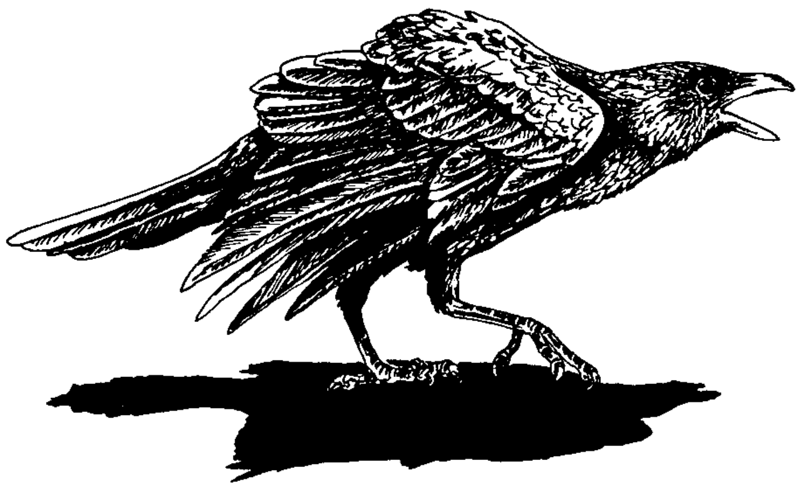
FINAL ENVIRONMENTAL ASSESSMENT:

BIRD DAMAGE MANAGEMENT
IN ARIZONA



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Arizona Department of Agriculture

Arizona Game and Fish Department

United States Fish and Wildlife Service

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ACRONYMS USED

ARS	Arizona Revised Statutes
ADA	Arizona Department of Agriculture
AVMA	American Veterinary Medical Association
AZGFD	Arizona Game and Fish Department
AI	Avian Influenza
APHIS	Animal and Plant Health Inspection Service
AZFO	Arizona Field Ornithologists
BBS	Breeding Bird Survey
BCR	Bird Conservation Regions
BDM	Bird Damage Management
BO	Biological Opinion
CAFO	Confined Animal Feeding Operation
CBC	Christmas Bird Count
CBSD	Common Birds in Steep Decline
CFR	Code of Federal Regulation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
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
NASS	National Agricultural Statistics Service
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NWRC	National Wildlife Research Center
PIF	Partners in Flight
PIFSC	Partners in Flight Science Committee
RMBO	Rocky Mountain Bird Observatory
RMS	Rocky Mountain States
SGNC	Species of Greatest Conservation Need
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
USC	United States Code
USDA	U.S. Department of Agriculture
USGS	United States Geological Survey
USFWS	U.S. Fish and Wildlife Service
WNV	West Nile Virus
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 conflict with agriculture, aviation safety, human safety, and other natural resources. Bird species that reside in or migrate into or through Arizona, may need to be managed to minimize 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' has a two part mission, developed through a strategic planning process (APHIS 2013), the first mission is to *"... improve the coexistence of people and wildlife. WS recognizes that the field of wildlife damage management is in a period of change, and those working in this field must consider a wide range of public interests that can conflict with one another. These interests include wildlife conservation, biological diversity, the welfare of animals, and the use of wildlife for enjoyment, recreation, consumption, and to make a living.* The second mission is to *"… provide Federal leadership in managing conflicts with 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 cause damage to agriculture and property, pose risks to human health and safety, and negatively affect industrial and natural resources. WS conducts research and provides technical assistance and operational assistance programs to resolve problems that occur when human activity and wildlife conflict with one another.* This is accomplished through:

< training of wildlife damage management (WDM) professionals;
< development of wildlife damage management strategies that are scientifically based, biologically sound, environmentally safe, and socially responsible;
< reduce damage caused by wildlife to the lowest possible levels while at the same time reducing wildlife mortality;
< 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.

