Aver. Clutch	2.5	2.5	2.5	2.5	2.5	2.5
Aver. Nests	1	1	1	1	1	1
% Fledge	44%	44%	44%	44%	44%	44%
Young Fledged/Stable Pop. Ann. Mort.	18,000	18,000	18,000	18,000	18,000	18,000
Total TX Population	80,000	80,000	80,000	80,000	80,000	80,000
TWSP Take	54	30	7	58	3	30
TWSP Take % of TX Ann. Mort.	0.3%	0.2%	0.0%	0.3%	0.0%	0.2%
Private Take in TX	0	0	9	5	1	3
Total Take	54	30	16	63	4	33
% TX Post-breeding Pop.	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%
% of TX Ann. Mortality	0.3%	0.2%	0.1%	0.4%	0.0%	0.2%

Red-tailed Hawks. Red-tailed Hawks are one of the most abundant raptors in the United States, expanding their range replacing the Red-shouldered Hawk and Ferruginous and Swainson's Hawks in their respective ranges of eastern and western United States. Contrary to many raptors, Red-tailed Hawks are able to thrive in the open, patchily wooded landscapes created by urban and exurban sprawl of human communities, if adequate prey is available (Preston and Beane 2009). This species preys on small mammals, some birds, reptiles, and insects. This species will kill native upland game birds, including prairie-chickens and quail, as well as poultry, a potential source of concern at times. However, much of the work that is conducted by TWSP personnel for Red-tailed Hawks has been associated with airports. Of the raptors, they are struck frequently and cause significant damage to aircraft with 46 being struck from FY02 to FY11 at airports in Texas and 35% of those caused damage (Appendix D: Table D1). They are common in grass-dominated habitat with sparse shrubs or trees, including cultivated lands, which often describes the air operating area at an airport. Red-tailed Hawks, as with other hawks, can cause significant damage to aircraft (Figure 15) and especially Red-tailed Hawks because they are abundant. BBS data indicates that the Red-tailed Hawk population from 1966 to 2007 increased significantly at 1.7%/year both surveywide and in Texas (Sauer et al. 2011). TWSP has taken relatively few Red-tailed Hawks, but have

Figure 15. Just prior to landing at 50 feet above ground level, this aircraft struck a Red-tailed Hawk damaging the radome which disabled the navigation system. The passengers and crew experienced significant vibrations during landing. The pilot landed the aircraft safely, but emergency vehicles responded to ensure that mishaps did not occur.

the potential to take them. From FY07 to FY11, TWSP annually averaged the take of 7 lethally. For an estimated population of 120,000, using FY07 to FY11 BBS data (USGS 2012), this would be an unnoticeable take, or a very minor impact. However, to illustrate the impact of TWSP BDM on this and other buteos, life history information will be used as above to determine an impact level where TWSP could expect that an impact may start to occur. At a very minimum, it would be expected that an impact would be low level until cumulative take (TWSP and USFWS permitted take) surpassed 50% of the expected annual mortality, allowing for other mortality factors (e.g., collisions with objects such as vehicles, planes, and wind turbines, predation, starvation due to drought and prey-base population crashes, and disease) to also occur. This level, then compared to the breeding population would give a good indication at what level an impact could be expected to start to occur with only knowing the breeding population. If TWSP take is compared to this, it could be determined whether or not an impact was likely.

To consider the impacts of TWSP, the Red-tailed Hawk population in Texas has been estimated at 120,000 from BBS data from FY07 to FY11 (USGS 2012). Females were not found to breed until they were mostly 3 years old, with some 2 year olds breeding. If 63% of the population were adult and 80% of the estimated adults bred (30,000 breeding females) with females averaging 2.5 eggs, with pairs (*n*=261) averaging 1.3 fledglings/nest (Preston and Beane 2009), annual production could be conservatively estimated at 39,000. Of this, it would be unlikely for an impact to occur until cumulative take by TWSP and USFWS permitted take surpassed 50% of the expected annual mortality for a stable population or 19,500 Red-tailed Hawks (a level equal to 15% of the breeding population) which would possibly be a moderate impact on this species. Obviously, an average of 7 taken lethally by TWSP from FY07 to FY11 (Table 8) is a minor percentage, far less than 1%. Cumulatively, USFWS reported the take of an average of 4 Red-tailed Hawks taken under permits in Texas during from 2006 to 2010. The highest cumulative take was in FY09 with 18 taken (<0.1% of the expected annual mortality). Thus, TWSP's impact on the Red-tailed Hawk population has been minimal. TWSP anticipates that cumulative take by TWSP and USFWS permitted take will not surpass 10% of the annual mortality.

Other Buteos. Texas hosts several other buteo species. This includes the more common Red-shouldered and Broad-winged Hawks of eastern Texas with estimated breeding populations of 170,000 and 49,000 which have been targeted by TWSP at airports (Table 8). The Broad-winged Hawks are particularly troublesome during migration when thousands migrate along coastal areas in large kettles (large numbers of hawks migrating together). Impacts to these 2 species have been minimal in contrast to their breeding populations in Texas or elsewhere. TWSP has taken an average of less than 5 of these 2 species from FY07 to FY11 and USFWS reported on 1 Red-shouldered Hawk taken from 2006 to 2010 (Table 8). This take compared to their breeding populations provides insight on the relative impact. For Red-tailed Hawks, the cumulative depredation take of 50% of their estimated annual mortality would be reached if 15% of their breeding population was taken. For Swainson's Hawks, this level would be reached at 12%. The take of 50% of their estimated annual mortality would likely be a low magnitude impact, possibly reaching a moderate impact depending on mortality from other factors including collisions with stationary and moving objects, predation, starvation, and disease. Thus, for buteos, with relatively low fecundity from the older breeding age, the take of 5% or less of their breeding population (< 25% of their expected annual mortality) as determined from FY07 to FY11 BBS data (USGS 2012) based on detectability factors from Rich et al. (2004) would represent a low magnitude impact. This level would be reached at the take of 9,000 Red-shouldered Hawks and 2,500 Broad-winged in Texas. For these 2 buteos that have been taken by TWSP, TWSP has had a minimal impact on them taking far less than 1% of their expected annual mortality.

TWSP encounters other buteos, most considered sensitive species, but the likelihood is minimal given these species numbers and range (most are away from BDM activities). The Ferruginous Hawk, a bird of conservation concern (USFWS 2008), has a minimal population of 200 (RMBO 2007) in the panhandle region of Texas, but winters further south into the State. Its CPS region and North American populations were estimated at 3,500 and 20,000 in the 1990s (RMBO 2007). BBS trends from 1966 to 2010 (Sauer et al. 2011) surveywide are increasing significantly at 1.4%/year, but decreased, nonsignificantly, in Texas at -2.5%/year. In fact, BBS data from FY07 to FY11 (USGS 2012) for Texas reflect a decrease in the population and could be estimated 140 using detectability parameters from Rich et al. (2004). TWSP and the other CPS WS programs did not take a Ferruginous Hawk from FY07 to FY11, but other WS Programs did. Its preferred habitat, open rangeland, could be within an airport environment. Thus, TWSP anticipates that it may take a few in any given year, but less than 5% of their estimated breeding population in the CPS region (most take would be in winter when the possibility exists for them to be at airports where TWSP conducts wildlife hazard management).

The Rough-legged Hawk with a North American breeding population of 300,000 (RMBO 2007) winters in Texas and has been targeted at airports by WS nationally. Nationally, take could easily reach 15,000 Rough-legged Hawks without an impact. However, WS nationally took an average of 15 Rough-legged Hawks from FY07 to FY11 with a high of 51 in FY11. This represented 0.02% of their breeding population, an imperceptible impact. TWSP could potentially take a Rough-legged Hawk, primarily at airports in the north half of the state, but anticipates that take would never surpass 100.

The sensitive Harris's, White-tailed, and Zone-tailed Hawks of south and west Texas could also be encountered and have breeding populations of 32,000, 1,400, and 700 (RMBO 2007) in Texas. FY07 to FY11 data (USGS 2012) suggests populations of 31,000, 2,900, and 140. Additionally, 2 other rare species (Appendix C: Table C3) found in this area periodically are the Gray Hawk and Common Black-Hawk, both State threatened species with estimated populations of 100 and 60 in Texas (RMBO 2007); neither were recorded on BBS counts from FY07 to FY11. It should be noted that all of these species except the Harris's Hawk have estimated populations of 2 million globally with the Harris's Hawk estimated at 400,000. Of these 5 species, the only with a BBS trend surveywide, due to a lack of data, is the Harris's Hawk; which exhibits a significant negative trend surveywide at -1.7%/year and in Teas at -1.8%/year from 1966 to 2010 (Sauer et al. 2011). Declines in Harris's Hawk numbers in Texas are most likely linked to widespread mesquite-control programs, but current brush-control program impacts on their population are unknown (Bednarz 1995). The above 5 buteo species' populations are primarily residents in Central America with their northern limits in southern areas of the United States including Texas. TWSP did not take any of these species from FY07 to FY11 and USFWS did not report permitted take of any of these species from 2006 to 2010. Thus, impact to these species was nil and anticipated to remain low. TWSP does not anticipate ever taking more than 5% of the breeding population of any of these species and likely less than 10 of any one of these species which would not impact their populations.

In addition to these species, 3 accidental species (Short-tailed, Crane, and Roadside Hawks) could be found during BDM, but unlikely (they have been recorded few times in the State all coming from areas primarily south of the Mexican border). These species could be targeted by TWSP, but were not from FY07 to FY11. USFWS reported no take of these species from 2006 to 2010 (Table 9). TWSP would not anticipate ever taking more than 2 of the accidental species. Considering their global populations, this would have a negligible impact on them.

Falcons and Accipiters. Several species of falcons (powerful flying hunters with pointed wings often flying fast to capture prey mid-air) and accipiters (woodland hunters with short rounded wings) inhabit Texas. Most are adapted to capture birds or insects while flying. Texas commonly hosts 5 falcons (American Kestrel, Merlin, Aplomado (endangered) and Prairie and Peregrine Falcons) and 2 accipiters (Sharp-shinned and Cooper's Hawks) (Appendix C: Table C1). Additionally, 2 other species of falcons (Gyrfalcon and Collared-Forest-Falcon) and 1 accipiter (Northern Goshawk) have also been documented in Texas (Appendix C: Table C3). Most, in general, cause few problems with the exception that occasionally the accipiters and larger falcons will take poultry. All of these species, but especially the falcons which are adapted to hunting in open areas, are airstrike hazards. Falcons were responsible for

39% of all raptor strikes and 6.5% of all known bird species strikes recorded by FAA in the United States from FY02 to FY11 with the American Kestrel responsible for 91% of the falcon strikes (Appendix D: Table D1). The accipiters were only responsible for 2% of all known raptor strikes illustrating their preference for hunting in more forested areas. Finally, a typical occurrence associated with these species, but especially the accipiters, is that they often become entrapped in buildings when they chase their prey birds, into warehouses and other structures through open doorways; often they cannot find their way back out and are often caught with nets and released back outdoors.

Populations of falcons and accipiters are mostly increasing. The Peregrine and Prairie Falcons are species of concern and the Peregrine is a State listed species. However, their population is increasing rapidly following the banning of DDT, a chemical pesticide that caused egg-shell thinning and the decline of the species (White et al. 2002). BBS data (Sauer et al. 2011) indicates that the American Kestrel is currently the only species showing significant negative trend surveywide at -1.5%/year from 1966 to 2010 along with a not significant trend of -0.3 for the Northern Goshawk. In the CPS region and North America north of Mexico, RMBO (2007) has 340,000 and 4.3 million American Kestrels, 720 and 400,000 Merlins, 1,400 and 30,000 Prairie Falcons, 70 and 300,000 Peregrine Falcons, 15,000 and 600,000 Sharp-shinned Hawks, and 59,000 and 500,000 Cooper's Hawks. Many of these species breed outside the CPS region as can be seen (e.g., most Peregrine Falcons breed north of the BBS limits). RMBO (2007) also has populations of 200,000 Aplomado Falcons globally and 200,000 North American Northern Goshawks. The Collared Forest-Falcon is an accidental species along the southern Texas border and does not have a breeding population in Texas. Most of these populations have increased since the estimates of the 1990s. USGS (2012) estimated population in Texas using detectability factors determined by Rich et al. (2004) 57,000 American Kestrels, 360 Prairie Falcons, 260 Peregrine Falcons, 350 Aplomado Falcons, 2,600 Sharp-shinned Hawks, and 51,000 Cooper's Hawks.

TWSP took 2 of these species lethally from FY07 to FY11, the American Kestrel and Cooper's Hawk averaging 20 and 1 with a maximum of 58 and 4, respectively. USFWS reported an average of 6 American Kestrels and no other species taken annually from 2006 to 2010 (Table 9). The cumulative take was less than 1% of their Texas breeding populations in winter and summer. TWSP could easily take a magnitude higher without impacting any of these species' populations. Thus, TWSP believe that the take of these species has been minimal and not had more than a minimal impact on their populations.

Kites and Harriers. Texas hosts 3 species of kites regularly, Mississippi, White-tailed, and Swallow-tailed Kites, and the Northern Harrier (Appendix C: Table C1). In addition, three species of kites, the Hook-billed, Snail, and Double-toothed Kites, are accidental species (Appendix C: Table C3), though the Hook-billed is encountered frequently along the lower Rio Grande River. Most of these species hunt from the air for insects and small vertebrates. Most are found in grasslands or wooded environments with open areas. Thus, they are sometimes encountered in airport environments, especially the harrier, and hazardous to aircraft. From FY02 to FY11 Northern Harriers caused 64 airstrikes, White-tailed Kites 18 (showing their preference for hunting grasslands), Mississippi Kites 8 and Swallow-tailed Kites 1 (Appendix D: Table D1). Of these, the only species that typically causes problems away from airports are the Mississippi Kites which are very aggressive nest protectors and will often strike people causing lacerations; those injured sometimes must seek medical attention because the lacerations are so deep. This is a concern when they nest in urban or other areas frequented by people that unknowingly get close to the nest. This is easily resolved by removing the nest and has occurred in Texas.

Populations of kites have mostly been showing nonsignificant positive trends from 1966 to 2010 in Texas, but the Northern Harrier has seen a nonsignificant decrease, -1.1%/year (Sauer et al. 2011). Surveywide, The White-tailed Kite shows a nonsignificant decreasing tend of -0.2%/year and the though the Mississippi Kite has shown no trend (0.0). Northern Harrier Harriers declined early in the 20th century from shooting, egg-shell thinning from DDT, and habitat degradation; however, habitat degradation is believed to be the primary cause for their decline more recently (MacWhirter and Bildstein

1996). Of the kite and harrier species, the Mississippi Kite and Swallow-tailed Kite are considered sensitive species in Texas (Appendix C: TableC1). In the CPS region and North America north of Mexico, RMBO (2007) has 150,000 and 190,000 Mississippi Kites, 1,500 and 11,000 White-tailed Kites, 0 and 3,700 Swallow-tailed Kites, and 60,000 and 400,000 Northern Harriers. The White-tailed and Swallow-tailed Kites and accidental kites are common globally, breeding in Central America. USGS (2012) for FY07 to FY11 BBS data using detectability parameters from Rich et al. (2004) yields populations of 79,000 Mississippi Kites, 5,000 White-tailed Kites, and 2,600 Northern Harriers (a decrease reflecting the significant downward trend), 370 Swallow-tailed Kites, and 110 Hook-billed Kites. Of these species, TWSP took an annual average of 12 Mississippi Kites and 1 Northern Harrier. USFWS reported no take of these species in the CPS region from 2006 to 2010. Thus, the cumulative impact to the 2 species represents much less than 1% of either population. Even if TWSP lethal take increased to 5% of their breeding population or any of these species' breeding population, an impact would not likely occur as this would be much less than their expected annual mortality. Thus, TWSP concludes that TWSP has had minimal to no impact on kites and harriers in Texas and the CPS region.

Eagles and Osprey. Texas has both Golden and Bald Eagles, and Ospreys. Golden Eagles are distributed at low densities across much of the western United States. In Texas, the greatest densities of golden eagles occur in winter in north and west Texas. During summer months, their greatest densities occur in western Texas. Bald Eagles are also mostly winter visitors in Texas with some breeding in primarily in east Texas. USFWS has management responsibility for these species which are protected under the Bald and Golden Eagle Protection Act. Under an MOU with USFWS, WS responds to complaints involving Bald and Golden Eagles. Ospreys are primarily winter visitors with some breeding. Current BBS data from FY07 to FY11 in Texas gives breeding population estimates of 210 Golden Eagles, 640 Bald Eagles, and 110 Ospreys (USGS 2012) based on detectability factors from Rich et al (2004). RMBO (2007) had estimates of 180 Golden Eagles and 170 Ospreys, but no Bald Eagles for Texas, and 840, 500, and 110 for the CPS region, respectively.. CBC data (NAS 2012) from FY07 to FY11 (aligning with 107th to 111th Counts), assuming all birds in the average 103.4 count circles of Texas are counted and counted only once, give winter estimates using no detectability parameters, of 15,000 Ospreys, 2,700 Bald Eagles, and 130 Golden Eagles inhabiting the State (these are likely underestimates). BBS 1966 to 2010 data show that trends for these three species have been all positive BBS surveywide and in Texas; Bald Eagles show significant increases surveywide at 5.5%/year and 58.3%/year in Texas, and Osprey shows a significant increase surveywide at 2.5%/year (Sauer et al. 20011). RMBO (2007) estimated the North American (north of Mexico) populations of Golden Eagles at 80,000, Bald Eagles at 300,000, and Osprey at 200,000.

Golden Eagles are typically found in open mountainous or hilly terrain where they hunt for small mammals, snakes and carrion. Golden Eagles will take lambs, kid goats, and other small livestock. They nest mostly on cliffs, but sometimes in trees and on power lines. Eagles and Ospreys have large bulky nests sometimes 8 feet across and 4 feet deep. Nestlings fledge at 9-10 weeks, but are dependent on their parents for another 30 days or more. Golden Eagles breed at about 5 years of age, mate for life, and a pair needs up to 35 square miles of territory in which to hunt (range 12-110 mi^2, and high as 400 mi^2 in eastern Canada), and average about 2 eggs/nest with 0.83 eaglets fledge/nest (Kochert et al. 2002). Percentages of ages are not known, but it can be assumed that about 50% of the population is of breeding age or older (Good et al. 2007) found adults comprised 7=67% of the population in their study). While some Golden Eagles migrate into the State during winter, we will just look at the resident population. If 80% of the adult breeding population, assumed 1:1 males to females, bred and 50% of the population was breeding age (42 breeding females), then a population of 210 eagles would have 35 fledglings. If TWSP took up to 10% of the expected annual mortality for eagles (3-4), it would likely result in a minimal impact on the population. However, WS anticipates that it would take few, if any, Golden Eagles annually and would only conduct such an activity with the appropriate eagle permit from USFWS. TWSP did not take or haze any Golden Eagles from FY94 to FY11, but anticipates that it would be possible to take a few Golden Eagles annually to abate severe livestock depredation problems and haze them from airfields.

However, limited take of Golden Eagles (up to 3) would be a very low magnitude impact on their population and not significant. This could increase or decrease, depending on the size of the population. With a positive long term trend (Sauer et al. 2011), it is possible that the eagle will increase in number in Texas.

Bald Eagles damage problems include killing livestock, causing damage at aquaculture facilities, and representing a significant strike risk (size) at airports. They are mostly found in Texas in winter, but a few nest. The species has made a remarkable recovery from precariously low numbers to numbers currently surpassing 7,000 nesting pairs in North America (Buehler 2000). Their population crashed primarily as a result of being susceptible to the effects of DDT which caused egg-shell thinning. However, long term bounty programs, mainly in Alaska, killed tens of thousands in the early 1900s (Buehler 2000). Population parameters are similar to the Golden Eagle, but they may wait until they are 7 years old to breed, though many start at 5 years old, and their fledgling success rate is somewhat higher at 1.2 or more fledglings/nest post-DDT (Buehler 2000). Texas has a fairly good nesting population considering there were basically none 20 years ago at an estimated 640. During the winter, the average number of Bald Eagles seen in an average of 103 CBC surveys was 180 from the 107th to 111th (correlates to FY07 to FY11) (NAS 2012a), suggesting a population of 2,700 wintering birds, extrapolated over Texas using no detectability values. Most requests for assistance have resulted from a loss of livestock or potential to cause problems at airports. TWSP has had few requests for livestock and continues to anticipate few, but TWSP could get more for airports as their population increases. Of the 40,000 known bird species strikes in the United States from FY02 to FY11, 99 were Bald Eagles with 53% causing damage (Appendix D: Table D1); 2 of these occurred at Texas airports. TWSP did not take or haze a Bald Eagle in Texas from FY93 to FY11, but anticipates such an occurrence with the current trend in their population. However, if this occurred it would be conducted with the appropriate permit from USFWS. The take of a few Bald Eagles (up to 10) in Texas would not impact their population. A lethal take permit would likely only be issued for severe ongoing depredation problems, and likely only following an intensive hazing program.

Ospreys were a bird greatly affected by the use of DDT and other insecticides can take fish at aquaculture facilities and be a strike risk (163 of the 40,000 known United States bird species strikes were Ospreys from FY02 to FY11 with one occurring at a Texas airport (Appendix D: Table D1)). They were encountered operationally by TWSP on airports. Osprey population parameters are similar to Golden Eagles, but most breed earlier (aver. age of first breeding 3.7 years with 50% breeding their third year). They have one nest per season and fledgling rates are quite variable, depending on food availability, but mostly are higher than 0.7 fledglings/nest (Poole et al. 2002). However, the breeding Osprey population in Texas is fairly low at just over 100 (USGS 2012). However, their winter population could be estimated for FY07 to FY11 from NAS (2012) data using no detectability parameters at 15,000 showing the significant increase in their population post DDT and as found in their surveywide BBS trend (Sauer et al. 2011). TWSP took one Osprey in each FY07 and FY08 which is a minor take. USFWS reported 1 taken under a permit in Texas from 2006 to 2010 in 2008 (Table 9). This had virtually no impact on their population considering their winter estimate, with no detectability parameters used, of 15,000. The 2 killed by TWSP and 1 taken under a USFWS permit in 2008 were the only ones taken in the CPS region, thus, representing a minimal effect on the population. TWSP could take several (up to 10) without having an impact on their population.

WS anticipates that the program will probably haze most eagles and Ospreys from damage situations, especially where they are found on an airfield (this would be a beneficial effect because it would reduce the likelihood of the eagle being struck and killed by aircraft) and possibly trap and relocate some eagles, again mostly from airports. However, TWSP expects that only a few eagles and Ospreys will ever be the focus of lethal control projects. If WS takes an eagle, it would be conducted under the appropriate USFWS permit and not have more than a negligible impact on their population. The take of up to 10 Osprey or 5 or fewer eagles would have an unnoticeable effect on their populations.

Owls. Texas is home to 12 species of owls (Appendix C: Tables C1 and C2) with 8 species that have the potential to cause damage (Appendix C: Table C1). Additionally, 5 species of owls have been accidentally found or are rare in Texas (Appendix C: Table C3). The Great Horned Owl is the primary species that causes damage to poultry and property, but the Barred Owl will sometimes cause these problems as well. The Barn Owl can cause damage, mostly to structures where they nest from their excrement and offal of small mammals; they nest in cracks and crevices often in structures such as barns. The other 5 species (Appendix C: Table C1) are mostly a strike risk at airports. Owls that are strike risks at airports often frequent open fields for hunting. However, the Burrowing Owl lives among burrowing rodents where it will occupy a burrow which can be within an air operating area. Five of the damaging species of owls are found year-round in Texas with the Great Horned, Barn, Barred, and Burrowing Owls, and Eastern Screech-Owl having estimated breeding populations of 220,000, 140,000, 66,000, 73,000, and 76,000, respectively, (population estimated using USGS (2012) FY07 to FY11 data and detectability parameters determined by Rich et al. (2004)) the estimates were somewhat similar estimates to RMBO (2007). The Western Screech-Owl is likely found in remote areas of west Texas year-round, but not found on any BBS routes. They do not have a population in the CPS Region, but have a population of 500,000 in western North America. The other two species of owls are seasonal in Texas during the winter, the Short-eared Owl and Long-eared Owl. The Short-eared Owl has a population of 29,000 in the CPS region and the Long-eared Owl, not documented during BBS routes in the CPS region, has a breeding population in the United States and Canada of 40,000 (RMBO 2007). Long-eared Owls were not found during BBS surveys in the CPS Region, except 2 in 2008 in North Dakota showing the difficulty in finding them. Thus no trend information is available for them. Species of conservation concern are the Burrowing and Short-eared Owls. BBS data (Sauer et al. 2011) in Texas show nonsignificant negative and positive trends in Texas (Appendix C). Surveywide, BBS data from 1966 to 2010 show that the Great Horned Owl and Short-eared Owl had significant declining trends of -0.8%/year and -2.5%/year. In addition, the Eastern and Western Screech-Owls, and the Burrowing Owl show nonsignificant decreases. The Barred Owl shows a significant increasing trend from 1966-2010 of 1.7%/year BBS surveywide, likely reflecting, in part, its range expansion. Owls, being nocturnal, are very difficult to census during BBS routes, but some are seen.

Many owls were shot in great numbers in the early 20th century and DDT and other pesticides probably took their toll, but habitat loss and low prey base probably are the biggest factors in these species declines. The Great Horned Owl declining trend could be linked to a variety of reasons, but has a robust population with no conservation concerns at this time (Houston et al. 1998). It adapts well to new habitats. The biggest reason for decline is often starvation of nestlings during years with few rodents and recent droughts have had the potential to reduce rodent availability. The authors noted that Great Horned Owls were extensively shot in an area of Saskatchewan with little to no impact on the population, thus they believed that take was not a primary factor in causes for decline. Additionally, Houston et al. (1998) note that the Great Horned Owl can be detrimental to other species, including T&E species such as the Spotted Owl where forests become fragmented. Great Horned Owls prey on the Attwater's Greater Prairie-Chicken and targeted to protect them. Like many other grassland species, the Short-eared Owl's decline is linked particularly to grassland habitat loss as they need extensive areas for nesting (Wiggins et al. 2006). The Western Screech-Owl decline is likely associated with habitat loss as it is most associated with riparian habitats and they have declined throughout the West (Cannings and Angell 2001). Many reasons are postulated to have caused local declines in the Eastern Screech-Owl population decline (e.g., DDT), but Gehlbach (1995) believed that their declines were more related to natural cycles and potentially habitat loss, especially loss of nesting trees. Burrowing Owl declines have also been linked mostly to some pesticides, though intensive agriculture in some areas is also a possibility (Poulin et al. 2011).

TWSP lethally took one Great Horned Owl to protect the endangered Attwater's Greater Prairie-Chicken in FY07 and another in FY11 with no other owls lethally taken from FY07 to FY11 (Table 8). TWSP did capture and relocate an average of 3 Common Barn Owls entrapped in buildings from FY07 to FY11 (Table 10). The only other owl taken from FY94 to FY03 was an Eastern Screech-Owl which was relocated outdoors from a building where it was trapped inside. Obviously, relocation in this case had no impact on owl populations in Texas. Cumulatively, USFWS reported the only owl permitted in Texas to be taken was one Barn Owl, but an average of 10 Great Horned Owls, 1 Barn Owl, 1 Short-eared Owl, and 1 Barred Owl in the CPS region from 2006 to 2010 (Table 9). TWSP could take up to 1% of the 5 species breeding in Texas or 0.1% of the populations that migrate into Texas without impacting their populations. However, as has been shown in the last 15 years, it is most likely that TWSP will take relatively few other than in trap and relocate programs to protect resources in Texas.

Shrikes. Two species of shrikes are found in Texas, the Loggerhead Shrike year-round and the Northern Shrike seasonally in primarily the northern panhandle during winter (Appendix C: Table C1). The only damage problems associated with these 2 species would be at airports as they are often found in grasslands. Problems with these species occur infrequently and are typically very minor. Loggerhead Shrikes were known to be struck 5 times at Texas airports from FY02 to FY11 (0.5 strikes/ year) (Appendix D: Table D1). The Loggerhead Shrike is a species of conservation concern which is reflected in BBS data (Sauer et al. 2011) with a significant downward trend surveywide at -3.2%/year and in Texas of -3.7%/year. Its decline is actually a mystery not fully explained by habitat loss, but mostly linked to it (Yosef 1996); the researcher stated that within its range in Texas, only 17% of the region remained in native grassland in 1979, providing the habitat most selected by this shrike which accounted for a decline. Their population in Texas and the CPS region was estimated at 510,000 and 1.1 million in the 1990s (RMBO 2007). FY07 to FY11 data (USGS 2012) reflects the declining trend at 270,000 in Texas. The Northern Shrike breeds in northern Canada and has an estimated population of 200,000 (RMBO 2007). It is doubtful that TWSP will need to conduct hazard management with this species as it only periodically winters in the north Texas panhandle. The take of less than 1% of Loggerhead Shrikes in Texas would have no impact on their population, especially considering they have high reproductive potential (Yosef 1996). Thus, TWSP has had no impact on the Loggerhead Shrike population in Texas and anticipates that take could occur, but likely would be minimal and have little or no effect on the population.

Native Doves and Pigeons

Texas hosts 7 species of native doves and pigeons including the Red-billed and Band-tailed Pigeons, the White-winged, Mourning, Inca, and White-tipped Doves, and the Common Ground-Dove. Additionally, 3 species of native doves have been found in Texas accidentally. Pigeons are relatively stocky birds with a square tail. Doves are smaller than pigeons, but possess many of the same physical characteristics, except typically are not as stocky and sport a longer tail. All are fast-flying grayish or brown birds that usually feed on seeds or spilled grain. TWSP conducted an average of 529 work task annually from FY07 to FY11 for the Mourning, White-winged, and Inca Doves, and Common Ground-Doves. Doves were involved in 4,412 and 952 aircraft strikes in the United States and Texas with Mourning Doves responsible for the majority of native dove strikes (99%) from known species with about 7% causing damage (Appendix D: Table D-1).

The Mourning and White-winged Doves are abundant in Texas and are the species mostly likely to be involved in BDM at airports, and for the protection of some agricultural crops and property. Inca Doves are fairly abundant and are most likely to be involved in BDM at airports. Band-tailed pigeons are found mostly in west Texas and more likely to be a problem in orchards; TWSP has documented this damage in west Texas, but has not conducted BDM for them. Red-billed Pigeons and White-tipped Doves are found in far south Texas along the Rio Grande and are unlikely to cause many problems in Texas as noted in a lack of work tasks associated with them. Finally, Common Ground-Doves are found in southern Texas and are not that likely to be involved in BDM because of habitat selection, but have been taken at an airport. TWSP has mostly worked with Mourning, White-winged and Inca Doves, with periodic requests involving Common Ground-Doves at airports.

The Mourning Dove population increased in the United States with the westward expansion of settlers (Otis et al. 2008). The White-winged Dove has been increasing too with range expansion to the north and west, but confined to mostly southern states. Recent data suggest that the breeding population of Mourning and White-winged Doves are abundant and have populations of 114 and 4.5 million surveywide (RMBO 2007), and 13 and 1.7 million in Texas (Table 4), based on BBS data from FY07 to FY11 (USGS 2012). Inca Doves, Common Ground Doves, and White-tipped Doves have populations of 390,000, 620,000, and 100,000 in Texas based on data from FY07 to FY11 (USGS 2012). Mourning Dove BBS data from 1966 to 2010 shows a significant negative trend of -1.1%/year in Texas and significant positive trends of +5.3%/year, +3.5%/year, and +1.7%/year for the White-winged and Inca Doves, and Common Ground-Doves, respectively (Sauer et al. 2011). BBS surveywide trends were similar except that the Common Ground-Dove has a nonsignificant negative trend (Sauer et al. 2011). Of the other pigeons and doves, only Band-tailed Pigeons show a significant declining trend surveywide from 1966 to 2010 of -2.7%/year (Sauer et al. 2011). The Mourning Dove is ranked high in relative abundance on BBS routes and is among the top ten most abundant species in the United States (Otis et al. 2008). However, as suggested by BBS trends, populations have declined in recent years likely as a result of land-use changes such as cleaner farming, removal of shelterbelts and fencerows, shifts in land use such as from agriculture to intensive forestry, grain crops to cotton, shrubland to grazing lands, or natural habitats to urban areas, and other sources of habitat loss (Otis et al. 2008). Even so, Mourning Doves are still abundant. The White-winged Dove is not as abundant as Mourning Doves, but still a very common species in Texas. The Inca Dove is even less abundant, but still somewhat common as their population estimates suggest. TWSP conducts mosh lethal BDM for Mourning Doves in Texas, followed by White-winged Doves to a lesser extent, but likely equivocal to their population numbers (Table 8).

Doves are classified as migratory game birds that are managed by state game departments, but the Inca Dove has full protection with no hunting seasons. Estimated take of Mourning Doves and White-winged Doves in Texas for the 2007 to 2011 hunting seasons averaged 6,023,000 and 1,437,000 birds (USFWS 2009, 2011a, 2012a). Most all Mourning and White-winged Dove mortality from TWSP BDM activities takes place at airports, with an average of 543 and 89 taken from FY07 to FY11. WS take in comparison to hunter harvest has been negligible (<0.1% of the total take). However, the take of Mourning Doves will be analyzed.

Following is an analysis of the impacts on the Mourning Dove population for Texas only, since most doves taken in depredation likely come from Texas rather than the CPS area. Female Mourning Doves can breed if born early enough in the year at 90 days, but most all as yearlings (second year); males can breed at 80 days (Otis et al. 2008). For the sake of estimating the population for this EA, it is assumed that 75% of the female Mourning Doves breed as yearlings, the sex ratio is 1:1 males to females, females lay 2 eggs and have an average of 3.75 nests annually; fledgling success was found to be 3.6 in the United States for each breeding female (Otis et al. 2008). Using these parameters, the estimated Texas breeding population of 13 million would have about 4.9 million breeding females that successfully fledge about 18 million nestlings, raising the post-fledgling population to about 31 million Mourning Doves (Table 26). This would be an increase in the population by a factor of 2.3. Mourning Dove populations experience very high annual mortality rates; depending on geographical region, 50 – 75% of the population dies each year. Significant causes of mortality include predation, hunting, weather events, and disease, but the significance of each is not well understood; for example, hunting mortality is considered compensatory, but weak evidence exists that it may be additive to other causes (Otis 2008). TWSP annually averaged the take of 543 Mourning Doves from FY07-FY11 with a high in FY10 of 743, less than 0.001% of the estimated annual mortality. However, the cumulative impact averaged 19% of the population and 33% of the estimated annual mortality. TWSP and USFWS permitted take combined was less than 0.1% of the annual harvest of doves by sportsmen, indicating the minimal number taken for depredation compared to the number harvested. For Mourning Doves, this would be a low level impact considering 50% to 75% of the population annually dies and a high of 25% was only reached. The BBS trend for Texas has been significantly negative, but several factors have been postulated to cause their decline as discussed (Otis et al. 2008). Therefore, we conclude that Mourning Doves have not been impacted by depredation take in Texas.

Table 26. Cumulative impact analysis for Mourning Doves killed in Texas by WS, private individuals and entities under USFWS permits, and sportsmen harvest from FY07 to FY11.

MOURNING DOVE IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Ave.
Estimated Texas Breeding Population	13,000,000	13,000,000	13,000,000	13,000,000	13,000,000	13,000,000
% Breeding Females in Population	37.5%	37.5	37.5%	37.5%	37.5	37.5%
Estimated Number Breeding Females	4,900,000	4,900,000	4,900,000	4,900,000	4,900,000	4,900,000
Ave. Clutch	2	2	2	2	2	2
Ave. Nests	4	4	4	4	4	4
% Fledge	45%	45%	45%	45%	45%	45%
Young Produced/ Stable Pop. Ann. Mort.	18,000,000	18,000,000	18,000,000	18,000,000	18,000,000	18,000,000
Total Texas Population	31,000,000	31,000,000	31,000,000	31,000,000	31,000,000	31,000,000
TWSP Take	305	698	305	743	666	543
WS Take % of Texas Annual Mortality	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
USFWS Permitted Take	0	0	266	340	7	123
Sport Harvest in Texas	5,463,300	4,849,600	4,945,100	7,194,900	7,657,700	6,022,120
Total Take	5,463,605	4,850,298	4,945,405	7,195,986	7,658,366	6,022,786
% Texas Post-breeding Pop.	18%	16%	16%	23%	25%	19%
% of Texas Annual Mortality	30%	27%	27%	40%	43%	33%

TWSP has also taken an average of 89 White-winged Doves from FY07 to FY11 with a high of 192 in FY07 (Table 8). USFWS permitted the average take of 9 from 2006 to 2010 (Table 9). However, in comparison to hunter harvest which averaged 1.4 million from 2007 to 2011, WS and permitted take was 0.01% of the total take of White-winged Doves in Texas, a negligible take that would not add to numbers taken by sportsmen. The White-winged Dove population in Texas is estimated at 1,700,000 from BBS data (Table 4). This would be a very high harvest, 82% of the estimated population. However, Schwertner et al. (2002) suggested that the BBS data is not reliable for counting White-winged Doves because of their habit of colonial nesting. This is likely true because hunter harvest would be higher than production if only 1.9 fledglings are produced per nesting pair per season (Schwertner et al. 2002). Production, if 37.5% of the females nested, would be 1.2 million. At this rate, the population should show a significant decrease at current harvest levels. BBS data is reliable for trends and the White-winged Dove population in Texas and survey wide has seen a significant increase from 1966 to 2010 (Sauer et al. 2011). Additionally, the trend from 2000 to 2010 in Texas has seen a significant increase of +10.4%/year, an incredibly high trend. Thus, by the trend alone, take, primarily from sportsmen harvest, has not impacted the population. It should be noted that research is currently underway by USFWS and TPWD to track and monitor White-winged Doves because of the high harvest.

Of the other species of doves and pigeons in Texas, TWSP anticipates that it will take relatively few Inca Doves, and possibly a few of the other species identified in Appendix C: Table C1, at a level not likely to ever exceed 100. However, even a minimal take of these species (<100) is not anticipated to impact their population. Many doves and pigeons in Texas are on the periphery of their range, but are abundant elsewhere. It is expected that WS take for these species will be less than 1% of their estimated populations. Thus, TWSP believes that it will not have more than a negligible impact on these species and all species of native doves and pigeons in Texas.

Grassland Passerine Species

Several species of passerines frequent grasslands and could become a problem with most only causing potential damage at airports. A few of these species, though, cause damage to crops. True grassland species include the meadowlarks, Horned Lark, pipits, emberizids (Lark Bunting, certain sparrows, and longspurs), Dickcissels, and Bobolinks. We include the flycatchers/kingbirds, orioles, and goldfinches with this group because often they are found in open grassland areas with some perches (trees, wires, poles, shrubs), but favor a wider variety of habitats. For the most part, damage associated with grassland species is typically much less than other groups of birds, but they can be significant locally. However, as a result mostly from work at airports and aircraft strikes, these species were responsible for an annual average of 610 work tasks valued at over $250,000. In all, these species were responsible for 6,335 strikes at U.S. airports from FY02 to FY11 with 633 occurring in Texas with just over 1% causing damage (Appendix D: Table D1). Of these species, the only species causing other types of damage, primarily to small grain crops, are Horned Larks, Lark Buntings, Dickcissels, and goldfinches.

About half of the true grassland species are significantly declining, even more than the grassland habitat making it difficult to determine limiting factors (North American Bird Conservation Initiative, U.S. Committee 2009). Grassland habitat is being reduced across North America, including the central United States and this is considered a prime factor for their decline. However, many of these species' declines are occurring more rapidly than the decline of grasslands. Other factors have been postulated such as habitat reduction on their wintering grounds and the use of unknown pesticides on their wintering grounds. Of the species that TWSP anticipates could be the focus of a BDM project (Appendix C: Table C1), BBS data for 1966 to 2010 (Sauer et al. 2011) show that most of the species in this group are significantly declining at the BBS surveywide level including Eastern Kingbird (-1.2%/year), Scissor-tailed Flycatcher (-0.7%/year), Horned Lark (-2.2%/year), Sprague's Pipit (-2.4%/year), Chestnut-collared Longspur (-4.4%/year), McCown's Longspur (-5.5%/year), Vesper Sparrow (-0.8%/year), Lark Sparrow (-1.0%/year), Lark Bunting (-2.4%/year), Savannah Sparrow (-1.1%/year), Grasshopper Sparrow (-2.5%/year), White-crowned Sparrow (-0.9%/year), Dickcissel (-0.4%/year), Bobolink (-2.2%/year), Eastern Meadowlark (-3.2%/year), Western Meadowlark (-1.0%/year), Bullock's Oriole (-0.4%/year), and Baltimore Oriole (-1.2%/year). Species significantly increasing include the Ash-throated Flycatcher (1.1%/year), Brown-crested Flycatcher (4.4%/year), Couch's Kingbird (11.1%/year), Western Kingbird (0.5%/year), and Lesser Goldfinch (1.0%/year), a much shorter list. Species nonsignificantly decreasing include Great-crested Flycatcher and Scott's Oriole while those nonsignificantly increasing include Eastern and Say's Phoebes, and Cassin's Kingbird. The American Goldfinch is stable at 0.0%/year. Several species do not breed or are very rare in the BBS area including Great Kiskadee, American Pipit, Lapland Longspur, and Smith's Longspur and do not have a BBS trend.

Most of the grassland species have high populations in Texas or the CPS area, except the American Pipit and White-crowned Sparrow which do not breed in the CPS area. Of the species taken lethally, four species have estimated populations greater than a million in Texas from FY07 to FY11 including the Eastern Meadowlark, Horned Lark, Scissor-tailed Flycatcher, and Western Kingbird (Table 4). The other 2 species taken lethally, the Western Meadowlark and Lark Bunting, have estimated populations in Texas of 640,000 and 130,000, respectively. Both have populations in the millions in the CPS area. The average take of these species by TWSP from FY07 to FY11 was 377 Eastern Meadowlarks (high 675), 141 Western Meadowlarks (high 298), 43 Western Kingbirds (high 173), 40 Scissor-tailed Flycatchers (high of 60), 33 Horned Larks (high of 52), and 17 Lark Buntings (high 50). The high and average represent less than 0.1% of these species' populations in Texas and less in the CPS area. Cumulatively in Texas, from FY07 to FY11 including USFWS permitted take, the take of these species was 418 Eastern Meadowlarks, 142 Western Meadowlarks, 36 Horned Larks, and 16 Scissor-tailed Flycatchers with Lark Buntings and Western Kingbirds the same as TWSP take. Thus, cumulative take in Texas remained below 0.1% of the populations, even during the years with highest take.

A cumulative impact analysis in the CPS area for Eastern Meadowlarks, the species with the highest take and one that serves as an example for the other species in this group, concludes minimal impact to Eastern Meadowlarks in Texas (Table 27). Cumulative take in Texas would be less than 0.1% of the expected annual mortality which would have no perceptible effect on the population. The same could be said for all of the other grassland species in Texas. It would take a high level of take to have an impact on any of these populations. Take would have to increase more than a hundred-fold before an impact from BDM would possibly be perceptible. TWSP anticipates that, at most, it is perceivable that take could increase ten-fold for these species depending primarily on the airports that request assistance from TWSP or private pest control operators, or the airports themselves. Thus at current levels of take, and even at potential levels of take, TWSP will not have more than an imperceptible impact on these species.

Table 27. Cumulative impact analysis for Eastern Meadowlarks killed in Texas by TWSP and private individuals and entities under USFWS permits from FY07 to FY11.

EASTERN MEADOWLARK IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated Texas Breeding Population	950,000	950,000	950,000	950,000	950,000	950,000
% Breeding Females in Population	37.5%	37.5	37.5%	37.5%	37.5	37.5%
Estimated Number Breeding Females	360,000	360,000	360,000	360,000	360,000	360,000
Aver. Clutch	4.8	4.8	4.8	4.8	4.8	4.8
Aver. Nests	2.0	2.0	2.0	2.0	2.0	2.0
% Fledge for All Nests	27%	27%	27%	27%	27%	27%
Young Produced/ Stable Pop. Ann. Mort.	930,000	930,000	930,000	930,000	930,000	930,000
Total Texas Population	1,900,000	1,900,000	1,900,000	1,900,000	1,900,000	1,900,000
TX TWSP Take	289	675	243	384	296	377
TWSP Take % of Ann. Mort.	0.03%	0.07%	0.03%	0.04%	0.03%	0.04%
Private Take in Texas	0	0	204	37	9	41
Total Take	289	675	447	421	305	418
% CPS Post-breeding Pop.	0.02%	0.04%	0.02%	0.02%	0.02%	0.02%
% of CPS Ann. Mortality	0.03%	0.07%	0.05%	0.05%	0.03%	0.04%

Several other grassland bird species listed in Appendix C: Table C1 have estimated populations at least in the hundreds of thousands in Texas (estimates using BBS raw data from 2007-11 (USGS 2012) using Rich et al. (2004) detectability parameters) including the Dickcissel, Bullock's and Scott's Orioles, Lesser Goldfinch, and all other flycatcher species except the Great Kiskadee which is found only in the Lower Rio Grande Valley with an estimated population of 29,000, but TWSP did not conduct lethal control for them. All other grassland species mostly do not breed in Texas. The Bobolink, Baltimore Oriole, and American Goldfinch have populations in the millions in the CPS area, but, for the most part, do not breed in Texas. The Sprague's Pipit, which breeds in North Dakota (with very few breeding in South Dakota) where its population is estimated to be 69,000 based on BBS data from 2007 to 2011 USGS 2012). It also breeds west into Montana and north into Canada had an estimated population 900,000 (RMBO 2007) in North America from data in the 1990s, but has declined since (Sauer et al. 2011). The final 2 species, the American Pipit and White-crowned Sparrow do not breed in the CPS area, but have estimated North American populations in the millions. TWSP did not take any of these species from FY07 to FY11, but USFWS permitted the take of an average of 4 Eastern Kingbirds in the CPS area (Table 9). Thus, take for BDM has been minimal or nonexistent for any of these species and is expected to continue to be minimal. The take of 1,000 cumulatively of any of these species in the CPS region would not impact any of these species' populations. TWSP does not anticipate taking many of these species, especially the Sprague's Pipit, but expects potential take could possibly reach 10 to 100, depending on the species, in a given year. This level of take would have no perceptible impact on the population. To illustrate this with the Sprague's Pipit, if the population has a sex ratio of 1:1, and 75% of the females breed, they produce an average of 4.4 eggs/nest, nest 1.5 times/season, fledge 1.4 young per season (Robbins and Dale 1999), then the estimated annual mortality would be 40,000 for the CPS region. The take of 100 would equal 0.3% of the estimated annual mortality in a stable population, or minimal impact to the population. However, TWSP does not anticipate that this would occur, only theorizes the potential impact of such a take. This illustrates that impacts to grassland species' populations would be negligible if minimal numbers were taken with the Sprague's Pipit representing a species with a low population.

Of the grassland species, the Scissor-tailed Flycatcher, Sprague's Pipit, Lark Bunting, McCown's Longspur, and Dickcissel are Birds of Conservation Concern (USFWS 2008). The Sprague's Pipit is being considered for ESA listing (FRN Vol. 74, No. 231:63337-43, Dec. 3, 2009) and reflects the significant declining trend in this species' population. Loss of grassland habitat is believed to be the primary cause for the decline for many of the true grassland-associated species including all of the Species of Conservation Concern discussed. Thus, these populations will decline regardless of any BDM conducted for them because the population is limited by habitat. However, most have populations in the hundreds of thousands. Thus, TWSP concludes that BDM will have no more than an imperceptible impact on any of the grassland species even if take were to increase into the hundreds for any of the sensitive species taken by TWSP or 100 for those that have not been taken. However, TWSP believes that take in the near future will basically mirror those birds already being taken or hazed.

Larids

Gulls. Throughout the United States, gulls are often taken for depredation management primarily at airports, landfills, and aquaculture facilities with WS nationally responsible for the take of several species for depredation purposes. Only one species of gull, the Laughing Gull, is found year-round in Texas. Four species of gulls, the Ring-billed, Herring, Bonaparte's, and Franklin's Gulls, commonly migrate through or winter in Texas coming from their northern breeding grounds. These species have been the focus of BDM projects in Texas. An additional 5 species of gulls are much less common, but routinely found in Texas during migration or winter, the Sabine's, California, Thayer's, Lesser Black-backed, and Glaucous Gulls. These species could be in flocks that are the focus of TWSP BDM projects, primarily at airports where they often loaf or feed on runways. They are often struck by aircraft which can cause extensive damage to the aircraft because of their size and flocking behavior (Dolbeer 2006). They have been found to be quite attracted to airports for loafing and feeding, especially on earthworms on runways following heavy rains. Of the 42,000 bird strikes with known species from FY02 to FY11, gulls were responsible for just over 4,293 (10%) of the strikes (Appendix D: Table D1). Of these, 18% had reported damage at high costs in the millions and many hours of lost time during repairs. Gulls can also cause other problems at aquaculture facilities, to property, and for human health concerns at landfills

TWSP takes considerably more Laughing Gulls than any of the other gulls averaging 300 from FY07 to FY11, with a maximum of 528 in FY08. BBS surveywide data from 1966 to 2010 indicates that the Laughing Gull has been increasing significantly surveywide at a rate of +3.7%/year and in Texas at 3.2%/year (Sauer et al. 2011). Laughing Gulls are found in the coastal areas of Texas and are not found in the CPS region other than Texas, except accidentally. Their population has been estimated at 800,000 in North America, north of Mexico (NAS 2012b) and, using no detectability parameters (=1), at 230,000 in Texas using FY07 to FY11 BBS data (USGS 2012). Belant and Dolbeer (1993) estimated 65,000 breeding pairs in Texas from 1977 to 1991. Laughing Gulls breed when they are in their third year, have 3 eggs with a fledgling success of 1.32/nest, and they have one nest per year, renesting if the first attempt fails from predation, weather, or other causes (Burger 1996). Age structure in gull populations is unknown, but it is assumed for this analysis that subadult birds make up 34% of the population as with other species that nest in their third year and that 75% of the females breed. Using these parameters, a population of 230,000 would have 58,000 breeding pairs, much less than that estimated by Belant and Dolbeer (1993) and considering their high increasing BBS trend (Sauer et al. 2011), a very conservative estimate of their population. In fact, the number of Laughing Gulls per count increased from 3.7/route for 1977 to 1991 to 8.4/route from 2007 to 2011 USGS) suggesting an increase in the population since that time. Thus, we believe that the estimated breeding pairs would be conservative, but reasonable for conservatively estimating impacts in this EA. Using these parameters, an impact analysis can be calculated (Table 28). The highest cumulative impact to the breeding population occurred in FY08 at 0.2% of their post-breeding population and 0.7% of the estimated annual mortality with USFWS reporting no take in FY08, but an average of 41 from 2006 to 2010 Laughing Gulls under permits (Table 9). This would be a negligible impact to the population of Laughing Gulls in Texas. To look at this nationally, Laughing Gulls are taken in several coastal states by WS. WS nationally took an average of 5,800 Laughing Gulls from FY07 to FY11. The majority of Laughing Gulls were taken in New York at John F. Kennedy Airport being conducted under an Environmental Impact Statement (USDA 1994). However, the total national take by WS equates to 0.7% of the estimated continental breeding population of 800,000 (NAS 2012b). Thus, take at the statewide and national level is minimal and we believe that this level of take will have no more than a minimal temporary impact on the population.

Table 28. Cumulative impact analysis for Laughing Gulls killed by TWSP and USFWS permitted private individuals and entities from FY07 to FY11.

LAUGHING GULL IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated TX Breeding Population	230,000	230,000	230,000	230,000	230,000	230,000
% Breeding Females in Population	25%	25%	25%	25%	25%	25%
Breeding Females	58,000	58,000	58,000	58,000	58,000	58,000
Aver. Clutch	3.0	3.0	3.0	3.0	3.0	3.0
Aver. Nests	1	1	1	1	1	1
% Fledge	44%	44%	44%	44%	44%	44%
Young Fledged/Stable Pop. Ann. Mort.	77,000	77,000	77,000	77,000	77,000	77,000
Total TX Population	310,000	310,000	310,000	310,000	310,000	310,000
TWSP Take	527	528	109	175	162	300
TWSP Take % of TX Ann. Mort.	0.7%	0.7%	0.1%	0.2%	0.2%	0.4%
Private Take in TX	0	0	201	0	2	41
Total Take	527	528	310	175	164	341
% TX Post-breeding Pop.	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%
% of TX Ann. Mortality	0.7%	0.7%	0.4%	0.2%	0.2%	0.4%

TWSP has taken 4 other species of gulls, but in very minimal numbers and none have breeding populations in Texas, though the Ring-billed Gull is now being seen on BBS routes (USGS 2012). BBS trend data for 1966 to 2010 surveywide for the species taken by TWSP are a significant increase of 3.4%/year for the Ring-billed Gull, significant decreases of -4.7%/year and -3.4%/year for the Franklin's and Herring Gulls, and no trend information for the Bonaparte's Gull which does not breed in the BBS surveywide area (Sauer et al. 2011). The only other gull, the California Gull, which breeds in the BBS surveywide area, shows a nonsignificant decrease of -1.8%/ year. Ring-billed Gulls increased significantly earlier in the century which was attributed to their ability to use supplemental food sources and expand their breeding habitat (Pollet et al. 2012). From BBS data in 2006, the population was estimated at 2.55 million which included immature gulls, but this is not the best data for estimating colonial waterbird populations (Pollet et al. 2012). Kushlan et al. (2002) estimated the population at 1.7 million breeders. For Franklin's Gull, the population in their primary breeding area increased, but recently has decreased (Burger and Gochfield 2009); a few breeding populations have crashed recently, including one in Minnesota, which could have affected their trend, but they seem secure. The Herring Gull population, decimated in the early 1900s, was believed to have increased beyond their historical numbers by the 1960s and now reflect a decrease to previous numbers (Pierotti and Good 1994). The Bonaparte's Gull primarily nests in areas north of the BBS limits, thus limited data is available for them (Burger and Gochfield 2002), but NAS (2012a) gives a global population estimate of 390,000. CBC data averaged for FY72-FY76 to FY07-FY11 for winter populations in Texas (0.684 to 0.815) appear to have been stable just below 1/party hour observed, but in the United States (5.33 to 1.94) appears to have decreased about three-fold (NAS 2012a). The continental breeding populations of Ring Billed, Bonaparte's, and Herring Gulls have been estimated at 2.6 million, 390,000, and 370,000 (NAS 2012b). Franklin's Gulls are also abundant and increased through the 1990s (Burger and Gochfeld 2009) with a breeding population range estimated at 320,000 to 990,000 (Kushlan et al. 2002), but now shows a high significant decreasing trend of -4.7%/year from 1966 to 2010 (Sauer et al. 2011). They appear secure, but some nesting

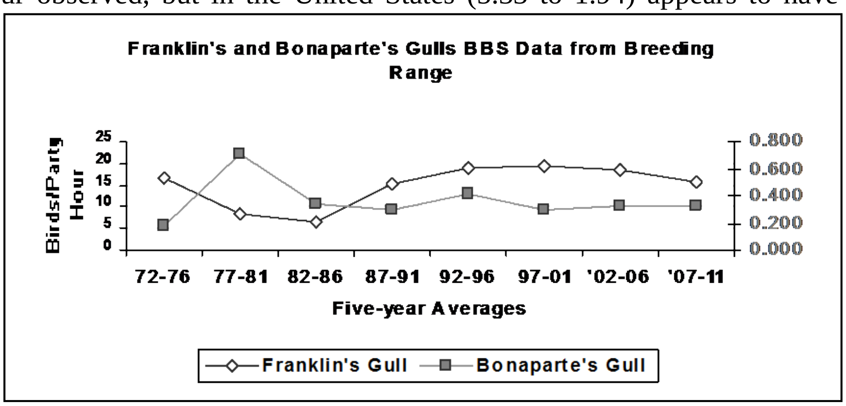

Figure 16. Franklin's and Bonaparte's Gulls' BBS trends from 5-year averages (Sauer et al. 2011) in their primary breeding range in the BBS area. The Franklin's Gull breeds primarily in Alberta, Saskatchewan, Manitoba, Montana, and North Dakota, while the Bonaparte's further north in Alberta, Saskatchewan, and the Yukon.

colonies have crashed which could cause concern in future (Burger and Gochfield 2009). In their primary breeding range (Alberta, Saskatchewan, Manitoba, Montana, and North Dakota), 5 year average of birds/route on BBS routes in this area reflect a decrease from 2002-06 to 2007-11, but it was not lower than earlier BBS results (Figure 16). Thus, it currently may be experiencing some fluctuations. A direct estimate of their population data from their primary breeding range yields an estimate of 1.2 million breeding birds using no detectability factors. All other gulls found in Texas, with the exception of the Thayer's Gull and Lesser Black-backed Gull (a recent colonizer of North America from Europe), are common. The Thayer's Gull has an estimated population of less than 10,000 breeders in Canada (Kushlan et al. 2002).

WS nationally took an average of 5,200 Ring-billed Gulls, 3,400 Herring Gulls, 450 Franklin's Gulls, and 73 Bonaparte's Gulls (<1% of their populations) from FY07 to FY11 with maximum takes of 6,500, 4,400, 860, and 140, respectively. Available data reflect stable to increasing populations of most gulls in the BBS region and, thus, it appears that the limited take from WS has not impacted these species' populations in Texas or nationally. TWSP has taken only a limited number of these gulls, averaging 7, 2, 3, and 1 from FY07 to FY11 (Table 8), respectively with USFWS permitted take in Texas averaging 1 unknown gull species, 41 Ring-billed Gulls, 0.4 Franklin's Gulls, and 0.4 Herring Gulls from 2006 to 2010 (Table 9). Intuitively, this is such a minor take that the population would not be affected nationally at less than 1% of their breeding population and in Texas. TWSP could easily increase take to several hundred for each species without impacting their populations. It is anticipated that TWSP will haze more gulls than take them lethally. Thus, it is concluded that the minor take of gulls by TWSP has and will not have an effect on the gull populations and TWSP does not believe that, from looking at the best available data, even the take of a few hundred gulls will not cause declines in their populations and TWSP anticipates that this level of take could be a possibility.

Terns. Texas hosts 12 tern species including the closely related Black Skimmer and jaegers (Appendix C: Table C1). Of the species, the most common species seen year-round, primarily along the coast are the Gull-billed Tern, Caspian Tern, Forster's Tern, Royal Tern, and Black Skimmer. The Least Tern is found along the coast and locally inland during the breeding season and migration. The Sooty Tern is an uncommon breeder on isolated islands off the Texas coast. The Black Tern and Common Tern are common during migration, the Sandwich Tern is uncommon year-round, and the jaegers are uncommon winter visitors. In addition, 8 species including noddies, skua, and jaeger have accidentally been found in Texas (Appendix C: Table C3). Any one of these species has the potential to be a problem should they be encountered at an airport. However, airstrikes as a whole are much less likely with terns than gulls, especially because most are fairly solitary or in small groups except near their nesting colonies; terns were responsible for 92 of the 42,000 bird airstrikes (0.2%) with known species reported to FAA from FY02 to FY11 (Appendix D: Table D1). Additionally, some species can be a problem at aquaculture facilities as noted in Appendix C: Table C1. Terns are smaller than gulls, often sporting a forked tail, and differ largely in feeding technique (dive and plunge). In addition, terns, other than at the nesting colonies, are often solitary, form small groups, or fly in loose-knit flocks rather than group in large flocks like gulls. Thus, they are not quite as big a problem at airports. Terns can be a problem at aquaculture facilities because most have a diet of fish. Skimmers are like large terns but do congregate in larger flocks and often loaf on beaches which could be near an airport. They feed by dragging their lower mandible along the water in search of small fishes and invertebrates in the water. The jaegers look like a combination between gulls and terns. However, they too fly in smaller flocks than gulls.

Many tern populations have not been estimated (NAS 2012b). However, the Gull-billed Tern is estimated to have a population of 10,000-25-000 in the United States and 200,000 globally and the Least Tern, Common Tern, and Black Skimmer have estimated continental populations of 68,000, 430,000 and 100,000 (NAS 2012b). The breeding population of Gull-billed Terns in Texas is about 2,200 nesting pairs (Molina and Erwin 2006). Without using detectability parameters for terns, BBS data for Texas from FY07 to FY11 yields 5,200 Gull-billed Terns, 3,900 Caspian Terns, 1,100 Royal Terns, 7,700 Forster's Terns, 2,900 Least Terns, and 1,200 Black Skimmers. BBS trend data (Sauer et al. 2011) for these species in Texas from 1966 to 2010 are 7.8%/year, 4.3%/year, 3.8%/year, -1.9%/year, 4.9%/year, and 2.0%/year, respectively, none being significant. Habitat loss and vandalism at nesting sites have accounted for the majority of the decline of the Forster's Tern (McNicholl et al. 2001), the only tern of these exhibiting a downward trend. The Interior Least Tern, the subspecies in the interior of Texas and not along the Gulf Coast, is a federally endangered species. The Central BBS area has seen a nonsignificant decline of -3.5%/year. Declines in its population have been tied to habitat availability, nest predation, and human activity at nest sites (Thompson et al. 1997). TWSP would require a special permit to harass or take this species, even though hazing at airports or contaminated sites would be beneficial for the tern, the two areas where TWSP would likely control them. The Sandwich and Common Terns have been documented on BBS routes, but relatively few are found during the surveys in Texas. The Common Tern has a decreasing trend of -7.6%/year from 1966 to 2010 in Texas, but only 0.8% BBS surveywide where it is a more common breeder (Sauer et al. 2011). Declines in the Common Tern population have been associated with trapping thousands on their wintering grounds (one throw of a cast net can capture up to 200 at a time), pesticides (this species is especially sensitive to the effects of pesticides), habitat loss, and vandalism (Nisbet 2002). The Sooty Tern nests off the coast and is not found on BBS counts. BBS surveywide, the only other species found commonly in Texas is the Black Tern. The Black Tern has the only significant decreasing trend of the terns BBS surveywide at -3.4%/year (Sauer et al. 2011). CBC data directly extrapolated for Texas from FY07 to FY11 results in average wintering populations of 83,000 Forster's Terns, 25,000 Royal Terns, 13,000 Caspian Terns, 1,600 Gull-billed Terns, 650 Least Terns, 610 Common Terns, 610 Sandwich Terns, and 49,000 Black Skimmers (NAS 2012a) (as can be seen, CBC data for estimating coastal bird populations likely does not provide the best means of determining the population considering low population numbers for birds that winter in Texas).

Besides the federally endangered Interior Least Tern, the Gull-billed, Sandwich, and Sooty Terns, and the Black Skimmer are species of concern. The Gull-billed Tern is highly sensitive to human disturbance from boating, recreation, and development; nest predation by gulls and other predators, especially in areas where the gull population has dramatically increased (e.g., Salton Sea California Gulls), has also been a factor in their decline (Molina et al. 2009). The primary threats to the Sandwich Terns are habitat destruction, predation, and egging (people collecting eggs to eat) (Shealer 1999). The Sooty Tern is a state threatened species but found in few numbers along the coast, primarily outlying islands. Their population is not globally threatened, but locally they have lost populations to introduced predators, egging, and development (Schreiber et al. 2002). They also breed much later than other terns at 4-6 years old which reduces production. Finally, human disturbance at the nest site including vandalism of the nests has had the biggest impact on the Black Skimmer (Gochfeld and Burger 1994).

From FY07 to FY11, TWSP took an average of 1 Forster's Tern and 1 Least Tern, (3 in one year for both species). The Least Terns were taken along the coast, and not from the Interior population. USFWS reported the average take of 2 Caspian Terns, 4 Forster's Terns, and 4 Royal Terns from 2006 to 2010 and all of it occurred in 2008. Cumulatively, this is a negligible impact to these species and take was less than 1% of any population. TWSP would expect that the take of 100 of the more common terns and Black Skimmer, and 20 of the sensitive species and jaegers would not impact their populations. TWSP does not anticipate taking many as suggested from take from FY07 to FY11, but it could be possible. However, compared to their North America and wintering populations in Texas, this take would be minor.

Shorebirds

Texas hosts 39 species of shorebirds regularly and 14 accidentally (Appendix C: Table C1 and C3). Only six of these species breed in Texas with the remainder migrating through the State for a short period during spring and fall, or wintering primarily along the coast. Shorebirds are mostly only a concern at airports as they are commonly struck by aircraft. Most are hazed, but some such as the Upland Plover and Killdeer are difficult to haze. Therefore, some are taken lethally. TWSP does monitor shorebirds for disease, primarily monitoring for human pathogens such as HP H5N1 AI, especially those species that breed in areas such as Alaska where other species of shorebirds and waterfowl breed that wintered the prior year in areas where HP H5N1 AI has been discovered (Asia). As a result of this intermingling with birds of other regions of the world, it is believed that diseases could spread through birds that have contracted it. Most disease work involves the use of nonlethal methods such as mist nets and cannon nets followed by release after sampling and most airport work involves the use of pyrotechnics, thus minimal lethal take occurs. From FY07 to FY11, TWSP lethally took 6 species of shorebirds (1 for disease work only) and hazed or captured then sampled and released 16 species (11 species only for disease work) (Table 10).

Several shorebirds are T&E or SMC species (19 of the 39 commonly found in Texas and 2 of the accidental or rare species), including the federally endangered Piping Plover and Audubon red Watchlist Species the Mountain Plover and Buff-breasted Sandpiper (NAS 2007). The Eskimo Curlew is a federally listed species, but is most likely extinct or has a population less than 50 (Morrison et al. 2006) as it has not been seen in many years (it is listed in the accidental species table, Appendix C: Table C3). However, it most likely migrated through Texas regularly at one time. Additionally, the Snowy Plover, Wilson's Plover, and American Oystercatcher, all USFWS (2008) species of conservation concern, have relatively low population estimates (Morrison et al. 2006). TWSP is aware of these species and adjusts methods to avoid take. A consultation was conducted with USFWS on the Piping Plover for conducting disease monitoring because this species could be caught in mist nets during sampling. TWSP follows the Reasonable and Prudent Measures and Alternatives and Terms and Conditions of that consultation to protect the Plover.

Of the shorebirds, only 2 are taken to any extent by TWSP with most coming from airports, the Upland Sandpiper and Killdeer, and only four others were taken from FY07 to FY11, the Greater and Lesser Yellowlegs, Long-billed Curlew, and Long-billed Dowitcher for disease monitoring and work at airports. With the exception of these 6 species, TWSP anticipates that no more than 100 shorebirds of any regularly occurring species, 5 of the 5 SMC species discussed above with low population estimates not federally listed, and no federally listed species (the 2 discussed b) will ever be taken lethally. An occasional accidental species may also be taken. From FY07 to FY11, TWSP did not surpass this. This is a minimal take and would not impact any of these species populations.

Upland Sandpiper. The Upland Sandpiper is an unusual shorebird because it is a grassland species that does not spend most of its time near water. Almost all work tasks conducted by TWSP have been associated with Upland Sandpipers on airports and reducing their hazards. It typically nests in tall grass on the ground, but moves it's young to shorter grass or other vegetation to avoid predators after they hatch, habitat often associated with airports. It typically spends about 4 months on its breeding grounds (primarily North and South Dakota, Nebraska, and Kansas) before leaving the United States for its wintering grounds. In the United States, it was responsible for 114 strikes from FY02 to FY11 with 67 of those occurring at Texas airports (Appendix D: Table D1). In the 1800s, this species was an easy target for market hunters. Its population declined drastically, but has rebounded (Houston and Bowen 2001). More recent declines in some areas of their range are linked to loss of grassland habitats and possibly increased nest depredation by species such as crows which have increased significantly in their breeding areas (Houston and Bowen 2001). BBS data indicates that the Upland Sandpiper population from 1966 to 2010 increased significantly at 0.5%/year and 0.8%/year surveywide and in the Central BBS Region, but decreased nonsignificantly in Texas -1.6%/year (Sauer et al. 2011). This suggests that habitat conditions and possibly other factors have caused them to increase throughout most of their breeding range, but decrease in Texas. Its North American population has been estimated at 350,000 (Morrison et al. 2006). BBS raw data (USGS 2012) for the CPS region gives an estimate of 330,000 without using detectability parameters suggesting a probable increase in their population.

Upland Sandpipers are abundant in ideal breeding areas of the north CPS. Upland Sandpipers have one nest per year, but may renest if the first attempt fails. They have a clutch of 3 to 5 eggs, but almost always have 4 (97% of nests) (Houston and Bowen 2001). They breed when they are 1 year old and the sex ratio may be slightly skewed to males (Houston and Bowen 2001). Thus, it is assumed that the sex ratio is 55 males: 45 females for the analysis and that 75% of the females breed. Estimates of nest success in northern Great Plains states range from 63% (Lindmeier 1960) to 100% (Lokemoen and Duebbert 1974). Buhnerkempe and Westemeier (1988) calculated nest success in Illinois to be 48%. Thus, we can assume that fledgling success, similar to other birds, is at least 37% from all eggs. Using these parameters, an estimated breeding population of 350,000 in BBS surveywide would annually fledge about 180,000 nestlings, the estimated annual mortality rate. WS in the CPS region took 0.1% of the estimated annual mortality rate from FY07 to FY11 with a high of 0.2% in FY08 (Table 29). The cumulative total take was similar as WS in the CPS region, except in 2008 when USFWS permitted the take of 70 Upland Sandpipers; this increased the average take to 0.2% of the estimated annual mortality from FY07 to FY11. TWSP and other CPS region WS programs could take several thousand Upland Sandpipers before a moderate magnitude impact would be reached. TWSP anticipates that it will not exceed the take 2% of the estimated annual mortality, with WS in the CPS area taking less than 5%. TWSP concludes, that even with implementation of lethal control for these sandpipers, TWSP will have a minor impact on them, at most.

Table 29. Cumulative impact analysis for Upland Sandpipers killed in Texas by TWSP, other CPS WS Programs, and USFWS permitted private individuals and entities from FY07 to FY11.

UPLAND SANDPIPER IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated CPS Breeding Population	350,000	350,000	350,000	350,000	350,000	350,000
% Breeding Females in Population	34%	34%	34%	34%	34%	34%
Breeding Females	120,000	120,000	120,000	120,000	120,000	120,000
Aver. Clutch	4	4	4	4	4	4
Aver. Nests	1	1	1	1	1	1
% Fledge	37%	37%	37%	37%	37%	37%
Young Fledged/ Stable Pop. Ann. Mort.	180,000	180,000	180,000	180,000	180,000	180,000
Total CPS Population	530,000	530,000	530,000	530,000	530,000	530,000
TWSP Take	181	294	47	175	109	161
Other CPS WS Take	49	90	106	109	176	106
TWSP Take % of CPS Ann. Mort.	0.1%	0.2%	0.1%	0.2%	0.2%	0.1%
Private Take in CPS Region	0	0	70	0	0	14
Total Take	230	384	213	284	285	271
% CPS Post-breeding Pop.	0.0%	0.1%	0.0%	0.1%	0.1%	0.1%
% of CPS Ann. Mortality	0.1%	0.2%	0.1%	0.2%	0.2%	0.2%

Killdeer. The Killdeer is found throughout North America and quite common. Much like the Upland Sandpiper, they can be found well away from wetland habitats, including short grass and human altered habitats such gravel roads and gravel rooftops, They are often found around airports and their hazards to aircraft is the only problem associated with them. Killdeer have been responsible for 2,427 strikes from FY02 to FY11 with 250 in Texas, 2nd among all species struck by aircraft, following only the Mourning Dove, indicating their preference to use airport habitat. They typically are found in sparsely vegetated areas near some source of water including lawn sprinklers. They often nest in open or sparsely vegetated areas on the ground and are precocial (capable of independent activity when hatch). They can be found year-round in Texas. Their population is most limited nest/hatchling destruction from predation and other known sources such as vehicles, and possibly impacts from pesticides (Jackson and Jackson 2000). Their population likely increased substantially with the spread of people in the United States. However, BBS data indicates that the Killdeer population from 1966 to 2010 decreased significantly at -1.0%/year surveywide, -0.3%/year in the Central BBS region, and -1.1%/year in Texas. Its North American population has not been estimated. However, BBS data in Texas (USGS 2012) using no detectability parameters indicate a population of 100,000. Detectability for Killdeer would likely be somewhere between many species, but likely in the mid-range of most species or about 4. Thus, the population is probably higher than this estimate. The North American breeding population has been estimated at 1 million (Morrison et al. 2006).

Killdeer are abundant in ideal breeding areas. Killdeer have one nest per year, but may renest if the first attempt fails. They have a clutch of 4 to 8 eggs, but almost always have 4 (Jackson and Jackson 2000). They breed when they are 1 year old and the sex ratio possibly is slightly skewed to males (Houston and Bowen 2001). However, it is assumed that the sex ratio is 1 male: 1 female for the analysis and that 75% of the females breed. Estimates of nest success ranged from .16 to 1.6 fledglings/nest, but averaged 0.5 fledglings/nest (Jackson and Jackson 2000), a 12.5% egg to fledgling success. Using these parameters, a population of 100,000 (no detectability parameters used) would fledge 19,000 young in Texas, a very conservative estimate. TWSP averaged the take of 51 from FY07 to FY11 with a high of 69 in FY10. USFWS permitted take from 2006 to 2010 averaged 19, with a high of 74 in 2008. As a result of permitted take, the highest cumulative take in Texas occurred in FY09 which was 95 or 0.5% of the expected annual mortality. TWSP could increase take substantially without impacting the population, easily to 1,000, which combined with private depredation take, would be expected to be about 5% of the expected annual mortality or less than 1% of the conservatively calculated breeding population. TWSP concludes, that even with implementation of large-scale lethal control of Killdeers on airfields in Texas, TWSP will have a minor impact on them, at most.

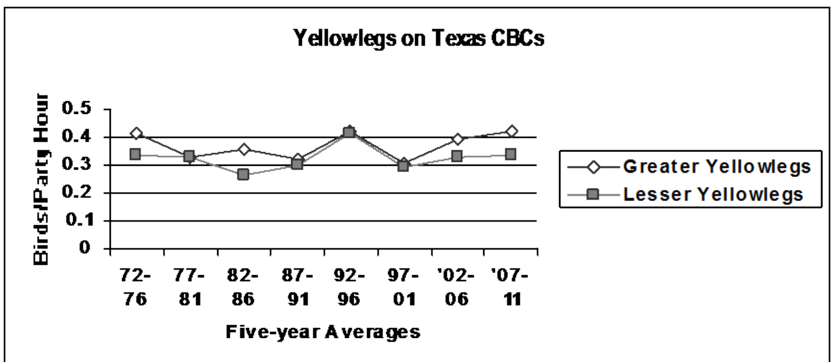

Figure 16. Greater and Lesser Yellowlegs BBS trend data for 5-year averages from 1972 to 2011.

Yellowlegs. The Lesser and Greater Yellowlegs breed in Canada and Alaska, mostly north of the BBS area. They winter in the southern United States including Texas and south along primarily the coasts of Central and South America to Chile and Argentina. From 1966 to 2010 surveywide, the Lesser Yellowlegs had a significant declining trend of -5.6%/year while the Greater Yellowlegs, a nonsignificant increasing trend of +4.0%/year (Sauer et al. 2011). However, CBC data does not correspond with a decreasing trend for Lesser Yellowlegs in the United States and, thus, the BBS data must be used cautiously (Tibbitts and Moskoff 1999). Few BBS routes actually monitor the Lesser Yellowlegs. The average number of Greater and Lesser Yellowlegs seen per party hour in Texas for 5 year averages during the CBC from 1972 to 2011 was has been fairly stable with normal minor fluctuations (NAS 2012a). Tibbitts and Moskoff (1999) also found that the population had remained relatively stable for Lesser Yellowlegs. The Canadian Wildlife Service estimates their population to be 0.5 million (Tibbitts and Moskoff 1999). Morrison et al. (2006) estimated the population at 400,000. The Greater Yellowlegs population has been estimated to be 100,000 (Morrison et al. 2006). Known causes of mortality include predators, diseases, pesticide poisoning, crushing by vehicles, and hunting in their wintering grounds (Elphick and Tibbitts 1998, Tibbitts and Moskoff 1999). CBC data extrapolated for Texas, assuming all yellowlegs were seen on the average 103.4 counts conducted between 2007 and 2011, gives estimates of 18,000 and 34,000 Lesser and Greater Yellowlegs wintering in Texas. TWSP took an average of 12

Lesser Yellowlegs with maximum of 61 in FY07 and 1 Greater Yellowlegs with a maximum of 5 from FY07 to FY11. Most all were taken for disease monitoring, thus, it is anticipated that take will be less. Take by TWSP was less than 1% of the Texas wintering population estimated with CBC data from 2007-2011 (NAS 2012a). USFWS did not have any permitted take during this time. The average take by WS nationally for Lesser and Greater Yellowlegs was 25 and 17 for FY07 to FY11 with highs of 72 and 24, less than 0.1% of their estimated population (Tibbitts and Moskoff 1999, NAS 2012b). This would have had little to no effect on their population. TWSP anticipates that a maximum of 400 Lesser Yellowlegs or 100 Greater Yellowlegs or 0.1% of their estimated populations (Morrison et al. 2006) would ever be taken in Texas. This would be a minimal take that would not impact their population.

Other Shorebirds. TWSP has taken minimal numbers of 2 other species of shorebirds from FY07 to FY11, the Long-billed Curlew and Long-billed Dowitcher at an airport. Their estimated North American populations, respectively, are 55,000 and 400,000 (Morrison et al. 2006). Most shorebirds nest above the BBS routes and are, therefore, among the species that trends are not monitored or not monitored accurately and includes the Long-billed Dowitcher. The Long-billed Curlew, though, breeds throughout much of the West. BBS data show a nonsignificant increase from 1966 to 2010 (Sauer et al. 2011). The Solitary Sandpiper, like the yellowlegs, breeds across Canada and Alaska and is found in a few of the northernmost routes. However, the Solitary Sandpiper breeds in out-of-the-way places and is fairly quiet making it hard to census them (Moskoff 1995). The other two species are not monitored by the BBS because they nest above the northern limits of the BBS. TWSP took an average of 1 of each species from FY07 to FY11 with a maximum of 4 Long-billed Curlews and 2 Long-billed Dowitchers. These are minimal numbers, less than 0.1% of the breeding population, thus, take would have no noticeable impact on their population. TWSP concludes that take of these 2 species did not impact their populations.

Many other species of shorebirds inhabit Texas commonly (34) and accidentally (14). TWSP does not anticipate taking many of any of these species and mostly with nonlethal methods. Of these, the Piping Plover and Eskimo Curlew are T&E species that will be avoided by TWSP unless they are present at airports or contaminated sites (e.g., oils spills). TWSP would only "take" (includes harassment and other nonlethal methods) these species with the appropriate permit from USFWS and nonlethally, primarily for their protection at airports and contaminated sites. TWSP does not expect that either species will be taken, but especially the Eskimo Curlew which could possibly be extinct. As discussed, TWSP expects not to ever take more than 5 of the Mountain Plover, Snowy Plover, Wilson's Plover, Buff-breasted Sandpiper, and American Oystercatcher with low populations or 100 of any regularly occurring, non-T&E species in Texas. This take would not impact any or their populations. However, as seen in the last 15 years, TWSP will likely take none of these species except potentially with non-lethal methods.

Wading Birds

Waders include 17 species of herons, egrets, ibises, and bitterns regularly found in Texas (Appendix C: Table C1) and the accidentally occurring Greater Flamingo, Jabiru, and Bare-throated Tiger-Heron (Appendix C: Table C3). The species most likely to be the focus of BDM in Texas are the Cattle Egret, Great Blue Heron, Great Egret, Snowy Egret, and Yellow-crowned Night-Heron because of their potential to cause damage. The Cattle Egret, White Ibis, and Great Egret are the most abundant species year-round, with estimated breeding populations extrapolated from BBS data for FY07 to FY11, not using detectability parameters, of 830,000, 81,000, and 63,000 (USGS 2012). The White-faced Ibis, Snowy Egret, Great Blue Heron, Little Blue Heron, Green Heron, Tricolored Heron, Roseate Spoonbill, and Black-crowned Night-Heron are fairly common year-round with estimated breeding populations of 46,000, 37,000, 31,000, 28,000, 17,000, 15,000, 14,000, and 10,000 (USGS 2012). The Yellow-crowned Night-Herons, Reddish Egret, Wood Stork, Glossy Ibis, Least Bittern and American Bittern are uncommon, but present with breeding populations 3,600, 940, 910, 350, 240, and 35 (USGS 2012). Of the 17, the Reddish Egret, White-faced Ibis, and Wood Stork are State threatened and the American and Least Bitterns, and Little Blue Heron are birds of conservation concern (USFWS 2008). Several of the wading birds are difficult to census because they are cryptic or nest in the understory below the canopy level where aircraft cannot survey them, especially the bitterns, Yellow-crowned Night-Herons, and Little Blue and Green Herons (Gibbs et al. 2009, Lowther et al. 2009, Watts 1995, Rodger and Smith 1995, Davis and Kushlan 1994). For example, ground surveying for Yellow-crowned Night-Herons in Virginia increased the population by 500% in 3 years (Watts 1995). Thus, it is assumed that the breeding numbers for most species given above are very conservative.

The most common requests for assistance involving these species are to protect aircraft and human health and safety at airports, to protect aquaculture produced fish (individual wading birds preying on fish at an aquaculture facility) and property in urban residential areas where they are a human health and safety concern (roosts). These conflicts can require the take of some individuals to reinforce hazing efforts, but often do not involve the take of many. In fact, wading birds were responsible for 904 WTs annually from FY07 to FY11 (Table 2), but relatively few were taken in comparison to damage. All are fairly common in the Central BBS area during the breeding season (a few on the edge of their range in Texas) with the exception of the bitterns, Reddish Egret and Glossy Ibis. TWSP believes that relatively few wading birds will ever be taken and take will have no impact on any species' population. Wading birds, their nests, eggs and young are protected by the Migratory Bird Treaty Act; any form of take requires a permit from the USFWS. TWSP' actual take of egrets and herons would be conducted with the appropriate USFWS permit and will likely be minor in comparison to the estimated potential take. Lethal shooting is generally used to reinforce harassment methods and is conducted at airports where there is great potential for damage to occur or in residential areas where a roost has formed.

Cattle Egrets. Cattle Egrets are native to Portugal, Spain and Africa; they first appeared in South America around the turn of the century. It is thought that cattle egrets were self-introduced to the New World, perhaps after being caught in high winds or a storm system. Since the early 1960's, the cattle egret has increased in population size and has extended its range throughout North America (Telfair 1983, 2006, Baumgartner and Baumgartner 1992) and is now one of the most abundant wading birds. Nationally, the Cattle Egret was responsible for 855 bird strikes at United States airports from FY02 to FY11 with 28% damaging; 67 of these occurred in Texas (Appendix D: Table D1). In Texas, Cattle Egrets increased from about 15.4 birds/BBS count for 1967-1971 to 30.4 birds/BBS count for FY07-FY11 (USGS 2012). Trend data from 1966 to 2010 for Texas shows a nonsignificant positive trend (1.9%/year) during that time, but a significant positive trend of 2.0%/year in the Central BBS Region; surveywide the trend is declining nonsignificantly at -0.5%/year (Sauer et al. 2011). The population increased rapidly in the 70s and 80s, reaching highs in the 1990s, but decreasing slightly since. It appears to be stabilizing, a common characteristic of invasive species although the cattle egret is considered a naturalized species. The breeding population in Texas and the CPS region can roughly be estimated from BBS data. However, the BBS data (USGS 2012) is not the best data to derive colonial waterbird populations. However, barring other estimates, the population could be estimated without the use of detectability parameters which would result in a conservative, but usable population estimate. From BBS data, the population could be estimated at 830,000 in Texas and 890,000 in the CPS area. A population of this size could withstand the take of tens of thousands without an impact on their population. Considering their current population and the fact that they only arrived in North America 60 years ago gives an indication of their reproductive capabilities. TWSP has taken relatively few cattle egrets considering their population. TWSP took an average of 103 Cattle Egrets from FY07 to FY11, primarily for the protection of human health and safety and aircraft at airports, with a high of 356 in FY08. However, take will be analyzed.