This Environmental Assessment (EA) evaluates ways that this responsibility could be carried out to resolve conflicts with bird species in Arizona. Bird damage management (BDM) is an important function of the WS-Arizona Program. Appendix C lists all bird species with their scientific names that have been found in Arizona (569) with Appendix C: Table C1 listing those species that have the highest probability of coming into conflict with people in Arizona or being part of disease surveillance projects (202). However, WS-Arizona has targeted only a minimal number of avian species from FY16 (Federal fiscal year 2016 = October 1, 2016 – September 30, 2017) to FY20 averaging 39 species per year and totaling 97 identified species. Shorebirds and waterfowl are currently the primary focus in disease surveillance because many of these species migrate into Arizona from far northern regions where they could have potentially become infected with diseases of concern. Most BDM projects conducted by WS-Arizona are focused on the protection of human health and safety, property and agriculture. WS-Arizona has personnel that conduct BDM to protect aviation safety and meet the needs of the airport's wildlife hazard management programs.

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 wildlife service's 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 service's involving mammalian and avian (*bird*) species that are reservoirs for zoonotic diseases.

In Arizona, all native birds are protected by federal or state laws. Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) by the U.S. Fish and Wildlife Service (USFWS). Most birds in Arizona are also managed and protected by laws regulated by the Arizona Game and Fish Department (AZGFD). 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. WS works with USFWS and AZGFD to obtain the necessary permits to control birds and assists in providing annual take data so that they can determine cumulative impacts on species and whether these are within the management objectives for the different avian species.

WS is a cooperatively funded (funding sources for the program come from federal appropriations, state and county agency contracts, and individuals), service oriented program. WS 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. *Work Initiation Documents* or *WS Work Plans* must be signed by land owner/administrator or the appropiate land management agency before WS can begin BDM activites.

1.1.1 The WS-Arizona Program

WS-Arizona responds to wildlife damage complaints from cooperators ranging from private citizens to other agencies. WS-Arizona works mostly in response to requests from the public, but conducts some BDM for agencies. In addition, Native American Tribes are responsible for wildlife management on their properties and can request assistance from WS-Arizona. WS-Arizona received requests for assistance for damage caused by 113 bird species with the inclusion of feral domestics (escaped domestic) from FY16 to FY20 (Table 2a, b, c).

WS-Arizona receives requests for BDM throughout Arizona. Arizona encompasses 113,635 mi^2 in 15 Counties (Figure 1): Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, and Yuma. The WS-Arizona Program is comprised of 2 Districts, both located at the State Office in Phoenix. WS-Arizona personnel receive requests to conduct BDM in many counties and on a variety of land classes including private, federal, state, Tribal, county, and municipal lands. Arizona is comprised of 27% Tribal, 20% BLM, 16% USFS, 14% private, 12% state, 10% other federal agency, and less than 1% local government lands.

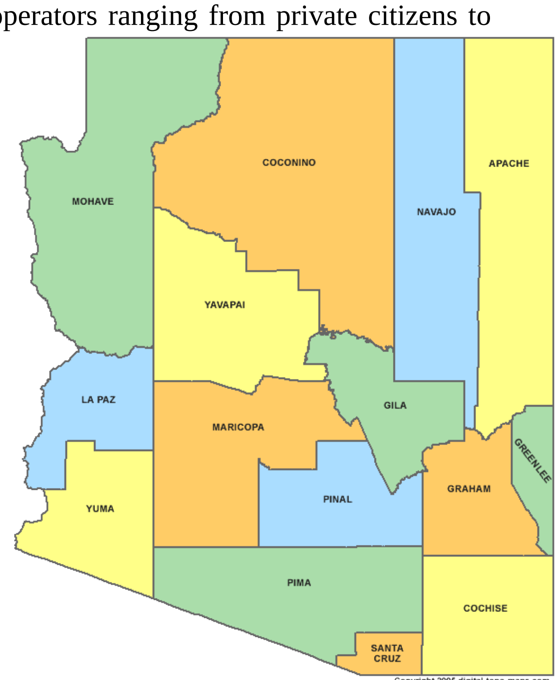

Figure 1. WS in Arizona has personnel to respond to bird damage complaints in Arizona's 15 Counties.