Cattle Egrets breed when they are two years old (third year). The population is assumed to consist of 34% juveniles, similar to other species that breed when they are two years old (Telfair 2006). For the sake of estimating the population for this EA, it is assumed that 66% of the estimated population are adults, that 75% of the adult females breed, the sex ratio is 1:1 males to females, females lay 1-6 eggs with an average of 3.0 eggs/nest, and the average nests/season is 1 (Telfair 2006). An average of 80% of the eggs hatch and 51% of those fledge or a 41% egg to fledgling percentage (this was quite varied with productivity sometimes double). Using these parameters, the CPS breeding population of 890,000 would have about 220,000 breeding females that successfully fledge about 270,000 nestlings, raising the post-fledgling population to about 1.2 million Cattle Egrets. This would be an increase in the population by a factor of 1.3.

The number of Cattle Egrets that might be taken by WS under the proposed action or Alternative 1 in Texas may rise to 5,000 depending on nest locations (if a nesting colony arose adjacent to an airfield, it is possible that a few thousand could be taken if they could not be successfully hazed), but it is much more likely that less than 1,000 will be taken. WS possibly could take double this number in the CPS area annually. However, the take between FY07 and FY11 would likely be more realistic which averaged 223 for all WS programs in the CPS region with a high of 438 in FY08 or 0.2% of the expected annual mortality (Table 30). Additional human-induced mortality of this species in the CPS region occurs from depredation take from private individuals and others conducting control. USFWS permitted take averaged 111 from 2006 to 2010 with a high 511 in FY10; the highest cumulative take at 609 was in FY10 which was less than 0.1% of the population and 0.2% of the expected annual mortality. Cumulatively, take was minor in comparison to the population. Thus, WS take and cumulative take has been minimal and a negligible percentage of the expected annual mortality. TWSP concludes that even with substantial increases in take, the population is not expected to be impacted.

Table 30. Cumulative impact analysis for Cattle Egrets killed in Texas by TWSP, other CPS WS Programs, and USFWS permitted private individuals and entities from FY07 to FY11.

CATTLE EGRET IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated CPS Breeding Population	890,000	890,000	890,000	890,000	890,000	890,000
% Breeding Females in Population	25%	25%	25%	25%	25%	25%
Breeding Females	220,000	220,000	220,000	220,000	220,000	220,000
Aver. Clutch	3	3	3	3	3	3
Aver. Nests	1	1	1	1	1	1
% Fledge	41%	41%	41%	41%	41%	41%
Young Fledged/ Stable Pop. Ann. Mort.	270,000	270,000	270,000	270,000	270,000	270,000
Total CPS Population	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000
TWSP Take	15	356	3	43	100	103
Other CPS WS Take	236	82	179	55	47	120
WS Take % of CPS Ann. Mort.	0.09%	0.16%	0.07%	0.04%	0.05%	0.08%
Private Take in CPS Region	0	0	34	511	10	111
Total Take	251	438	216	609	157	334
% CPS Post-breeding Pop.	0.02%	0.04%	0.02%	0.05%	0.01%	0.03%
% of CPS Ann. Mortality	0.09%	0.16%	0.08%	0.23%	0.06%	0.12%

Great Blue Herons. The Great Blue Heron is commonly found throughout much of North America, but does not extend into northern Canada and Alaska. They tend to be found in wetlands with emergent vegetation or along banks, and sometimes in drier upland sites. They feed on fish, invertebrates, and small mammals such as mice. They are strongly territorial and, therefore, typically found singly in any given area. They were responsible for 180 strikes from FY02 to FY11 with 39% damaging, a high percentage; of these, 3 occurred in Texas (Appendix D: Table D1), indicating some preference to be found around airport habitats (they often "mouse" in open fields). They nest in the tops of trees among fairly large breeding colonies. They can be found year-round in Texas. It is unknown what limits their population, but territoriality in feeding and a limited feed supply may keep populations at low levels (Vennesland and Butler 2011). BBS data indicates that the Great Blue Heron population increased significantly in Texas and surveywide from 1966 to 2010 at 1.8% and 0.8%/year. Its North American population has been estimated at 120,000 (Table 4). BBS data in Texas (USGS 2012) using no detectability parameters indicate a breeding population of 31,000 in Texas and 66,000 in the CPS States.

Great Blue Herons are abundant in ideal breeding areas. Great Blue Herons are known to have one and possibly two nests per year, renesting if the first attempt fails (Vennesland and Butler 2011). Their clutch is 2 to 6 eggs, averaging 3.2/nest that hatch 2.3 young/nest. Great Blue Herons breed when they are 2 year old, thus, for this analysis the nonbreeding population is estimated to be 33% of the population. The sex ratio is assumed to be 1 male: 1 female for the analysis and that 75% of the adult females breed. A small study found that nests fledged 62.5% of the number of eggs or about 2/nest (Vennesland and Butler 2011). Using these parameters, a population of 66,000 (no detectability parameters used) would fledge 34,000 young in the CPS area (Table 31). WS averaged the take of 61 from FY07 to FY11 with a high of 86 in FY11. USFWS permitted take from 2006 to 2010 averaged 164, with the highest in 2009 (418). As a result of permitted take, the highest cumulative take in Texas occurred in FY08 which was 458 or 1.3% of the expected annual mortality (Table 31). WS in the CPS region including TWSP could increase take substantially without impacting the population, easily into the thousands, before a medium level of impact would occur. It is anticipated that cumulative take will remain below 10% of the expected annual mortality (3,400) or 5% of the conservatively calculated breeding population. TWSP concludes, that even with implementation of increased take of Great Blue Herons, the population is not expected to be impacted.

Table 31. Cumulative impact analysis for Great Blue Herons killed in Texas by TWSP, other CPS WS Programs, and USFWS permitted private individuals and entities from FY07 to FY11.

GREAT BLUE HERON IMPACT ANALYSIS						
	FY07	FY08	FY09	FY10	FY11	Aver.
Estimated CPS Breeding Population	66,000	66,000	66,000	66,000	66,000	66,000
% Breeding Females in Population	25%	25%	25%	25%	25%	25%
Breeding Females	17,000	17,000	17,000	17,000	17,000	17,000
Aver. Clutch	3.2	3.2	3.2	3.2	3.2	3.2
Aver. Nests	1	1	1	1	1	1
% Fledge	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%
Young Fledged/ Stable Pop. Ann. Mort.	34,000	34,000	34,000	34,000	34,000	34,000
Total CPS Population	100,000	100,000	100,000	100,000	100,000	100,000
TWSP Take	29	36	24	31	12	26
Other CPS WS Take	39	36	16	12	74	35
WS Take % of CPS Ann. Mort.	0.2%	0.2%	0.1%	0.1%	0.3%	0.2%
Private Take in CPS Region	119	92	418	108	81	164
Total Take	187	164	458	151	167	225
% CPS Post-breeding Pop.	0.2%	0.2%	0.5%	0.2%	0.2%	0.2%
% of CPS Ann. Mortality	0.6%	0.5%	1.3%	0.4%	0.5%	0.7%

Other Wading Birds. TWSP has taken minimal numbers or none of the other 15 species of wading birds in Texas and most all to reduce wildlife hazards to aircraft and their passengers at airports. From FY07 to FY11, TWSP has averaged the take of 10 or less Great Egrets (10), Yellow-crowned Night-Herons (6), Snowy Egrets (3), Little Blue Herons (1), Green Herons (1), and Tricolored Herons (0.2). USFWS permitted take included 6 additional species of wading birds in Texas. Cumulatively, an average of 53 Great Egrets, 29 Snowy Egrets, 3 Little Blue Herons, 6 Green Herons, 10 Yellow-crowned Night-Herons, 5 Black-crowned Night-Herons, and less than 1 Tricolored Heron was taken from FY07 to FY11 by TWSP and private depredation take. This take represents <0.5% of any of their estimated breeding populations using BBS data (USGS 2012) without detectability parameters applied in Texas. The detectability of a species is reflected in their population estimates. Detection is paramount for several of these species, especially the more cryptic bitterns, Yellow-crowned Night-Herons and Green Herons, and, therefore, the population estimates given are likely extremely conservative. Thus, it is likely that the cumulative take was even much less than what would be determined from estimating their populations without detectability parameters.

BBS data surveywide data from 1966 to 2010 show a significant decreases for the Green Heron at -1.6%/year with nonsignificant decreases for the American Bittern (-1.1), Tricolored Heron (-0.5), Little Blue Heron (-0.9), Black-crowned Night-Heron (-0.6), and Yellow-crowned Night-Heron (-0.4). The remaining species have positive trends with the Roseate Spoonbill, White and White-faced Ibises, and Great Egret being significant (Sauer et al. 2011). The Green Heron is the only species with a significant negative trend in Texas at -1.6%/year, identical to the surveywide trend. However, the Great Egret, Snowy Egret, and Black-crowned Night-Heron all show significant increases (Sauer et al. 2011). The Green Heron's significantly decreasing trend is difficult to interpret because of its cryptic nature and, thus, the validity of its BBS trend is difficult to determine (Davis and Kushlan 1994). Stochastic climatic events, nest predation, and loss of large wetland habitats may be primary reasons for their decline (Davis and Kushlan 1994) similar to reasons given for the decline of Wood Storks which have only recently started to increase (Coulter et al. 1999). The Little Blue Heron has ample nesting habitat, but is declining possibly from a reduction in their foraging habitat; a decline in feeding areas and agonistic behavior with the abundant Cattle Egret are likely the primary factors related to their decline (Rodgers and Smith 1995). The American Bittern has also decreased which is linked almost entirely to the loss of large wetlands with emergent vegetation (Lowther et al. 2009). Finally, the Yellow-crowned Night-Heron is reflecting a negative trend, possibly to a lack of foraging sites or nesting substrate which regulate their population (Watts 1995). However, Watts (1995) stated that their population increased and their range expanded between 1925 and the 1970s. Thus, the nonsignificant negative trend could also be normal fluctuations of a population that expanded and subsequently receded to factors such as weather which sometimes reduce a population that has expanded its range. Therefore, depredation take is likely not a limiting factor for these species. On the other hand, species that are showing significant increasing trends surveywide from 1966 to 2011 are not being impacted by depredation take (Sauer et al. 2011). The numbers taken by WS and USFWS permitted take are low enough numbers to intuitively know that this level of take would be insignificant to the population. Cumulatively, the level of take for these species did not have more than a negligible effect on these species. In fact, TWSP could increase take for all of the species discussed in this section above, at least ten-fold or more, without impacting their populations, easily to 10% of their breeding populations.

A few other wading bird species inhabit Texas as discussed above. However, TWSP has not taken any in the last 15 years. TWSP will likely take none of these species in the foreseeable future except potentially with non-lethal methods. However, the take of a few, up to 10, will not impact any of the other species populations.

TWSP anticipates that take will continue to occur or could occur with any of these other species, but take would likely be very minimal and not exceed 5% of their breeding populations in Texas. TWSP concludes that these other wading bird species' populations will not be impacted by TWSP BDM individually or cumulatively with private depredation take.

Waterbirds

Several waterbirds (15) are present in Texas, most primarily along the Gulf Coast especially during winter, but none are especially abundant. The most common breeding birds are the Neotropic and Double-crested Cormorants, Anhingas, Brown and American White Pelicans, and Pied-billed and Least Grebes, and, to a lesser extent, Belted, Green, and Ringed Kingfishers. Additionally, the Common Loon, and Horned, Eared, Western, and Clark's Grebes are present during the winter. The most abundant during this time are the cormorants, pelicans, Pied-billed and Eared Grebes, and Belted Kingfisher. BBS trend data suggest that most water bird populations are increasing, the Brown Pelican is increasing significantly surveywide at 5.4%/year, the Anhinga, Double-crested Cormorant, and American White Pelican in the Central BBS Region are increasing significantly at 2.4%/year, 4.9%/year, and 7.3%/year in Texas (Sauer et al. 2011). However, two species decreased significantly from 1966-2010 surveywide and in the Central BBS Region, the Horned Grebe (-2.6% and -2.4%/year) and Belted Kingfisher (-1.4% and 1.3%/year). The Horned Grebe decline is likely the result of nesting habitat loss to agricultural activities and other developments and territorial behavior during nesting for the remaining sites; their winter range is most threatened by oils spills and pesticide contaminants (Stedman 2000). The Belted Kingfisher decline is likely related to water quality, cover, and available nesting sites; human disturbance at potential nesting sites can also cause kingfishers to try to select alternate sites (Kelly et al. 2009). Surveywide, the Clark's/Western Grebe and Pied-billed Grebe (not in Texas or the Central BBS Region where increasing trend) surveywide show decreasing trends, and the Eared Grebe in the Central BBS Region (Sauer et al. 2011).

The typical damage associated with these birds is aircraft strikes, especially the larger ones such as pelicans and cormorants. Waterbirds were responsible for 245 strikes from FY02 to FY11 with a high percentage (56%) of them causing damage (Appendix D: Table D1). Where populations are especially abundant, damage can also occur to aquaculture facilities and sport fisheries. TWSP had 422 work tasks associated with waterbirds from FY07 to FY11. From FY07 to FY11, TWSP only had lethal take of the Double-crested Cormorant and one Eared Grebe. Private persons targeted Double-crested Cormorants too, but also American White Pelicans and Pied-billed Grebes under the appropriate USFWS depredation permits. WS State Programs in the CPS region took only a few Pied-billed Grebes (average of 5) and an Eared Grebe, with no other waterbirds taken. It is possible that TWSP could target other waterbirds lethally should the need arise.

Double-crested Cormorants. While few Double-crested Cormorants nest in Texas, an estimate of 2,700 was made with FY07 to FY11 BBS data using no detectability parameters (USGS 2012), many winter in the State (estimated directly from CBC data using no detectability parameters at 830,000 (NAS 2012a)). As discussed, the Double-crested Cormorant population is significantly increasing in many areas. As a result of the increased Double-crested Cormorant population, USFWS issued a depredation order in the eastern U.S., including Texas, where people can take them without going through the normal permitting procedures "*…to reduce depredation of aquaculture stock at freshwater commercial aquaculture facilities and State/Federal fish hatcheries*." However, USFWS must be notified of intentions to take cormorants.

TWSP provided assistance with cormorant depredation problems from FY07 to FY11 and averaged the take of 35 annually with a high of 151 in FY07. WS in the remainder of the CPS area took an annual average of 27. USFWS permitted individuals took an annual average 359 Double-crested Cormorants from 2006 to 2010 in the CPS region which equals a cumulative average of 421 taken with a high in FY08 of 570. Using no detectability parameters, the CPS region has an estimated 74,000 Double-crested Cormorants that breed in the CPS region. If 25% of the population were breeding females (breed when 4 years old, though most breed when 3 years old (78%), and some 2 and 1 year olds), then an estimated 74,000 cormorants would fledge 33,000 young (the expected annual mortality) using an average of 1.8 nestlings fledged per nest and only one nest per season, though one study found that 1 in 3 nest double-clutched (Hatch and Weseloh 1999). In FY08, the cumulative impact on the cormorant population would have been less than 2% of the estimated annual mortality. WS would have taken about 0.2% of the expected annual mortality of the conservatively estimated population from FY07-FY11. This level of take by WS and private permitted individuals would have a negligible impact on the population. Take would have to increase into the thousands, even tens of thousands, before a moderate impact would occur, especially considering the potential wintering population in Texas.

Other Waterbirds.

WS does have the potential to take a few of the other waterbirds found in Texas, especially the American White Pelican and Brown Pelican along the Gulf, because their populations are abundant more than 120,000 and 190,000 breeders nationwide, respectively, and both increasing at fairly rapid rates (Kushlan et al. 2002); they are very large and flocking and can cause significant damage to aircraft. WS did not take any American White Pelicans in the CPS area from FY07 to FY11, which is no impact. USFWS permitted the take of 32 annually in the CPS area with 6 of these in Texas which is a minimal take. Cumulative impacts would be less than those discussed for Double-

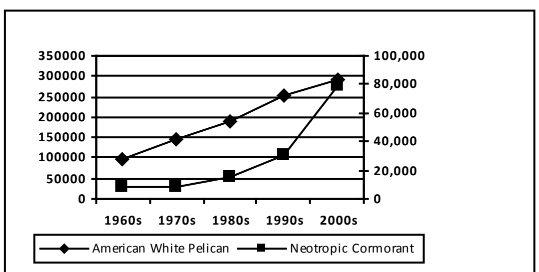

Figure 16. Wintering population growth of American White Pelican and Neotropic Cormorant in Texas extrapolated from CBC data 1960-2009 for 10 year averages (NAS 2012a).

crested Cormorants. WS anticipates that this species will be taken primarily because they can inflict serious damage to aquaculture and planes and will take no more than 100. WS anticipates that the cumulative impact for this species would be less than 1% of their conservatively estimated breeding population of 120,000 in the CPS region. The Grebes and loons could become a problem, but these mostly inhabit larger bodies of water, are not as abundant, and are fairly solitary. Thus, it is not likely that few will be encountered at airports in Texas. WS anticipates that it could take a few of each of these species, but that take will remain relatively low, under 10 of each. Thus, taking 10 from these species populations would have no more than a negligible impact on the populations.

TWSP only took one other waterbird from FY07 to FY11, one Eared Grebe. Eared Grebes do not breed in Texas, but in the north CPS region, primarily the Dakotas. Without the use of detectability factors, an estimated 23,000 breed in the upper CPS. Kushlan et al. (2002) estimated that the population at about 3.8 million. The take of one would have no perceptible impact on the population. TWSP could take Pied-billed Grebes which were taken by WS in the CPS region, averaging 5 from FY07 to FY11. These breed throughout the CPS region with most in North Dakota. The North American population has been estimated at 125,000 for two subspecies (Kushlan et al. 2002). The population with no detectability parameters in the CPS region could be estimated at 27,000. The take of 5 would have no perceptible impact on the population. The other Grebes that could be taken by TWSP, mostly at airports and typically singly or in pairs, would be the Western Grebe, Clark's Grebe, Horned Grebe, and, though not as likely because of habitat preference and location, the least Grebe; TWSP anticipates that 10 of each of these species could be taken without impacting their populations. Additionally, TWSP has the potential to take a few of the other waterbirds found in Texas, especially the Neotropic Cormorant and American White Pelican because their populations are abundant and increasing at a fairly rapid rate (Figure 16); extrapolating population estimates at the average for 10 year increments from CBC data for 1960 to 2009, figure 16 shows their increase. Ten year averages show a steady three-fold increase in American White Pelicans from 100,000 to 300,000 wintering in Texas and an exponential increase in Neotropic Cormorants from 8,000 to 80,000. TWSP anticipates that these 2 species will be taken primarily because they can inflict serious damage to aquaculture and planes. However, TWSP would anticipate that cumulatively no more than 1% of their conservatively estimated winter population would be taken. The Brown Pelican could become a problem, but inhabits more coastal areas where they will not cause as much damage, though they are encountered more frequently at coastal airports and inland as their population increases and have been hazed at airports in the past by TWSP. The Anhinga is often solitary and not too numerous, thus reducing the potential for damage (Frederick and Siegel-Causey 2000). The Anhinga, Common Loon, and the grebes are not as likely to cause too many problems, especially because they are much more solitary and not as abundant. The booby, gannet, and frigatebird are typically much more pelagic (stay out at sea) so have little potential to cause damage. TWSP anticipates that it could take a few of each of these species, but that take will remain relatively low, or cumulatively less than 1% of their estimated winter populations in Texas which is greater than 1,000 except for Magnificent Frigatebird and Masked Booby. Thus, TWSP expects that less than 10 of these species would ever be taken and less for the Magnificent Frigatebird, Masked Booby, and accidental species seen rarely in Texas.

Waterfowl

Many species of waterfowl are present during some portion of the year in Texas with most during winter coming from northern breeding grounds including 32 ducks and geese and 5 cranes and rails that will likely cause damage. In addition, Texas has 13 species of ducks, swans, and the Brant which are accidental in the state. Of these, 11 species of waterfowl commonly breed in the State (estimated population from FY07-FY11 >2,000 not using detectability parameters), the Black-bellied and Fulvous Whistling-Ducks, Canada Goose, Wood Duck, Mallard, Mottled Duck, Blue-winged Teal, Northern Shoveler, Ruddy Duck, American Coot, and Common Moorhen (USGS 2012). Eight other species have been found on BBS routes and breed in Texas, but only in minimal numbers (USGS 2012). A few other species can be found in lesser numbers in Texas, but typically are not associated with damage situations, except potentially at airports. Conservation efforts over the last several decades such as closely regulating hunter harvest, slowing the loss of wetlands, and improving the quality of wetland habitat have helped reverse the decline for many waterfowl species. In response to the conservation efforts of wildlife managers, sportsmen, conservationists, and others, waterfowl populations, particularly Canada Geese, Snow Geese, Ross's Geese, and Mallards, have flourished in recent years. These species of waterfowl, especially the midcontinent populations of geese, are considered "overabundant" and cause extensive damage to natural resources (Snow Geese are damaging their breeding grounds because of their sheer numbers), agricultural crops, property, and other resources, and can pose a threat to human health and safety, especially at airports. Of the 50 regular and accidental species that have been found in Texas, any could be associated with a BDM project, but most are not. Of these, TWSP has lethally taken 19 different species from FY07 to FY11, but averaged only 11 annually. It should be noted that any of the 50 could be involved in BDM since most waterfowl are large and flock, and could be taken at airports during hazing activities, though the 5 year averages in Tables 8 and 10 gives a good indication of which species and the number that would be involved in BDM projects annually. Additionally, waterfowl were monitored for HP H5N1 AI virus because they had a high potential for intermingling with birds from other continents.

Of the 29 species that breed in the BBS surveywide, the Mottled Duck (-3.9%/year), American Wigeon (-3.5%/year), Northern Pintail (-2.6%/year), and Lesser Scaup (-2.3%/year) showed significant declining trends from 1966 to 2010; the Lesser Scaup and Northern Pintail, though, show nonsignificant increases from 2000-2010; additionally, several species have nonsignificant negative trends from 1966 to 2010 including the Common Merganser (-1.3%/year), Red-breasted Merganser (-7.6%/year), American Black Duck (-0.4%/year), Green-winged Teal (-0.4%/year), Blue-winged Teal (-0.3%/year), Cinnamon Teal (-2.8%/year), Canvasback (-0. %/year 5), Barrow's Goldeneye (-1.0%/year), Purple Gallinule (-2.7%/year), Common Moorhen (-1.5%/year), and American Coot (-0.8%/year) (of these, from 2000-2010, only the Cinnamon Teal, Barrow's Goldeneye, Purple Gallinule, and Common Moorhen continued to have a negative tend) (Sauer et al. 2011). On the other hand, the Gadwall, Wood Duck, Canada Goose, Black-bellied Whistling-Duck, and Sandhill Crane have shown significant positive trends from 1966 to 2010 (Sauer et al. 2011). In Texas, only the Mottled Duck shows a significant negative trend of -5.5%/year (Sauer et al. 2011). In all, most waterfowl are doing very well despite annual harvests from sportsmen in the thousands, a much higher percentage of the population than the cumulative impacts discussed thus far in this document. Hunters annually harvest a moderate percentage of the population, but most populations have remained relatively stable or increased (Table 32). This level of take gives a good indication of the low impact of BDM on these species as well as others and what the level of cumulative take bird populations can withstand. Table 32 gives the estimated midcontinent waterfowl populations or other population estimate as designated, their average hunter harvest in the CPS area and Texas from FY07 to FY11, WS average take in the CPS area (FY07 toFY11), and USFWS permitted average take for 2006 to 2010, and potential maximum take by TWSP. It also gives the cumulative impact percentage for all take on their populations and the depredation percent take compared to hunter harvest. Depredation take (WS and permitted take) did not exceed 0.1% of the harvest except for Canada/Cackling Geese (0.39%), mergansers (0.12%), other ducks which were primarily Black-bellied Whistling-Ducks (0.12%), and American Coots (0.76%). This is an imperceptible percentage of the total take and an unnoticeable impact on the population (cumulative depredation take was typically much less 0.1% of the population in the CPS region). The highest cumulative take was for Canada/Cackling Geese at 35% of the midcontinent population; it must be noted that the survey areas do not take into account the "resident" population of Canada Geese which is considerable in the CPS area because survey areas are farther north. Most WS take and some sportsman harvest were from these populations.

Table 32. Estimated waterfowl populations for the traditional survey area less Alaska ((Survey Areas 13-50, 75-77, but not including Survey Units 1-12) (USFWS 2012d) for Canada/Cackling Geese, American Coots, and most ducks, excluding those that nest south of the survey area in the United States including Wood Duck, Mottled Duck, and Cinnamon Teal (NAS 2012), or those that nest in arctic areas and islands north of the survey area such as the Snow, Ross's, and Greater White-fronted Geese (USFWS 2011b), and the Sandhill Cranes which have their own surveys (USFWS 2012c). Hunter harvest was obtained from USFWS (2009, 2011a, 2012b).

	Annual Average from 2007 to 2011							
Species	Est. North American Midcontinent Breeding Pop.	CPS Hunter Harvest	TX Hunter Harvest	WS CPS Take (incl. TX) Aver.	CPS USFWS Permit Take	Cum. Impact % of CPS Pop.	WS & USFWS Permit Take % Harvest	Potential TWSP Maximum Est. Annual Lethal Take
Greater White-fronted Goose[3*]	712,000	86,000	66,000	0.2	0.4	12.1%	0.00%	10
Snow Goose[3*]	2,792,000	190,000	124,000	7	2	6.8%	0.00%	1,000
Ross' Goose[3*]		28,000	21,000	0	0	na	0.00%	100
Cackling/Canada Goose	1,233,000	430,000	52,000	407	1,266	35.0%	0.39%	1,000#
Wood Duck[2**]	4,600,000	53,000	33,000	2	0	1.2%	0.00%	10
Gadwall	3,070,000	737,000	538,000	24	3	24.0%	0.00%	100
American Wigeon	1,551,000	145,000	85,000	10	2	9.3%	0.01%	100
Mallard	7,904,000	624,000	87,000	196	41	7.9%	0.04%	1,000
American Black Duck	21,000	210	130	0	0	1.0%	0.00%	1
Mottled Duck[2**]	660,000	11,000	11,000	5	0	1.7%	0.05%	100
Blue-winged Teal	7,199,000	280,000	174,000	12	10	3.9%	0.01%	100
Cinnamon Teal[**]	na			0.2	0			10
Northern Shoveler	3,736,000	126,000	71,000	11	2	3.4%	0.01%	100
Northern Pintail	2,377,000	107,000	63,000	12	1	4.5%	0.01%	100
Green-winged Teal	2,392,000	293,000	174,000	11	3	12.2%	0.00%	100
Canvasback	602,000	22,000	10,000	0.2	0	3.7%	0.00%	10
Redhead	1,104,000	83,000	44,000	1	2	7.5%	0.00%	10
Ring-necked Duck	1,057,000	71,000	41,000	7	3	6.7%	0.01%	10
Greater Scaup	3,010,000	2,400	1,600	0	0	1.4%	0.00%	10
Lesser Scaup		39,000	15,000	4	9		0.03%	100
Bufflehead	1,147,000	17,000	4,600	2	0	1.5%	0.01%	10
Goldeneye spp.	691,000	5,200	1,500	2	0	0.8%	0.04%	10
Long-tailed Duck	75,000	30	0	0	0	0.0%	0.00%	1
Merganser spp.	681,000	9,200	4,200	3	8	1.4%	0.12%	10
Ruddy Duck	626,000	5,900	1,900	2	0	0.9%	0.03%	10
Scoter spp.	792,000	170	23	0	0	0.0%	0.00%	10
Other Ducks[2+]	1,550,000	5,600	5,400	7	0.2	0.4%	0.13%	100
American Coot	2,902,000	14,000	7,300	51	56	0.5%	0.76%	1,000
Sandhill Crane[3]	570,000	17,400	11,825	8	0.2	3.1%	0.05%	100
TOTAL		3,402,170	1,647,448	785	1,409	3.1%	0.09%	-

na – not available *Breeds mostly north of survey areas ** Breeds mostly south of survey areas

CPS = Central Plains States – TX, OK, KS, NE, SD, ND Harvest estimates from USFWS (2009, 2011a, 2012b)

Population Estimates from [1] USFWS (2012d) database and included USFWS Waterfowl Strata 13-18, 20-23, 25-49, 75-77, excluded Alaska and eastern survey area, [2]Continental Population (NAS 2012b), or [3] USFWS (2012c)

Note: Population estimates do not include estimates from below the standard sampled USFWS tiers which is especially prevalent for Canada Geese and Mallards because these species are abundant breeders in the CPS area.

+ Most "Other Ducks" in the CPS area taken were likely Black-bellied Whistling Ducks, and possibly Fulvous Whistling Ducks and some accidental species. Population estimate for Black-bellied Whistling Ducks since harvest in Texas was most likely this species.

Table 32 includes an estimate of the maximum potential take by TWSP for waterfowl. The species that TWSP anticipates taking the most are Snow Geese, Canada Geese, Mallards, and American Coots, the species most associated with damage in Texas other than at airports and are often taken to reduce their damage. However, TWSP averaged lethally taking only 7, 407, 196, and 51 of these species from FY07 to FY11, a minimal number. The most work tasks (WTs) associated with waterfowl (Table 2) were for Black-bellied Whistling-Ducks (234), Blue-winged Teals (167), American Wigeons (134), American Coots (133) and Gadwalls (128), species primarily hazed at airports or taken for disease monitoring by TWSP. However, the species with the highest averages of being hazed from FY07 to FY11 (Table 10) were Northern Pintails (1,808/year), Sandhill Cranes (1,074/year), Black-bellied Whistling-Ducks (332), Northern Shoveler (320), Gadwalls (237), and American Wigeons (200) with most all of these at airports. Thus, several species of waterfowl have the potential to be involved in BDM in Texas and some can be taken as indicated in Table 8. TWSP anticipates that take will remain fairly minimal, especially in comparison to hunting take. TWSP believes that, for the most part, the maximum take will be less than 1% of the average harvest in Texas. The primary exceptions are for coots (25% of hunter harvest) and scoters (10% of hunter harvest) which are not hunted at the magnitude of other waterfowl, and Canada Geese (2% of hunter harvest) because of their potential to cause damage especially in urban areas with populations that are not as impacted by hunting.

Canada and Cackling Geese. Canada Geese were recently split into 2 species, the Canada Goose and smaller Cackling Goose. BBS and other data did not separate these species until just recently. Thus, data for the 2 species are mostly combined and will be for the purposes of this analysis (the "residents" are Canada Geese only). Of the waterfowl species, a significant increase has occurred with Canada Geese (Figure 14) at +10.5%/year (*P*<.05) from 1966 to 2010 (Sauer et al. 2011) surveywide. The Canada Goose, which could be seen year round, is more common than the Cackling Goose which breeds in Canada and winters in Texas.

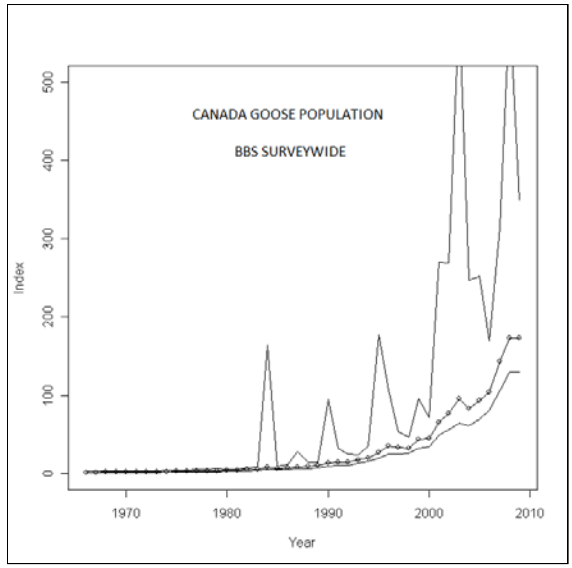

Figure 14. BBS survey-wide Canada Goose population trend (*from* Sauer et al. 2011).

The establishment of Canada Geese has occurred throughout the United States, primarily from introduction and transplant programs (Oberheu 1973, Blandin and Heusmann 1974, Ankney 1996). These programs were very successful and Canada Geese established large "resident" populations in many urban centers in the continental United States, creating an increased number of conflicts between human interests and the geese (Conover and Chasko 1985, Hindman and Ferrigno 1990, Ankney 1996, Mobray et al. 2002). USFWS identifies "resident" Canada Geese as those nesting in any of the months from March to June or residing in any months from April to August within the lower 48 states and the District of Columbia (Fed. Reg. Notice 71(154):45964-45993). USFWS has provided a depredation order for Canada Geese and landowners that register with USFWS can take nests and eggs of Canada Geese to resolve or prevent injury to people, property, agricultural crops, or other interests (50 CFR 20 and 21). TWSP could be requested at any time to remove a significant portion of a "resident" population that has become too abundant and associated with excessive damage and health concerns such as in parks, at golf courses, and in residential areas. These geese are typically euthanized and could increase TWSP take. WS in many other State Programs have removed hundreds of "resident" geese to resolve conflicts, but Texas only has few urban Canada Goose populations. Canada Geese have caused catastrophic incidents at airports such as that at Elmendorf Air Force Base. In 1995, a Boeing 700 AWACS jet taking off from Elmendorf Air Force Base in Alaska ingested geese into 2 engines and crashed, killing all 24 crew members and destroying the $180 million aircraft. The removal of geese in urban areas will not have significant on their population, as the population because it is above the desired number in the CPS region (USFWS 2005).

TWSP has conducted BDM for a few overabundant resident Canada Geese, most in northern Texas from Dallas to Amarillo, primarily in urban areas where they were causing excessive damage. However, several projects have also been done for migratory Canada/Cackling Geese, primarily at airports where they are a wildlife hazard. TWSP averaged the lethal take of 18 from FY07 to FY11, a minimal number that would not impact the population. These mostly came from the "resident" population in northern Texas. TWSP has also hazed a few geese annually (12), primarily from airports, and trapped and relocated them from damage situations (33).

Of all waterfowl, TWSP anticipates that BDM could be conducted mostly for "resident" Canada Geese with TWSP possibly taking up to 1,000 in the future (many WS programs have been requested to cull a few thousand as the populations have increased exponentially). With the increasing population in Texas (Figure 15), following a similar pattern to other areas where geese were transplanted, TWSP could be requested to conduct "culling" to reduce populations considered overabundant, especially in parks and at golf courses with considerable damage. The estimated population of resident Canada Geese in Texas is likely minimal, possibly approaching 10,000. BBS data, if extrapolated for Texas without any detectability parameters, would give a population estimate of 5,600 Canada Geese which is likely low. Canada Geese have 1 nest per year, average 5.6 eggs per nest, start breeding as 2 year olds (3rd year), with 2 year olds having 0.58 goslings fledge/female and 4 year olds or older having 2.1 goslings fledge/female (Mowbray et al. 2002). Data was unavailable on age structure, but assuming that 20% of the population are nonbreeding 1 year olds, 10% of the population are 2 year olds, and 70% of the population are 3+ year olds (Canada Geese are long-lived with the oldest banding record at just over 30 years old (Klimkiewicz 2008)), and that 3 year olds are similar to 4 year olds in gosling number, then a breeding population of 10,000 Canada Geese would recruit 7,600 goslings into the population annually. This would be about 43% and 57% goslings and adults in the population. In Nevada, a translocation program captured 11,400 geese from 1986 to 2001 comprised of 40% goslings and 60% adults captured (Hall and Groninger 2002). However, recent data from Nevada showed that as the population of geese was reduced in urban areas, the number of goslings in the population increased to over 50% (T. Hall, WS, *unpubl. data*). Thus, the take of 1,000 geese would represent 13% of the annual mortality or 6% of the total population and is not expected to impact the population. WS would coordinate removal efforts with TPWD to determine if they wanted to translocate the Canada Geese to a wildlife management area as this has been shown to be successful to reduce damage problems, but could move problems to other areas of the state (e.g., Canada Geese damage urban landscaping could be moved to a wildlife management area where close by crops would become damaged). However, WS believes that it will take few geese to resolve problems unless the Canada Goose population continues to grow in urban areas and near airports.

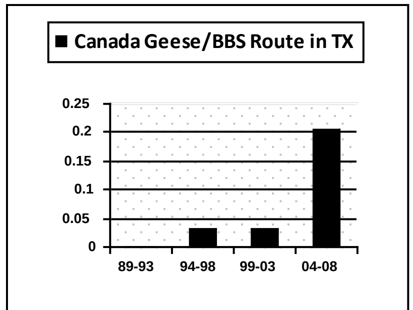

Figure 15. The average number of Canada Geese found on BBS routes in Texas for 5 year intervals from 1989 to 2008 (BBL 2009).

Cumulative take for Canada and Cackling Geese in the Central Flyway has been moderate at 35% (Table 32), but the population estimate does not include resident Canada Geese. Population estimates are conducted from parts of South Dakota north. This excludes production in Texas through Nebraska. USFWS (2005) had average estimates for 1998-2000 for the remaining states (CO, KS, MT, NE, NM, OK, TX, WY) in the Central Flyway of 410,000 which were projected to be 780,000 in 2010 at the current rate of growth. These are also harvested during the hunting season; often close to where they are resident (these typically do not migrate like those that breed in northern Canada). Adding the 1998-2000 average with the 1.2 million estimated breeding population in the Central Flyway, would result in the production of about 1.2 million goslings that fledge, the annual rate of mortality for a stable population. Harvest and depredation take would represent about 36% of the estimated annual mortality, for what we believe is a conservatively estimated breeding population or 22%. This would be less than what would be expected to reduce the population. BBS trend data (Sauer et al. 2011) for Texas, the Central Flyway, and BBS surveywide show high significant increases with the Central BBS Region being +16.3%/year from 2000 to 2010 suggesting that control and hunting of Canada Geese has had no impact on their population since the population continues to grow. TWSP believes that take depredation could increase several fold in the Central Flyway, especially in Texas. TWSP took an average of 18 Canada Geese from FY07 to FY11 (Table 8) which is a minimal take and anticipates that this number could increase, primarily in northern Texas. WS in the CPS area took an average of 407 Canada Geese while USFWS permitted the average take of 1,266. Cumulatively, including hunter harvest and depredation take, impact to the population estimated from USFWS (2012d) was 35% (Table 32). This would not impact the population and WS concludes that it would have, at most, a minimal impact on Canada Geese.

Snow, Ross's, and White-fronted Geese. The Snow and Ross's Geese are very similar in appearance and are separated by size, the Ross's Goose being smaller with a few morphological differences such as a stubby bill. These species breed primarily in the arctic or subarctic tundra in habitat that is relatively featureless (few trees). The west Central Flyway population of these geese is considered abundant, but the mid-continent population is considered overabundant (USFWS 2007). Their populations have had serious ecological impacts on their nesting grounds and USFWS has instituted very liberal hunting seasons for them. WS took an average of 3 Snow Geese and no Ross's Geese from FY07 to FY11 (Table 8), a minimal percentage of hunter harvest (190,000 Snow Geese and 28,000 Ross's Geese). It is anticipated that WS could take some lethally, especially to reinforce hazing programs protecting crops and airplanes. However, even if TWSP took considerably higher numbers, a thousand of either species, especially if USFWS requested such action to reduce the population to stop irreparable damage to their breeding grounds, their populations, considering that they are overabundant in the midcontinental area, would not be impacted. TWSP would have to take hundreds of thousands to begin to have an impact on their population. This level of take is not likely to ever occur, but TWSP anticipates that 1,000 Snow Geese and 100 Ross's Geese could be taken. This level of take will have no noticeable effect on their populations.

The Greater White-fronted Goose is also an arctic and subartic tundra breeder, but will also nest in the taiga of northern Canada in areas with willows and spruce. Similar to other geese, they are most likely to cause problems at airports. Their population appears to have increased in the 1980s-90s (Ely and Dzubin 1994), but fairly stable in recent years averaging 712,000 in the traditional surveys from FY07-FY11 in the midcontinent area (USFWS 2011b). TWSP did not conduct lethal control for this species from FY07 to FY11, but anticipates such could happen and would take a maximum of 10. The USFWS did not permit the lethal removal of any Greater White-fronted Geese from 2006-2010 in Texas. WS and USFWS permitted take in the CPS area averaged 1 from FY 07 to FY11. This level of take and the anticipated maximum take by TWSP would not have a noticeable effect on this species.

TWSP anticipates that take will continue to occur or could occur with any of these geese, but take in Texas would likely be very minimal and not exceed 0.1% of their midcontinent breeding populations. TWSP concludes that these geese species' populations will not be impacted by TWSP BDM individually or cumulatively with private depredation take.

Mallards, American Wigeons, and Other Ducks. TWSP took 14 different species of ducks from FY07 to FY11 (Table 8), though only minimally with TWSP averaging taking less than ten for all species. WS in the CPS area took minimal numbers of ducks. Mallards and wigeons cause similar damage to Canada Geese, primarily to landscaping, greens on golf courses, and water quality. Mallards, in particular, use swimming pools and other landscaped water features and can foul these impoundments. Generally, these are hazed from damage situations, but Mallards in particular, habituate rapidly to hazing methods without lethal reinforcement. WS and USFWS permitted take did not result in significant numbers of either species being taken with an average of 237 Mallards and 12 American Wigeons taken from FY07 to FY11 (Table 32). TWSP took an average of 7 Mallards and 5 American Wigeons, a minimal take that likely had no noticeable effect on the population. It is doubtful that WS in the CPS area or TWSP will ever remove more than a few hundred Mallards and fewer wigeons for BDM, but it is anticipated that TWSP could potentially take a 1,000 Mallards and 100 wigeons. These numbers represent a minimal percentage of their populations and, if taken, would have an unnoticeable effect on their populations. The American Wigeon has seen a significant decline in their BBS trend (Sauer et al. 2011), but a long term decline in breeding habitat and possible effects of climate change (more droughts) have impacted their population and postulated as causing their decline (Mobray 1999). In fact, TWSP could likely increase these maximums at least ten-fold without having an impact on the populations. TWSP believes that it has not had an effect on either species, the two ducks that will likely be taken at places other than airports.

Of the remaining ducks, Gadwalls and Blue-winged Teal averaged the highest depredation take by WS and USFWS permittees in the CPS area of the other ducks with an average of 27 and 22 taken from FY07 to FY11 (Table 32) with TWSP contributing an average take of 7 and 3 for these species (Table 8). This was minimal in terms of depredation take contributing to cumulative impact. Of the ducks, cumulative impact (sportsmen harvest and depredation take compared to the population) was highest at 24% for Gadwalls (Table 32); however, this apparently has not impacted the population because the population has increased significantly at 3.0%/year in the Central BBS region from 1966 to 2010 (Sauer et al. 2011). WS and USFWS permitted depredation take for all ducks in the CPS area was less than 0.1% of the hunter harvest, except mergansers (0.12%) and the other ducks category (0.13%), and less than 0.01% of the estimated midcontinent populations. Sportsmen harvest for these other species, the 3 species of mergansers and ducks form the "other ducks" category (primarily Black-bellied Whistling-Ducks with some Fulvous Whistling-Ducks in Texas and accidentals (e.g., Garganey) in the other CPS states) was minimal, so depredation take was a higher percentage, but still minimal. The minimal level of depredation take suggests that depredation take has not impacted any population. Even for the species that have seen significant declines, as discussed above, depredation take was not expected to contribute to their decline. The Mottled Duck, the only sensitive species which is an Audubon Watchlist red species (NAS 2007), has the only significant negative trend in Texas, as discussed. Degradation of habitat, especially in Texas and Louisiana, some pesticides, and potentially hunting (impact currently unknown, but thought to be compensatory) has been cited as causative factors in their decline (Bielefeld et al. 2010). The minimal level of take for all the other species of ducks would have no noticeable effect on their populations. The anticipated take for the other species of ducks is expected to be a maximum between 10 and 100 (1 for accidentals in Texas). This level of take will be insignificant in terms of their respective populations (Table 32). It should be noted that many species of ducks, especially those that breed in Arctic areas where some birds from Asia or Europe mingle with them, could be collected to sample for international diseases such as HP H5N1 AI. This could increase the level of take during a given year depending on the species targeted for collection. However, as possible, data would be collected from hunter harvested ducks or with capture and release methods instead of TWSP harvesting these as has been the methods used to take samples in the last few years.

Coots, Moorhens, and Gallinules. WS in the CPS area took minimal numbers of American Coots, an average of 51 annually from FY07 to FY11, and 1 Common Gallinule (aver. 0.2 annually from FY07 to FY11). TWSP had an annual average of 22 work tasks with a value of $33,000 for American Coots from FY07 to FY11, but did not have work tasks associated with the other species. American Coots cause similar damage to Mallards, primarily to landscaping, greens on golf courses, and water quality. Generally, these are hazed from damage situations, but coots in particular, habituate rapidly to hazing methods without lethal reinforcement. American Coots and a Common Gallinule were the only species taken from FY07 to FY11 in Texas and the CPS area for depredation, including USFWS permitted take, with TWSP contributing an average take of 3 and 0.2 from FY07 to FY11. This is a minimal take compared to their population and hunter harvest. It should be noted that coots are not a highly sought gamebird as compared to a species like the Mallard and, thus, hunters harvest relatively few coots in comparison to their population (Table 32) as compared to the ducks and geese. WS and USFWS permitted depredation coot take in the CPS area, 107, was 0.8% of hunter harvest, the most significant depredation take compared to hunter harvest of all the waterfowl (Table 32). The higher coot percentage, as compared to ducks, illustrates their minimal take as a game species, but their target in BDM. It is doubtful that WS in the CPS area or TWSP will ever remove more than a few hundred coots in BDM, but it is anticipated that TWSP could potentially take 1,000 because of their potential to cause damage at particular sites. This number represents a minimal percentage of their population (0.03%) which would be unnoticeable to their population, if taken. In fact, TWSP could take could increase this maximum ten-fold without having an impact on the population. TWSP anticipates that neither this species nor the other species will likely be taken in any significant numbers. The other species are fairly sedentary in marshes and cause minimal problems, primarily only t airports where such habitat abuts runways. However, TWSP does anticipate that a few may be taken at airports or other areas on a rare occasion.

Cranes. Sandhill cranes are abundant from fall through spring in Texas and can be an airport hazard or damage crops. Their population BBS-wide has significantly increased from 1966 to 2010 at +5.1%/year (Sauer et al. 2011), a very high increase. In many states, Sandhill cranes can be hunted. From the 2007 to 2011 hunting seasons, 17,400 were harvested in the Central Flyway with Texas hunters harvesting 11,800 (Table 32). WS in the CPS area took an annual average of 8 from FY07 to FY11 with 5 of these coming from Texas. TWSP had a maximum depredation take of 23 in FY07 or 0.2% of the hunter harvest in Texas. This is a minimal percentage and would not impact the population. TWSP hazed many more (aver. 1,074) from damage situations and anticipates that hazing as the primary method. TWSP anticipates that a maximum of 100 would ever be taken by TWSP which is less than 1% of the cumulative take.

It must be noted that TWSP could always "take" a Whooping Crane. Since this is an endangered species, take includes hazing. The most likely reasons for "take" would be to haze them from an airport or contaminated site such as an oil spill. These would serve to protect this species from potentially being killed and, thus, beneficial in the long term (they would temporarily be impacted from being harassed). This would require a Section 10 permit from USFWS which TWSP would obtain. Therefore, TWSP believes that it would not impact this species, but potentially provide a benefit if it is successfully hazed from a harmful situation.

Swallows, Nighthawks, and Swifts

TWSP is often requested to control damage caused by swallows, nighthawks, and swifts (aerialists), mostly either from the mud nests built by some swallows, nest insect infestations that have an effect on livestock, or protecting aircraft from strikes at an airport. The 3 aerialist groups, respectively, were associated 3,693, 319, and 375 aircraft strikes in the United States with 222, 44, and 13 occurring in Texas from FY02 to FY11 (Appendix D: Table D1) with about 1% causing damage overall, though 6% in Texas. From FY07 to FY11, TWSP annually averaged 232 work tasks for 4 species of swallows (Cliff, Cave, and Barn Swallows and Purple Martin), 19 for Common and Lesser Nighthawks, and 1 for Chimney Swifts. The breeding populations of these species in Texas estimated using BBS data from 2007 to 2011 (USGS 2012) are greater than a million for all but Lesser Nighthawk (610,000) and Chimney Swift (480,000). All of the other species in this group commonly found in Texas are either common or common migrants in the State.

BBS data from 1966 to 2010 indicate that in Texas of the species being lethally taken, the Common Nighthawk and Chimney Swift show significant declines of -1.2%/year and -2.9%/year while the Cliff and Barn Swallows, the species most frequently taken, show significant increases (Sauer et al. 2011). Of the other breeders in Texas in this group, the Chuck-will's-widow is significantly decreasing at -1.4%/year, and the Whip-poor-will, White-throated Swift, and Bank Swallow show nonsignificant declining trends from 1966 to 2010. BBS surveywide shows significant declining trends for those species common in Texas including species not likely to be involved in BDM, other than for the three mentioned above in Texas, for the Whip-poor-will (-2.6%/year), Purple Martin (-0.5%/year), Tree Swallow (-1.0%/year), and Barn Swallow (-1.2%/year) (Sauer et al. 2011). Declines have mostly been attributed to primarily decline in nesting habitat for each particular species (e.g., trees for Tree Swallows) and possibly pesticide use and a loss of their prey (Brown 1997, Garrison 1999, Cink 2002, Brigham et al. 2011, Winkler et al. 2011, Straight and Cooper 2012). Nest-site competition with House Sparrows and, possibly, weather have been given for Purple Martin declines in some areas (Brown 1997). Thus, the populations will decline regardless of any BDM conducted for them because the population is limited by habitat.

TWSP took four of these species (possibly 5), with an annual average of 48 Cliff Swallows, 41 Barn Swallows, 22 Common or Lesser Nighthawks (most likely Common, but possibly Lesser Nighthawks were taken too making 5 species), and 0.2 Chimney Swifts. USFWS permitted the take in Texas of 1 Common or Lesser Nighthawks, 1 Cliff Swallow, 1 Barn Swallow, and 1 Bank Swallow. The cumulative total for these species is less than 0.01% of the breeding populations in Texas. TWSP concludes that BDM will have no more than an imperceptible impact on any of the aerialist species, even if take were to increase to 1,000 (<0.2% of the estimated Lesser Nighthawk population, the least abundant of the species taken) for any of these species.

Woodpeckers

TWSP is periodically requested to assist with woodpecker damage, most always for damage to structures and also damage to crops such as pecans. TWSP conducted an average of 76 work tasks annually from FY07 to FY11 in Texas for a total of 7 species of woodpeckers of the 12 species that are regularly found in Texas (3 additional species have been accidental). Several species of woodpeckers are abundant in Texas (USGS 2012, Rich et al. 2003), but only a few cause much of the damage. Two species are only found during winter or during migration. Those with estimated breeding populations from FY07-FY11 numbering over 50,000 include Red-headed Woodpecker, Golden-fronted Woodpecker, Red-bellied Woodpecker, Ladder-backed Woodpecker, and Downy Woodpecker. Those with populations from 10,000-50,000 are Northern Flicker, Hairy Woodpecker, and Pileated Woodpecker. The Yellow-bellied Sapsucker and Red-naped Sapsucker do not breed in Texas, but have estimated breeding populations in the CPS area of 63,000 and 71,000 with their actual populations much greater as the core breeding populations are to the north and west of the CPS area, respectively. The Acorn Woodpecker and endangered Red-cockaded Woodpecker have populations estimated to be less than 10,000. The Acorn Woodpecker is found in west Texas on the periphery of its range with an estimated population in Texas of 3,500. The endangered Red-cockaded Woodpecker is on the west part of its range in east Texas, but has increased in abundance since the 1990s from 1,100 (RMBO 2007) to 2,700 as determined from FY07 to FY11 BBS data (USGS 2012) based on detectability factors from Rich et al. (2004). Thus, most woodpeckers in Texas have fairly abundant populations.

Most woodpecker species are solitary, though a few species live in colonies. Requests usually involve individual birds or nesting pairs. To illustrate potential impacts to woodpeckers, population dynamics for the Pileated Woodpecker (a more conservative breeder found in east Texas) will be used (Bull and Jackson 1995). Most woodpeckers breed at 1 year of age and have more than 1 brood per season, but a few, such as the Pileated Woodpecker have only 1 brood. Most have 4 or more eggs per nest and fledge 1 or more young (Pileated Woodpeckers average 3.83 eggs/nest and 2.0 fledglings/nest). Rich et al. (2004) used a corrective factor for detectability of 3.16 and estimated their population in the 1990s at 32,000, but BBS data for FY07-FY11 (USGS 2012) suggests an increase to 38,000 which reflects the significant upward BBS trend for Texas (1.3%/year) from 1966 to 2010 (Sauer et al. 2011). In the current population, assuming 80% females breed in a 50:50 male:female population, the current recruitment into the population or the annual mortality, assuming the above parameters, would be 30,000 or 44% of the post-recruitment population. Thus, if TWSP were to take 10% of the expected annual mortality of Pileated Woodpeckers, 3,000 would be taken. TWSP anticipates taking few, if any, Pileated Woodpeckers, but the take of few in any given year, up to 1% of their estimated annual mortality, would not significantly impact their population. Similarly, the take of other woodpeckers is expected to be, at most, a minimal percentage of their expected annual mortality and will not likely surpass 1% of this number. TWSP took only 1 woodpecker species from FY07 to FY11, the Golden-fronted (average 3/year)., less than 0.01% of their estimated population, a negligible impact. In prior years, TWSP took a few Ladder-backed Woodpeckers and Northern Flickers from FY92 to FY06. TWSP will continue to conduct limited control for woodpeckers and will not cause a significant impact to any of their populations.

<u>Other Birds</u>

Other birds in this EA from Appendix C: Table C1 that have not been discussed include gallinaceous birds (turkeys, grouse, quail), cuckoos (roadrunners and anis), frugivorous birds (robins, waxwings, finches), and miscellaneous birds (mockingbirds, cardinals, and grosbeaks). WS did not take any birds from the other groups of species discussed in Section 2.1.1.1, except a total of 2 Wild Turkeys and 1 American Robin from FY07 to FY11 (Table 8). Additionally, no other species was taken from FY93 to FY06. TWSP hazed an average of 2 turkeys and 15 Cedar Waxwings from FY07 to FY11 and trapped and relocated 3 House Finches, indicating these species could be taken lethally in some situations. USFWS (Table 9) permitted the take of an average of 1 Northern Mockingbird, 0.2 Northern Cardinal, and 0.2 House Finches from 2006 to 2010. This suggests that several species may represent a problem, but rarely create one. Of the other species that are in this category listed in Appendix C: Table C1, two are SMC species, the Lesser Prairie-Chicken, a federal candidate species, and the Scaled Quail. TWSP does not anticipate taking or hazing either, unless they were at an airport where TWSP was conducting wildlife hazard management. Six of the species listed in Appendix C: Table C1, the Northern Bobwhite, Scaled Quail, Northern Mockingbird, Rose-breasted Grosbeak, Cassin's Finch, and Purple Finch, have significantly declining trends BBS surveywide from 1966 to 2010 with similar trends in Texas (Sauer et al. 2011). The quail and Northern Mockingbird have been declining apparently as a result of weather patterns, and for quail specifically, livestock overgrazing (Brennan 1999, Dabbert et al. 2009, Farnsworth et al. 2011), Rose-breasted Grosbeak possibly forest successional changes (Wyatt and Francis 2002), Purple Finch from interspecific competition with the expanding House Finch population (Wootten 1996), and Cassin's Finch from variable factors (Hahn 1996). However, TWSP did not take any of these species. TWSP anticipates that while the potential is there for these species to be the focus of BDM, it will be very limited, except potentially at airports. WS anticipates that no more than 100 birds of any species would be taken of the other bird species listed in Appendix C: Table C1. The exceptions to this would be the take of SMC species; TWSP anticipates that it will likely never take these species, but possibly 1 in any given year. Additionally, Appendix C: Table C3 and, possibly, Table C2 list species that WS does not anticipate taking, but possibly could. Few, if any, of the species listed in the two Tables will ever be taken. The take of a few these species would be a very minor impact on any of their populations. Federally listed T&E species will not be taken except with the appropriate permit from and consultation with USFWS. However, none of the bird populations is expected to be impacted by such activities. It is concluded that the minor take by TWSP has and will not have an effect on the other species' populations.

Impacts to T&E, and Sensitive Species from BDM

TWSP did not target, lethally or nonlethally, any federally or state listed T&E species from FY07 to FY11 (Tables 8 and 10), nor did private persons under a USFWS permit (Table 9). TWSP did take 5 Least Terns along the coast, the population not considered endangered, during late May when Interior Least Terns have migrated inland (Thompson et al. 1997). TWSP anticipates that encounters with T&E species could occur (Table 5 summarizes the potential impacts of BDM to target T&E bird species), but that such requests would be rare. TWSP believes that most species would only potentially be involved in hazing operations at airports and rarely for any other BDM activity. BDM activities directed at any of these species would only be conducted after obtaining the necessary permit. Many of these species could easily cause a catastrophic incident at an airport as many of the reported strikes for these species (338) from FY02 to FY11 (Appendix D: Table D1) caused damage (66 of the 172 strikes with information on damage – 38%). TWSP did take 10 Species of Management Concern (USFWS 2008, NAS 2007). As discussed above in the various sections, take associated with these species was minimal and would not impact their populations. Thus, TWSP concludes that impacts to T&E and sensitive species by TWSP have been minor to nonexistent.

4.1.1.2 Alternative 2 - Nonlethal BDM by TWSP Only. Under this alternative, TWSP would not intentionally take any target species lethally because lethal methods would not be used. AgriLife Extension or TPWD would likely provide some level of professional BDM assistance for lethal activities, but this would be limited by resources such as personnel available and funding and conducted without federal assistance. Nonlethal activities conducted by TWSP would likely intensify, but result in similar to higher levels of nonlethal activities as conducted under Alternative 1 with similar numbers of birds hazed or captured and released or relocated (Table 10). Nonlethal harassment could be ineffective on some bird species, in particular pigeons, raptors, and urban waterfowl, because some birds would quickly become habituated to harassment techniques. Thus, where lethal techniques would be implemented to reinforce hazing efforts, TWSP would continue to conduct nonlethal control but with little success. This could be ineffective, especially at airports and for crop protection, and resource owners could become frustrated by TWSP's apparent lack of success. Therefore, private entities would conduct BDM, more than under Alternative 1, but resulting in, at most, similar levels of take to that that would occur under Alternative 1. Additionally, many nonlethal techniques cannot be used in certain situations (use of pyrotechnics in some residential areas to move roosts and at livestock feeding facilities such as dairies where their use can cause agitation of the livestock and loss of production).

The primary difference between BDM under the current program and that conducted by private entities would be the use of chemicals and a reduced take of migratory birds requiring a depredation permit from USFWS. Private entities would rely on Avitrol and Starlicide Complete, which contains the chemical in DRC-1339, to control starlings, feral pigeons, House Sparrows, and blackbirds. Technical grade DRC-1339 and A-C are currently available for use only by TWSP and could not be used by the public. This would likely lead to less species being taken under this alternative with chemical BDM methods. Additionally, not all private individuals would want to obtain a depredation permit from USFWS, and, thus, less migratory birds requiring a permit would be taken. As a result, this alternative would likely lead to private entities having similar or somewhat less impacts to target bird species populations as described under Alternative 1. However, it is unlikely that blackbird, raptor, waterfowl, or other target bird populations would be impacted significantly by implementation of this alternative for the same reasons shown in the population impacts analysis in Section 4.1.1.1.

Impacts and hypothetical risks of illegal chemicals or the use of unwise methods under this alternative as described in Sections 2.1.3 and 2.2.3 would probably be greater than the proposed action, similar to Alternative 3, but less than Alternative 4. The use of illegal methods would lead to unknown risks to target species populations. Use of these methods under this alternative will occur, but probably much more frequently than under Alternative 1.

4.1.1.3 Alternative 3 - TWSP Provides Technical Assistance Only for BDM. Under this alternative, TWSP would have no impact on any bird species population in Texas because the program would not conduct any operational BDM activities. TWSP would offer advice on the BDM techniques that could be used to resolve different damage problems. AgriLife Extension would likely provide some level of professional BDM assistance, but this would be limited by resources (i.e., personnel, funding, etc.) without federal assistance. Nonlethal efforts to repel birds from damaging situations may decrease under this alternative. Private efforts to reduce or prevent bird damage and perceived disease transmission risks would increase under this alternative and take would be similar to, but likely less than, the proposed action which would result in similar impacts on bird populations. Technical grade DRC-1339 and A-C could not be used by private individuals or entities, and thus, take with these chemicals would be nil, but other BDM methods, primarily Avitrol and Starlicide Complete, would likely be used to make up for this loss. For the same reasons shown in the population impacts analysis in Section 4.1.1.1, however, it is unlikely that blackbirds, raptors, waterfowl, or other target bird populations would be impacted significantly by implementation of this alternative. Under this alternative, the hypothetical use of illegal methods for BDM would be high because frustrations from the inability of resources owners to reduce losses would be higher than under the proposed action because TWSP would not provide assistance in many situations. The use of illegal chemicals and other methods under this alternative as described in Sections 2.1.3 and 2.2.3 could lead to real but unknown impacts on target bird populations. Impacts and hypothetical risks of illegal chemical toxicant use under this alternative would probably be more than under Alternative 2 and less than under Alternative 4.

4.1.1.4 Alternative 4 - No Federal TWSP BDM. Under this alternative, TWSP and other federal agencies would have no impact on any bird species populations in Texas. AgriLife Extension or TPWD would likely provide some level of professional BDM assistance, but this would be limited by resources (i.e., personnel, funding, etc.) without federal assistance. Private efforts to reduce or prevent depredations would increase which would result in impacts on target species populations similar to those that would occur under Alternative 1. However, impacts on target species under this alternative could be the same, less, or more than those of the proposed action depending on the level of effort expended by private persons. For the same reasons shown in the population impacts analysis in Section 4.1.1.1 it is unlikely that any target bird populations would be impacted significantly by implementation of this alternative. Technical grade DRC-1339 and A-C are currently only available for use by TWSP employees and, therefore, take with these chemicals would be nil. Use of Avitrol and Starlicide Complete, which contains the same chemical that is in DRC-1339, would likely increase. Under this alternative, the hypothetical use of illegal or unwise methods for BDM would be greatest of the alternatives because frustrations from the inability of resources owners to reduce losses would be highest because resource owners might not receive any assistance in resolving bird damage problems. The use of illegal or unwise chemicals or other BDM methods under this alternative as described in Sections 2.1.3 and 2.2.3 could lead to real but unknown impacts on target bird populations.

4.1.2 Effects of BDM on Nontarget Species Populations, Including T&E Species

Nontarget species can be impacted by BDM whether implemented by TWSP, other agencies, or the public. Impacts can range from direct take while implementing BDM methods to indirect impacts resulting from implementing BDM methods (e.g., birds entangled in netting meant only to keep them out of an area) and reduction of a bird species in a given area (positive impact on nesting song birds from the removal of brow-headed cowbirds where nest parasitism is high as discussed in Section 1.3.7). Measures are often incorporated into BDM to reduce impacts to nontarget species. Various factors may, at times, preclude use of certain methods, so it is important to maintain the widest possible selection of BDM tools for resolving bird damage problems. However, the BDM methods used to resolve damage must be legal and biologically sound. Often, but not always, impacts to nontarget species can be minimized. Where impacts occur, they are mostly of low magnitude in terms of nontarget species populations. Following is a discussion of the various impacts under the alternatives.

4.1.2.1 Alternative 1 - Continue the Current Federal BDM Program. From FY07 to FY11, WS lethally took 7 Mourning Doves and 1 Crested Caracara averaging the lethal take of 2 nontargets. TWSP also released 2 Crested Caracaras from FY07 to FY11. Additionally from FY07 to FY11, 100 feral Rock Pigeons were taken at a feedlot where they were being targeted with other methods, but taken as nontargets under the DRC-1339 Feedlot label and 1 Mallard and 2 Canada Geese were targeted with A-C for relocation, but accidentally died during their captures (target species, unintentionally taken). The annual average was 21 unintentional targets. The total take of nontargets by TWSP annually averaged 22 from FY07 to FY11. From FY94-FY06, TWSP also lethally took other species with most being associated with a Brown-headed Cowbird trapping program to protect Golden-cheeked Warblers and Black-capped Vireos, but take was very minimal and did not impact any species.

Nontarget take by TWSP has been minimal compared to target take, 0.01% of total take for FY07 to FY11, and would not impact any of these species populations. Take is analyzed in Section 4.1.1.1 for most of these species and none would be noticeably impacted because all of the species populations are relatively abundant. Although it was possible that some nontarget birds were unknowingly killed by use of DRC-1339 or Avitrol for starling, blackbird, pigeon, or House Sparrow control, the method of application is designed to minimize or eliminate that risk. For example, during projects where DRC-1339 was used, the appropriate type and size of bait material was selected to be the most acceptable to the target species. The treated bait is only applied after a period of prebaiting with untreated bait material and observation in which nontarget birds are not observed coming to feed at the site. In some cases, DRC-1339 is applied on elevated stands, platforms, or other restricted locations to further minimize potential impacts to ground feeding birds or any other animals. While every precaution is taken to safeguard against taking nontarget birds, at times, changes in local flight patterns and other unanticipated events can result in the incidental take of unintended species. This is particularly true for bait substrates preferred by nontarget species such as rice. However, even hazards to nontarget species with rice baits were found to be low (Cummings et al. 2003). These occurrences are rare and should not affect the overall populations of any species under the current program. TWSP documented only 2 DRC-1339 projects where nontargets were taken and included Mourning Doves and feral Rock Pigeons (take was analyzed in Section 4.1.1.1).

TWSP has the potential to provide beneficial impacts to species by conducting BDM for bird species that impact other wildlife species. The take of starlings and Brown-headed Cowbirds, as discussed in Section 1.3.7, could be beneficial at a very local level, but as described in Section 4.1.1.1, TWSP does not anticipate that populations of either species has been affected by BDM. BDM for these species would have to be focused during the nesting period when and where TWSP could reduce these species breeding populations during a critical time period, for example during the nesting season of the Black-capped Vireo or Golden-cheeked Warbler. The take of gulls or Great-tailed Grackles invading a nesting colony of Interior Least Terns or Sooty Terns could also be beneficial for these species. However, it would have to be focused specifically on gulls or grackles impacting the nesting colony. TWSP is currently conducting BDM for nesting colonial seabirds and the Attwater's Greater Prairie-Chicken, and for other species in the past, and these projects have been successful in reducing predation or other limiting factor for the T&E species population.

***T&E Species Impacts*.** TWSP has not had an impact on any federally listed T&E or candidate species (Tables 5 and 6) in Texas from FY93 to FY11. T&E species and potential impacts were discussed in Section 2.1.2 and mitigation measures to avoid T&E impacts were described in Section 3.5.2.2. TWSP believes that the BDM program will have no effect on T&E species. The inherent safety features of most BDM methods such as DRC-1339 has precluded or minimized hazards to listed species. A formal risk assessment was conducted on the use of DRC 1339 and other methods used in BDM and found minimal hazards to nontarget species (USDA 1997, Appendix P). Those measures and characteristics should assure there would be no jeopardy to T&E species or adverse impacts on mammalian or non-T&E bird scavengers from the proposed action. Of the methods used in BDM, potential effects on T&E species would most likely occur with frightening devices, mist nets, cage or live traps, and potentially toxicants. None of the other control methods described in the proposed action alternative pose any hazard to nontarget or T&E species. Examples of potential benefits to a listed T&E species would be the reduction of local cowbird populations which could reduce nest parasitism on the endangered Southwestern Willow Flycatcher, Black-capped Vireo, and Golden-cheeked Warbler, or the management of birds that could directly predate on adult Interior Least Terns, their nests, eggs or young, as discussed above.

Other sensitive species in Texas were given in Section 2.1.2.3 and those bird species are denoted in Appendix C. Other than the sensitive species targeted during BDM, discussed in Section 4.1.1.1, TWSP has not had any impacts on them from FY93 to FY11. TWSP anticipates that BDM will not have more than a minor impact on any such species, and are more likely to be taken as targets in BDM with the appropriate permits and consultations.

4.1.2.2 Alternative 2 - Nonlethal BDM by TWSP Only. Under this alternative, TWSP would have the potential to kill few nontarget animals because lethal methods would not be used. Some nonlethal BDM methods have the potential to take nontarget species such as from entanglement in netting, but even so, nontarget take by TWSP would be minimal and less than under the proposed action. However, TWSP took few nontarget species from FY07 to FY11, and therefore, nontarget take would not differ substantially from the current program. TPWD or AgriLife Extension would likely provide some level of professional BDM assistance with lethal control activities, but this would be limited by resources (i.e., personnel, funding, etc.) without federal assistance. TPWD or AgriLife Extension take of nontarget species would likely be similar to TWSP's and be minimal. On the other hand, individuals and organizations whose bird damage problems were not effectively resolved by nonlethal control methods alone would likely resort to other means of lethal control such as use of shooting by private persons or use of chemical toxicants. This could result in less experienced persons implementing control methods and could lead to greater take of nontarget wildlife than the proposed action. For example, shooting by persons not proficient at bird and damage identification could lead to killing of nontarget birds. It is hypothetically possible that frustration caused by the inability to reduce losses could lead to illegal use of chemical toxicants or unwise use of BDM methods which could lead to unknown impacts on local nontarget species populations, including T&E species. Hazards to raptors, including Bald Eagles and falcons, could therefore be greater under this alternative if chemicals, that are less selective or that cause secondary poisoning, are used by frustrated private individuals. Therefore, it is likely that nontarget take under this alternative would be greater than under the proposed action and could include T&E and sensitive species.

4.1.2.3 Alternative 3 – TWSP Provides Technical Assistance Only for BDM. Alternative 3 would not allow TWSP to conduct any direct operational BDM in Texas and, therefore, TWSP would not have an impact on nontarget or T&E species. AgriLife Extension or TPWD would likely provide some level of professional BDM assistance, but this would be limited by resources (i.e., personnel, funding, etc.) without federal assistance. Their BDM efforts would likely result in similar levels of nontarget species take as that of WS which has been minimal. WS would provide technical assistance or self-help information at the request of producers and others. This technical support might lead to selective use of control methods by private parties, more than that which might occur under Alternative 4, but private efforts to reduce or prevent depredations could still result in less experienced persons implementing control methods leading to greater take of nontarget wildlife than under the proposed action. The take of nontarget species would likely be more than under Alternative 2 because TWSP would not provide any operational support to resolve damage problems. It is hypothetically possible that, probably to a greater extent than under Alternative 2, frustration caused by the inability to reduce losses could lead to illegal use of chemical toxicants which could lead to unknown impacts on local nontarget species populations, including some T&E species. Hazards to raptors, including Bald Eagles, fish, aquatic species, and other nontarget species could therefore be greater under this alternative if chemicals are used by frustrated private individuals that cause secondary poisoning, leach into wetlands, and kill indiscriminately.

4.1.2.4 Alternative 4 - No Federal TWSP BDM. Under this alternative, neither TWSP nor any other federal agency would provide assistance with BDM and, therefore, would not have an effect on nontarget, T&E, or sensitive species. USDA (1997, pg. 4-8) demonstrated that under the no federal program alternative, more nontarget animals would be affected. AgriLife Extension or TPWD would likely provide some level of professional BDM assistance, but could be limited by resources (i.e., personnel, etc.) without federal assistance. Private efforts to reduce or prevent depredations would increase the most under this alternative. This would result in less experienced persons implementing BDM methods leading to a greater take of nontarget wildlife (potentially including T&E species) than under the current program or any of the other Alternatives. This is partially due to the lack of using SOPs to minimize nontarget take such as TWSP's self-imposed restrictions and policies to minimize or nullify nontarget take. As described in Sections 2.1.3 and 2.2.3, the hypothetical use of chemical toxicants and illegal BDM methods could impact nontarget species populations, including T&E species, under this alternative. It is, therefore, likely that more impacts to nontarget species would occur under this alternative than the current program and the other alternatives. Use of illegal chemicals and other methods could lead to significant, but unknown, impacts, especially to sensitive species.

4.1.3 Effects of BDM on Public and Pet Safety and the Environment

The public, pets, and the environment can be impacted by BDM whether implemented by TWSP, other agencies, or the public. Impacts can range from direct injury while implementing BDM methods to indirect impacts resulting from implementing BDM methods (e.g., impacts to water quality from chemicals used in BDM leaching into the system). Measures are often incorporated into BDM to minimize or nullify risks to the public, pets, and the environment. Various factors may, at times, preclude use of certain methods, so it is important to maintain the widest possible selection of BDM tools for resolving bird damage problems. However, the BDM methods used to resolve bird damage must be legal and biologically sound. Following is a discussion of the various impacts under the Alternatives.

4.1.3.1 Alternative 1 - Continue the Current Federal BDM Program. BDM methods that might raise safety concerns include the use of firearms, pyrotechnics for hazing, traps, cage traps, and chemical repellents, toxicants, drugs, and reproductive inhibitors. TWSP poses minimal threat to people, pets and the environment with BDM methods such as shooting, hazing with pyrotechnics, trapping, and use of chemicals (USDA 1997, Appendix P). All firearm and pyrotechnic safety precautions are followed by TWSP when conducting BDM and TWSP complies with all applicable laws and regulations governing the lawful use of firearms. Shooting with shotguns or rifles is used to reduce bird damage when lethal methods are determined to be appropriate. Shooting is selective for target species. Firearms are only used by TWSP personnel who are experienced in handling and using them. Firearm use is very sensitive and a public concern because firearms can be misused. To ensure safe use and awareness, TWSP employees who use firearms to conduct official duties "*. . . will be provided safety and handling training as prescribed in the WS Firearms Safety Manual and continuing education training on firearms safety and handling will be taken biennially by all employees who use firearms*." (WS Directive 2.615). TWSP Specialists, who use firearms as a condition of employment, are required to certify that they meet the criteria as stated in the Lautenberg Amendment. TWSP also follows safety precautions and WS Policies when using pyrotechnics. TWSP uses a variety of traps for birds such as decoy cage traps. These are strategically placed to minimize exposure to the public and pets. Appropriate signs are posted on all properties where traps are set to alert the public of their presence. TWSP has had no accidents involving the use of firearms, pyrotechnics or traps in which a member of the public or a pet was harmed. A formal risk assessment of WS' operational management methods found that risks to human safety were low (USDA 1997, Appendix P). Therefore, no significant impact on human safety from WS' use of non-chemical BDM methods is expected.

TWSP personnel that use avian toxicants are certified through TDA. Three avian toxicants have been used in BDM by TWSP, DRC-1339, Avitrol, and SLS. Additionally, an insecticide, deltamethrin, was used to reduce insect abundance on an airfield to reduce bird aircraft strikes. Immobilization and euthanasia drugs are used only by TWSP personnel trained and certified to use them per WS policy. TWSP personnel abide by WS policies and SOPs, and federal and state laws and regulations when using BDM methods that have potential risks. The same would apply to immunocontraceptives should they become registered for use in Texas. USDA (1997, Appendix P) conducted a risk assessment on WS's use of BDM methods and concluded that they had minimal hazards to the public, pets, and the environment.

<u>DRC-1339 (3-chloro-p-toluidine hydrochloride)</u>. DRC-1339 is the primary lethal chemical BDM method that would be used under the current program alternative. TWSP used an average of about 3.4 pounds of DRC-1339 from FY07 to FY11 with a high of 4.7 pounds used in FY10 (Table 7). There has been some concern expressed by a few members of the public that unknown but significant risks to human health may exist from DRC-1339 used for BDM.

DRC-1339 is one of the most extensively researched and evaluated pesticides ever developed in the field of wildlife management. Over 30 years of studies have demonstrated the safety and efficacy of this compound. USDA (1997, Appendix P) provides detailed information on this chemical and its use in BDM. Factors that virtually eliminate any risk of public health problems from use of this chemical are:

- Federal label and State law requires that the chemical be applied only by an individual trained and certified in its use; that the chemical be applied under strict guidelines in regard to suitable locations and bait materials to be used.

- DRC-1339 is highly unstable and degrades rapidly when exposed to sunlight, heat, or ultraviolet radiation. The half-life is about 25 hours, which means that the chemical on treated bait material generally is nearly 100% broken down within a week.

- The chemical is more than 90% metabolized in target birds within the first few hours after they ingest the bait. Therefore, little material is left in bird carcasses that may be found or retrieved by people.

- The application rates are extremely low (< 0.1 lb. of active ingredient per acre) (EPA 1995).

- People or pets would need to ingest the internal organs of birds found dead from DRC-1339 to have any chance of receiving even a minute amount of the chemical or its metabolites into their system. This is highly unlikely to occur with people and pets could not likely eat enough dead birds to receive a lethal dose.

- EPA concluded that, based on studies of mutagenicity (the tendency to cause gene mutations in cells), this chemical is not a mutagen or a carcinogen (i.e., cancer-causing agent) (EPA 1995). Regardless, however, the extremely controlled and limited circumstances in which DRC-1339 is used would prevent any exposure of the public to this chemical.

The above analysis indicates that human health risks from DRC-1339 use would be virtually nonexistent under any alternative.

Avitrol® (Avitrol Corp., Tulsa, OK)[14]. Avitrol is another chemical method that is used by TWSP in BDM. TWSP used an average of 3.9 pounds of prepared bait materials (0.3 oz. of active ingredient) from FY07 to FY11 with a high of 8.9 pounds (0.7 oz. of active ingredient) in FY08. Although this chemical was not identified as being one of concern for human health effects, analysis of the potential for adverse effects is presented here. USDA (1997, Appendix P) provides more detailed information on this chemical.

Avitrol is available as a prepared grain bait mixture that is mixed in with clean bait at no greater than a 1:1 and 1:9 treated to untreated mixture for pigeons and blackbirds, respectively. Recent use has been extremely limited by TWSP, especially in FY11 when the manufacturer closed the business. In addition to this factor, other factors that virtually eliminate health risks to members of the public from use of this product are:

- Federal label and State law requires that the chemical be applied only by an individual trained and certified in its use; that the chemical be applied under strict guidelines.

[14] Avitrol Corporation was closed from 10/2010 to 11/2011, until new owners took over the business. During that time, stockpiles of Avitrol could be used, but the manufacturer was no longer selling the product. TWSP did not use any Avitrol during this time (FY11). It remains registered in Texas for use by TWSP and others.

- It is readily broken down or metabolized into removable compounds that are excreted in urine in the target species (Extension Toxicology Network 1996). Therefore, little of the chemical remains in killed birds to present a hazard to humans.

- A human would need to ingest the internal organs of birds found dead from Avitrol ingestion to have any chance of receiving even a minute amount of the chemical or its metabolites into his/her system. This is highly unlikely to occur. Furthermore, secondary hazard studies with mammals and birds have shown that there is virtually no hazard of secondary poisoning.

- Although Avitrol has not been specifically tested as a cancer-causing agent, though it is plausible, the chemical was found not to be mutagenic in bacterial organisms (EPA 2012). Therefore, the best scientific information available indicates it is not a carcinogen. Regardless, however, the extremely controlled and limited circumstances in which Avitrol is used would prevent exposure of members of the public and pets to this chemical.

The above analysis indicates that human health risks from Avitrol use would be virtually nonexistent under any alternative as used per label instructions.

Sodium Lauryl Sulfate. SLS, (Stepanol® WA-Extra PCK, Stepan Co., Northfield IL) is considered a minimum-risk pesticide because it actually has about little toxic properties as a chemical with the exception that it is moderately toxic to aquatic organisms and possibly harmful to some plants. SLS is a surfactant commonly used in soap products. When applied to birds, SLS allows water to penetrate and saturate the feathers so that with low temperatures (<41 °F) and sufficient water, birds die of hypothermia. It works by washing oils off the bird feathers. It must be used in upland situations, basically to keep SLS from entering wetland ecosystems with permanent water bodies. It was exempt from FIFRA requirements because the pesticide satisfied certain conditions. In general, conditions claiming that a pesticide should be exempt from registration under FIFRA Section 25(b) are that claims cannot be made regarding control of public-health pests, and the product cannot be used on food or feed crops. SLS (Chemical Abstract Service No. 151-21-3) was included on the list of 31 exempt compounds. SLS can be used to control starlings, most blackbird species, crows, magpies, and ravens. TWSP used an average of 8 gallons from FY07 to FY11, all in FY09 (40 gallons) (Table 7). TWSP anticipates using this method in the future, especially to control starling and blackbird roosts in urban areas.

Other BDM Chemicals. As discussed in Section 3.3.1.3, TWSP could use registered rodenticides and insecticides to reduce the attractiveness of areas, particularly airports, where insects and rodents often attract bird species hazardous to aircraft. From FY07 to FY11, TWSP used an average of 81 pounds of deltamethrin, an insecticide, with a high of 203 pounds in FY10; TWSP had no know effects to nontargets, people, pets, or the environment following label restrictions.

Nonlethal BDM chemicals that might be used or recommended by TWSP include repellents such as methyl anthranilate (MA is the artificial grape flavoring used in foods and soft drinks sold for human consumption), which has been used as an area repellent and is currently being researched as a livestock feed additive, tactile polybutene repellents, nicarbazin (OvoControlTM G) reproductive inhibitor, and A-C. TWSP only used an average of 0.62 oz. of A-C from FY07 to FY11 in Texas. The only nontargets taken were actually targets that succumbed to the tranquilizer while being held prior to relocation; TWSP had the unintentional deaths of 2 target Canada Geese and 1 target Mallard during routine operations (sometimes a target animal will acquire two doses of the baits which can be fatal). Other than that, TWSP had no known effects on people, pets, nontarget species, or the environment using chemicals.

> Such chemicals must undergo rigorous testing and research to prove safety, effectiveness, and low environmental risks before they would be registered by EPA or FDA. Any operational use of these chemicals would be in accordance with labeling requirements under FIFRA and state pesticide laws and regulations which are established to avoid unreasonable adverse effects on the environment. Following labeling requirements and use restrictions are a built-in mitigation measure that would assure that use of registered chemical products would avoid significant adverse effects on human health. As discussed, TWSP only used deltamethrin and A-C operationally from FY07 to FY11.

Based on a thorough Risk Assessment, APHIS concluded that, when WS program chemical methods are used in accordance with label directions, they are highly selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997, Appendix P). TWSP did not have any known incidents involving the public or pets conducting BDM from FY07 to FY11.