1.2 PURPOSE

The purpose of this EA is to analyze the effects of WS-Arizona activities within the state of Arizona. WS-Arizona BDM activities are conducted to protect human health and safety, agricultural and aquaculture resources, property, and natural resources. Arizona has 340 species of birds (Appendix C) that can be found regularly in all or a portion of the State at some time during the year. An additional 219 species have been documented to occur in Arizona, 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, 202 could be the focus of a BDM project. Of these, 97 species could be targeted to protect resources other than aircraft and human health and safety at airports (Appendix C). The species that this EA will address are those listed on Table 1. Table 1 lists the species that has caused the greatest amount of damage from FY16-FY20. Though other avian species have caused damage, the take of these species was minimal and had no impact to the population of these species. The primary species that WS-Arizona receives requests for assistance are the Red-tailed Hawk, American Kestrel, Turkey Vulture, Northern Harrier, Mourning Dove, Horned Larks, Great-tailed Grackle, and Western Meadowlarks. Several other species cause minor, but potentially locally serious, problems. Information is given on these and other species or their groups in Section 2.1.1.1.

Table 1 – Primary bird species addressed by WS in Arizona and the resource types damaged

Species	Resource				Species	Resource			
	A	N	P	H		A	N	P	H
Red-tailed Hawk			X	X	**Western Meadowlark**			X	X
American Kestrel			X	X	**Great Blue Heron**		X	X	X
Mourning Dove	X		X	X	**Prairie Falcon**			X	X
Northern Harrier			X	X	**American Coot**			X	X
Turkey Vulture			X	X	**White-winged Dove**			X	X
Great-tailed Grackle			X	X	**Swainson's Hawk**			X	X
Rock Pigeon	X	X	X	X	**Common Raven**	X	X	X	X
Mallard	X		X	X	**Northern Flicker**			X	
Great Egret			X	X	**Cooper's Hawk**			X	X
Killdeer			X	X	**Lesser Nighthawk**			X	X
Horned Lark	X		X	X	**Violet-green Swallows**			X	X
Gila Woodpecker			X		**Acorn Woodpecker**			X	

A=Agriculture, N=Natural Resource, P=Property, H=Human Safety

According to APHIS procedures for implementing the National Environmental Policy Act (NEPA), individual WDM actions, 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, WS-Arizona prepared this EA on BDM in Arizona to facilitate planning and interagency coordination, and to streamline program management. This EA documents the need for BDM in Arizona and assesses potential impacts and effects of various alternatives addressing bird damage in Arizona.

Following the finalization of the EA, if a new issue arises or the analysis in monitoring reports concludes that WS-Arizona BDM activities are outside the scope of that EA, the EA would be supplemented to include the new information and sent out for public review. Additionally, many new species have the potential for being involved in BDM, especially at airports, and this EA will discuss all species that could potentially be involved in BDM in Arizona, though many likely never will be.

1.3 NEED FOR ACTION

This EA documents the need for BDM in Arizona and assesses potential impacts and effects of various alternatives addressing bird damage in Arizona. Birds are a valuable natural resource, long enjoyed by the American public for aesthetic, recreational, and emotional reasons; their attendant economic benefits are important in many communities. However, native birds in overabundance or individual animals that have learned and habituated to use resources supplied by humans, especially food, can come into conflict with humans. Introduced, feral, or invasive bird species may outcompete native species and cause damage to other resources. Highly adaptable and flexible species often reach unnaturally high densities. Some animals and localized populations may adapt to change by using human infrastructure or concentrated agricultural practices for their life cycle needs, such as obtaining food and water, finding areas to breed or rest.