Thus, TWSP poses minimal risks to public and pet health and safety when implementing BDM. In fact, TWSP can reduce public safety hazards. Many TWSP BDM projects have been to reduce the potential for bird strikes with aircraft at airports and a reduction in roosting birds that pose a threat to people from disease. Several BDM projects have been conducted to remove roosting birds such as pigeons from residential areas where the birds and their droppings are a potential disease source. Thus, this alternative would reduce threats to public health and safety by removing birds from sites where they pose a potential strike hazard to aircraft or have the potential of transmitting a disease.

4.1.3.2 Alternative 2 - Nonlethal BDM by TWSP Only. Alternative 2 would not allow for any lethal methods use by TWSP. TWSP would only implement nonlethal methods such as harassment with shooting firearms and pyrotechnics, live traps, repellents (e.g., MA and polybutene tactile repellents), tranquilizing drugs (A-C), and reproductive inhibitors (nicarbazin). As discussed under Alternative 1, use of these BDM devices is not anticipated to have more than minimal risks to the public, pets, and the environment. The public is often especially concerned with the use of chemicals. The nonlethal chemicals that could be used by TWSP in BDM, excluding toxicants, were discussed above and not expected to impact the public, pets, or the environment. Such chemicals must undergo rigorous testing and research to prove safety, effectiveness, and low environmental risks before they would be registered by EPA or FDA. Any operational use of chemical repellents and tranquilizer drugs would be in accordance with labeling requirements under FIFRA and state pesticide laws and regulations and FDA rules which are established to avoid unreasonable adverse effects on the environment. Following labeling requirements and use restrictions is a built-in mitigation measure that would assure that use of registered chemical products would avoid significant adverse effects on human health and pet safety.

TPWD or AgriLife Extension would likely provide some level of professional BDM assistance with lethal control activities, but this would be limited by resources (i.e., personnel, funding, etc.) without federal assistance. The impact on human and pet health and safety from TPWD or AgriLife Extension activities would likely be similar to WS's and be minimal. Excessive cost or ineffectiveness of nonlethal techniques could result in some individuals or entities to reject TWSP's assistance and resort to lethal BDM methods. Private efforts to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing lethal BDM methods such as use of firearms and leading to greater risks than under Alternative 1. However, because some of these private parties would be receiving advice and instruction from WS, concerns about human health risks from firearms and chemical BDM methods use should be less than under Alternative 3 or 4. Commercial pest control services would be able to use Avitrol and Starlicide Complete (where available) and such use would likely occur more often in the absence of TWSP's assistance than under Alternative 1. Use of these chemicals in accordance with label requirements should avoid any hazard to members of the public. It is hypothetically possible that frustration caused by the inability to alleviate bird damage could lead to illegal use of certain methods such as toxicants that, unlike TWSP's controlled use of DRC-1339 and Avitrol, could pose secondary poisoning hazards to pets and to mammalian and avian scavengers. Some chemicals that could be used illegally would present greater risks of adverse effects on humans than those used under the current program alternative.

4.1.3.3 Alternative 3 - TWSP Provides Technical Assistance Only for BDM. Alternative 3 would not allow any direct operational BDM assistance by TWSP in the State. TWSP would only provide advice and, in some cases, equipment or materials (i.e., by loan or sale) to other persons who would then conduct their own damage management actions. Concerns about human health risks from TWSP implementing BDM under this alternative would be nullified. Additionally, DRC-1339 and A-C are only registered for use by TWSP personnel and would not be available for use by private individuals; Avitrol and Starlicide Complete are registered in Texas and available to private pesticide applicators. TPWD or Extension would likely provide some level of professional BDM assistance with BDM and use methods that have risks associated with them. The impact on human and pet health and safety from state agency activities would likely be similar to TWSP's and be minimal. Private efforts to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing damage management methods and leading to a greater risk than the Proposed Action Alternative. However, because some of these private parties would be receiving advice and instruction from TWSP, people, pets, and the environment may not be as at great a risk compared to persons using hazardous BDM methods with no instruction, similar to that discussed under Alternative 4. TPWD or AgriLife Extension may provide some services and risks from BDM method use would be similar to the proposed action for projects they completed. Commercial pest control services would be able to use Avitrol and Starlicide Complete and such use would likely occur to a greater extent in the absence of TWSP's assistance. Use of Avitrol and Starlicide Complete in accordance with label requirements should avoid any hazard to members of the public and pets. It is hypothetically possible that frustration caused by the inability to alleviate bird damage, as discussed in Sections 2.1.3 and 2.2.3, could lead to illegal use of certain toxicants that, unlike TWSP's controlled use of firearms, pyrotechnics, traps, and chemicals, could pose secondary poisoning hazards to pets and to mammalian and avian scavengers. Some chemicals that could be used illegally would present greater risks of adverse effects to humans and the environment, than those used under the Current Program Alternative. Therefore, risks to people, pets, and the environment would be expected to be greater under this alternative than the proposed action, but similar and possibly greater than Alternative 2. Risks, though, would be less than under Alternative 4.

4.1.3.4 Alternative 4 - No Federal TWSP BDM. Alternative 4 would not allow TWSP or any other federal agency to conduct BDM in the State. Therefore, concerns about risks to people, pets, and the environment from TWSP would be nullified. In addition, DRC-1339 and A-C, registered for use only for TWSP personnel, would not be available for use by private individuals. TPWD or AgriLife Extension would possibly provide some level of professional BDM and their actions and associated risks would be similar to Alternative 1; state agency employees that are licensed applicators could use Avitrol and Starlicide Complete for BDM projects under this Alternative to provide assistance with particular projects. Private efforts to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing BDM methods and potentially leading to greater risks to people, pets, and the environment as has been described under the alternatives. Commercial pest control services would be able to use Avitrol, Starlicide Complete, and other available pesticides and requests for such use would likely be greater than present in the absence of TWSP's assistance. However, use of Avitrol or other BDM chemicals in accordance with label requirements should avoid any hazard to members of the public. It is hypothetically possible that frustration caused by the inability to alleviate bird damage could lead to the use of illegal methods such as certain toxicants that could pose risks to people, pets, and the environment and these risks would likely be highest under this alternative compared to the other three. Therefore, BDM methods and their associated risks, and illegal activities would be greater under this alternative than under Alternatives 1, 2, and 3.

4.1.4 Effects of BDM on Aesthetics

Aesthetics is the philosophy dealing with the nature or appreciation of beauty. Therefore, aesthetics is truly subjective in nature and wholly dependent on what an observer regards as beautiful. On the one hand, birds are often regarded as being aesthetic. In addition, birds can provide economic and recreational benefits (Decker and Goff 1987), and the mere knowledge that they exist is a positive benefit to many people. Wildlife populations provide a range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive use (i.e. wildlife-related recreation, observation, harvest, sale), indirect benefits derived from vicarious wildlife related experiences (i.e., reading, television viewing), and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (i.e., ecological, existence, bequest values) (Bishop 1987). These positive traits of wildlife generally become incorporated into their overall aesthetic value.

On the other hand, aesthetics also includes the environment in which people live including public and private lands. The same wildlife populations that are enjoyed by many can also create conflict with a number of land uses and human health and safety. The activities of some wildlife, such as starlings and blackbirds, result in economic losses to agriculture and damage to property. Human safety is jeopardized by wildlife collisions with aircraft, and wild animals may harbor diseases transmissible to humans. Damage by, or to, wildlife species that have special status, such as T&E species, is a public concern. Certain species of wildlife are regarded as nuisances in certain settings. Some people do not enjoy viewing the local environment with excessive bird excrement covering walkways, lawns and structures. These are negative values associated with birds and damages they can inflict.

Public reaction is variable and mixed because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts and problems between humans and wildlife. The population management (capture and euthanasia) method provides relief from damage or threats to human health or safety to urban people who would have no relief from such damage or threats if nonlethal methods were ineffective or impractical. Many people directly affected by problems and threats to human health or safety caused by birds insist upon their removal from their property or public location when the wildlife acceptance capacity is exceeded. Some people have the view that birds should be captured and relocated to a rural area to alleviate damage or threats to human health or safety. Some people directly affected by the problems caused by birds strongly oppose the removal of the birds regardless of the amount of damage. Individuals not directly affected by the harm or damage may be supportive, neutral, or totally opposed to any removal of birds such as pigeons from specific locations or sites. Some of the totally opposed people want to teach tolerance for bird damage and threats to human health or safety, and that birds should never be captured or killed. Some of the people who oppose removal of birds do so because of human-affectionate bonds with individual birds such as pigeons or magpies. These human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment.

Human dimensions of wildlife management include identifying how people are affected by conflicts between them and wildlife, attempting to understand people's reactions, and incorporating this information into policy and management decision processes and programs (Decker and Chase 1997). Wildlife acceptance capacity is the limit of human tolerance for wildlife or the maximum number of a given species that can coexist compatibly with local human populations. Wildlife acceptance capacity is also known as the cultural carrying capacity. This primarily involves wildlife aesthetics and acceptance of their management. These terms are important in urban areas because they define the sensitivity of a local community to a specific wildlife species. For any given damage situation, thresholds for those directly and indirectly affected by the damage will vary. This damage threshold is a primary factor in determining the wildlife acceptance capacity. Once this wildlife acceptance capacity is met or exceeded, people will begin to implement population control methods, including capture and euthanasia, to alleviate property damage and human health or safety threats related to the accumulation of fecal droppings.

4.1.4.1 Alternative 1 - Continue the Current Federal BDM Program. Some people who routinely view or feed individual birds such as feral domestic pigeons or urban waterfowl would likely be disturbed by removal of such birds under the current program. TWSP is aware of such concerns and considers this issue seriously prior to implementing BDM. In some projects, mitigation measures can be incorporated into BDM to reduce or nullify impacts. For example, in urban situations where waterfowl are damaging resources, TWSP could selectively capture the target species (coots, ducks, geese, etc.) utilizing A-C or trapping without disturbing the other waterfowl species that are present and deemed enjoyable to the public. This strategy could also be used on individual birds that could be creating a damage problem. This type of consideration can help to mitigate adverse effects on local peoples' enjoyment of certain individual birds or groups of birds.

Some people have expressed opposition to the killing of any birds during BDM activities. Under the current program, lethal and nonlethal control of birds would continue and these persons would continue to be opposed to killing birds in BDM. However, many persons who voice opposition have no direct connection or opportunity to view or enjoy the particular birds that would be killed by TWSP's lethal control activities. Lethal control actions would generally be restricted to local sites and to small, unsubstantial percentages of overall populations. Therefore, the species subjected to limited lethal control actions would remain common and abundant and would, therefore, continue to remain available for viewing by persons with that interest.

Some people do not believe that geese, herons, and egrets or nuisance blackbird or starling roosts should even be harassed to stop or reduce damage problems. Some people who enjoy viewing birds could feel their interests are harmed by TWSP's nonlethal bird harassment activities. Mitigating any such impact, however, is the fact that overall numbers of birds in the area would not be diminished by the harassment program and people who like to view these species could still do so on State wildlife management areas, National Wildlife Refuges, or on numerous private property sites where the owners are not experiencing damage to the birds and are tolerant of their presence.

Under this alternative, operational assistance in reducing nuisance pigeon and other bird problems in which droppings from the birds cause unsightly mess would improve aesthetic values of affected properties in the view of property owners and managers.

Relocation of nuisance roosting or nesting populations of birds (e.g., blackbird/starling roosts, vulture roosts) with harassment can sometimes result in the birds causing the same or similar problems at the new location. If TWSP is providing direct operational assistance in relocating such birds, coordination with local authorities to monitor the birds' movements is generally conducted to assure they do not reestablish at other undesirable locations.

Therefore, we believe that bird populations will not be impacted under this alternative and people will have continued opportunities to see and enjoy wildlife. At the same time, those that find wildlife undesirable at specific locations (e.g., geese on golf courses) would be able to enjoy the site without specific types of damages (e.g., excrement on walkways and fairways). Thus, the broadest satisfaction would likely be available under this alternative.

4.1.4.2 Alternative 2 - Nonlethal BDM by TWSP Only. Under this alternative, TWSP would not conduct any lethal BDM but would still conduct harassment of birds that cause damage. Some people who oppose lethal control of wildlife by government but are tolerant of government involvement in nonlethal BDM would favor this alternative. Persons who have developed affectionate bonds with individual wild birds would not be affected by TWSP's activities under this alternative because the individual birds would not be killed by WS. However, other private entities would likely conduct similar

BDM activities as those that would no longer be conducted by TWSP which means the impacts would then be similar to the current program alternative.

Under this alternative, TWSP would be restricted to nonlethal methods only. Nuisance pigeon problems would have to be resolved by nonlethal barriers and exclusion methods. Assuming property owners would choose to allow and pay for the implementation of these types of methods, this alternative would result in nuisance pigeons and other birds relocating to other sites where they would likely cause or aggravate similar problems for other property owners. Thus, this alternative would most likely result in more property owners experiencing adverse effects on the aesthetic values of their properties than the current program alternative. Many of the current materials for used barriers (netting, metal flashing, wire, etc.) could, in some cases, reduce the aesthetic property value.

Thus, it is anticipated that bird populations would not be impacted under this alternative, but some people may have more problems with bird damage than under the proposed action.

4.1.4.3 Alternative 3 - TWSP Provides Technical Assistance Only for BDM. Under this alternative, TWSP would not conduct any direct operational BDM but would still provide technical assistance or self-help advice to persons requesting assistance with bird damage. TWSP would also not conduct any harassment of geese, egrets, herons and other birds that were causing damage. Some people who oppose direct operational assistance in BDM by the government but favor government technical assistance would favor this alternative. Persons who have developed affectionate bonds with individual wild birds would not be affected by TWSP activities under this alternative because the individual birds would not be killed or harassed by TWSP. However, other private entities would likely conduct similar BDM activities as those that would no longer be conducted by TWSP which means the impacts would then be similar to the current program alternative.

Under this alternative, the lack of operational assistance in reducing nuisance pigeon and other bird problems would mean aesthetic values of some affected properties would continue to be adversely affected but this would not occur to as great a degree as under the No Program Alternative. This is because some of these property owners would be able to resolve their problems by following TWSP's technical assistance recommendations.

Relocation of birds damaging crops (e.g., geese hazing program to protect crops) and nuisance roosting or nesting population of birds (e.g., blackbird/starling roosts, vulture roosts) through harassment, barriers, or habitat alteration can sometimes result in the birds causing the same problems at the new location. If TWSP has only provided technical assistance to local residents or municipal authorities, coordination with local authorities to monitor the birds' movements to assure the birds do not reestablish in other undesirable locations might not be conducted. In such cases, limiting TWSP to technical assistance only could result in a greater chance of adverse impacts on aesthetics of property owners at other locations than the current program alternative.

Thus under this Alternative, we anticipate that the effects would be similar to that that would occur under Alternative 2.

4.1.3.4 Alternative 4 - No Federal TWSP BDM. Under this alternative, TWSP would not conduct any lethal removal of birds nor would the program conduct any harassment of geese, egrets, herons and other birds. Persons who have developed affectionate bonds with individual wild birds would not be affected by TWSP under this alternative. However, other private entities would likely conduct similar BDM activities as those that would no longer be conducted by TWSP which means the impacts would then be similar to the current program alternative.

Under this alternative, the lack of TWSP support in BDM in reducing nuisance pigeon and other bird problems where droppings from the birds cause unsightly messes would mean aesthetic values of some affected properties would continue to be adversely affected if the property owners were not able to achieve BDM some other way. In many cases, this type of aesthetic "damage" would worsen because property owners would not be able to resolve their problems and bird numbers would continue to increase.

We believe that this Alternative would have the highest possible effects under this Alternative. Unaesthetic damage would be greatest. Additionally, as described in Sections 2.1.3 and 2.2.3, the hypothetical use of chemical toxicants and illegal or unwise BDM methods could impact target as well as nontarget species populations, including T&E species, under this alternative. It is, therefore, likely that more impacts to aesthetics would occur under this alternative than the current program and the other alternatives. Use of illegal chemicals and other methods could lead to significant, but unknown, impacts, especially to sensitive species.

4.2 SUMMARY AND CONCLUSION

The environmental effects of implementing BDM in Texas, as described herein, corresponds with the findings of other EAs (WS 1996, 1998, 1999, 2001, 2006, 2008, 2009). Impacts associated with activities under consideration here are not expected to be "significant." Based on experience, impacts of the BDM methods and strategies considered in this document are very limited in nature. The addition of those impacts to others associated with past, present, and reasonably foreseeable future actions, will not result in cumulatively significant environmental impacts. Monitoring the impacts of the program on the populations of both target and nontarget species will continue. All bird control activities that may take place will comply with relevant laws, regulations, policies, orders, and procedures, including the Endangered Species Act, Migratory Bird Treaty Act, and FIFRA. A summary of the overall effects of the BDM alternatives relative to the issues is given in Table 33. The current program alternative provides the lowest overall negative environmental consequences combined with the highest positive effects.

Table 33. A summary of the environmental consequences of each program alternative relative to each issue.

Issue		Potential Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Target Spp.		Non-Sensitive	0	0	0	0
		Sensitive	0	0	0	-/0
Nontarget Spp.		Non-Sensitive	0	0	0	0
		Sensitive	0/++	-/+	-/0	-/0
Risks	Adverse	People & Pets	-/0	--/0	--/0	--/0
		Environment	-/0	--/0	--/0	--/0
	Beneficial	People & Pets	++	+	+	0/+
Aesthetics		Enjoyment	-/0	-/0	-/0	-/0
		Damage	++	0/+	0/+	-/+

Ratings: "- -" = High Negative; "-" = Low Negative; "0" = None; "+" = Low Positive, and "++" = High positive.
Note: While a control action or removal might have a negative effect on that individual animal, group of animals, or issue, removing an individual bird or group of birds could also have a positive effect on the resource being protected such as a T&E species.

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APPENDIX A – POPULATION ESTIMATES

Population estimates for species taken lethally by TWSP in BDM with an average of more than 10 from FY07 to FY11. The estimates are given for the Central Plain States (CPS) (Texas, Oklahoma, Kansas, Nebraska, South Dakota, and North Dakota) for migratory species and in only Texas for the more sedentary species, species taken primarily during the breeding season, or species that are only found in Texas and south. The estimates are based on 2007-2011 BBS raw data (USGS 2012) and Partners in Flight (PIF) adjustment factors for estimating populations (Rich et al. 2004). The adjustment factors for estimating populations were used by RMBO (2007) to estimate landbird populations from 1990 BBS data. In addition, BBS population trends are given for the individual CPS States, Central BBS area (CBBS), and BBS surveywide area (SWBBS) for the period 1966-2010 (Sauer et al. 2011) with those in bold font that are significant.

Table A1. Red-winged Blackbird Population Estimate FY07-FY11.

State	Size (mi^2)	RMBO (2007)	Ave Count FY07-FY11	PIF Adjust	Est. Breeding Population	Trend 1966-2010
Kansas	82,282	7,900,000	79.565	9.07	6,049,347	-0.3
Nebraska	77,358	5,200,000	83.541	9.07	5,969,285	-0.3
North Dakota	70,704	11,000,000	222.978	9.07	14,561,349	-0.2
Oklahoma	69,903	3,000,000	25.460	9.07	1,644,396	-0.5
South Dakota	77,121	7,500,000	79.362	9.07	5,652,722	-0.3
Texas	268,601	12,000,000	39.816	9.07	2,347,609	**-2.2**
Pop. Est. for CPS		46,600,000			36,224,708	**CBBS: -0.6**
						SWBBS: -0.9

Table A2. Brown-headed Cowbird Population Estimate FY07-FY11.

State	Size (mi^2)	RMBO (2007)	Ave Count FY07-FY11	PIF Adjust	Est. Breeding Population	Trend 1966-2010
Kansas	82,282	2,800,000	39.416	9.44	3,117,052	-0.4
Nebraska	77,358	2,300,000	29.453	9.44	2,190,358	-0.3
North Dakota	70,704	6,000,000	84.105	9.44	5,716,447	+0.6
Oklahoma	69,903	1,500,000	19.791	9.44	1,329,582	**-1.3**
South Dakota	77,121	3,300,000	54.995	9.44	4,072,619	**+1.3**
Texas	268,601	3,500,000	12.036	9.44	3,106,991	**-1.9**
Pop. Est. for CPS		19,400,000			19,533,049	CBBS: -0.1
						SWBBS: -0.6

Table A3. Great-tailed Grackle Population Estimate FY07-FY11.

State	Size (mi^2)	RMBO (2007)	Ave Count FY07-FY11	PIF Adjust	Est. Breeding Population	Trend 1966-2010
Kansas	82,282	100,000	1.378	10.55	121,815	**+8.7**
Nebraska	77,358	700	0.195	10.55	16,204	+45.4
North Dakota	70,704	0	-	10.55	0	-
Oklahoma	69,903	200,000	0.597	10.55	44,849	-1.6
South Dakota	77,121	10	0.234	10.55	19,382	-
Texas	268,601	6,000,000	23.605	10.55	6,812,239	**+2.4**
Pop. Est. for CPS		6,300,710			7,014,489	**CBBS: +2.5**
						SWBBS: +2.8

Table A4. Common Grackle Population Estimate FY07-FY11.

State	Size (mi^2)	RMBO (2007)	Ave Count FY07-FY11	PIF Adjust	Est. Breeding Population	Trend 1966-2010
Kansas	82,282	4,700,000	24.275	11.15	2,268,489	**-1.6**
Nebraska	77,358	3,900,000	60.289	11.15	5,295,795	-0.4
North Dakota	70,704	4,500,000	56.436	11.15	4,530,719	**+1.7**
Oklahoma	69,903	2,000,000	6.967	11.15	553,072	-1.3
South Dakota	77,121	3,300,000	46.312	11.15	4,055,116	+0.2
Texas	268,601	4,300,000	7.273	11.15	2,218,650	+0.7
Pop. Est. for CPS		22,700,000			18,921,841	**CBBS: -1.2**
						SWBBS: -1.6

Table A5. Brewer's Blackbird Population Estimate FY07-FY11.

State	Size (mi^2)	RMBO (2007)	Ave Count FY07-FY11	PIF Adjust	Est. Breeding Population	Trend 1966-2010
Kansas	82,282	0	-	9.81	0	-
Nebraska	77,358	18,000	0.585	9.81	45,203	+10.1
North Dakota	70,704	700,000	12.812	9.81	904,948	**+3.7**
Oklahoma	69,903	0	-	9.81	0	-13.5
South Dakota	77,121	160,000	2.275	9.81	175,279	+2.2
Texas	268,601	0	0.001	9.81	342	-
Pop. Est. for CPS		878,000			1,125,772	**CBBS: -0.6**
						SWBBS: -2.1

Table A6. Yellow-headed Blackbird Population Estimate FY07-FY11.

State	Size (mi^2)	RMBO (2007)	Ave Count FY07-FY11	PIF Adjust	Est. Breeding Population	Trend 1966-2010
Kansas	82,282	100,000	0.027	11.60	2,592	-2.0
Nebraska	77,358	300,000	3.164	11.60	288,599	+0.4
North Dakota	70,704	7,000,000	75.282	11.60	6,276,693	+0.9
Oklahoma	69,903	1,000	-	11.60	0	-9.4
South Dakota	77,121	1,700,000	14.317	11.60	1,301,911	**+2.4**
Texas	268,601	500	0.071	11.60	22,618	+10.5
Pop. Est. for CPS		9,101,500			7,892,413	CBBS: +0.5
						SWBBS: -0.4

Table A7. American Crow Population Estimate FY07-FY11.

State	Size (mi^2)	RMBO (2007)	Ave Count FY07-FY11	PIF Adjust	Est. Breeding Population	Trend 1966-2010
Kansas	82,282	520,000	16.622	3.11	433,151	-0.5
Nebraska	77,358	280,000	7.346	3.11	179,979	-0.8
North Dakota	70,704	300,000	8.204	3.11	183,713	+0.1
Oklahoma	69,903	780,000	25.863	3.11	572,519	+0.4
South Dakota	77,121	130,000	4.106	3.11	100,268	**-1.4**
Texas	268,601	1,500,000	15.051	3.11	1,280,097	**+1.0**
Pop. Est. for CPS		3,510,000			2,749,727	**CBBS: -0.4**
						SWBBS: +0.3

Table A8. Black Vulture Population Estimate FY07-FY11.

State	Size (mi^2)	RMBO (2007)	Ave Count FY07-FY11	PIF Adjust	Est. Breeding Population	Trend 1966-2010
Kansas	82,282	1,000	-	1.25	0	-
Nebraska	77,358	0	-	1.25	0	-
North Dakota	70,704	0		1.25	0	-
Oklahoma	69,903	1,000	0.555	1.25	4,934	**+7.3**
South Dakota	77,121	0	-	1.25	0	-
Texas	268,601	100,000	5.801	1.25	198,204	**+7.3**
Pop. Est. for CPS		102,000			203,138	**CBBS: +6.5**
						SWBBS: +4.5

Table A9. Mourning Dove Population Estimate FY07-FY11.

State	Size (mi^2)	RMBO (2007)	Ave Count FY07-FY11	PIF Adjust	Est. Breeding Population	Trend 1966-2010
Kansas	82,282	7,200,000	77.069	10.48		
Nebraska	77,358	6,200,000	77.195	10.48	6,	
North Dakota	70,704	5,400,000	48.392	10.48	3,652,552	
Oklahoma	69,903	3,600,000	39.199	10.48		
South Dakota	77,121	4,000,000	43.656	10.48	3,593,909	
Texas	268,601	16,000,000	46.755	10.48		
Pop. Est. for CPS		42,400,000				CBBS:
						SWBBS:

Table A10. Upland Sandpiper Population Estimate FY07-FY11.

State	Size (mi^2)	RMBO (2007)	Ave Count FY07-FY11	PIF Adjust	Est. Breeding Population	Trend 1966-2010
Kansas	82,282	na	4.763	1.00	39,912	-0.9
Nebraska	77,358	na	9.176	1.00	72,289	**+2.0**
North Dakota	70,704	na	14.210	1.00	102,312	+0.8
Oklahoma	69,903	na	0.739	1.00	5,263	+2.8
South Dakota	77,121	na	16.032	1.00	125,900	+0.4
Texas	268,601	na	0.004	1.00	105	-1.6
Pop. Est. for CPS		0			345,781	**CBBS: +0.8**
						SWBBS: +0.5

Table A10. Breeding population estimates for selected species in Texas that are mostly sedentary, controlled primarily during the breeding season, or found mostly in Texas and south (Sauer et al. 2011).

Species	TX size (mi^2)	RMBO (2007)	Ave Count FY07-FY11	PIF Adjust	Est. Breeding TX Population (N Amer last 2)	Trend (*P significant bold font*) 1966-2010		
						Texas	CBBS	SWBBS
Boat-tailed Grackle	268,601	190,000	0.597	12.34	201,424	+1.5%	-1.8%	-0.8%
Bronzed Cowbird	268,601	500,000	2.313	10.36	655,205	0.0%	-0.1%	-0.3%
European Starling	268,601	2,000,000	7.101	9.52	1,848,976	+0.6%	**-0.9%**	**-1.2%**
Feral Pigeon	268,601	1,100,000	2.550	12.70	885,706	+1.2%	**-0.9%**	**-0.9%**
Eurasian Collared-Dove	268,601	400,000	3.839	10.56	1,108,928	+45.6%|	+42.5%|	+36.8%|
House Sparrow	268,601	6,000,000	16.591	8.48	3,848.097	**-3.6%**	**-3.9%**	**-3.7%**
Common Raven	268,601	4,800	0.425	0.65	7,551	+1.8%	**+6.0%**	**+2.5%**
Chihuahuan Raven	268,601	92,000	0.802	2.81	61,644	-0.8%	-0.4%	+0.3%
Black Vulture	268,601	100,000	5.801	1.25	198,204	**+7.3%**	**+6.5%**	**+4.5%**
Turkey Vulture	268,601	520,000	16.742	1.30	595,318	**+1.3%**	**+1.9%**	**+2.3%**
Swainson's Hawk	268,601	63,000	0.903	2.52	62,482	**+0.9%**	+0.2%	**+0.6%**
Crested Caracara	268,601	65,000	1.621	3.32	147,217	**+6.3%**	**+6.3%**	**+6.6%**
Laughing Gull	268,601	800,000*	8.402	**	229,806	**+3.2%**	**+3.3%**	**+3.7%**
Double-crested Cormorant	268,601	1,600,000*	0.099	**	2,721	+6.5%	**+4.9%**	+3.6%
Killdeer	268,601	1,000,000+	3.730	**	102,012	**-1.1%**	**-0.3%**	**-1.0%**
Cattle Egret	268,601	500,000#	30.381	**	830,991	+1.9%	**+2.0%**	-0.5%
Great Blue Heron	268,601	120,000*	1.142	**	31,255	**+1.8%**	**+1.4%**	**+0.8%**
Great Egret	268,601	270,000*	2.287	**	62,554	**+3.0%**	**+3.0%**	**+2.3%**
Canada Goose	268,601	5,300,000*	0.235	**	6,419	+43.5%|	**+11.8%**	**+10.5%**
Eastern Meadowlark	268,601	1,600,000	14.580	2.37	945,161	**-2.8%**	-2.9%	-3.2%
Western Meadowlark	268,601	1,200,000	8.449	2.47	570,808	**-0.9%**	**-0.8%**	**-1.0%**
Lark Bunting	268,601	80,000	0.418	8.71	99,670	-1.9%	**-4.8%**	**-4.8%**
Horned Lark	268,601	2,800,000	5.249	10.76	1,545,098	**-3.0%**	**-2.3%**	**-2.2%**
Scissor-tailed Flycatcher	268,601	5,700,000	15.126	10.16	4,203,346	**-0.6%**	**-0.7%**	**-0.7%**
Western Kingbird	268,601	2,600,000	10.184	12.43	3,462,300	**+2.8%**	**+0.5%**	**+0.5%**
Mourning Dove	268,601	16,000,000	46.755	10.48	13,402,301	**-1.1%**	**-0.5%**	**-0.4%**
White-winged Dove	268,601	730,000	5.629	10.82	1,665,844	**+5.3%**	**+4.2%**	+1.2%
Common Nighthawk	268,601	3,100,000	6.680	13.45	2,457,411	**-1.2%**	**-0.8%**	**-1.9%**
Lesser Nighthawk	268,601	670,000	1.555	14.30	608,153	+1.4%	+1.0%	+1.0%
Barn Swallow	268,601	4,000,000	16.360	9.55	4,273,342	**+4.1%**	-0.2%	**-1.2%**
Cliff Swallow	268,601	9,000,000	52.355	10.48	14,978,749	+3.3%	+4.0%	**+0.8%**
Rusty Blackbird*	N Amer.	2,000,000	++	11.51	1,657,889	N/A	+9.8%	**-6.2%**
Lesser Yellowlegs	N Amer.	400,000[+]	++	**	256,445	N/A	-0.6%	**-5.3%**

* North American population (NAS 2012)
na - not available
\+ Morrison 2006
| too little data for significance
** PIF did not estimate waterbird populations (did not use a detectability factor)
N/A - not applicable
\# Tibbitts and Moskoff 1999
++ used sum of population estimates for each state/province where found.

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APPENDIX B – ESTIMATED BIRD TAKE IN TEXAS AND THE CENTRAL FLYWAY BY WS FOR THOSE BIRDS TAKEN WITH TOXICANTS

Precise information on bird mortality due to WS control operations involving toxicants is not available. The MIS[1] requires WS Specialists to record only the dead birds found following a control operation which may only be a small percentage of the birds actually taken, especially for projects involving the use of DRC-1339. However, some WS State Directors or District Supervisors may require Specialists to estimate the number of birds such as starlings and blackbirds taken during a control operation. Since recording data in the MIS has been variable from one operation to another and one state to the next, MIS data for birds taken with toxicants are not used for determining total take, unless take has been estimated for all projects. However, potential take can be estimated with a basic knowledge of the toxicant used, bait type (e.g., cracked corn), and basic bird species biology for those birds targeted. This appendix provides estimates of birds taken with DRC-1339 and Avitrol® by TWSP in Texas for species being analyzed at the statewide level. Additionally, take by WS in the Central Plains States (CPS) is given for those species being analyzed at the regional level.

Bird mortality by TWSP operations involving toxicants in Texas and the CPS area has been limited and conducted with DRC-1339 treated baits and most projects involved European Starlings and blackbirds. Glahn and Avery (2001) described methods to estimate bird mortality from using assessments of bait consumption with other calculations. Homan et al. (2005) developed an empirical model based on bioenergetics for starlings at feedlots and the model predicted that 93 starlings would be killed for every pound of treated cattle ration pellet baits used (116 starlings/g DRC-1339). However, field studies testing the model found that treated baits only killed an average of 67 starlings per pound used (72.5% of the "ideal" model). This would equate to 84 starlings being taken for every gram of DRC-1339 used. Packham (1965) found that an average of 57 starlings were killed per pound of DRC-1339 treated French fries (a larger bait size - 71 starlings/g DRC-1339) used at feedlots. Thus, a difference exists between what models predict the take will be to the take which actually occurs under field conditions, and take with different baits. Most models predict the maximum number of target species that can be taken or the "ideal." However, ideal conditions rarely exist in the field and take is typically only a fraction of the expected results (Glahn and Avery 2001).

Part of the problem with predicting take with DRC-1339 treated baits is that breakdown of the chemical starts relatively quickly once baits are prepared. Within hours to a few days after baits are prepared and exposed to environmental conditions (e.g., precipitation, heat, and sunlight), baits degrade, lose potency, and discolor turning dark gray, a color which is not often selected by the target species. Thus, baits may be consumed and not be toxic (degraded) or discolored and not selected making them less effective. Additionally, baits may be made for a set number of birds seen during prebaiting operations and this number may not return when baits are placed out. Thus, baits may remain following treatments which then are disposed according to the label. The MIS system does not capture this "wastage" (bait placed in the field and not consumed, and, hence, disposed), but only the amount placed in the field. These factors (degradation, discoloration, and wastage) would increase the estimated target species take using WS MIS data because all DRC-1339 used in operations is recorded whether or not it was successful. Homan's et al. (2005) field trials, compared to the empirical model, accounted for most problems with discoloration and degradation (72.5% efficacy from predicted to actual field trial take), but did not account for wastage including loss of efficacy from precipitation because the amount of bait consumed was recorded for each field trial subtracting baits picked up after treatment. For WS projects using DRC-1339, wastage likely averages between 10% and 25% of the baits placed. Thus, realistically the baits used that are successful in typical field conditions (from preparation to take of the target species) are probably closer to 60% of the estimated "ideal" or modeled take for the grams of DRC-1339 used, instead of the 72.5%. To

[1] MIS - Computer-based Management Information System used by WS for tracking Program activities.

conservatively estimate the number of target starlings taken for a given project, the Homan et al. (2005) field trial data will be multiplied by a factor of 90% to account for wastage, assuming wastage at10%, or 76 starlings taken per gram of DRC-1339 used.

WS also targets blackbirds in the family Icteridae in the Texas and the CPS area at feedlots, rice fields, and for other resources. Estimated take is very different depending on the bait substrate used and method of baiting (piles or broadcast). Take is different for each species, as well as sex with most males weighing much more than females, based on the target species weight and daily feed consumption. Average weights for a species, the average of the mean weight for males and females (Table B1) and assuming a 1:1 sex ratio, are 54 grams for Red-winged Blackbirds, 76 grams for Yellow-headed Blackbirds, 66 grams for Brewer's and Rusty Blackbirds, 107 for Common Grackles, 169 for Great-tailed Grackles, 157 grams for Boat-tailed Grackles, 40 grams for Brown-head Cowbirds, and 63 grams for Bronzed Cowbirds. It is expected that these species, respectively, consume 11g, 13g, 12g, 12g, 18g, 24g, 23 g, 9g, and 12 g of bait. DRC-1339 treated rice baits are broadcast at 10 to 20 pounds/acre. DRC-1339 treated baits for feedlots are not broadcast, but put in feeding lanes and so birds have easier access to large quantities of baits whereas more searching is required for rice baits. It is estimated that blackbirds get 12.5% of their daily intake needs from baited sites, but it is likely that less would be obtained from areas treated with rice baits as compared to feedlots and other sites. However, wastage would be much greater in rice treated fields, probably a third or up to half, because baits are broadcast requiring searching by birds which becomes more tedious as the number of baits decline. The percentage of birds obtaining a lethal dose in rice fields is much less, about 50% mortality (Cummings et al. NWRC, pers. comm. 2006, Johnston et al. 2005, Johnston et al. 2006).

Field studies with rice found that birds ingested an average of about 25 rice kernels (0.5g) or about 2% to 6% of their daily intake requirements with Red-winged Blackbirds and Brown-headed Cowbirds, the species most targeted with treatments to protect rice, between 5% and 6% of their daily intake. Thus, using the current assumptions of 12.5% of the daily intake would be similar to take with rice baits (for Red-winged Blackbirds, the assumptions 100% mortality with 12.5% intake and 10% wastage results in 840 birds taken per gram of DRC-1339 vs. 50% mortality with 5% intake and 42% wastage results in 820 taken per gram of DRC-1339) and used for estimating take for each species in Table B1. The take for each species of blackbird is estimated for feedlot baits and rice baits in Table B1. For blackbirds, because of varying weights, Table B1 estimates the number taken with the different baits and formulations based on their daily consumption. Blackbirds move around in feedlots and fallow fields and thus get much more of their diet from non-baited areas. It is assumed that blackbirds get an eighth of their daily dietary needs from treated areas whereas starlings, pigeons, and House Sparrows, also discussed herein, which are much more sedentary in feedlots than blackbirds, would probably get at least 25% (likely much higher for these species). These are conservative estimates, especially because the efficacy of baits in the field compared to the "ideal" take is not used for blackbirds which would reduce take estimates by at least 25% (Homan et al. 2005), but adequate for determining impacts.

Cummings et al. (unpubl data, NWRC, pers. comm. 2006) found that treated baits at feedlots "ideally" would take an estimated 400 blackbirds per gram of DRC-1339 used. Table B1 found that take would range from 163 per gram of DRC 1339 used for "other" baits for Great-tailed Grackles to 434 for Brown-headed Cowbirds. Cummings et al. (unpubl data, NWRC, pers. comm. 2006) also found that for each pound of treated cut (1 treated: 26 untreated) rice baits placed in fields, 374 blackbirds were killed. Johnston et al. (2005) predicted that 324 Red-winged Blackbirds from a pound of rice baits would be killed (this number declined with the days of baiting to 285 for 5 days). These estimates would equate to 1,057 and 913 blackbirds killed per gram of DRC-1339 used. It should be noted that the first estimate included primarily Red-winged Blackbirds and Brown-headed Cowbirds and the second only Red-winged Blackbirds. Table B1 estimates that take will range from 385 for Great-tailed Grackles to 1,027 for Brown-headed Cowbirds. It also should be noted that birds were captured following feeding in treated fields and not all birds died from the dose they received. Several birds were collected and the number of rice grains in all birds was not enough to kill them (about 50% mortality rate for birds feeding in treated rice fields). However, their take estimates were similar to those determined in Table B1. It should also be noted that efficacy, similar to what Homan et al. (2005) found for starlings (the "ideal" take *vs.* actual take), was not calculated into these estimates. This would reduce take estimates by a fourth. However, our estimates in Table B1 include an assumed 10% wastage loss which would make the estimates very close to those found by researchers. The predicted take estimates from Table B1 will be used to calculate the take of each species taken in Table B3.

TWSP in Texas also targets feral pigeons with DRC-1339. Per label directions, WS uses whole kernel corn for these projects with 1.7 g DRC-1339 treating 1 pound of bait which is then cut at 1 treated: 5 untreated. Baits can be cut at 1 treated: 1 untreated depending on the needs of the project and the length of time birds are observed feeding during prebaiting. The standard average number of whole corn kernels in a pound is 1,300 (Ontario Corn Producer Association 2007), but this is variable depending on variety of corn (1,600 by J. Homan, NWRC Bismarck, ND, pers. comm. 2007 and 1,700 by M. Marlow, Okla. WS, pers. comm. 2007). However, lower or higher weights for kernels would not change the outcome. Assuming that 1,300 kernels equals one pound and are treated, each kernel (350 mg) would have about 1.3 mg DRC-1339 (prior to being cut with untreated baits). The oral LD_{50} for pigeons is 18 mg/kg (Timm 1994, Eisemann et al. 2003). Thus, it likely takes more than 18 mg for 100% efficacy (acute doses for all) because only 50% of the pigeons would be killed at this level. At an estimated average weight of 310 g (270 g (Sibley 2000) or 350 g (Johnston 1992) equals 4.9 mg to 6.3 mg – website searches came up with similar weights)) it would take 5.6 treated baits to kill 50% or 6 baits (rounded up). Pigeons eat about 36 gm. of feed per day (British Columbia Ministry of Environment 2001) or, with whole corn, about 103 kernels at 1,300/pound. It is likely that when feed is put out, pigeons will consume between a quarter to half their daily consumption (depending on the number of pigeons feeding, the distribution of baits, and the length of time the pigeons are exposed to the baits), or about 26 to 52 kernels. This would be enough for about half of the birds to get a lethal dose averaging about 4 to 9 treated baits for cut baits (1:5 ratio of treated:untreated). Assuming pigeons feed on whole kernel corn baits that have 1,300 kernels per pound and consume a third of their daily intake (34 kernels) while baits are placed out, one pound of cut bait would take 19 pigeons (each pigeon would get an average of 5.7 treated baits – the level for 50% to be killed). This would equate to taking 67 pigeons per gram of DRC-1339. Using a similar factor to account for wastage in field use (10%) as above, would result in a conservatively estimated 60 pigeons taken with each gram of DRC-1339 used. It should be noted that baits can be cut at 1:1 to 1:5 for pigeons depending on how much bait is required at a site for the number of pigeons present; WS Specialists use the 1:1 treated to untreated baits for projects with very few pigeons or when there are a lot of pigeons present to ensure they get enough toxicant. A lower ratio of treated to untreated would reduce the number of birds that could be taken. However, for the purposes of this EA, it is assumed that all baits are cut at the 1:5 rate which would increase the number of birds taken, but be a more conservative estimate for the purposes of analysis. Additionally, baits are often left out for pigeons as long as they are feeding. It is likely that pigeons would consume at least half their dietary needs, if not 100%. If pigeons consumed 100% of their daily consumption requirements and this reached a level of LD100, then 13 pigeons would be killed per pound of bait or 40 per gram of DRC-1339 (taking wastage into account). It is likely that the latter is closer to the estimate. However, to be conservative, the first estimate will be used in the EA.