Across the United States, bird habitat has been substantially changed as human populations expand and land is used for human needs. Human uses and needs can compete with the needs of birds, which increases the potential for conflict. With the continued and more intensive use of land by people, increased production of livestock, water resource management, urbanization, and other modern agricultural, cultural, and transportation practices associated with human development have caused substantial changes in the ways that humans and wildlife interact.

Birds are responsible for damaging a wide variety of agricultural resources, property, and natural resources. In addition, birds can be a threat to human health and safety. From FY16 to FY20, 97 bird species (ave. 39 spp. per year) were responsible for an annual average of 16,897 work tasks (Table 2 a, b, c) for BDM assistance to resolve associated damage, 60% for property, 39% for human health and safety < 0.01% for natural resources, and 0.01% for agriculture and (Table 3). In addition to the aforementioned work tasks, WS-Arizona was also involved in conducting disease surveillance (no damage) and collected an annual average of 263 disease samples from FY16 to FY20 from 20 species of birds and their droppings. This information is kept in the MIS[2]. Requests for assistance are an indication of need, but the requests that WS-Arizona receives likely represents only a portion of the need. WS-Arizona loss reports do not actually reflect the total value of bird damage in Arizona, but provides an indicator of the annual losses. Also, some people are unaware of the WS-Arizona program and may try to resolve problems themselves without requesting WS-Arizona assistance.

[2] MIS - Computer-based Management Information System used by WS for tracking Program activities. WS-Arizona has had the SQL-based MIS system operational since FY92. However, a new system, the MIS 2000, replaced an old system 10/01/04. Differences in the systems have changed some outputs such as requests for assistance. Thus, information will be given for FY16 to FY20 in this document. MIS reports will not be referenced in the Literature Cited Section since most reports from the MIS are not kept on file. A database is kept that allows queries to be made to retrieve the information needed.

Table 2a. The average annual work tasks (WTs) and value of damage associated with birds in Arizona for FY16 through FY20. Table 2a has work tasks and damage from bird species that are associated with water.

AVERAGE ANNUAL WORK TASKS AND DAMAGE VALUE FOR WATER ASSOCIATED BIRDS RECORDED BY WS-ARIZONA FOR FY16-FY20								
Resource	Human Health & Safety		Property		Agriculture		Annual Ave. FY16-FY20	
Species	WTs	Value	WTs	Value	WTs	Value	WTs	Value
Black-bellied Whistling-Duck	13.8	$0	27.6	$0	-	-	41.4	$0
Feral Goose	0.2	$0	-	-	-	-	0.2	$0
Ross's Goose*	1	$0	2	$0	-	-	3	$0
Canada Goose	122.6	$0	197.2	$0	0.8	$0	320.6	$0
Gadwall	25.2	$0	50.4	$0	0.8	$0	76.4	$0
American Wigeon	2.6	$0	6	$0	0.8	$0	9.4	$0
Mallard	147.8	$0	262	$1,200	0.8	$0	410.6	$1,200
Feral Duck	0.2	$0	1.2	$0	-	-	1.4	$0
Blue-winged Teal	-	-	-	-	0.8	$0	0.8	$0
Cinnamon Teal	24.4	$0	48.8	$0	0.8	$0	74	$0
Northern Shoveler	0.4	$0	0.8	$0	0.8	$0	2	$0
Northern Pintail	-	-	-	-	0.8	$0	0.8	$0
Green-winged Teal	-	-	-	-	0.8	$0	0.8	$0
Canvasback	1.2	$0	2	$0	0.8	$0	4	$0
Redhead	0.2	$0	0.4	$0	0.8	$0	1.4	$0
Ring-necked Duck	0.2	$0	0.4	$0	-	-	0.6	$0
Wood Duck	25	$0	50	$0	0.8	$0	75.8	$0
Common Merganser	2.8	$0	5.6	$0	-	-	8.4	$0
Ruddy Duck	0.2	$0	0.4	$0	-	-	0.6	$0
American Coot	6	$0	19.2	$270	-	-	25.2	$270
Black-necked Stilt	38.6	$0	77.2	$0	-	-	115.8	$0
Killdeer	208.6	$0	331.4	$0	-	-	540	$0
Long-billed Curlew	119.4	$0	215.4	$0	-	-	334.8	$0
Long-billed Dowitcher	0.2	$0	0.4	$0			0.6	$0
Least Sandpiper	96.6	$0	193.2	$0	-	-	289.8	$0
Western Sandpiper	1	$0	2	$0	-	-	3	$0
Neotropic Cormorant	5.4	$0	9	$0	-	-	14.4	$0
Double-crested Cormorant	102.2	$100	201.2	$0	-	-	303.4	$100
Greater Yellowlegs	30	$0	60	$0	-	-	90	$0
Great Blue Heron	140.6	$0	280.4	$0	-	-	421	$0
Great Egret	178	$0	324.4	$0	-	-	502.4	$0
Cattle Egret	5.4	$0	10.8	$0	-	-	16.2	$0
Snowy Egret	11.2	$0	14	$0	-	-	25.2	$0
Green Heron	51.2	$0	102.4	$0	-	-	153.6	$0
Black-crowned Night Heron	49.4	$0	71.4	$0	-	-	120.8	$0
Whimbrel	5.8	$0	11.6	$0	-	-	17.4	$0
Willet	0.2	$0	0.4	$0	-	-	0.6	$0
Unknown Bird Species[1]	23	$0	28.2	$85,704	-	-	51.2	$85,704
Total	1440.6	$100	2607.4	$87,174	9.6	$0	4057.6	$87,274

1 Unknown bird species is used when a requestor is given technical assistance for a project involving an unknown species or where the bird is not known because unrecognizable such as after an aircraft strike.
* Species is not usually found in Arizona.

Table 2b. The average annual work tasks (WTs) and value of damage associated with birds in Arizona for FY16 through FY20. Table 2b has work tasks and damage from terrestrial non-passerine bird species.

AVERAGE ANNUAL WORK TASKS AND DAMAGE VALUE FOR TERRESTRIAL ASSOCIATED NON-PASSERINE BIRDS RECORDED BY WS-ARIZONA FOR FY16-FY20								
Resource	Human Health & Safety		Property		Agriculture		Annual Ave. FY16-FY20	
Species	WTs	Value	WTs	Value	WTs	Value	WTs	Value
Gambel's Quail	50.4	$0	100.8	$0	-	-	151.2	$0
Quail (other)	0.2	$0	-	-	-	-	0.2	$0
Wild Turkey	0.6	$0	-	-	-	-	0.6	$0
Feral Chicken	0.4	$0	0.4	$0			0.8	$0
Feral Guinea Fowl	-	-	0.2	$0	-	-	0.2	$0
Rock Pigeon	24	$0	196	$40	-	-	220	$40
Greater Roadrunner	85.2	$0	144.8	$0	-	-	230	$0
Eurasian Collared-Dove	69.4	$0	71.6	$0	-	-	141	$0
White-winged Dove	172.6	$0	280	$6,647.40	-	-	452.6	$6,647.40
Mourning Dove	390.6	$0	529.8	$68,918.20	24	$0	944.4	$68,918.20
Anna's Hummingbird	0.2	$0	-	-	-	-	0.2	$0
Costa's Hummingbird	0.2	$0	-	-	-	-	0.2	$0
Black-chinned Hummingbird	0.8	$0	-	-	-	-	0.8	$0
Black Vulture	0.4	$0	-	-	-	-	0.4	$0
Turkey Vulture	244.4	$0	389.5	$17,431	-	-	633.9	$17,431
Osprey	105.8	$0	209.4	$0	-	-	315.2	$0
Northern Harrier	288.4	$0	462.8	$0	-	-	751.2	$0
Cooper's Hawk	190.4	$0	282	$0	-	-	472.4	$0
Common Black Hawk	0.2	$0	0.4	$0	-	-	0.6	$0
Harris's Hawk	41.2	$0	43	$0	-	-	84.2	$0
Swainson's Hawk	195.8	$0	296.8	$0	-	-	492.6	$0
Zone-tailed Hawk	0.4	$0	0.8	$0	-	-	1.2	$0
Red-tailed Hawk	374	$0	520.6	$500,000	-	-	894.6	$500,000
Ferruginous Hawk	102.6	$0	205.2	$0	-	-	307.8	$0
Common Barn Owl	48.8	$0	96	$0	-	-	144.8	$0
Great Horned Owl	114.8	$0	213.8	$0	-	-	328.6	$0
Short-eared Owl	0.2	$0	0.4	$0	-	-	0.6	$0
Burrowing Owl	71.8	$0	90.6	$2	-	-	162.4	$2
Acorn Woodpecker	-	-	0.2	$900	-	-	0.2	$900
Gila Woodpecker	-	-	84.4	$39,910	-	-	84.4	$39,910
Northern Flicker	-	-	13.4	$950	-	-	13.4	$950
American Kestrel	307.4	$0	501.4	$0	-	-	808.8	$0
Peregrine Falcon	119	$0	136.4	$0	-	-	255.4	$0
Prairie Falcon	219	$0	351.4	$0	-	-	570.4	$0
Merlin Falcon	0.2	$0	0.4	$0	-	-	0.6	$0
Total	3238.8	$0	5260.3	$635,099	24	$0	8465.9	$634,799