TWSP Specialists also target American Crows under a Special Local Need label to protect pecans and other crops with whole kernel corn and pecan baits. Take would be similar to pigeons, except that crows would likely take fewer baits when they feed. The average crow in the Central BBS area weighs about 515 grams (Verbeek and Caffrey 2002) and consumes about 52 grams of feed per day. The oral LD_{50} for crows is 1.33-1.78 mg/kg and they are likely to get a lethal dose consuming low quantities of bait (1 kernel would likely be enough to kill a crow). If crows consume a fourth of their daily diet at a treated site (similar to pigeons because would tend to remain at a feeding station longer), they would consume 13 grams of prepared baits. Assuming that baits are made with whole kernel corn (about 1300 kernels/pound), crows would consume about 37 kernels or about 6 treated baits. At this consumption rate, a pound of prepared bait would take 35 crows. This would equate to taking 45 crows per gram of DRC-1339. Using the same wastage percentage (10%) as discussed, WS expects that it could take 40 crows per gram of DRC-1339 used.

Ravens and crows are also targeted for livestock protection with egg baits. It is assumed that 4 eggs (Coates 2006) will take one raven or crow, or 13 per gram of DRC-1339 (1 g = 50 treated eggs). However, this may be an overestimate (Coates and Delehanty 2004) because caching and consumption of more than 4 eggs by targeted ravens or crows and consumption by nontarget species, especially ground squirrels (not affected by the baits) reduces the number of eggs for targeted individual ravens crow. Thus, our belief that a crow or a raven would be taken with 4 eggs is likely an overestimate, but to be conservative, this estimate will be used to determine take by WS.

Avitrol® is another toxicant used by TWSP in BDM for House Sparrows, starlings, pigeons, and blackbirds in Texas and other Central Flyway States, and comes prepackaged by the pound formulated at 0.5% 4-aminopyridine (the active ingredient) on mixed grain or corn chops. TWSP then mixes the bait with the same untreated bait at 1:9. The number of birds taken with an ounce of bait depends on the species targeted, the ratio of treated to untreated baits in the formulation (TWSP almost always cuts treated baits at the suggested 1:9 ratio, but this can be lowered to 1:5 for House Sparrows), and precipitation. TWSP uses mostly the mixed grain bait, but also uses some corn chops and whole kernel corn. The number of grain particles per pound varies by type and size of the bait, but would likely be from 6,000 to 23,000 particles per pound for mixed grain and cracked corn. Cracked corn sifted for particle sizes between 40mg to 50mg result in about 9,000 to 12,000 particles per pound (between #5 and #7 U.S. Standard Sieves). House Sparrows eat at least 6 grams of feed per day based on kilocalorie requirements of 20 to 28Kcal/day assuming that 3.5 Kcal are produced from a gram of grain (Cabe 1993). Starlings, with a high caloric diet, eat on average 23 grams/day (Twedt 1985) and pigeons likely require about 36 grams of feed per day (British Columbia Ministry of Environment 2001). Assuming that these 3 species eat at least 25% of the necessary daily intake at one feeding before other individuals react to the Avitrol® (House Sparrows and starlings, especially, would likely stop feeding after a few individuals reacted to the chemical because of their vocalizations), that the bait is mixed at 1 treated:9 untreated which is TWSP's standard application rate, and each pound of bait has 10,000 treated particles, then House Sparrows would eat about 33 particles (3 treated), starlings 127 particles (13 treated), and pigeons 198 particles (20 treated). It takes 20 minutes or more before a bird reacts to Avitrol®. Avitrol® is formulated at 0.5% which would mean that at these consumption rates, House Sparrows would get 7 mg of Avitrol®, starlings 29 mg, and pigeons 45 mg. The acute oral LD50 for House Sparrows is 3.00-7.70 mg/kg and for starlings is 4.90-6.00 mg/kg. The acute oral LD50 for hydrochloride salt of 4-aminopyridine for pigeons is 20 mg/kg. The oral LD50 for the average weight House Sparrow would be met with 0.2 mg Avitrol®, for starling 0.5 mg, and for pigeons 7.1 mg. Therefore, all species would likely receive a toxic dose by consuming the estimated amounts. These amounts would then dictate the number that could be taken with an ounce of Avitrol® treated baits (the MIS records the ounces of Avitrol® used and does not include the added untreated baits). Thus, it would be theoretically possible to take 189 House Sparrows, 49 starlings, and 32 pigeons. It is likely that fewer issues such as degradation and discoloration would occur with the use of Avitrol® because it is more stable than DRC-1339. Using 10% loss or wastage, similar factor as discussed for DRC-1339, would result in the take of 170 House Sparrows, 44 starlings, and 28 pigeons per ounce of Avitrol® used. Blackbird take with Avitrol® is given in Table B1. Take of blackbirds with Avitrol® ranged from 85 to 226 depending on the consumption rates of the different species.

The calculations of take can be used to estimate the number of target birds taken by WS with DRC-1339 and Avitrol®. However, the MIS allows WS Specialists to use a code, "Mixed Blackbirds," for sites where several species of blackbirds (starlings, blackbirds, cowbirds, and grackles) are present. Thus, species composition at operation sites also needs to be estimated where this code was used.

Table B1. Estimated blackbird take with DRC-1339 and Avitrol® treated baits. These estimates will be used to determine impacts.

Species*	RWBL	YHBL	BRBL	RUBL	COGR	GTGK	BTGK	BHCO	BROC
Spp. Aver. Weight (g)	54	76	66	66	107	169	157	40	63
Daily Aver. Consumpt. (g)	11	13	12	12	18	24	23	9	12
% Daily Aver. Cons. Eaten	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%
Wastage	10%	10%	10%	10%	10%	10%	10%	10%	10%
DRC-1339 Rice Baits									
Std g DRC Used for Bait	92	92	92	92	92	92	92	92	92
Pounds bait made	260	260	260	260	260	260	260	260	260
Lbs. bait/1 g DRC	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83
# birds/g DRC	840	711	770	770	513	385	402	1,027	770
DRC-1339 Other Baits									
Std g DRC Used for Bait	92	92	92	92	92	92	92	92	92
Pounds bait made	110	110	110	110	110	110	110	110	110
Lbs. bait/1 g DRC	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
# birds/g DRC	355	300	325	325	217	163	170	434	325
Avitrol Baits									
Std. Pounds Avitrol Mixed	1	1	1	1	1	1	1	1	1
Pounds Bait Made	10	10	10	10	10	10	10	10	10
Lbs. bait/1 oz. Avitrol	0.625	0.625	0.625	0.625	0.625	0.625	0.625	0.625	0.625
# birds/oz. Avitrol	185	157	170	170	113	85	89	226	170

RWBB = Red-winged Blackbird, YHBB = Yellow-headed Blackbird, BRBB = Brewer's Blackbird, RUBB = Rusty Blackbird, CGRK = Common Grackle, GTGK = Great-tailed Grackle, BTGK = Boat-tailed Grackle, BHCB = Brown-headed Cowbird, BRCB = Bronzed Cowbird

Starlings are the most prevalent species at feedlots in the Central Flyway seen by WS, including work conducted at feedlots in Texas. Almost all BDM conducted by TWSP at feedlots occurs in the panhandle area of Texas. In most other States in the Central Flyway, starling work mostly occurs in areas where feedlots are concentrated. Starlings are the most prevalent species at these facilities. Starlings require a high protein, high calorie diet, and livestock feed such as cattle ration, pelleted feed are a great source. Unlike most blackbirds, starlings eat little grain due to their poor assimilation efficiency (turning feed into energy) for grain (Twedt 1985). Starlings prefer insects and eat them as available. As insects wane in cold weather, starlings turn to feedlots to acquire the necessary energy to survive. Thus, starlings can be found in abundance at feedlots during winter which is the case in the Great Plains states. On the other hand, blackbirds efficiently assimilate grains into energy and have more opportunity to find them in harvested and fallow fields (spillage) and rangeland (weed seeds), and, therefore, may forage more in these areas than in feedlots (Twedt 1985).

In States where WS used DRC-1339 and Avitrol®, the percentage of starlings at feedlots was estimated by the WS Specialists. The following starling/blackbird percentages for the MIS "Mixed Blackbirds" category were determined by WS Specialists at feedlots that were treated. Their percentages will be used for feedlot work in the Central Flyway with Kansas, Nebraska, Oklahoma, and Texas having an estimated 95% starlings, Colorado at 85%, and New Mexico at 40% with the remaining percentages distributed to blackbird percentages found in the states at different times of the year. Homan (NWRC, pers. comm. 2007) stated that during his research in Kansas, starling flocks in feedlots constituted 99% or more of the birds in feedlots with few other species ever present. He also stated that a graduate student trapping birds in feedlots in the winter and spring of 2006-07 caught no other birds besides starlings in traps. Thus, an estimate of 95% would be considered conservative for blackbird species, but believed to be within reason for starlings. We believe that the numbers estimated in Table B3 are conservative estimates and will be used for the take Tables. Additionally, it should be noted that WS Specialists recorded take for species in DRC-1339 projects under the new MIS system to species more readily. Thus, the "Mixed-blackbird" code was used less frequently and only in the States of Kansas, Oklahoma, and Texas where, in the Central Flyway, much of the work at feedlots is conducted.

Table B2. Composition of blackbirds in the Central Flyway in States where WS took "Mixed Blackbirds" with chemical toxicants. Starlings accounted for most work conducted at feedlots and their percentage was estimated by WS field personnel. The species composition for Texas rice growing areas was separated out because it is a smaller specific area with the potential of taking a couple additional species.

State	Species**	Birds/BBS route 2007-11	BBS %	CBC Aver. 2006-10	CBC %	Winter Factor	BBS/CBC aver.	Migrating Factor
Kansas	RWBL	39.816	55.001%	1,295,019	98.600%	4.930%	76.801%	3.840%
	YHBL	0.027	0.018%	1	0.000%	0	0.009%	0%
	BRBL	0	0%	2,861	0.248%	0.011%	0.124%	0.006%
	RUBL	0	0%	538	0.041%	0.002%	0.021%	0.001%
	COGR	24.275	16.781%	2,092	0.159%	0.008%	8.470%	0.424%
	GTGR	1.378	0.952%	4,764	0.363%	0.018%	0.658%	0.033%
	BHCO	39.416	27.247%	8,130	0.619%	0.031%	13.933%	0.697%
Total		**144.660**	**100.00%**	**1,313,405**	**100.00%**	**5.000%**	**100.00%**	**5.000%**
Nebraska	RWBL	83.541	47.135%	98,526	99.882%	4.995%	73.509%	3.675%
	YHBL	3.164	1.785%	0.2	0%	0%	0.893%	0.045%
	BRBL	0.585	0.330%	0.8	0.001%	0%	0.166%	0.008%
	RUBL	0	0%	24	0.024%	0.001%	0.012%	0.001%
	COGR	60.289	34.016%	26	0.026%	0.001%	17.021%	0.851%
	GTGR	0.195	0.110%	44	0.045%	0.002%	0.078%	0.004%
	BHCO	29.453	16.618%	21	0.021%	0.001%	8.320%	0.416%
	BRCO	0.013	0.007%	0	0%	0%	0.004%	0%
Total		**177.239**	**100.00%**	**98,642**	**100.00%**	**5.000%**	**100.00%**	**5.000%**
Oklahoma	RWBL	25.460	48.205%	4,772,319	82.027%	4.102%	65.116%	3.256%
	YHBL	0	0%	0.6	0%	0%	0.000%	0%
	BRBL	0	0%	66,537	1.144%	0.058%	0.572%	0.029%
	RUBL	0	0%	11,567	0.199%	0.010%	0.100%	0.005%
	COGR	6.967	13.191%	276,314	4.749%	0.237%	8.970%	0.449%
	GTGR	0.597	1.131%	234,408	4.029%	0.201%	2.580%	0.129%
	BHCO	19.791	37.473%	456,875	7.853%	0.393%	22.663%	1.133%
Total		**52.815**	**100.00%**	**5,818,021**	**100.00%**	**5.000%**	**100.00%**	**5.000%**
Texas	RWBL	39.816	46.217%	1,781,060	66.105%	3.305%	56.161%	2.808%
	YHBL	0.071	0.083%	3,158	0.117%	0.006%	0.100%	0.005%
	BRBL	0.001	0.001%	20,010	0.743%	0.037%	0.372%	0.019%
	RUBL	N/A	N/A	241	0.008%	0	0.004%	0%
	COGR	7.273	8.442%	116,294	4.316%	0.216%	6.379%	0.319%
	GTGR	24.032	27.895%	254,368	9.447%	0.472%	18.671%	0.934%
	BTGR	0.609	0.707%	20,393	0.757%	0.038%	0.732%	0.037%
	BHCO	12.036	13.970%	493,114	18.302%	0.915%	16.136%	0.807%
	BROC	2.313	2.684%	5,643	0.209%	0.010%	1.447%	0.072%
Total		**86.150**	**100.00%**	**2,694,281**	**100.00%**	**5.000%**	**100.00%**	**5.000%**
SE Texas (in BBS phys. areas 3&6 combined) (from 2004-08 because 2006-10 not available)	RWBL	110.66	47.16%	950,609	68.021%		57.591%	
	YHBL	0	0%	3	0%		0.000%	
	BRBL	0	0%	5,833	0.417%		0.209%	
	RUBL	0	0%	32	0.002%		0.001%	
	COGR	31.80	13.55%	51,331	3.673%		8.612%	
	GTGR	66.78	28.46%	73,473	5.257%		16.859%	
RICE*	BTGR	11.88	5.06%	19,927	1.426%		3.243%	
	BHCO	12.44	5.30%	296,267	21.199%		13.250%	
	BROC	1.10	0.47%	56	0.004%		0.237%	
Total		**234.66**	**100.00%**	**1,397,531**	**100.00%**		**100.00%**	

* Southeast Texas rice-growing area includes BBS Routes 11, 13 , 20-25, 305, 306, and 311-314 and CBC Count Circles AP, AY, BF, BO, BZ, CY, FR, GA, GF, HO, LH, MM, OC, OR, SB, SC, SR, TN, and VI
** Codes for species names are in Table B1

Under the "Mixed Blackbird" category, the species composition of blackbirds taken in control operations will be calculated using the species composition from U.S. Geological Survey Breeding Bird Survey (BBS) data averaged with NAS Christmas Bird Count (CBC) data for projects occurring from April 1 to November 30, and from CBC data for projects occurring from December 1 to March 31. Projects protecting rice growers in Texas will be estimated using blackbird (excluding starlings) composition from

BBS and CBC data for the same time in the southeastern rice growing belt of Texas. Starlings have rarely been seen feeding on treated rice bait plots and, therefore, will be assumed not to be taken during such operations. As discussed above, starlings are more likely to be feeding on insects and not on grains, unless insects are not available. Table B2 provides the percentages used for blackbird species (excluding starlings) for estimating take with toxicants.

Rusty Blackbirds winter in the southeastern United States including Texas. Their habitat preference is wet woodlands feeding on invertebrates and they are typically not associated with other blackbirds while feeding. Though, it is possible that they may be found at a confined animal feeding operation (feedlot) or in rice fields, it is unlikely. However, to consider impacts, this species is included, but it should be noted that none are likely ever taken.

Once the information above was calculated, the WS take of birds with toxicants in the Central Flyway can be estimated. For feral pigeons, starlings, and House Sparrows only the take in Texas is being considered in the EA and, thus, information for these species is only given for Texas. It should be noted that a higher estimate was made for Yellow-headed Blackbirds with a third the percentage of birds found in Nebraska for Kansas and Oklahoma, because these percentages were estimated to be zero from bird surveys. The migratory percentage (aver. between BBS and CBC) was also increased for Texas because this was low. The CBC and BBS counts miss the migration of Yellow-headed Blackbirds through these states from northern breeding areas because of the timing of these counts (BBS=May-June, CBC=December-January). A few projects occur while these birds are migrating from July to September, but their migration is fairly quick with only a few birds lingering between breeding (northern parts of the Central Flyway) and wintering grounds (in Mexico from the Texas border south). The percentages of Yellow-headed Blackbirds in rice producing areas of Texas were found to be zero. However, projects to protect rice were excluded because few Yellow-headed Blackbirds are found in that area of Texas even during migration.

Table B3. Estimated take of birds in Texas with chemical and other methods, and the Central Plains States for species being analyzed in the EA at that level.

State- Method	FY07	FY08	FY09	FY10	FY11	%	Take/g or/oz.	FY07	FY08	FY09	FY10	FY11	Aver.
(w-winter, m-migr)	Use of DRC-1339 (g), Avitrol (oz.)							Estimated Take					
European Starling													
TX DRC-1339	681.0	9.0	466.4	1,467.5	560.5	100%	76	51,756	684	35,446	111,530	42,598	48,403
TX DRC Mix BB	0.0	77.0	0.0	0.0	0.0	95%	76	0	5,559	0	0	0	1,112
TX Avitrol Mix BB	0	33	0	0	0	95%	44	0	1,379	0	0	0	276
TX Other Methods								13	27	64	73	316	99
TOTAL TAKE TX								51,769	7,650	35,510	111,603	42,914	49,889
Feral Pigeon													
TX DRC-1339	72.0	21.0	26.0	18.0	21.0	100%	60	4,320	1,260	1,560	1,080	1,260	1,896
TX Avitrol	26	109	112	15	0	100%	28	728	3,052	3,136	431	0	1,469
TX Other Methods								2,203	1,399	2,328	759	1,872	1,712
TOTAL TAKE TX								7,251	5,711	7,024	2,270	3,132	5,078
House Sparrow													
TX Avitrol	10	0	0	6	0	100%	170	1,700	0	0	986	0	537
TX Other Methods								2	0	0	51	44	19
TOTAL TAKE TX								1,702	0	0	1,037	44	557
Red-winged Blackbird													
KS DRC (w)	0.0	0.0	0.0	94.0	0.0	4.930%	355	0	0	0	1,645	0	329
KS DRC (m)	0.0	2,314.0	0.0	0.0	0.0	3.840%	355	0	31,544	0	0	0	6,309
ND DRC (all)	0.0	0.0	113.0	0.0	0.0	100%	355	0	0	40,115	0	0	8,023
NE DRC1339 (w)	0.0	0.0	427.6	0.0	0.0	4.995%	355	0	0	7,582	0	0	1,516
NE DRC1339 (m)	0.0	0.0	233.5	0.0	0.0	3.675%	355	0	0	3,046	0	0	609
OK DRC (w)	46.0	12.0	46.0	757.6	0.0	4.102%	355	670	175	670	11,032	0	2,509
OK DRC (m)	0.0	46.0	230.0	141.4	0.0	3.256%	355	0	532	2,659	1,634	0	965
TX feed DRC (w)	0.0	77.0	0.0	0.0	0.0	3.305%	355	0	903	0	0	0	181
TX rice DRC (w)	850.0	606.0	0.0	0.0	0.0	68.021%	840	485,670	346,254	0	0	0	166,385
TX rice DRC (all)	0.0	0.0	430.7	89.2	315.4	100%	840	0	0	361,788	74,928	264,936	140,330

TX Avitrol (w)	0	33	0	0	0	3.305%	185	0	202	0	0	0	40
KS Other (w)	0	13	0	0	0	4.930%		0	1	0	0	0	0
KS Other (m)	114	24	97	21	0	3.840%		4	1	4	1	0	2
OK Other (w)	50	325	0	30	0	4.102%		2	13	0	1	0	3
OK Other (m)	0	45	85	120	0	3.256%		0	31	2	0	2	22
Other Take KS								0	0	0	0	49	10
Other Take ND								0	816	2,246	10,459	11,310	4,966
Other Take-NE								75	103	55	53	76	72
Other Take-OK								252	146	150	222	462	246
Other Take TX								84	11	57	242	144	108
MAXIMUM RWBL TAKE BY WS IN THE CENTRAL FLYWAY								486,757	380,703	418,374	100,222	276,977	332,607
TEXAS MAXIMUM TAKE								485,754	347,370	361,845	75,170	265,080	307,044
OTHER WS STATES IN CENTRAL FLYWAY MAXIMUM TAKE								1,003	33,332	56,529	25,052	11,897	25,563
Brown-headed Cowbird													
KS DRC (w)	0.0	0.0	0.0	94.0	0.0	0.619%	434	0	0	0	253	0	51
KS DRC (m)	0.0	2,314.0	0.0	0.0	0.0	0.697%	434	0	7,000	0	0	0	1,400
NE DRC1339 (w)	0.0	0.0	427.6	0.0	0.0	0.001%	434	0	0	2	0	0	0
NE DRC1339 (m)	0.0	0.0	233.5	0.0	0.0	0.416%	434	0	0	422	0	0	84
OK DRC (w)	46.0	12.0	46.0	757.6	0.0	0.393%	434	78	20	78	1,292	0	294
OK DRC (m)	0.0	46.0	230.0	141.4	0.0	1.133%	434	0	226	1,131	695	0	410
OK DRC (all)	161.0	0.0	0.0	0.0	0.0	100%	434	69,874	0	0	0	0	13,975
TX feed DRC (w)	0.0	77.0	0.0	0.0	0.0	3.305%	434	0	1,104	0	0	0	221
TX DRC feed (all)	0.0	0.0	0.0	0.0	24.5	100%	434	0	0	0	0	10,633	2,127
TX rice DRC (w)	850.0	606.0	0.0	0.0	0.0	21.199%	1,027	185,057	131,935	0	0	0	63,398
TX rice DRC (all)	0.0	0.0	301.0	348.1	311.1	100%	1,027	0	0	309,127	357,499	319,500	197,225
TX Avitrol (w)	0	33	0	0	0	3.305%	226	0	246	0	0	0	49
KS Other (w)	0	13	0	0	0	0.619%		0	0	0	0	0	0
KS Other (m)	114	24	97	21	0	0.697%		1	0	1	0	0	0
OK Other (w)	50	325	0	30	0	0.001%		0	0	0	0	0	0
OK Other (m)	0	45	85	120	0	0.416%		0	0	0	0	0	0
Other take KS	Other take included decoy cage traps and shooting							10	5	10	45	803	175
Other take NE								29	429	136	1,059	746	480
Other take OK								518	171	286	475	18	294
Other take TX								0	39	10	0	59	22
MAXIMUM BHCO TAKE BY WS IN THE CENTRAL FLYWAY								255,567	141,176	311,203	361,318	331,759	280,205
TEXAS MAXIMUM TAKE								185,057	133,285	309,127	357,499	330,133	263,020
OTHER WS STATES IN CENTRAL FLYWAY MAXIMUM TAKE								70,510	7,891	2,076	3,820	1,626	17,185
Common Grackle													
KS DRC (w)	0.0	0.0	0.0	94.0	0.0	0.159%	217	0	0	0	32	0	6
KS DRC (m)	0.0	2,314.0	0.0	0.0	0.0	0.424%	217	0	2,129	0	0	0	426
NE DRC1339 (w)	0.0	0.0	427.6	0.0	0.0	0.001%	355	0	0	2	0	0	0
NE DRC1339 (m)	0.0	0.0	233.5	0.0	0.0	0.851%	355	0	0	705	0	0	141
OK DRC (w)	46.0	12.0	46.0	757.6	0.0	0.237%	217	24	6	24	390	0	89
OK DRC (m)	0.0	46.0	230.0	141.4	0.0	0.449%	217	0	45	224	138	0	81
OK DRC (all)	7.0	0.0	0.0	27.6	0.0	100%	217	1,519	0	0	5,989	0	1,502
TX feed DRC (w)	0.0	77.0	0.0	0.0	0.0	0.037%	217	0	6	0	0	0	1
TX feed DRC (all)	2.0	4.0	35.7	0.0	0.0	100%	217	434	868	7,747	0	0	1,810
TX rice DRC (w)	850.0	606.0	0.0	0.0	0.0	3.673%	513	16,016	11,419	0	0	0	5,487
TX rice DRC (all)	0.0	0.0	36.5	31.7	26.9	100%	513	0	0	18,725	16,262	13,800	9,757
TX Avitrol (w)	0	33	0	0	0	0.037%	113	0	1	0	0	0	0
KS Other (w)	0	13	0	0	0	0.159%		0	0	0	0	0	0
KS Other (m)	114	24	97	21	0	0.424%		0	0	0	0	0	0
OK Other (w)	50	325	0	30	0	0.851%		0	3	0	0	0	1
OK Other (m)	0	45	85	120	0	0.237%		0	0	0	0	0	0
Other take KS	Other take included decoy cage traps and shooting							13	32	109	26	70	50
Other take NE								90	92	176	151	74	117
Other take OK								231	118	70	105	280	161
Other take TX								40	0	3	113	310	93
MAXIMUM COGR TAKE BY WS IN THE CENTRAL FLYWAY								18,368	14,719	27,785	23,207	14,534	19,722
TEXAS MAXIMUM TAKE								16,490	12,294	26,474	16,375	14,110	17,149
OTHER WS STATES IN CENTRAL FLYWAY MAXIMUM TAKE								1,878	2,425	1,310	6,832	424	2,574

Great-tailed Grackle													
KS DRC (w)	0.0	0.0	0.0	94.0	0.0	0.018%	163	0	0	0	3	0	1
KS DRC (m)	0.0	2,314.0	0.0	0.0	0.0	0.033%	163	0	124	0	0	0	25
NE DRC1339 (w)	0.0	0.0	427.6	0.0	0.0	0.002%	163	0	0	1	0	0	0
NE DRC1339 (m)	0.0	0.0	233.5	0.0	0.0	0.004%	163	0	0	2	0	0	0
OK DRC (w)	46.0	12.0	46.0	757.6	0.0	0.201%	163	15	4	15	248	0	56
OK DRC (m)	0.0	46.0	230.0	141.4	0.0	0.129%	163	0	10	48	30	0	18
OK DRC (all)	0.0	5.0	0.0	3.5	0.0	100%	163	0	815	0	571	0	277
TX feed DRC (w)	0.0	77.0	0.0	0.0	0.0	0.472%	163	0	59	0	0	0	12
TX feed DRC (all)	49.0	121.0	18.0	164.6	6.5	100%	163	7,987	19,723	2,934	26,830	1,060	11,707
TX rice DRC (w)	850.0	606.0	0.0	0.0	0.0	1.426%	385	4,667	3,327	0	0	0	1,599
TX rice DRC (all)	0.0	0.0	0.8	0.3	6.1	100%	385	0	0	308	116	2,349	554
TX Avitrol (w)	0	33	0	0	0	0.472%	85	0	13	0	0	0	3
KS Other (w)	0	13	0	0	0	0.018%		0	0	0	0	0	0
KS Other (m)	114	24	97	21	0	0.033%		0	0	0	0	0	0
OK Other (w)	50	325	0	30	0	0.002%		0	0	0	0	0	0
OK Other (m)	0	45	85	120	0	0.004%		0	0	0	0	0	0
Other take KS								0	13	6	0	15	7
Other take OK								450	710	757	822	232	594
Other take TX								1,359	1,625	2,908	848	312	1,410
MAXIMUM GTGR TAKE BY WS IN THE CENTRAL FLYWAY								14,478	26,424	6,979	29,467	3,967	16,263
TEXAS MAXIMUM TAKE								14,013	24,688	6,150	27,793	3,720	15,273
OTHER WS STATES IN CENTRAL FLYWAY MAXIMUM TAKE								465	1,735	829	1,673	247	990
Brewer's Blackbird													
KS DRC (w)	0.0	0.0	0.0	94.0	0.0	0.011%	325	0	0	0	3	0	1
KS DRC (m)	0.0	2,314.0	0.0	0.0	0.0	0.006%	325	0	45	0	0	0	9
NE DRC1339 (w)	0.0	0.0	427.6	0.0	0.0	0%	325	0	0	0	0	0	0
NE DRC1339 (m)	0.0	0.0	233.5	0.0	0.0	0.008%	325	0	0	6	0	0	1
OK DRC (w)	46.0	12.0	46.0	757.6	0.0	0.057%	325	9	2	9	140	0	32
OK DRC (m)	0.0	46.0	230.0	141.4	0.0	0.029%	325	0	4	22	13	0	8
TX feed DRC (w)	0.0	77.0	0.0	0.0	0.0	0.037%	325	0	9	0	0	0	2
TX rice DRC (w)	850.0	606.0	0.0	0.0	0.0	0.417%	770	2,729	1,946	0	0	0	935
TX Avitrol (w)	0	33	0	0	0	0.037%	170	0	2	0	0	0	0
KS Other (w)	0	13	0	0	0	0.011%		0	0	0	0	0	0
KS Other (m)	114	24	97	21	0	0.006%		0	0	0	0	0	0
OK Other (w)	50	325	0	30	0	0.057%		0	0	0	0	0	0
OK Other (m)	0	45	85	120	0	0.029%		0	0	0	0	0	0
Other Take - OK								10	11	1	9	19	10
MAXIMUM BRBL TAKE BY WS IN THE CENTRAL FLYWAY								2,748	2,020	37	166	19	998
TEXAS MAXIMUM TAKE								2,729	1,957	0	0	0	937
OTHER WS STATES IN CENTRAL FLYWAY MAXIMUM TAKE								19	63	37	166	19	61
Yellow-headed Blackbird													
KS DRC (w)	454	839	0	0	0	0%	300	0	0	0	0	0	0
KS DRC (m)	907	907	1,814	0	2,314	0%	300	5	5	11	0	14	7
OK DRC (w)	46	0	18	0	5	0%	300	0	0	0	0	0	0
OK DRC (m)	0	0	0	0	46	0%	300	0	0	0	0	0	0
TX feed DRC (w)	91	0	55	0	77	0.006%	300	3	0	2	0	3	2
TX feed DRC (m)	0	23	0	0	0	0.005%	300	0	0	0	0	0	0
TX rice DRC (w)	572	942	37	850	606	0%	711	0	0	0	0	0	0
TX rice DRC (m)	0	0	743	0	0	0%	711	0	0	0	0	0	0
TX Avitrol (w)	80	0	37	0	0	0.006%	157	2	0	1	0	0	0
TX Avitrol (m)	0	0	0	0	33	0.005%	157	0	0	0	0	0	0
KS Other (w)	0	13	0	0	0	0%		0	0	0	0	0	0
KS Other (m)	114	24	97	21	0	0%		0	0	0	0	0	0
OK Other (w)	50	325	0	30	0	0%		0	0	0	0	0	0
OK Other (m)	0	45	85	120	0	0%		0	0	0	0	0	0
Other Take - ND	Other take included firearms							0	0	12	57	350	84
Other Take - OK								7	0	0	0	0	1
MAXIMUM YHBL TAKE BY WS IN THE CENTRAL FLYWAY								17	5	26	57	367	94
TEXAS MAXIMUM TAKE								2	0	1	0	0	1
OTHER WS STATES IN CENTRAL FLYWAY MAXIMUM TAKE								15	5	25	57	367	94

Rusty Blackbird													
KS DRC (w)	0.0	0.0	0.0	94.0	0.0	0.002%	325	0	0	0	1	0	0
KS DRC (m)	0.0	2,314.0	0.0	0.0	0.0	0.001%	325	0	8	0	0	0	2
NE DRC1339 (w)	0.0	0.0	427.6	0.0	0.0	0.001%	325	0	0	1	0	0	0
NE DRC1339 (m)	0.0	0.0	233.5	0.0	0.0	0.001%	325	0	0	1	0	0	0
OK DRC (w)	46.0	12.0	46.0	757.6	0.0	0.010%	325	2	0	1	25	0	6
OK DRC (m)	0.0	46.0	230.0	141.4	0.0	0.005%	325	0	1	4	2	0	1
TX feed DRC (w)	0.0	77.0	0.0	0.0	0.0	0%	325	0	0	0	0	0	0
TX rice DRC (w)	850.0	606.0	0.0	0.0	0.0	0%	770	0	0	0	0	0	0
TX Avitrol (w)	0	33	0	0	0	0%	170	0	0	0	0	0	0
KS **Other** (w)	0	13	0	0	0	0.002%		0	0	0	0	0	0
KS Other (m)	114	24	97	21	0	0.001%		0	0	0	0	0	0
OK Other (w)	50	325	0	30	0	0.010%		0	0	0	0	0	0
OK Other (m)	0	45	85	120	0	0.005%		0	0	0	0	0	0
MAXIMUM RUBL TAKE BY WS IN THE CENTRAL FLYWAY								2	9	7	28	0	9
TEXAS MAXIMUM TAKE								0	0	0	0	0	0
OTHER WS STATES IN CENTRAL FLYWAY MAXIMUM TAKE								2	9	7	28	0	9
Boat-tailed Grackle													
TX feed DRC (w)	0.0	77.0	0.0	0.0	0.0	0.757%	170	0	99	0	0	0	20
TX rice DRC (w)	850.0	606.0	0.0	0.0	0.0	1.426%	402	4,873	3,474	0	0	0	1,669
TX Avitrol (w)	0	33	0	0	0	0.757%	89	0	22	0	0	0	4
Other take TX	Other take included decoy cage traps and shooting							0	0	0	0	42	8
TEXAS MAXIMUM TAKE (ALL WS TAKE IN THE CENTRAL FLYWAY)								4,873	3,595	0	0	42	1,702
Bronzed Cowbird													
TX feed DRC (w)	0.0	77.0	0.0	0.0	0.0	0.010%	325	0	3	0	0	0	1
TX rice DRC (w)	850.0	606.0	0.0	0.0	0.0	0.004%	770	26	19	0	0	0	9
TX Avitrol (w)	0	33	0	0	0	0.010%	170	0	1	0	0	0	0
TEXAS MAXIMUM TAKE (ALL WS TAKE IN THE CENTRAL FLYWAY)								26	22	0	0	0	10
American Crow													
NE DRC 1339 eggs	0.0	6.0	0.0	0.0	2.0	100%	13	0	78	0	0	26	21
OK DRC 1339	681.0	588.8	1,278.8	216.0	772.8	100%	40	27,240	23,552	51,152	8,640	30,912	28,299
TX DRC-1339	157.0	17.0	64.8	0.0	13.8	100%	40	6,280	680	2,592	0	552	2,021
TX DRC 1339 eggs	3.0	1.0	2.8	2.0	5.5	100%	13	39	13	36	26	72	37
KS Other Methods	Other take included firearms							0	0	0	17	21	8
NE Other Methods								0	8	3	6	9	5
OK Other Methods								502	429	856	350	581	544
TX Other Methods								0	7	4	18	70	20
MAXIMUM TAKE BY WS IN THE CENTRAL FLYWAY								34,061	24,760	54,639	9,039	32,173	30,934
MAXIMUM TEXAS TAKE								6,319	700	2,632	44	694	2,078
OTHER WS STATES IN CENTRAL FLYWAY MAXIMUM TAKE								27,742	24,060	52,007	8,995	31,479	28,857
Chihuahuan Raven													
TX DRC-1339 eggs	1.0	0.0	0.0	0.0	0.0	100%	13	13	0	0	0	0	3
MAXIMUM TEXAS TAKE								13	0	0	0	0	3
Common Raven													
TX DRC-1339 eggs	5.0	2.0	6.0	9.0	15.5	100%	13	65	26	78	117	202	98
TX Other Methods								4	0	2	2*	1	2
MAXIMUM TEXAS TAKE								69	26	80	117	203	99

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APPENDIX C: BIRD SPECIES OF TEXAS

The Texas Birds Record Committee (TBRC 2012) lists 638 bird species that have been documented in Texas (does not include extinct spp.) and 3 species that need further documentation (not including 1 group). Texas Parks and Wildlife Department (TPWD 2006) lists 649 species of wild birds and exotics that have been documented in Texas or are hypothetically present, but this list was not used for Tables C1 to C3, but introduced species not accepted as having wild populations in Texas were used in Table C4. Texas has 459 species that reside for some part of the year in the State (Table C1 and C2). Additionally, 175 species have been accidentally seen inside the state from outside their normal range or reside in remote areas and are seen infrequently (Table C3). Most of these species will not ever be the focus of a BDM project in Texas, but all are listed in the following tables to let readers know the diversity of birds in the state and that the potential exists that these species could be encountered. Texas WS expects to conduct BDM for relatively few of these species and anticipates that BDM will have at most a minimal effect on any given species in Texas and the Central Breeding Bird Survey area unless a population is specifically targeted for removal with an invasive species.

Table C1. Common and scientific names are given for the 275 wild bird species that typically reside for some part of the year in Texas that have the potential of being the target of a BDM project. Even though all of these species have the potential to invoke a request, the majority will not be involved in BDM in Texas. About half of the species would only be involved in BDM at airports where they are known to be a strike risk or for disease surveillance (148). If the species has the potential to be involved in a request for assistance other than BDM at airports or for disease surveillance, the type of resources typically damaged is noted (127).