Table 2c. The average annual work tasks (WTs) and value of damage associated with birds in Arizona for FY16 through FY20. Table 2c has work tasks and damage from terrestrial passerine bird species.

AVERAGE ANNUAL WORK TASKS AND DAMAGE VALUE FOR PASSERINE SPECIES RECORDED BY WS-ARIZONA FOR FY16-FY20								
Resource	Human Health & Safety		Property		Agriculture		Annual Ave. FY16-FY20	
Species	WTs	Value	WTs	Value	WTs	Value	WTs	Value
Say's Phoebe	26.4	$0	25.4	$0	-	-	**51.8**	**$0**
White-throated Swift	0.2	$0	1.2	$0	-	-	**1.4**	**$0**
Lesser Nighthawk	19.2	$0	37.8	$300	-	-	**57**	**$300**
Nighthawks (all)	0.2	$0	-	-	-	-	**0.2**	**$0**
Ash-throated Flycatcher	-	-	0.2	$0	-	-	**0.2**	**$0**
Western Kingbird	115.2	$0	133.6	$0	-	-	**248.8**	**$0**
Common Raven	186.8	$0	150.2	$0	26.4	$81,766	**363.4**	**$81,766**
Horned Lark	225.8	$0	357.2	$40,203	0.2	$0	**583**	**$40,203**
Lark Buntings	6.8	$0	13.6	$0	-	-	**20.4**	**$0**
Lazuli Buntings	-	-	0.2	$0	-	-	**0.2**	**$0**
Violet-green Swallow	0.4	$0	1.5	$44,132	-	-	**1.9**	**$44,132**
Cliff Swallow	40.4	$0	82.2	$0	-	-	**122.6**	**$0**
Barn Swallow	14.8	$0	13.6	$0	-	-	**28.4**	**$0**
Cactus Wren	0.2	$0	-	-	-	-	**0.2**	**$0**
Curve-billed Thrasher	0.8	$0	0.2	$0	-	-	**1**	**$0**
European Starling	118	$0	162.6	$0	25	$0	**305.6**	**$0**
Verdin	0.2	$0	-	-	-	-	**0.2**	**$0**
American Pipit	93.8	$0	187.8	$0	-	-	**281.6**	**$0**
Dark-eyed Junco	0.2	$0	-	-	-	-	**0.2**	**$0**
House Finch	87	$0	174.2	$0	-	-	**261.2**	**$0**
American Goldfinch	0.4	$0	-	-	-	-	**0.4**	**$0**
Lesser Goldfinch	-	-	0.2	$0	-	-	**0.2**	**$0**
Wilson's Warbler	0.2	$0	-	-	-	-	**0.2**	**$0**
Black-throated Gray Warbler	-	-	0.2	$0	-	-	**0.2**	**$0**
Orange-crowned Warbler	-	-	0.2	$0	-	-	**0.2**	**$0**
Yellow Warbler	-	-	0.4	$0	-	-	**0.4**	**$0**
Townsend's Warbler	-	-	0.4	$0	-	-	**0.4**	**$0**
Canyon Towhee	0.6	$0	-	-	-	-	**0.6**	**$0**
Green-tailed Towhee	-	-	0.2	$0	-	-	**0.2**	**$0**
House Sparrow	87.8	$0	85.2	$0	-	-	**173**	**$0**
Lincoln's Sparrow	-	-	0.2	$0	-	-	**0.2**	**$0**
Vesper Sparrow	0.2	$0	0.2	$0	-	-	**0.4**	**$0**
Black-chinned Sparrow	3.4	$0	13.8	$0	-	-	**17.2**	**$0**
Brewer's Sparrow	0.4	$0	1.2	$0	-	-	**1.6**	**$0**
Lark Sparrow	0.2	$0	0.4	$0	-	-	**0.6**	**$0**
Savannah Sparrow	-	-	0.2	$0	-	-	**0.2**	**$0**
Black-headed Grosbeak	-	-	0.2	$0	-	-	**0.2**	**$0**
Common Poorwill	0.4	$0	-	-	-	-	**0.4**	**$0**
Northern Mockingbird	14.2	$0	14.4	$0	-	-	**28.6**	**$0**
Red-winged Blackbird	87.8	$0	158	$0	24.4	$0	**270.2**	**$0**
Western Meadowlark	234.6	$0	365	$0	-	-	**599.6**	**$0**
Eastern Meadowlark	1.4	$0	1.6	$0	-	-	**3**	**$0**
Yellow-headed Blackbird	25.6	$0	51.2	$0	24	$0	**100.8**	**$0**
Brewer's Blackbird	110.2	$0	20.9	$0	-	-	**131.1**	**$0**
Great-tailed Grackle	247.2	$300	364	$0	-	-	**611.2**	**$300**
Brown-headed Cowbird	26	$0	26	$0	0.4	$0	**52.4**	**$0**
Mixed Blackbirds[1]	25	$0	25	$0	0.4	$0	**50.4**	**$0**
Total (Ave 39 spp./yr)	**1782.6**	**$300**	**2432.8**	**$84,335**	**100.8**	**$81,766**	**4373.4**	**$166,701**
Totals of Table 2a, 2b, 2c	**6462**	**$400**	**10,300.5**	**$806,608**	**134.4**	**$81,766**	**16,896.9**	**$888,774**

1. Blackbirds, including starlings, in mixed flocks damage and harassment are often combined in the MIS

Birds cause damage but they also have value, depending on personal perceptions. Clucas et al. (2012) summarized that human attitudes towards wildlife in general range from negative to utilitarian in Germany and North America. Some people dislike wildlife that damage their property, others value their utilitarian considerations such as sport hunting, while many appreciate their intrinsic values. Human perceptions, attitudes, and emotions differ depending on how humans desire to "use" different bird species and how they interact with individual or groups of animals. For example, seeing a group of birds in a field may be seen as a positive experience, while seeing the same group of birds feeding in your garden or cornfield can be frustrating. Watching a hawk feeding on rodents may be exciting, but having the same hawk predating your pet or farm animals on your property may be highly undesirable. Some individuals have the cultural perceptions that birds of prey are "horrible" and "ravenous" because they feed and hunt on other wildlife, while other individuals enjoy the natural beauty of these species (Lusby 2018). Some people spend substantial amounts of money to travel to see wildlife in their native habitats or even in zoos, while other people may spend equally substantial amounts of money to have birds removed or harassed away from their neighborhoods, livestock, crops, airports, and even recreational areas where the animals may cause damage or people may feel or be threatened. Some people are even happy just to know that certain types of animals still exist somewhere, even if they never have the opportunity to see them; they believe that their existence shows that areas of America are still "*wild*."