Species	*Scientific Name*
Order Anseriformes - Waterfowl	
Black-bellied Whistling-Duck	*Dendrocygna autumnalis*
Fulvous Whistling-Duck	*Dendrocygna bicolor*
Greater White-fronted Goose[2]	*Anser albifrons*
Snow Goose[2,5]	*Chen caerulescens*
Ross's Goose[2]	*Chen rossii*
Cackling Goose[2]	*Branta hutchinsii*
Canada Goose[2,4,5,6]	*Branta canadensis*
Wood Duck[2]	*Aix sponsa*
Gadwall	*Anas strepera*
American Wigeon[6]	*Anas americana*
Mallard[2,4,5,6]	*Anas platyrhynchos*
Mottled Duck [AR]	*Anas fulvigula*
Blue-winged Teal	*Anas discors*
Cinnamon Teal	*Anas cyanoptera*
Northern Shoveler	*Anas clypeata*
Northern Pintail	*Anas acuta*
Green-winged Teal	*Anas crecca*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Ring-necked Duck[1]	*Aythya collaris*
Greater Scaup	*Aythya marila*
Lesser Scaup	*Aythya affinis*
Surf Scoter[1]	*Melanitta perspicillata*
White-winged Scoter[1]	*Melanitta fusca*
Black Scoter[1]	*Melanitta nigra*
Long-tailed Duck	*Clangula hyemalis*
Bufflehead[1]	*Bucephala albeola*
Common Goldeneye[1]	*Bucephala clangula*
Hooded Merganser[1]	*Lophodytes cucullatus*
Common Merganser[1]	*Mergus merganser*
Red-breasted Merganser[1]	*Mergus serrator*
Ruddy Duck	*Oxyura jamaicensis*
Order Galliformes – Pheasants, Grouse, Turkey, & Quail	
Plain Chachalaca	*Ortalis vetula*
Scaled Quail [AY]	*Callipepla squamata*
Gambel's Quail	*Callipepla gambelii*
Northern Bobwhite[2]	*Colinus virginianus*
Ring-necked Pheasant (I)[2]	*Phasianus colchicus*
Lesser Prairie-Chicken [FC AR BCC]	*Tympanuchus pallidicinctus*
Wild Turkey[2]	*Meleagris gallopavo*
Order Gaviiformes - Loons	
Common Loon[1]	*Gavia immer*
Order Podicipediformes - Grebes	
Least Grebe	*Tachybaptus dominicus*
Pied-billed Grebe[1]	*Podilymbus podiceps*
Horned Grebe[1]	*Podiceps auritus*
Eared Grebe[1]	*Podiceps nigricollis*
Western Grebe[1]	*Aechmophorus occidentalis*
Clark's Grebe [AY 1]	*Aechmophorus clarkii*
Order Ciconiiformes – Storks	
Wood Stork [ST 1]	*Mycteria americana*
Order Suliformes – Frigatebirds, Gannets, Cormorants, & Allies	
Magnificent Frigatebird [AR]	*Fregata magnificens*
Masked Booby [AY]	*Sula dactylatra*
Northern Gannet	*Morus bassanus*
Neotropic Cormorant[1,5]	*Phalacrocorax brasilianus*
Double-crested Cormorant[1,5]	*Phalacrocorax auritus*
Anhinga[1]	*Anhinga anhinga*
Order Pelecaniformes – Pelicans, Bitterns, Herons, & Allies	
American White Pelican[1,5]	*Pelecanus erythrorhynchos*
Brown Pelican[1]	*Pelecanus occidentalis*
American Bittern [BCC 1]	*Botaurus lentiginosus*
Least Bittern [BCC]	*Ixobrychus exilis*
Great Blue Heron[1]	*Ardea herodias*
Great Egret[1,4,6]	*Ardea albus*
Snowy Egret[1,4,6]	*Egretta thula*
Little Blue Heron [BCC 1,4,6]	*Egretta caerulea*
Tricolored Heron[1,4,6]	*Egretta tricolor*
Reddish Egret [ST AR BCC 1,4,6]	*Egretta rufescens*
Cattle Egret[1,4,6]	*Bubulcus ibis*
Green Heron[1]	*Butorides striatus*
Black-crowned Night-Heron[1,4,6]	*Nycticorax nycticorax*
Yellow-crowned Night-Heron[1]	*Nyctanassa violacea*
White Ibis	*Eudocimus albus*
Glossy Ibis	*Plegadis falcinellus*
White-faced Ibis [ST]	*Plegadis chihi*
Roseate Spoonbill	*Platalea ajaja*
Order Accipitriformes – Vultures, Eagles, Kites, Harriers & Hawks	
Black Vulture[3,4,5,6]	*Coragyps atratus*
Turkey Vulture[3,4,5,6]	*Cathartes aura*
Osprey[1]	*Pandion haliaetus*
Swallow-tailed Kite [ST AY BCC]	*Elanoides forficatus*
White-tailed Kite	*Elanus leucurus*
Mississippi Kite [BCC 4]	*Ictinia mississippiensis*
Bald Eagle [ST BCC 1,3]	*Haliaeetus leucocephalus*
Northern Harrier	*Circus cyaneus*

Sharp-shinned Hawk[3]	*Accipiter striatus*
Cooper's Hawk[3]	*Accipiter cooperii*
Harris's Hawk[BCC]	*Parabuteo unicinctus*
Red-shouldered Hawk	*Buteo lineatus*
Broad-winged Hawk	*Buteo platypterus*
Swainson's Hawk[AY BCC]	*Buteo swainsoni*
White-tailed Hawk[ST BCC]	*Buteo albicaudatus*
Zone-tailed Hawk[ST]	*Buteo albonotatus*
Red-tailed Hawk[3,5]	*Buteo jamaicensis*
Ferruginous Hawk[BCC]	*Buteo regalis*
Rough-legged Hawk	*Buteo lagopus*
Golden Eagle[BCC 3]	*Aquila chrysaetos*
Order Falconiformes – Caracaras & Falcons	
Crested Caracara[3]	*Caracara cheriway*
American Kestrel[BCC*]	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine Falcon[SE/T** BCC]	*Falco peregrinus*
Prairie Falcon[BCC]	*Falco mexicanus*
Order Gruiformes – Rails & Cranes	
Purple Gallinule	*Porphyrio martinica*
Common Gallinule	*Gallinula galeata*
American Coot[6]	*Fulica americana*
Sandhill Crane[2]	*Grus canadensis*
Whooping Crane[FE SE AR]	*Grus americana*
Order Charadriiformes – Shorebirds, Gulls, & Terns	
Black-bellied Plover	*Pluvialis squatarola*
American Golden-Plover[AY]	*Pluvialis dominica*
Snowy Plover[AY BCC]	*Charadrius nivosus*
Wilson's Plover[AY BCC]	*Charadrius wilsonia*
Semipalmated Plover	*Charadrius semipalmatus*
Piping Plover[FT ST AR]	*Charadrius melodus*
Killdeer	*Charadrius vociferus*
Mountain Plover[AR BCC]	*Charadrius montanus*
American Oystercatcher[BCC]	*Haematopus palliatus*
Black-necked Stilt	*Himantopus mexicanus*
American Avocet	*Recurvirostra americana*
Spotted Sandpiper	*Actitus macularia*
Solitary Sandpiper[BCC]	*Tringa solitaria*
Greater Yellowlegs	*Tringa melanoleuca*
Willet	*Tringa semipalmata*
Lesser Yellowlegs[BCC]	*Tringa flavipes*
Upland Sandpiper[BCC]	*Bartramia longicauda*
Whimbrel[BCC]	*Numenius phaeopus*
Long-billed Curlew[AY BCC]	*Numenius americanus*
Hudsonian Godwit[AY BCC]	*Limosa haemastica*
Marbled Godwit[AY BCC]	*Limosa fedoa*
Ruddy Turnstone	*Arenaria interpres*
Red Knot[FC# AY BCC##]	*Calidris canutus*
Sanderling[AY]	*Calidris alba*
Semipalmated Sandpiper[AY]	*Calidris pusilla*
Western Sandpiper[AY]	*Calidris mauri*
Least Sandpiper	*Calidris minutilla*
White-rumped Sandpiper[AY]	*Calidris fuscicollis*
Baird's Sandpiper	*Calidris bairdii*
Pectoral Sandpiper	*Calidris melanotos*
Dunlin	*Calidris alpina*
Stilt Sandpiper[AY]	*Calidris himantopus*
Buff-breasted Sandpiper[AR BCC]	*Tryngites subruficollis*
Short-billed Dowitcher[BCC]	*Limnodromus griseus*
Long-billed Dowitcher	*Limnodromus scolopaceus*
Wilson's Snipe	*Gallinago delicata*
American Woodcock	*Scolopax minor*
Wilson's Phalarope	*Phalaropus tricolor*
Red-necked Phalarope	*Phalaropus lobatus*
Sabine's Gull	*Xema sabini*
Bonaparte's Gull[1,4,6]	*Chroicocephalus philadelphia*
Laughing Gull[1,4,6]	*Leucophaeus atricilla*
Franklin's Gull[1,4,6]	*Leucophaeus pipixcan*
Ring-billed Gull[1,4,6]	*Larus delawarensis*
California Gull[1,4,6]	*Larus californicus*
Herring Gull[1,4,6]	*Larus argentatus*

Thayer's Gull[AY1,4,6]	*Larus thayeri*
Lesser Black-backed Gull[1,4,6]	*Larus fuscus*
Glaucous Gull[1,4,6]	*Larus hyperboreus*
Sooty Tern[ST]	*Onychoprion fuscatus*
Least Tern[FE SE AR BCC]	*Sternula antillarum*
Gull-billed Tern[AY BCC 1]	*Gelochelidon nilotica*
Caspian Tern[1]	*Hydroprogne caspia*
Black Tern[1]	*Childonias niger*
Common Tern[1]	*Sterna hirundo*
Forster's Tern[1]	*Sterna forsteri*
Royal Tern[1]	*Thalasseus maximus*
Sandwich Tern[BCC]	*Thalasseus sandvicensis*
Black Skimmer[AY BCC]	*Rhynchops niger*
Pomarine Jaeger	*Stercorarius pomarinus*
Parasitic Jaeger	*Stercorarius parasiticus*
Order Columbiformes – Doves & Pigeons	
Rock Pigeon (I)[2,3,4,5,6]	*Columba livia*
Red-billed Pigeon[BCC]	*Patagioenas flavirostris*
Band-tailed Pigeon[2]	*Patagioenas fasciata*
Eurasian Collared Dove (I)[2,3,4,5,6]	*Streptopelia decaocto*
White-winged Dove[2,3,4, 6]	*Zenaida asiatica*
Mourning Dove[2,3,4, 6]	*Zenaida macroura*
Inca Dove	*Columbina inca*
Common Ground-Dove	*Columbina passerina*
White-tipped Dove	*Leptotila verreauxi*
Order Psittaciformes - Parrots	
Monk Parakeet (I)[6]	*Myiopsitta monachus*
Green Parakeet[AR BCC]	*Aratinga holochroa*
Red-crowned Parrot[FC AR BCC]	*Amazona viridigenalis*
Order Cuculiformes – Cuckoos & Roadrunners	
Greater Roadrunner[5]	*Geococcyx californianus*
Groove-billed Ani	*Crotophaga sulcirostris*
Order Strigiformes - Owls	
Barn Owl[4,6]	*Tyto alba*
Western Screech-Owl	*Otus kennicottii*
Eastern Screech-Owl	*Otus asio*
Great Horned Owl[3]	*Bubo virginianus*
Burrowing Owl[BCC]	*Athene cunicularia*
Barred Owl[3]	*Strix varia*
Long-eared Owl	*Asio otus*
Short-eared Owl[AY BCC]	*Asio flammeus*
Order Caprimulgiformes - Goatsuckers	
Lesser Nighthawk	*Chordeiles acutipennis*
Common Nighthawk	*Chordeiles minor*
Order Apodiformes - Swifts	
Chimney Swift[4,6]	*Chaetura pelagica*
White-throated Swift	*Aeronautes saxatilis*
Order Coraciiformes - Kingfishers	
Ringed Kingfisher[1]	*Megaceryle torquata*
Belted Kingfisher[1]	*Megaceryle alcyon*
Green Kingfisher[1]	*Chloroceryle americana*
Order Piciformes - Woodpeckers	
Red-headed Woodpecker[AY BCC 2,6]	*Melanerpes erythrocephalus*
Acorn Woodpecker[2,6]	*Melanerpes formicivorus*
Golden-fronted Woodpecker[2]	*Melanerpes aurifrons*
Red-bellied Woodpecker[2]	*Melanerpes carolinus*
Yellow-bellied Sapsucker[2,6]	*Sphyrapicus varius*
Red-naped Sapsucker[2,6]	*Sphyrapicus nuchalis*
Ladder-backed Woodpecker[2]	*Picoides scalaris*
Downy Woodpecker[2]	*Picoides pubescens*
Hairy Woodpecker[2]	*Picoides villosus*
Northern Flicker[2,6]	*Colaptes auratus*
Pileated Woodpecker[2]	*Dryocopus pileatus*
Order Passeriformes – Perching Birds	
Family Tyrannidae - Flycatchers	
Eastern Phoebe	*Sayornis phoebe*
Say's Phoebe	*Sayornis saya*
Ash-throated Flycatcher	*Myiarchus cinerascens*
Great Crested Flycatcher	*Myiarchus crinitus*
Brown-crested Flycatcher	*Myiarchus tyrannulus*
Great Kiskadee	*Pitangus sulphuratus*

Couch's Kingbird	*Tyrannus couchii*
Cassin's Kingbird	*Tyrannus vociferans*
Western Kingbird	*Tyrannus verticalis*
Eastern Kingbird	*Tyrannus tyrannus*
Scissor-tailed Flycatcher [BCC]	*Tyrannus forficatus*
Family Laniidae - Shrikes	
Loggerhead Shrike [BCC]	*Lanius ludovicianus*
Northern Shrike	*Lanius excubitor*
Family Corvidae – Crows & Jays	
Green Jay[2]	*Cyanocorax yncas*
Steller's Jay[2]	*Cyanocitta stelleri*
Blue Jay[2,4,6]	*Cyanocitta cristata*
Western Scrub-Jay[4]	*Aphelocoma californica*
Mexican Jay	*Aphelocoma wollweberi*
American Crow[2,3,4,6]	*Corvus brachyrhynchos*
Fish Crow[2]	*Corvus ossifragus*
Chihuahuan Raven[2,3,4,5,6]	*Corvus cryptoleucus*
Common Raven[2,3,4,5,6]	*Corvus corax*
Family Alaudidae - Larks	
Horned Lark[2]	*Eremophila alpestris*
Family Hirundinidae - Swallows	
Purple Martin[6]	*Progne subis*
Tree Swallow	*Tachycineta bicolor*
Violet-green Swallow	*Tachycineta thalassina*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Bank Swallow	*Riparia riparia*
Cliff Swallow[6]	*Petrochelidon pyrrhonota*
Cave Swallow[6]	*Petrochelidon fulva*
Barn Swallow[3,6]	*Hirundo rustica*
Family Turdidae – Robins & Thrushes	
American Robin[2]	*Turdus migratorius*
Family Mimidae – Mockingbirds & Thrashers	
Northern Mockingbird[4]	*Mimus polyglottos*
Family Sturnidae - Starlings	
European Starling (I)[2,3,4,5,6]	*Sturnus vulgaris*
Family Motacillidae - Pipits	
American Pipit	*Anthus rubescens*
Sprague's Pipit [FC AY]	*Anthus spragueii*
Family Bombycillidae - Waxwings	
Cedar Waxwing[2]	*Bombycilla cedrorum*
Family Calcariidae - Longspurs	
Lapland Longspur	*Calcarius lapponicus*
Chestnut-collared Longspur [AY BCC]	*Calcarius ornatus*
Smith's Longspur [AY BCC]	*Calcarius pictus*
McCown's Longspur [BCC]	*Rhynchophanes mccownii*
Family Emberizidae –Towhees & Sparrows	
Vesper Sparrow	*Pooecetes gramineus*
Lark Sparrow	*Chondestes grammacus*
Lark Bunting [AY BCC 2]	*Calamospiza melanocorys*
Savannah Sparrow	*Passerculus sandwichensis*
Grasshopper Sparrow [BCC]	*Ammodramus savannarum*
White-crowned Sparrow[2,6]	*Zonotrichia leucophrys*
Family Cardinalidae – Cardinals, Grosbeaks, & Buntings	
Northern Cardinal[4]	*Cardinalis cardinalis*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Dickcissel [BCC]	*Spiza americana*
Family Icteridae – Blackbirds, Meadowlarks, & Orioles	
Bobolink	*Dolichonyx oryzivorus*
Red-winged Blackbird[2,3,6]	*Agelaius phoeniceus*
Eastern Meadowlark	*Sturnella magna*
Western Meadowlark	*Sturnella neglecta*
Yellow-headed Blackbird[2,3]	*Xanthocephalus xanthocephalus*
Rusty Blackbird [AY 6]	*Euphagus carolinus*
Brewer's Blackbird[2,3,6]	*Euphagus cyanocephalus*
Common Grackle[2,3,6]	*Quiscalus quiscula*
Boat-tailed Grackle[2,3,4]	*Quiscalus major*
Great-tailed Grackle[2,3,4,6]	*Quiscalus mexicanus*
Bronzed Cowbird[2,3]	*Molothrus aeneus*
Brown-headed Cowbird[2,3,5,6]	*Molothrus ater*
Bullock's Oriole	*Icterus bullockii*
Baltimore Oriole	*Icterus galbula*
Scott's Oriole	*Icterus parisorum*
Family Fringillidae - Finches	
Purple Finch[6]	*Carpodacus purpureus*
Cassin's Finch[6]	*Carpodacus cassinii*
House Finch[2,4,,6]	*Carpodacus mexicanus*
Red Crossbill	*Loxia curvirostra*
Lesser Goldfinch	*Spinus psaltria*
American Goldfinch	*Spinus tristis*
Family Passeridae – Old World Sparrows	
House Sparrow (I)[2,3,4,6]	*Passer domesticus*

(I) - Introduced Species, **F** = Federal, **S** = State, **E** = Endangered, **T** = Threatened, **C** = Candidate, **AY/AR** - Audubon's Watch List (NAS 2007) Yellow/Red Species where Yellow = Concern, Red = High Concern, **BCC** = Birds of Conservation Concern (USFWS 2008)
1 = Aquaculture; **2** = Crops; **3** = Livestock and Feed; **4**= Human Health and Safety; **5** = Natural resources; **6** = Property
-** Subspp. *paulus* *-** Subspp. *anatum/tundrius*
\# - Subspp. *rufa* ## - Subspp *roselaari/rufa*

Table C2. Common and scientific names are given for the 185 bird species commonly occurring in Texas that have little to no potential to be the target of a TWSP BDM project including BDM projects at airports because these species are mostly limited in their distribution in Texas, not typically associated with any type of damage, and are not found in habitat associated with areas of potential damage (e.g., urban areas, croplands, airport operating areas). Thus, TWSP does not anticipate that it will conduct BDM for these species, but the possibility could always arise.

Species	*Scientific Name*
Montezuma Quail [AY]	*Cyrtonyx montezumae*
Greater Prairie-Chicken [FE* SE* AR]	*Tympanuchus cupido*
Cory's Shearwater [AY]	*Calonectris diomedea*
Audubon's Shearwater [AY BCC]	*Puffinus lherminieri*
Yellow Rail [AR BCC]	*Coturnicops noveboracensis*
Black Rail [AR BCC]	*Laterallus jamaicensis*
Clapper Rail [AY]	*Rallus longirostris*
King Rail [AY]	*Rallus elegans*
Virginia Rail	*Rallus limicola*
Sora	*Porzana carolina*
Yellow-billed Cuckoo [FC BCC]	*Coccyzus americanus*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Flammulated Owl [AY BCC]	*Otus flammeolus*
Ferruginous Pygmy-Owl [ST]	*Glaucidium brasilianum*
Elf Owl [AY BCC]	*Micrathene whitneyi*
Spotted Owl [FT ST AR]	*Strix occidentalis*
Common Pauraque	*Nyctidromus albicollis*
Common Poorwill	*Phalaenoptilus nuttallii*
Chuck-will's-widow	*Caprimulgus carolinensis*
Eastern Whip-poor-will	*Caprimulgus vociferus*
Mexican Whip-poor-will	*Caprimulgus arizonae*
Buff-bellied Hummingbird [BCC]	*Amazilia yucatanensis*
Ruby-throated Hummingbird	*Archilochus colubris*
Black-chinned Hummingbird	*Archilochus alexandri*
Broad-tailed Hummingbird	*Selasphorus platycercus*
Rufous Hummingbird	*Selasphorus rufus*
Northern Beardless-Tyrannulet [ST BCC]	*Camptostoma imberbe*
Olive-sided Flycatcher [AY]	*Contopus cooperi*
Western Wood-Pewee	*Contopus sordidulus*
Eastern Wood-Pewee	*Contopus virens*
Yellow-bellied Flycatcher	*Empidonax flaviventris*
Acadian Flycatcher	*Empidonax virescens*
Alder Flycatcher	*Empidonax alnorum*
Willow Flycatcher [FE** SE** AY BCC]	*Empidonax traillii*
Least Flycatcher	*Empidonax minimus*
Hammond's Flycatcher	*Empidonax hammondii*

Gray Flycatcher	*Empidonax wrightii*
Dusky Flycatcher	*Empidonax oberholseri*
Cordilleran Flycatcher	*Empidonax occidentalis*
Black Phoebe	*Sayornis nigricans*
Vermillion Flycatcher	*Pyrocephalus rubinus*
White-eyed Vireo	*Vireo griseus*
Bell's Vireo [AR BCC]	*Vireo bellii*
Black-capped Vireo [FE SE AR]	*Vireo atricapilla*
Gray Vireo [AR BCC]	*Vireo vicinior*
Yellow-throated Vireo	*Vireo flavifrons*
Plumbeous Vireo	*Vireo plumbeus*
Cassin's Vireo	*Vireo cassinii*
Blue-headed Vireo	*Vireo solitarius*
Hutton's Vireo	*Vireo huttoni*
Warbling Vireo	*Vireo gilvus*
Philadelphia Vireo	*Vireo philadelphicus*
Red-eyed Vireo	*Vireo olivaceus*
Carolina Chickadee	*Poecile carolinensis*
Mountain Chickadee	*Poecile gambeli*
Juniper Titmouse	*Baeolophus ridgwayi*
Tufted Titmouse	*Baeolophus bicolor*
Black-crested Titmouse	*Baeolophus atricristatus*
Verdin [BCC]	*Auriparus flaviceps*
Bushtit	*Psaltriparus minimus*
Red-breasted Nuthatch	*Sitta canadensis*
White-breasted Nuthatch	*Sitta carolinensis*
Pygmy Nuthatch	*Sitta pygmaea*
Brown-headed Nuthatch	*Sitta pusilla*
Brown Creeper	*Certhia americana*
Cactus Wren	*Campylorhynchus brunneicapillus*
Rock Wren	*Salpinctes obsoletus*
Canyon Wren	*Catherpes mexicanus*
Carolina Wren	*Thryothorus ludovicianus*
Bewick's Wren	*Thryomanes bewickii*
House Wren	*Troglodytes aedon*
Winter Wren	*Troglodytes hiemalis*
Sedge Wren [BCC]	*Cistothorus platensis*
Marsh Wren	*Cistothorus palustris*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Black-tailed Gnatcatcher	*Polioptila melanura*
Golden-crowned Kinglet	*Regulus satrapa*
Ruby-crowned Kinglet	*Regulus calendula*
Eastern Bluebird	*Sialia sialis*
Western Bluebird	*Sialia mexicana*
Mountain Bluebird	*Sialia currucoides*
Townsend's Solitaire	*Myadestes townsendi*
Veery	*Catharus fuscescens*
Gray-cheeked Thrush	*Catharus mimimus*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
Wood Thrush [AY]	*Hylocichla mustelina*
Gray Catbird	*Dumetella carolinensus*
Sage Thrasher	*Oreoscoptes montanus*
Brown Thrasher	*Toxostoma rufum*
Long-billed Thrasher	*Toxostoma longirostre*
Curve-billed Thrasher [BCC]	*Toxostoma curvirostre*
Crissal Thrasher	*Toxostoma crissale*
Phainopepla	*Phainopepla nitens*
Ovenbird	*Seiurus aurocapilla*
Worm-eating Warbler	*Helmitheros vermivorum*
Louisiana Waterthrush	*Parkesia motacilla*
Northern Waterthrush	*Parkesia noveboracensis*
Golden-winged Warbler [AR]	*Vermivora chrysoptera*
Blue-winged Warbler [AY]	*Vermivora cyanoptera*
Black-and-white Warbler	*Mniotilta varia*
Prothonotary Warbler [AY BCC]	*Protonotaria citrea*
Swainson's Warbler [AY BCC]	*Limnothylpis swainsonii*
Tennessee Warbler	*Oreothlypis peregrina*
Orange-crowned Warbler	*Oreothlypis celata*
Colima Warbler [AY BCC]	*Oreothlypis crissalis*
Lucy's Warbler [AY]	*Oreothlypis luciae*

Nashville Warbler	*Oreothlypis ruficapilla*
Virginia's Warbler [AY BCC]	*Oreothlypis virginiae*
MacGillivray's Warbler	*Geothlypis tolmiei*
Mourning Warbler	*Geothlypis philadelphia*
Kentucky Warbler [AY]	*Geothlypis formosa*
Common Yellowthroat	*Geothlypis trichas*
Hooded Warbler	*Setophaga citrina*
American Redstart	*Setophaga ruticilla*
Cape May Warbler	*Setophaga tigrina*
Cerulean Warbler [AY]	*Setophaga cerulea*
Northern Parula	*Setophaga americana*
Tropical Parula [ST BCC]	*Setophaga pitiayumi*
Magnolia Warbler	*Setophaga magnolia*
Bay-breasted Warbler [AY]	*Setophaga castanea*
Blackburnian Warbler	*Setophaga fusca*
Yellow Warbler [BCC*]	*Setophaga petechia*
Chestnut-sided Warbler	*Setophaga pensylvanica*
Blackpoll Warbler	*Setophaga striata*
Black-throated Blue Warbler	*Setophaga caerulescens*
Palm Warbler	*Setophaga palmarum*
Pine Warbler	*Setophaga pinus*
Yellow-rumped Warbler	*Setophaga coronata*
Yellow-throated Warbler	*Setophaga dominica*
Prairie Warbler [AY]	*Setophaga discolor*
Grace's Warbler [AY BCC]	*Setophaga graciae*
Black-throated Gray Warbler	*Setophaga nigrescens*
Townsend's Warbler	*Setophaga townsendi*
Hermit Warbler [AY]	*Setophaga occidentalis*
Golden-cheeked Warbler [FE SE AR]	*Setophaga chrysoparia*
Black-throated Green Warbler	*Setophaga virens*
Canada Warbler [AY]	*Cardellina canadensis*
Wilson's Warbler	*Cardellina pusilla*
Painted Redstart [AY]	*Myioborus pictus*
Yellow-breasted Chat	*Icteria virens*
White-collared Seedeater [BCC]	*Sporophila torqueola*
Olive Sparrow	*Arremonops rufivirgatus*
Green-tailed Towhee	*Pipilo chlorurus*
Spotted Towhee	*Pipilo maculatus*
Eastern Towhee	*Pipilo erythrophthalmus*
Rufous-crowned Sparrow [BCC]	*Aimophila ruficeps*
Canyon Towhee	*Melozone fuscus*
Botteri's Sparrow [ST BCC]	*Peucaea botterii*
Cassin's Sparrow [BCC]	*Peucaea cassinii*
Bachman's Sparrow [ST AR]	*Peucaea aestivalis*
American Tree Sparrow	*Spizella arborea*
Chipping Sparrow	*Spizella passerina*
Clay-colored Sparrow	*Spizella pallida*
Brewer's Sparrow [AY]	*Spizella breweri*
Field Sparrow	*Spizella pusilla*
Black-chinned Sparrow [AR BCC]	*Spizella atrogularis*
Black-throated Sparrow	*Amphispiza bilineata*
Sage Sparrow [AY]	*Amphispiza belli*
Henslow's Sparrow [AR BCC]	*Ammodramus henslowii*
Le Conte's Sparrow [AR BCC]	*Ammodramus leconteii*
Nelson's Sparrow [AY BCC]	*Ammodramus nelsoni*
Seaside Sparrow [AR BCC]	*Ammodramus maritimus*
Fox Sparrow	*Passerella iliaca*
Song Sparrow	*Melospiza melodia*
Lincoln's Sparrow	*Melospiza lincolnii*
Swamp Sparrow	*Melospiza georgiana*
White-throated Sparrow	*Zonotrichia albicollis*
Harris's Sparrow [BCC]	*Zonotrichia querula*
Dark-eyed Junco	*Junco hyemalis*
Hepatic Tanager	*Piranga flava*
Summer Tanager [BCC]	*Piranga rubra*
Scarlet Tanager	*Piranga olivacea*
Western Tanager	*Piranga ludoviciana*
Pyrrhuloxia	*Cardinalis sinuatus*
Blue Grosbeak	*Passerina caerulea*
Lazuli Bunting	*Passerina amoena*
Indigo Bunting	*Passerina cyanea*

Varied Bunting [AY BCC]	*Passerina versicolor*
Painted Bunting [AY BCC]	*Passerina ciris*
Orchard Oriole [BCC]	*Icterus spurius*
Hooded Oriole [BCC]	*Icterus cucullatus*
Altamira Oriole [BCC]	*Icterus gularis*
Audubon's Oriole [AY BCC]	*Icterus graduacauda*
Pine Siskin	*Spinus pinus*

F = Federal, **S** = State, **E** = Endangered, **T** = Threatened, **AY/AR** - Audubon's Watch List (NAS 2007) Yellow/Red Species where Yellow = Concern, Red = High Concern, **BCC** = Birds of Conservation Concern (USFWS 2008)
*****Subspp. a*ttwateri* ****** Subspp. *extimus* # Subspp. *sonorana*

Table C3. Common and scientific names are given for the 176 bird species that are infrequently or accidentally seen in Texas (does not include extinct/extirpated species). Most of the following species (150 which includes 3 species that need further documentation) have been designated by TBRC (2012) as review species because they have been documented to occur in Texas once or a few times. In addition, 4 subspecies and 1 seasonal species from Tables C1 and C2 are designated review species and (this Table does not include unknown murre spp. (*Uria sp.*). included in TBRC (2012)), but have creditable sightings. Some of these species have the potential of being the focus of a BDM project. Shaded species will not likely ever be involved in a BDM project. These species are discussed little in the EA because they occur so infrequently or in such remote areas on the border, especially in the Lower Rio Grande Valley along the border of Texas or in the Gulf of Mexico, that it is highly unlikely in any given span of years that these would be the focus of a single BDM project. These are given to let the reader know that TWSP is aware of the other species potentially present in Texas. TBRC (2012) also lists 2 extinct and 1 extirpated species the Ivory-billed Woodpecker (*Campephilus principalis)*.

Species	*Scientific Name*
Brant	*Branta bernicla*
Trumpeter Swan [AY]	*Cygnus buccinator*
Tundra Swan [#]	*Cygnus columbianus*
Muscovy Duck [# (wild)]	*Cairina moschata*
Eurasian Wigeon	*Anas penelope*
American Black Duck	*Anas rubripes*
White-cheeked Pintail	*Anas bahamensis*
Garganey	*Anas querquedula*
King Eider	*Somateria spectabilis*
Common Eider	*Somateria mollissima*
Harlequin Duck	*Histrionicus histrionicus*
Barrow's Goldeneye	*Bucephala islandica*
Masked Duck	*Nomonyx dominicus*
Red-throated loon [#]	*Gavia stellata*
Pacific Loon [#]	*Gavia pacifica*
Yellow-billed Loon [AY]	*Gavia adamsii*
Red-necked Grebe	*Podiceps grisegena*
American Flamingo	*Phoenicopterus ruber*
Yellow-nosed Albatross	*Thalassarche chlororhynchos*
Black-capped Petrel [AR]	*Pterodroma hasitata*
Stejneger's Petrel	*Pterodroma longirostris*
White-chinned Petrel	*Procellaria aequinoctialis*
Great Shearwater [AY]	*Puffinus gravis*
Sooty Shearwater [AY]	*Puffinus griseus*
Manx Shearwater [AY]	*Puffinus puffinus*
Leach's Storm-Petrel	*Oceanodroma leucorhoa*
Band-rumped Storm-Petrel [# AR]	*Oceanodroma castro*
Red-billed Tropicbird	*Phaethon aethereus*
Jabiru	*Jabiru mycteria*
Blue-footed Booby	*Sula nebouxii*
Brown Booby	*Sula leucogaster*
Red-footed Booby	*Sula sula*
Bare-throated Tiger-Heron	*Tigrisoma mexicanum*
Hook-billed Kite [#]	*Chondrohierax uncinatus*
Snail Kite	*Rostrhamus sociabilis*
Double-toothed Kite	*Harpagus bidentatus*
Northern Goshawk	*Accpiter gentilis*
Crane Hawk	*Geranospiza caerulescens*
Common Black-Hawk [# ST BCC]	*Buteogallus anthracinus*
Roadside Hawk	*Buteo magnirostris*
Gray Hawk [# ST]	*Buteo nitidus*
Short-tailed Hawk	*Buteo brachyurus*
Collared Forest-Falcon	*Micrastur semitorquatus*
Aplomado Falcon [# FE SE]	*Falco femoralis*
Gyrfalcon	*Falco rusticolus*
Paint-billed Crake	*Neocrex erythrops*
Spotted Rail	*Pardirallus maculatus*
Double-striped Thick-knee	*Burhinus bistriatus*
Pacific Golden-Plover	*Pluvalis fulva*
Collared Plover	*Charadrius collaris*
Northern Jacana	*Jacana spinosa*
Wandering Tattler	*Tringa incana*
Spotted Redshank	*Tringa erythropus*
Eskimo Curlew [FE SE AR]	*Numenius borealis*
Surfbird [AY]	*Aphriza virgata*
Red-necked Stint	*Calidris ruficollis*
Sharp-tailed Sandpiper	*Calidris acuminata*
Purple Sandpiper	*Calidris maritima*
Curlew Sandpiper	*Calidris ferruginea*
Ruff	*Philomachus pugnax*
Red Phalarope	*Phalaropus fulicarius*
Black-legged Kittiwake	*Rissa tridactyla*
Black-headed Gull	*Chroicocephalus ridibundus*
Little Gull	*Hydrocoloeus minutus*
Black-tailed Gull	*Larus crassirostris*
Heermann's Gull [AY]	*Larus heermanni*
Mew Gull	*Larus canus*
Western Gull	*Larus occidentalis*
Yellow-legged Gull	*Larus michahellis*
Iceland Gull [AY]	*Larus glaucoides*
Slaty-backed Gull	*Larus schistisagus*
Glaucous-winged Gull	*Larus glaucescens*
Great Black-backed Gull	*Larus marinus*
Kelp Gull	*Larus dominicanus*
Brown Noddy	*Anous stolidus*
Black Noddy	*Anous minutus*
Bridled Tern [# AY]	*Onychoprion anaethetus*
Roseate Tern [AY]	*Sterna dougallii*
Arctic Tern	*Sterna paradisaea*
Elegant Tern [AY]	*Thalasseus elegans*
South Polar Skua	*Stercorarius maccormicki*
Long-tailed Jaeger	*Stercorarius longicaudus*
White-crowned Pigeon [AR]	*Patagioenas leucocephala*
Ruddy Ground-Dove	*Columbina talpacoti*
Ruddy Quail-Dove	*Geotrygon montana*
Dark-billed Cuckoo	*Coccyzus melacorhyphus*
Mangrove Cuckoo [AY]	*Coccyzus minor*
Snowy Owl	*Bubo scandiaca*
Northern Pygmy-Owl	*Glaucidium gnoma*
Mottled Owl	*Ciccaba virgatta*
Stygian Owl	*Asio stygius*
Northern Saw-whet Owl	*Aegolius acadicus*
Black Swift	*Cypseloides niger*
White-collared Swift	*Streptoprocne zonaris*
Green Violet-ear	*Colibri thalassinus*
Green-breasted Mango	*Anthracothorax prevostii*
Broad-billed Hummingbird [#]	*Cynanthus latirostris*
White-eared Hummingbird	*Hylocharis leucotis*
Berylline Hummingbird	*Amazilia beryllina*
Violet-crowned Hummingbird	*Amazilia violaceps*

Blue-throated Hummingbird# AY	*Lampornis clemenciae*
Magnificent Hummingbird#	*Eugenes fulgens*
Lucifer Hummingbird# BCC	*Calothorax lucifer*
Anna's Hummingbird#	*Calypte anna*
Costa's Hummingbird AY	*Calypte costae*
Calliope Hummingbird# AY	*Stellula calliope*
Allen's Hummingbird# AY	*Selasphorus sasin*
Elegant Trogon AY	*Trogon elegans*
Amazon Kingfisher	*Chloroceryle amazona*
Lewis's Woodpecker# AR BCC	*Melanerpes lewis*
Williamson's Sapsucker# AY	*Sphyrapicus thyroideus*
Red-breasted Sapsucker	*Sphyrapicus ruber*
Red-cockaded Woodpecker# FE SE AR	*Picoides borealis*
Barred Antshrike	*Thamnophilus doliatus*
Greenish Elaenia	*Myiopagis viridicata*
White-crested Elaenia	*Elaenia albiceps*
Tufted Flycatcher	*Mitrenphanes phaeocercus*
Greater Pewee	*Contopus pertinax*
Buff-breasted Flycatcher	*Empidonax fulvifrons*
Dusky-capped Flycatcher	*Myiarchus tuberculifer*
Nutting's Flycatcher	*Myiarchus nuttingi*
Social Flycatcher	*Myiozetetes similis*
Sulphur-bellied Flycatcher	*Myiodynastes luteiventris*
Piratic Flycatcher	*Legatus leucophaius*
Tropical Kingbird#	*Tyrannus melancholicus*
Thick-billed Kingbird AY	*Tyrannus crassirostris*
Gray Kingbird	*Tyrannus dominicensis*
Fork-tailed Flycatcher	*Tyrannus savana*
Masked Tityra	*Tityra semifasciata*
Rose-throated Becard ST BCC	*Pachyramphus aglaiae*
Yellow-green Vireo#	*Vireo flavoviridis*
Black-whiskered Vireo	*Vireo altiloquus*
Yucatan Vireo	*Vireo magister*
Brown Jay	*Psilorhinus morio*
Pinyon Jay AY	*Gymnorhinus cyanocephalus*
Clark's Nutcracker	*Nucifraga columbiana*
Black-billed Magpie	*Pica hudsonia*
Tamaulipas Crow	*Corvus imparatus*
Gray-breasted Martin	*Progne chalybea*
Black-capped Chickadee	*Poecile atricapillus*
American Dipper	*Cinclus mexicanus*
Northern Wheatear	*Oenanthe oenanthe*
Orange-billed Nightingale-Thrush	*Catharus aurantiirostris*
Black-headed Nightingale-Thrush	*Catharus mexicanus*
Clay-colored Thrush#	*Turdus grayi*
White-throated Thrush	*Turdus assimilis*
Rufous-backed Robin	*Turdus rufopalliatus*
Varied Thrush AY	*Ixoreus naevius*
Aztec Thrush	*Ridgwayia pinicola*
Black Catbird	*Melanoptila glabrirostris*
Blue Mockingbird	*Melanotis caerulescens*
Bohemian Waxwing	*Bombycilla garrulus*
Gray Silky-Flycatcher	*Ptilogonys cinereus*
Olive Warbler	*Peucedramus taeniatus*
Snow Bunting	*Plectrophenax nivalis*
Crescent-chested Warbler	*Oreothlypis superciliosa*
Connecticut Warbler	*Oporornis agilis*
Gray-crowned Yellowthroat	*Geothlypis poliocephala*
Fan-tailed Warbler	*Basileuterus lachrymosus*
Rufous-capped Warbler	*Basileuterus rufifrons*
Golden-crowned Warbler	*Basileuterus culicivorus*
Red-faced Warbler# AY BCC	*Cardellina rubrifrons*
Slate-throated Redstart	*Myioborus miniatus*
Yellow-faced Grassquit	*Tiaris olivaceus*
Baird's Sparrow# AR BCC	*Ammodramus bairdii*
Golden-crowned Sparrow	*Zonotrichia atricapilla*
Yellow-eyed Junco	*Junco phaeonotus*
Flame-colored Tanager	*Piranga bidentata*
Crimson-collared Grosbeak	*Rhodothraupis celaeno*
Blue Bunting	*Cyanocompsa parellina*
Shiny Cowbird	*Molothrus bonariensis*
Black-vented Oriole	*Icterus wagleri*
Streaked-backed Oriole	*Icterus pustulatus*
Pine Grosbeak	*Pinicola enucleator*
White-winged Crossbill	*Loxia leucoptera*
Common Redpoll	*Acanthis flammea*
Lawrence's Goldfinch AY	*Spinus lawrencei*
Evening Grosbeak	*Coccothraustes vespertinus*

(I) - Introduced Species, **F** = Federal, **S** = State, **E** = Endangered, **T** = Threatened, **AY/AR** - Audubon's Watch List (NAS 2007) Yellow/Red Species where Yellow = Concern, Red = High Concern, **BCC** = Birds of Conservation Concern (USFWS 2008)
- Rare species in Texas that are not TBRC (2012) review species, but restricted to small areas of the state or outside their normal range.

Table C4. Several species of waterfowl, gallinaceous birds, doves, and parrots have been released into the wild from captivity and periodically are the focus of a BDM project (feral poultry and parrots) with prevalent species seen given (does not include well-established introduced/feral populations given in Tables C1 to C3). The most common species involved in feral poultry damage management projects are the domestic varieties of Mallard, Muscovy Duck, Greylag and Chinese Goose, peafowl, Guineafowl, and feral chickens. Several other species of birds escape from private collections and have the possibility of being seen and the focus of a BDM project. Table C4 adds 12 species of birds to the potential list of species in Texas (Wild Mallard and Muscovy Duck are already listed in Table C1). Shaded species are not likely to cause problems in Texas.

Species	*Scientific Name*
Emu	*Dromaius novaehollandiae*
Domestic Greylag Goose	*Anser anser*
Domestic Swan-Goose (Chinese)	*Anser cygnoides*
Mute Swan	*Cygnus olor*
Domestic Mallard	*Anas platyrhynchos*
Domestic Muscovy Duck	*Cairina moschata*
Common Peafowl	*Pavo cristatus*
Helmeted Guineafowl	*Numida meleagris*
Feral chicken (Red Junglefowl)	*Gallus gallus*
Chukar	*Alectoris chukar*
African Collared-Dove*	*Streptopelia risoria*
Budgerigar	*Melopsittacus undulatus*
Red-lored Parrot	*Amazona autumnalis*
Yellow-headed Parrot	*Amazona oratrix*

*Ringed Turtle-Dove

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APPENDIX D: BIRD STRIKES IN THE UNITED STATES AND TEXAS

Bird Strikes in the United States are reported to the Federal Aviation Administration on a form. Most bird strikes are not reported. However, pilots have become more aware of the importance of bird strike reporting and are doing so more frequently. In the 1990s it was assumed that, at most, about 20% of the strikes were reported. However, pilots and airports have been reporting with more frequency. As a result, more air strikes are being reported, but increases in air traffic and several bird species populations have increased strikes, and the numbers being reported today far exceed the number reported in the 1990s. Table D1 has all of the strikes reported in the United States and Texas from FY02 to FY11.

Table D1. Bird strikes at airfields in the United States and Texas as reported to the Federal Aviation Administration from FY02 to FY11 (FAA 2012). The species included are only those that are commonly found in Texas. The other known categories include those species not found in Texas where the species was known such as "Other Duck" which includes American Black Duck, Long-tailed Duck, and others not commonly found in Texas. A total of 82,516 and 6,601 were recorded in the United States and Texas with about 50% of strikes from known species.

	UNITED STATES					TEXAS				
SPECIES	**Number of Strikes**	**% of Strikes w/ Known Sp.**	**Damaging Strikes**	**% Strikes That Cause Damage**	**# Strikes w/ No Damage Data**	**Number of Strikes**	**% of Strikes w/ Known Sp.**	**Damaging Strikes**	**% Strikes That Cause Damage**	**# Strikes w/ No Damage Data**
Waterfowl (Geese, Swans, Ducks, Cranes, Gallinules, Rails)										
Black-bellied Whistling-Duck	1	0.00%	0	0%	0	1	0.03%	0	0%	0
Greater White-fronted Goose	23	0.06%	13	65%	3	1	0.03%	1	100%	0
Snow Goose	61	0.15%	50	86%	3	4	0.12%	3	100%	1
Canada/Cackling Goose	626	1.55%	315	58%	87	5	0.15%	4	80%	0
Other Goose (Brant)	12	0.03%	4	67%	6	-	-	-	-	-
Unknown Goose	109	0.27%	62	59%	4	3	0.09%	3	100%	0
All Swans	13	0.03%	8	89%	4	-	-	-	-	-
Muscovy Duck	1	0.00%	1	100%	0	-	-	-	-	-
Wood Duck	28	0.07%	10	63	12	2	0.06%	1	100%	1
Gadwall	39	0.10%	12	40%	9	2	0.06%	1	50%	0
American Wigeon	35	0.09%	12	39%	4	1	0.03%	0	0%	0
Mallard	417	1.03%	92	39%	184	5	0.15%	1	25%	1
Mottled Duck	15	0.04%	3	43%	8	-	-	-	-	-
Blue-winged Teal	20	0.05%	7	41%	3	1	0.03%	0	N/A	1
Cinnamon Teal	4	0.01%	1	50%	2	-	-	-	-	-
Northern Shoveler	33	0.08%	16	53%	6	3	0.09%	1	100%	0
Northern Pintail	94	0.23%	52	58%	4	1	0.03%	0	0%	0
Green-winged Teal	41	0.10%	10	33%	11	-	-	-	-	-
Canvasback	14	0.03%	6	67%	5	-	-	-	-	-
Redhead	5	0.01%	1	33%	2	1	0.03%	1	100%	0
Ring-necked Duck	11	0.03%	4	44%	2	3	0.09%	2	67%	0
Greater Scaup	5	0.01%	2	50%	1	-	-	-	-	-
Lesser Scaup	26	0.06%	12	60%	6	1	0.03%	1	100%	0
White-winged Scoter	1	0.00%	1	100%	0	-	-		-	
Long-tailed Duck	4	0.01%	1	25%	0	-	-		-	
Bufflehead	9	0.02%	1	17%	3	-	-	-	-	-
Common Goldeneye	5	0.01%	2	67%	2	-	-	-	-	-
Hooded Merganser	4	0.01%	1	33%	1	-	-	-	-	-
Common Merganser	2	0.00%	1	100%	1	-	-	-	-	-
Red-breasted Merganser	5	0.01%	1	25%	1	-	-	-	-	-
Ruddy Duck	30	0.07%	6	40%	15	1	0.03%	0	0%	0
Other Duck*	36	0.09%	2	18%	25	-	-	-	-	-
Unknown Duck	260	0.64%	86	36%	21	16	0.48%	6	40%	1
Unknown Goose/Swan/Duck	41	0.10%	11	27%	0	4	0.12%	2	50%	0
Waterfowl Total	**2,030**	**5.02%**	**806**	**50%**	**432**	**53**	**1.59%**	**26**	**54%**	**5**
Gallinaceous Bird (Quail, Grouse, Turkey and Introduced Pheasant, Francolin, and Partridge)										
Scaled Quail	3	0.01%	0	N/A	3	3	0.09%	0	N/A	3
Northern Bobwhite	4	0.01%	0	0%	2	-	-	-	-	-
Unknown Quail	6	0.01%	0	0%	2	-	-	-	-	-
Ring-necked Pheasant	25	0.06%	8	53%	10	-	-	-	-	-
Other Grouse*	45	0.11%	12	32%	7	-	-	-	-	-
Unknown Grouse	1	0.00%	0	0%	0	-	-	-	-	-
Wild Turkey	36	0.09%	13	48%	9	-	-	-	-	-
Gallinaceous Bird Total	**120**	**0.30%**	**33**	**38%**	**33**	**3**	**0.09%**	**0**	**N/A**	**3**
Waterbirds (Loons, Grebes, Pelicans, Cormorants, Pelagics, Kingfishers)										
Common Loon	19	0.05%	11	79%	5	-	-	-	-	-
Other Loons*	3	0.01%	2	100%	1	-	-	-	-	-

Unknown Loon	2	0.00%	1	50%	0	-	-	-	-	-
Pied-billed Grebe	18	0.04%	2	20%	8	3	0.09%	0	0%	1
Horned Grebe	7	0.02%	2	100%	5	-	-	-	-	-
Eared Grebe	2	0.00%	0	N/A	2	-	-	-	-	-
Western Grebe	14	0.03%	5	63%	6	-	-	-	-	-
Clark's Grebe	1	0.00%	0	N/A	1	-	-	-	-	-
Red-necked Grebe (Other)	2	0.00%	0	N/A	2	-	-	-	-	-
Unknown Grebe	6	0.01%	2	50%	2	-	-	-	-	-
Pelagic Birds*	14	0.03%	0	0%	13	-	-		-	-
American White Pelican	12	0.03%	9	82%	1	1	0.03%	1	100%	0
Brown Pelican	26	0.06%	11	48%	3	1	0.03%	1	100%	0
Unknown Pelican	1	0.00%	1	100%	0	-	-		-	-
Double-crested Cormorant	77	0.19%	25	58%	34	3	0.09%	1	50%	1
Unknown Cormorant	3	0.01%	0	0%	2	-	-	-	-	-
Anhinga	15	0.04%	8	57%	1	1	0.03%	1	100%	0
Other Pelecaniformes*	21	0.05%	8	44%	3	-	-	-	-	-
Belted Kingfisher	2	0.00%	0	0%	1	-	-	-	-	-
Waterbird Total	**245**	**0.61%**	**87**	**56%**	**90**	**9**	**0.27%**	**4**	**57%**	**2**
Wading Birds (Herons, Egrets, Ibises, Storks, Bitterns, Rails, Cranes)										
Wood Stork	12	0.03%	4	50%	4	-	-	-	-	-
American Bittern	7	0.02%	2	33%	1	-	-	-	-	-
Least Bittern	2	0.00%	0	0%	1	-	-	-	-	-
Great Blue Heron	180	0.45%	41	39%	75	3	0.09%	0	0%	0
Great Egret	44	0.11%	10	37%	17	2	0.06%	0	N/A	2
Snowy Egret	19	0.05%	1	25%	15	3	0.09%	1	50%	1
Tricolored Heron	2	0.00%	0	N/A	2	1	0.03%	0	N/A	1
Little Blue Heron	4	0.01%	0	N/A	4	-	-	-	-	-
Cattle Egret	181	0.45%	17	16%	75	27	0.81%	1	11%	18
Green Heron	12	0.03%	0	0%	5	-	-	-	-	-
Black-Crowned Night Heron	36	0.09%	2	29%	29	-	-	-	-	-
Yellow-crowned Night-Heron	14	0.03%	3	43%	7	6	0.18%	1	33%	3
Unknown Egret/Heron	115	0.28%	11	12%	20	14	0.42%	3	25%	2
White Ibis	4	0.01%	0	0%	3	-	-	-	-	-
White-faced Ibis	11	0.03%	6	86%	4	-	-	-	-	-
Unknown Ibis	3	0.01%	0	0%	0	-	-	-	-	-
Roseate Spoonbill	2	0.00%	0	0%	1	1	0.03%	0	N/A	1
Clapper Rail	4	0.01%	0	0%	3	-	-	-	-	-
Virginia Rail	7	0.02%	0	0%	3	-	-	-	-	-
Sora	26	0.06%	1	6%	9	3	0.09%	1	50%	1
Unknown Rail	3	0.01%	0	0%	1	-	-	-	-	-
Purple Gallinule	1	0.00%	1	100%	0	1	0.03%	1	100%	0
Common Gallinule	2	0.00%	1	50%	1	-	-	-	-	-
American Coot	101	0.25%	20	35%	44	3	0.09%	1	33%	0
Sandhill Crane	62	0.15%	25	49%	11	3	0.09%	2	67%	0
Whooping Crane	1	0.00%	1	100%	0	-	-	-	-	-
Total Wading Birds	**855**	**2.11%**	**146**	**28%**	**334**	**67**	**2.01%**	**11**	**29%**	**29**
Raptors (Vultures, Kites, Eagles, Harriers, Accipiters, Hawks, Falcons, Owls, Shrikes)										
Turkey Vulture	336	0.83%	150	52%	50	44	1.32%	23	64%	8
Black Vulture	91	0.23%	52	62%	7	9	0.27%	5	63%	1
Unknown Vulture	131	0.32%	74	58%	4	17	0.51%	12	71%	0
Osprey	163	0.40%	29	31%	68	1	0.03%	1	100%	0
Swallow-tailed Kite	4	0.01%	1	33%	1	-	-	-	-	-
White-tailed Kite	18	0.04%	3	30%	8	-	-	-	-	-
Mississippi Kite	8	0.02%	0	0%	1	2	0.06%	0	0%	0
Bald Eagle	99	0.24%	40	53%	23	2	0.06%	1	100%	1
Golden Eagle	10	0.02%	1	20%	5	-	-	-	-	-
Unknown Eagle	3	0.01%	2	67%	0	1	0.03%	0	0%	0
Northern Harrier	64	0.16%	1	7%	50	1	0.03%	0	N/A	1
Sharp-shinned Hawk	14	0.03%	1	17%	8	-	-	-	-	-
Cooper's Hawk	54	0.13%	3	14%	32	-	-	-	-	-
Northern Goshawk	2	0.00%	0	N/A	2	-	-	-	-	-
Harris's Hawk	2	0.00%	0	N/A	2	-	-	-	-	-
Red-shouldered Hawk	20	0.05%	2	20%	10	2	0.06%	0	0%	1
Broad-winged Hawk	15	0.04%	2	20%	5	1	0.03%	0	N/A	1
Swainson's Hawk	78	0.19%	12	28%	35	10	0.30%	3	43%	3
White-tailed Hawk	2	0.00%	0	N/A	2	2	0.06%	0	N/A	2
Red-tailed Hawk	1,153	2.85%	165	29%	586	46	1.38%	8	35%	23
Ferruginous Hawk	16	0.04%	1	17%	10	2	0.06%	0	0%	0
Rough-legged Hawk	48	0.12%	4	27%	33	-	-	-	-	-
Unknown Hawk	554	1.37%	100	23%	117	30	0.90%	9	36%	5
Unknown Hawk/Eagle/Vulture	11	0.03%	4	36%	0	1	0.03%	0	0%	0
American Kestrel	2,388	5.91%	15	2%	1,681	87	2.61%	2	7%	60
Merlin	42	0.10%	0	0%	26	1	0.03%	0	0%	0
Peregrine Falcon	154	0.38%	11	21%	102	2	0.06%	0	N/A	2
Prairie Falcon	18	0.04%	1	11%	9	1	0.03%	0	0%	0

Caracara	6	0.01%	1	50%	4	5	0.15%	0	0%	4
Other Falcon*	2	0.00%	0	N/A	2	-	-	-	-	-
Unknown Falcon	26	0.06%	0	0%	6	-	-	-	-	-
Barn Owl	604	1.49%	20	11%	427	30	0.90%	1	11%	21
Western Screech-Owl	2	0.00%	0	0%	1	-	-	-	-	-
Eastern Screech-Owl	1	0.00%	1	100%	0	-	-	-	-	-
Great Horned Owl	128	0.32%	16	35%	82	9	0.27%	0	0%	8
Burrowing Owl	96	0.24%	0	0%	71	4	0.12%	0	N/A	4
Barred Owl	13	0.03%	0	0%	9	-	-	-	-	-
Long-eared Owl	7	0.02%	2	100%	5	-	-	-	-	-
Short-eared Owl	251	0.62%	6	8%	174	6	0.18%	0	0%	5
Other Owl*	47	0.12%	4	24%	30	-	-	-	-	-
Unknown Owl	124	0.31%	11	12%	30	10	0.30%	0	0%	4
Loggerhead Shrike	13	0.03%	0	0%	8	5	0.15%	0	0%	4
Raptor Total	**6,818**	**16.86%**	**735**	**24%**	**3,726**	**331**	**9.92%**	**65**	**38%**	**158**
Shorebirds (Plovers, Sandpipers, Curlews, Godwits, Turnstones, Snipe, Phalaropes)										
Black-bellied Plover	71	0.18%	4	15%	44	-	-	-	-	-
American Golden-Plover	80	0.20%	3	11%	53	4	0.12%	0	N/A	4
Snowy Plover	1	0.00%	0	0%	0	-	-	-	-	-
Wilson's Plover	3	0.01%	0	0%	2	-	-	-	-	-
Semipalmated Plover	54	0.13%	0	0%	39	-	-	-	-	-
Piping Plover	3	0.01%	1	33%	0	-	-	-	-	-
Killdeer	2,427	6.00%	30	4%	1,602	250	7.49%	6	9%	184
Unknown Plover	39	0.10%	2	7%	10	-	-	-	-	-
American Oystercatcher	7	0.02%	0	N/A	7	-	-	-	-	-
Black-necked Stilt	3	0.01%	0	0%	2	1	0.03%	0	0%	0
American Avocet	2	0.00%	1	100%	1	-	-	-	-	-
Spotted Sandpiper	17	0.04%	2	25%	9	1	0.03%	0	N/A	1
Solitary Sandpiper	3	0.01%	0	N/A	3	-	-	-	-	-
Greater Yellowlegs	5	0.01%	1	20%	0	-	-	-	-	-
Willet	3	0.01%	0	N/A	3	-	-	-	-	-
Lesser Yellowlegs	5	0.01%	1	50%	3	1	0.03%	0	N/A	1
Upland Sandpiper	114	0.28%	1	4%	86	67	2.01%	0	0%	54
Whimbrel	9	0.02%	2	40%	4	-	-	-	-	-
Long-billed Curlew	7	0.02%	1	33%	4	-	-	-	-	-
Hudsonian Godwit	3	0.01%	0	N/A	3	1	0.03%	0	N/A	1
Marbled Godwit	2	0.00%	1	100%	1	1	0.03%	1	100%	0
Ruddy Turnstone	8	0.02%	0	0%	7	-	-	-	-	-
Red Knot	3	0.01%	0	0%	0	-	-	-	-	-
Sanderling	21	0.05%	1	11%	12	1	0.03%	0	N/A	1
Semipalmated Sandpiper	37	0.09%	0	0%	10	1	0.03%	0	N/A	1
Western Sandpiper	50	0.12%	2	5%	10	-	-	-	-	-
Least Sandpiper	71	0.18%	1	3%	39	7	0.21%	0	0%	6
White-rumped Sandpiper	4	0.01%	0	N/A	4	-	-	-	-	-
Baird's Sandpiper	14	0.03%	0	0%	9	3	0.09%	0	N/A	3
Pectoral Sandpiper	10	0.02%	1	17%	4	3	0.09%	0	N/A	3
Dunlin	24	0.06%	2	15%	11	-	-	-	-	-
Buff-breasted Sandpiper	25	0.06%	0	0%	15	2	0.06%	0		2
Unknown Sandpiper	140	0.35%	6	8%	64	15	0.45%	1	33%	12
Short-billed Dowitcher	7	0.02%	1	17%	1	-	-	-	-	-
Long-billed Dowitcher	7	0.02%	0	0%	5	-	-	-	-	-
Wilson's Snipe	46	0.11%	2	7%	16	-	-	-	-	-
American Woodcock	45	0.11%	1	5%	23	1	0.03%	0	0%	0
Wilson's Phalarope	2	0.00%	0	0%	0	-	-	-	-	-
Red-necked Phalarope	3	0.01%	0	0%	2	-	-	-	-	-
Other Shorebird*	515	1.27%	5	3	347	-	-	-	-	-
Unknown Shorebird	19	0.05%	0	0%	6	-	-	-	-	-
Shorebird Total	**3,909**	**9.67%**	**72**	**5%**	**2,458**	**359**	**10.76%**	**8**	**9%**	**273**
Larids (Gulls, Terns, Skimmers, Jaegers)										
Bonaparte's Gull	26	0.06%	0	0%	15	-	-	-	-	-
Laughing Gull	192	0.47%	11	12%	100	17	0.51%	1	9%	6
Franklin's Gull	80	0.20%	3	8%	44	21	0.63%	1	9%	12
Ringed-billed Gull	817	2.02%	64	18%	464	8	0.24%	0	0%	3
California Gull	90	0.22%	8	16%	41	-	-	-	-	-
Herring Gull	685	1.69%	57	22%	429	5	0.15%	0	N/A	5
Thayer's Gull	2	0.00%	0	0%	1	-	-	-	-	-
Lesser Black-backed Gull	3	0.01%	1	50%	1	-	-	-	-	-
Glaucous Gull	15	0.04%	1	14%	8	-	-	-	-	-
Other Gull*	246	0.61%	26	25%	143	-	-	-	-	-
Unknown Gull	2,135	5.28%	317	18%	403	55	1.65%	8	20%	15
Sooty Tern	1	0.00%	0	N/A	1	-	-	-	-	-
Least Tern	21	0.05%	0	0%	12	2	0.06%	0	0%	1
Gull-billed Tern	3	0.01%	0	0%	2	-	-	-	-	-
Caspian Tern	15	0.04%	0	0%	12	-	-	-	-	-
Black Tern	4	0.01%	0	0%	0	1	0.03%	0	0%	0

Common Tern	10	0.02%	1	33%	7	-	-	-	-	-
Forster's Tern	6	0.01%	0	N/A	6	-	-	-	-	-
Royal Tern	1	0.00%	0	N/A	1	-	-	-	-	-
Sandwich Tern	1	0.00%	0	N/A	1	-	-	-	-	-
Black Skimmer	6	0.01%	0	N/A	6	-	-	-	-	-
Parasitic Jaeger	2	0.00%	0	N/A	2	-	-	-	-	-
Other Tern/Larid*	9	0.02%	0	0%	6	-	-	-	-	-
Unknown Tern	13	0.03%	0	0%	4	-	-	-	-	-
Unknown Gull/Tern	2	0.00%	0	0%	0	-	-	-	-	-
Larid Total	**4,385**	**10.85%**	**489**	**18%**	**1,709**	**109**	**3.27%**	**10**	**15%**	**42**
Invasive Species (Introduced Parrots, Doves, Starlings, Sparrows)										
Budgerigar	9	0.02%	0	0%	8	4	0.12%	0	N/A	4
Parrots	4	0.01%	0	0%	3	-	-	-	-	-
Feral Rock Pigeon	1,335	3.30%	114	17%	655	258	7.73%	26	18%	114
Eurasian Collared-Dove	1	0.00%	0	N/A	1	-	-	-	-	-
Spotted Dove	3	0.01%	1	33%	0	-	-	-	-	-
Hawaii Exotic Doves*	261	0.65%	1	1%	130	-	-	-	-	-
Unknown Pigeon/Dove	34	0.08%	5	17%	4	-	-	-	-	-
European Starling	1,944	4.81%	67	6%	898	50	1.50%	1	5%	28
House Sparrow	110	0.27%	3	6%	61	4	0.12%	0	0%	2
Hawaii Exotic Passerines*	194	0.48%	0	0%	91	-	-	-	-	-
Invasive Spp. Total	**3,895**	**9.63%**	**191**	**9%**	**1,849**	**316**	**9.47%**	**27**	**16%**	**148**
Natives Doves and Pigeons										
Band-tailed Pigeon	7	0.02%	3	50%	1	-	-	-	-	-
White-winged Dove	33	0.08%	1	7%	18	10	0.30%	0	0%	6
Mourning Dove	3,908	9.67%	93	7%	2,491	758	22.72%	26	11%	520
Inca Dove	5	0.01%	0	0%	4	-	-	-	-	-
Common Ground-Dove	6	0.01%	0	0%	5	-	-	-	-	-
Unknown Dove	453	1.12%	18	8%	215	184	5.52%	7	9%	105
Native Dove Total	**4,412**	**10.91%**	**115**	**7%**	**2,734**	**952**	**28.54%**	**33**	**10%**	**631**
Aerialists (Nightjars, Swifts, Swallows, Hummingbirds)										
Common Nighthawk	296	0.73%	1	1%	180	37	1.11%	0	0%	28
Lesser Nighthawk	5	0.01%	0	N/A	5	1	0.03%	0	N/A	1
Common Poorwill	6	0.01%	0	N/A	6	-	-	-	-	-
Chuck-will's-widow	5	0.01%	0	0%	2	1	0.03%	0	0%	0
Whip-poor-will	3	0.01%	0	0%	2	1	0.03%	0	N/A	1
Unknown Nightjar	4	0.01%	0	N/A	4	4	0.12%	0	N/A	4
Chimney Swift	325	0.80%	2	1%	91	13	0.39%	0	0%	2
White-throated Swift	21	0.05%	1	5%	2	-	-	-	-	-
Other swift*	22	0.05%	0	0%	9	-	-	-	-	-
Unknown Swift	7	0.02%	0	0%	1	-	-	-	-	-
Hummingbird spp.*	28	0.07%	0	0%	7	2	0.06%	0	0%	1
Purple Martin	125	0.31%	2	2%	43	7	0.21%	1	25%	3
Tree Swallow	301	0.74%	0	0%	112	-	-	-	-	-
Violet-green Swallow	13	0.03%	0	0%	6	-	-	-	-	-
N. Rough-winged Swallow	24	0.06%	1	8%	13	-	-	-	-	-
Bank Swallow	177	0.44%	2	2%	89	1	0.03%	0	0%	0
Cliff Swallows	679	1.68%	7	2%	310	50	1.50%	4	15%	24
Cave Swallow	3	0.01%	1	33%	0	2	0.06%	1	50%	0
Barn Swallow	1,804	4.46%	8	1%	983	122	3.66%	1	2%	80
Unknown Swallow	545	1.35%	2	1%	144	40	1.20%	0	0%	17
Aerialist Total	**4,393**	**10.86%**	**27**	**1%**	**2,009**	**279**	**8.36%**	**7**	**6%**	**160**
Other Non-passerines (Woodpeckers, Cuckoos)										
Yellow-bellied Sapsucker	21	0.05%	0	0%	4	1	0.03%	0	N/A	1
Red-naped Sapsucker	3	0.01%	1	33%	0	-	-	-	-	-
Downy Woodpecker	2	0.00%	0	0%	1	-	-	-	-	-
Hairy Woodpecker	3	0.01%	0	0%	2	-	-	-	-	-
Northern Flicker	42	0.10%	3	21%	28	2	0.06%	0	0%	1
Unknown Woodpecker	5	0.01%	0	0%	1	-	-	-	-	-
Yellow-billed Cuckoo	28	0.07%	3	14%	7	1	0.03%	0	N/A	1
Black-billed Cuckoo	1	0.00%	0	0%	0	-	-	-	-	-
Greater Roadrunner	1	0.00%	0	N/A	1	-	-	-	-	-
Unknown Cuckoo	4	0.01%	1	25%	0	-	-	-	-	-
Other Bird Total	**110**	**0.27%**	**8**	**12%**	**44**	**6**	**0.18%**	**0**	**0%**	**4**
Grassland Species (Larks, Pipits, Longspurs, Sparrows, Meadowlarks)										
Horned Lark	1,916	4.74%	18	2%	1,032	71	2.13%	5	13%	32
American Pipit	51	0.13%	0	0%	15	6	0.18%	0	0%	1
Sprague's Pipit	3	0.01%	0	0%	1	2	0.06%	0	0%	1
Unknown Pipit	2	0.00%	0	0%	0	-	-	-	-	-
Lapland Longspur	16	0.04%	0	0%	6	-	-	-	-	-
Chestnut-collared Longspur	5	0.01%	0	0%	0	4	0.12%	0	0%	1
Smith's Longspur	5	0.01%	0	0%	0	1	0.03%	0	0%	0
McCown's Longspur	1	0.00%	0	N/A	1	1	0.03%	0	N/A	1

Other Longspur*	125	0.31%	0	0%	54	-	-	-	-	-
Eastern Towhee	3	0.01%	0	0%	2	-	-	-	-	-
American Tree Sparrow	14	0.03%	1	11%	5	2	0.06%	1	50%	0
Chipping Sparrow	34	0.08%	0	0%	11	3	0.09%	0	0%	1
Brewer's Sparrow	1	0.00%	0	0%	0	-	-	-	-	-
Field Sparrow	18	0.04%	0	0%	9	-	-	-	-	-
Lark Sparrow	18	0.04%	0	0%	14	2	0.06%	0	0%	1
Vesper Sparrow	31	0.08%	0	0%	14	7	0.21%	0	0%	1
Black-throated Sparrow	1	0.00%	0	N/A	1	-	-	-	-	-
Sage Sparrow	8	0.02%	0	0%	3	-	-	-	-	-
Lark's Bunting	72	0.18%	0	0%	56	5	0.15%	0	0%	4
Savannah Sparrow	235	0.58%	1	1%	97	10	0.30%	0	0%	9
Grasshopper Sparrow	43	0.11%	2	9%	20	3	0.09%	1	100%	2
Nelson's Sparrow	2	0.00%	0	0%	1	-	-	-	-	-
Fox Sparrow	22	0.05%	1	6%	4	-	-	-	-	-
Song Sparrow	64	0.16%	0	0%	29	4	0.12%	0	N/A	4
Lincoln's Sparrow	25	0.06%	1	4%	1	1	0.03%	0	N/A	1
Swamp Sparrow	21	0.05%	0	0%	6	1	0.03%	0	N/A	1
White-throated Sparrow	68	0.17%	1	2%	15	-	-	-	-	-
Harris's Sparrow	1	0.00%	0	N/A	1	-	-	-	-	-
White-crowned Sparrow	34	0.08%	0	0%	7	1	0.03%	0	0%	0
Dark-eyed Junco	65	0.16%	3	6%	11	-	-	-	-	-
Other Sparrow*	4	0.01%	0	0%	1	-	-	-	-	-
Unknown Sparrow	1,434	3.55%	17	2%	464	111	3.33%	0	0%	45
Dickcissel	7	0.02%	0	0%	4	-	-	-	-	-
Bobolink	22	0.05%	0	0%	3	-	-	-	-	-
Eastern Meadowlark	782	1.93%	13	4%	438	86	2.58%	8	11%	14
Western Meadowlark	513	1.27%	10	5%	327	39	1.17%	3	12%	14
Unknown Meadowlark	314	0.78%	2	3%	238	129	3.87%	1	3%	97
Grassland Species Total	**5,976**	**14.78%**	**71**	**2%**	**2,891**	**488**	**14.63%**	**20**	**8%**	**228**
Corvids (Ravens, Crows, Magpies, Jays)										
Blue Jay	11	0.03%	0	0%	4	-	-	-	-	-
Black-billed Magpie	6	0.01%	0	0%	2	-	-	-	-	-
American Crow	174	0.43%	10	10%	75	8	0.24%	1	13%	0
Common Raven	19	0.05%	5	50%	9	-	-	-	-	-
Unknown Crow	64	0.16%	9	24%	27	-	-	-	-	-
Other Corvid	5	0.01%	0	N/A	3	-	-	-	-	-
Corvid Total	**279**	**0.69%**	**24**	**15%**	**120**	**4**	**0.12%**	**0**	**0%**	**1**
Woodland Birds (Vireos, Chickadees, Nuthatches, Thrushes, Waxwings, Warblers)										
White-eyed Vireo	5	0.01%	0	0%	0	1	0.03%	0	0%	0
Yellow-throated Vireo	4	0.01%	0	0%	0	1	0.03%	0	N/A	1
Cassin's Vireo	2	0.00%	0	0%	0	-	-	-	-	-
Blue-headed Vireo	2	0.00%	0	0%	0	-	-	-	-	-
Warbling Vireo	15	0.04%	1	9%	4	1	0.03%	0	N/A	1
Red-eyed Vireo	45	0.11%	1	2%	3	1	0.03%	0	0%	0
Unknown Vireo	5	0.01%	0	0%	1	-	-	-	-	-
Carolina Chickadee	2	0.00%	0	0%	1	2	0.06%	0	0%	1
Mountain Chickadee	1	0.00%	0	0%	1	-	-	-	-	-
Other Chickadee	15	0.04%	0	0%	7	-	-	-	-	-
Unknown Chickadee	3	0.01%	1	50%	1	-	-	-	-	-
White-breasted Nuthatch	1	0.00%	0	N/A	1	-	-	-	-	-
Golden-crowned Kinglet	4	0.01%	0	0%	2	-	-	-	-	-
Ruby-crowned Kinglet	13	0.03%	0	0%	2	-	-	-	-	-
Eastern Bluebird	5	0.01%	0	0%	2	-	-	-	-	-
Western Bluebird	4	0.01%	0	0%	2	-	-	-	-	-
Mountain Bluebird	7	0.02%	0	0%	3	-	-	-	-	-
Veery	7	0.02%	0	0%	1	-	-	-	-	-
Gray-cheeked Thrush	12	0.03%	0	0%	1	-	-	-	-	-
Swainson's Thrush	76	0.19%	3	4%	4	5	0.15%	0	0%	0
Hermit Thrush	66	0.16%	1	2%	7	1	0.03%	0	0%	0
Wood Thrush	15	0.04%	0	0%	0	-	-	-	-	-
American Robin	466	1.15%	28	9%	139	9	0.27%	0	0%	4
Other Thrush (Varied)	28	0.07%	5	19%	1	-	-	-	-	-
Unknown Thrush	56	0.14%	1	2%	0	-	-	-	-	-
Cedar Waxwing	80	0.20%	2	3%	19	12	0.36%	1	20%	7
Other (Bohemian)/Unk. Waxwing	2	0.00%	0	0%	0	-	-	-	-	-
Ovenbird	33	0.08%	1	3%	0	1	0.03%	0	0%	0
Louisiana Waterthrush	2	0.00%	0	0%	0	-	-	-	-	-
Northern Waterthrush	10	0.02%	0	0%	3	-	-	-	-	-
Black-and-white Warbler	9	0.02%	0	0%	5	-	-	-	-	-
Prothonotary Warbler	1	0.00%	0	0%	0	-	-	-	-	-
Tennessee Warbler	2	0.00%	0	0%	0	-	-	-	-	-
Orange-crowned Warbler	15	0.04%	1	7%	1	2	0.06%	0	0%	1
Nashville Warbler	12	0.03%	0	0%	0	2	0.06%	0	0%	0
MacGillivray's Warbler	2	0.00%	0	N/A	0	-	-	-	-	-

Mourning Warbler	3	0.01%	0	0%	1	1	0.03%	0	N/A	1
Common Yellowthroat	38	0.09%	1	3%	2	-	-	-	-	-
Hooded Warbler	4	0.01%	0	0%	0	-	-	-	-	-
American Redstart	13	0.03%	1	8%	1	3	0.09%	1	50%	1
Cape May Warbler	6	0.01%	0	0%	0	-	-	-	-	-
Northern Parula	3	0.01%	0	0%	0	-	-	-	-	-
Magnolia Warbler	15	0.04%	0	0%	2	-	-	-	-	-
Blackburnian Warbler	2	0.00%	0	0%	0	-	-	-	-	-
Yellow Warbler	18	0.04%	1	7%	3	-	-	-	-	-
Chestnut-sided Warbler	2	0.00%	0	0%	0	-	-	-	-	-
Blackpoll Warbler	33	0.08%	0	0%	3	-	-	-	-	-
Black-throated Blue Warbler	10	0.02%	0	0%	0	-	-	-	-	-
Palm Warbler	6	0.01%	0	0%	2	-	-	-	-	-
Pine Warbler	9	0.02%	0	0%	2	-	-	-	-	-
Yellow-rumped Warbler	83	0.21%	1	1%	7	1	0.03%	1	100%	1
Yellow-throated Warbler	3	0.01%	0	N/A	3	-	-	-	-	-
Prairie Warbler	1	0.00%	0	0%	0	-	-	-	-	-
Black-throated Gray Warbler	2	0.00%	0	0%	1	-	-	-	-	-
Townsend's Warbler	5	0.01%	0	0%	0	-	-	-	-	-
Hermit Warbler	1	0.00%	0	0%	0	-	-	-	-	-
Black-throated Green Warbler	1	0.00%	0	N/A	1	-	-	-	-	-
Canada Warbler	6	0.01%	0	0%	2	-	-	-	-	-
Wilson's Warbler	22	0.05%	0	0%	2	1	0.03%	0	N/A	1
Yellow-breasted Chat	6	0.01%	0	0%	1	-	-	-	-	-
Unknown Wood Warblers	55	0.14%	1	2%	13	-	-	-	-	-
Woodland Bird Total	**1,375**	**3.40%**	**50**	**4%**	**260**	**44**	**1.32%**	**3**	**12%**	**19**
Open Woodland Birds (Flycatchers, Wrens, Thrashers, Grosbeaks, Cardinal, Finches)										
Olive-sided Flycatcher	1	0.00%	0	N/A	1	-	-	-	-	-
Western Wood-Pewee	2	0.00%	0	0%	1	-	-	-	-	-
Eastern Wood-Pewee	3	0.01%	0	0%	2	-	-	-	-	-
Yellow-bellied Flycatcher	1	0.00%	0	N/A	1	1	0.03%	0	N/A	1
Acadian Flycatcher	2	0.00%	0	0%	1	-	-	-	-	-
Least Flycatcher	2	0.00%	0	N/A	2	-	-	-	-	-
Hammond's Flycatcher	1	0.00%	0	0%	0	-	-	-	-	-
Gray Flycatcher	2	0.00%	0	0%	0	-	-	-	-	-
Eastern Phoebe	3	0.01%	0	0%	0	-	-	-	-	-
Say's Phoebe	6	0.01%	0	0%	3	-	-	-	-	-
Ash-throated Flycatcher	1	0.00%	0	0%	0	-	-	-	-	-
Great-crested Flycatcher	3	0.01%	0	0%	0	-	-	-	-	-
Western Kingbird	128	0.32%	0	0%	92	46	1.38%	0	0%	32
Eastern Kingbird	18	0.04%	1	10%	8	1	0.03%	0	N/A	1
Scissor-tailed Flycatcher	103	0.25%	2	5%	59	84	2.52%	0	0%	53
Other Tyrant Flycatchers*	4	0.01%	0	0%	1	-	-	-	-	-
Unknown Tyrant Flycatcher	19	0.05%	0	0%	12	6	0.18%	0	0%	5
Bushtit	1	0.00%	0	0%	0	-	-	-	-	-
Cactus Wren	3	0.01%	0	0%	2	-	-	-	-	-
Rock Wren	1	0.00%	0	N/A	1	-	-	-	-	-
Carolina Wren	2	0.00%	0	N/A	2	-	-	-	-	-
Bewick's Wren	1	0.00%	0	N/A	1	1	0.03%	0	N/A	1
House Wren	10	0.02%	0	0%	5	-	-	-	-	-
Winter Wren	1	0.00%	0	N/A	1	-	-	-	-	-
Marsh Wren	6	0.01%	0	0%	2	-	-	-	-	-
Unknown Wren	18	0.04%	0	0%	2	1	0.03%	0	0%	0
Blue-gray Gnatcatcher	6	0.01%	0	0%	0	1	0.03%	0	0%	0
Wrentit	1	0.00%	0	N/A	1	-	-	-	-	-
Gray Catbird	61	0.15%	0	0%	8	-	-	-	-	-
Northern Mockingbird	38	0.09%	0	0%	22	9	0.27%	0	0%	7
Sage Thrasher	1	0.00%	0	0%	0	-	-	-	-	-
Brown Thrasher	6	0.01%	0	0%	3	-	-	-	-	-
Curve-billed Thrasher	1	0.00%	0	N/A	1	1	0.03%	0	N/A	1
Unknown Mimidae (Thrashers et	7	0.02%	0	0%	0	1	0.03%	0	0%	0
Scarlet Tanager	6	0.01%	1	20%	1	-	-	-	-	-
Western Tanager	14	0.03%	0	0%	1	-	-	-	-	-
Unknown Tanager	2	0.00%	0	0%	0	-	-	-	-	-
Northern Cardinal	6	0.01%	0	0%	5	-	-	-	-	-
Rose-breasted Grosbeak	3	0.01%	0	0%	0	1	0.03%	0	0%	0
Black-headed Grosbeak	1	0.00%	0	0%	0	-	-	-	-	-
Indigo Bunting	17	0.04%	1	6%	1	1	0.03%	0	0%	0
Painted Bunting	1	0.00%	0	0%	0	-	-	-	-	-
Cardinals, buntings, sparrows	4	0.01%	0	0%	0	-	-	-	-	-
Purple Finch	2	0.00%	0	0%	1	1	0.03%	0	0%	0
House Finch	52	0.13%	0	0%	29	-	-	-	-	-
White-winged Crossbill	1	0.00%	0	N/A	1	-	-	-	-	-
Pine Siskin	5	0.01%	0	0%	0	1	0.03%	0	0%	0
Lesser Goldfinch	2	0.00%	0	N/A	2	2	0.06%	0	N/A	2
American Goldfinch	33	0.08%	0	0%	20	-	-	-	-	-

Evening Grosbeak	1	0.00%	0	0%	0	-	-	-	-	-
Unknown Finches	46	0.11%	1	4%	18	-	-	-	-	-
Open Woodland Species Total	**659**	**1.63%**	**6**	**2%**	**313**	**159**	**4.77%**	**0**	**0%**	**97**
Blackbirds (Blackbirds, Cowbirds, Grackles, Orioles)										
Red-winged Blackbird	154	0.38%	3	4%	81	8	0.24%	1	25%	4
Yellow-headed Blackbird	6	0.01%	0	0%	3	-	-	-	-	-
Rusty Blackbird	2	0.00%	0	0%	1	-	-	-	-	-
Brewer's Blackbird	36	0.09%	1	20%	31	1	0.03%	0	N/A	1
Other Blackbird (Tricolored)	1	0.00%	0	0%	0	-	-	-	-	-
Common Grackle	92	0.23%	3	9%	58	14	0.42%	0	0%	9
Great-tailed Grackle	26	0.06%	1	8%	14	18	0.54%	1	11%	9
Boat-tailed Grackle	6	0.01%	1	20%	1	-	-	-	-	-
Unknown Grackle	68	0.17%	5	20%	43	37	1.11%	3	21%	23
Brown-headed Cowbird	119	0.29%	1	2%	68	5	0.15%	0	0%	4
Orchard Oriole	3	0.01%	0	0%	0	1	0.03%	0	0%	0
Bullock's Oriole	3	0.01%	0	0%	2	-	-	-	-	-
Baltimore Oriole	19	0.05%	0	0%	3	4	0.12%	0	0%	0
Unknown Blackbird/Oriole	437	1.08%	21	5%	53	52	1.56%	2	5%	9
Blackbird Total	**972**	**2.40%**	**36**	**6%**	**358**	**141**	**4.23%**	**7**	**9%**	**59**
SPECIES	**# Strikes**	**% of All Strikes**	**Damaging Strikes**	**% Strikes That Cause Damage**	**# Strikes w/ No Damage Data**	**# Strikes**	**% of All Strikes**	**Damaging Strikes**	**% Strikes That Cause Damage**	**# Strikes w/ No Damage Data**
Identified Bird Strikes (Total of Species Above)										
Known Bird Spp. Total	**40,433**	**49.0%**	**2,896**	**13.7%**	**19,360**	**3,336**	**50.5%**	**218**	**14.9%**	**1,872**
Unidentified Birds Strikes										
Unknown Bird	37,507	45.45%	2,791	8%	2,679	2,962	44.87%	195	7%	187
Unknown Passerine	483	0.59%	13	3%	20	30	0.45%	2	7%	0
Unknown Bird/Bat (Less Bats**)	4,093	4.96%	52	1%	4	273	4.14%	21	8%	2
Unknown Total	**42,083**	**51.0%**	**2,856**	**7.3%**	**2,703**	**3,265**	**49.5%**	**218**	**7.1%**	**189**
BIRD STRIKE TOTAL FY01 TO FY10										
ALL BIRD STRIKE TOTAL	**82,516**	**100%**	**5,752**	**11.0%**	**22,063**	**6,601**	**100%**	**436**	**9.6%**	**2,061**

***All Swan**= Mute (5), Trumpeter (2), Tundra (5), Unknown Swan (1)
Other Duck = American Black Duck (30), Common Eider (1), Harlequin Duck (1), Hawaiian Duck (4)
Other Grouse = Chukar (2), Red-legged Partridge (1), Gray Partridge (3), Ruffed Grouse (1), Greater Sage-Grouse (29), Ptarmigan sp. (1), Black Francolin (3), Gray Francolin (3), Sharp-tailed Grouse (2)
Other Loons = Red-throated Loon (2), Pacific loon (1)
Pelagic Birds = Fork-tailed Storm-Petrel (1), Townsend's Shearwater (5), Wedge-tailed Shearwater (8)
Other Pelecaniformes = Tropicbirds (12), Frigatebirds (7), Great Cormorant (1), Pelagic Cormorant (1)
Other Falcon = Eurasian Kestrel (1), Gyrfalcon (1)
Other Owl = Northern Hawk-Owl (1), Northern Pygmy-Owl (1), Northern Saw-whet Owl (2), Snowy Owl (43)
Other Shorebird = European Golden-Plover (5), Pacific Golden-Plover (508), Black Turnstone (1), Rock Sandpiper (1)
Other Gull = Black-legged Kittiwake (2), Red-legged Kittiwake (1), Mew Gull (44), Western Gull (75), Glaucous-winged Gull (56), Great Black-backed Gull (68)
Other Tern/Larid = Fairy Tern (1), White Tern (2), Little Tern (1), Roseate Tern (1), Artic Tern (2), Black Noddy (1), Long-tailed Jaeger (2)
Invasive Parrots = Black-hooded (Nanday) Parakeet (1), Monk Parakeet (1), Unknown Parrot (3)
HI Invasive Doves = Spotted Dove (111), Mourning Dove (4), Zebra Dove (119), Unknown Dove (27)
HI Invasive Passerines = Sky Lark (46), Red-vented Bulbul (3), Common Myna (43), Unknown Myna (5), Japanese White-eye (2), Red-crested Cardinal (2), Red Avadavat (3), Black-headed Munia (28), White-throated Munia (3), Nutmeg Mannikin (43), Unknown Mannikin-Munia (7), Java Sparrow (2), Common Waxbill (4), Unknown (3)
Other Swift = Black Swift (3), Vaux's Swift (19)
Hummingbirds = Ruby-throated Hummingbird (14), Black-chinned Hummingbird (1), Anna's (5), Calliope (1), Rufous (1), and Unknown (5)
Other Longspur = Snow Bunting (124), McKay's Bunting (1)
Other Sparrow = California Towhee (1), Golden-crowned Sparrow (3)
Other Corvid = Gray Jay (1), Yellow-billed Magpie (1), Northwestern Crow (3)
Other Chickadee = Black-capped Chickadee (14), Gray-headed Chickadee (1)
Other Tyrant Flycatchers Pacific-slope Flycatcher (3), Sulphur-bellied Flycatcher (1)

**A total of 671 and 152 known bat strikes compared to 78,423 and 6,328 known bird strikes were reported from FY02 to FY11 in the United States and Texas for a 0.85% and 2.35% reporting of bats to the sum total, respectively. Using that percentage to estimate the percentage of bats in the Unknown Bird/Bat Strikes (4,128 and 280 in the U.S. and TX) would result in 35 and 7 strikes caused by bats with 0 and 1 damaging strike in the United States and Texas. Reducing these categories to birds only would result in 4,093 bird strikes with 52 damaging in the United States and 273 bird strikes with 21 damaging for birds (the Unknown Data category would not be reduced).