Table 3. The average annual work tasks (WTs) and value of damage caused by birds in Arizona as reported to or verified by WS-Arizona from FY16 to FY20 for property, natural resources, human health and safety, and agriculture. The damage reported in this table is only a fraction of the actual damage caused by birds in Arizona.

Category	Resource	Annual Ave. FY16-FY20	
		WTs	Value
Property	Aircraft	6,274.4	$677,646
	airport runways/taxiways	3,978.2	$0
	buildings, non-residential	49.6	$1,010
	buildings, residential	78.4	$11,360
	food items, human	0.2	$0
	golf courses	4.8	$270
	pets (companion/hobby animals)	2.4	$0
	property (general)	34.2	$29,440
	railroads/trestles	3.8	$0
	recreational areas (other) **	0.6	$0
	sportfish, private stocked	8.2	$0
	swimming pools	2.6	$0
	turf and/or flowers	13.4	$200
	Vehicles, land	0.2	$0
	zoo/zoo animals	100	$1000
Property Subtotal		***10,551.0***	***$720,926***
Natural Resources	birds, z-(other)	1	$0
	designated natural areas	24.4	$0
	fish, trout, apache (t/e)	0.2	$0
	fish, trout, rainbow	0.2	$40
Natural Resources Subtotal		***25.8***	***$40***
Human Health and Safety	Aviation	6,262.2	$0
	Transportation	0.2	$0
	General	501.2	$440
Human Health and Safety Subtotal		***6,763.6***	***$440***
Agriculture	cattle adult (dairy)	1.2	$0
	feed, livestock	144.4	$0
	fowl, chickens (other)	4.4	$0
	fowl, turkeys (domestic)	4.4	$0
	grasses/sod	0.8	$0
	lettuce	0.6	$0
	nuts, pecans	2.4	$81,766
	trees, citrus (all)	0.2	$0
Agriculture Subtotal		***158.4***	***$81,766***
GRAND TOTAL		**17,503**	**$803,172**

The values that people hold regarding wild animals differ based on their past and day-to-day experiences, as well as the values held by people they trust. For example, people who live in rural areas that depend on land and natural resources tend to consider wildlife from a more utilitarian viewpoint, such as for hunting. Age and gender also influence viewpoints, with younger people and females tending to feel more emotional towards wildlife (Kellert 1994, Kellert and Smith 2000). Table 4 summarizes values that wildlife have to different people. As summarized by Lute and Attari (2016), people have strong opinions about killing wildlife, dependent on a myriad of factors, such as social identity and experience and knowledge about different species. Determining whether an individual animal has intrinsic value (the inherent right of an entity to exist beyond its use to anyone else) is a predictor to support for conservation. Factors relevant to how people respond to wildlife can include intrinsic value attributions given to humans, some or all animals, ecosystems; considerations such as moral, economic factors, the practicality with which one views wildlife, and cost-benefit analysis; and species characteristics, such as whether an animal is considered attractive, dangerous, endangered, familiar, nuisance, important to the economy, important to one's well-being, and important to ecosystems. The interactions of how individual people view themselves in relation to the environment, their economic security, the values associated with natural areas and property, and people's needs and desires within the context of their relationship with specific individual animals and species and their intrinsic values and flaws create highly complex attitudes and associated behaviors, including potentially mutually exclusive ones.

Table 4. Basic wildlife values (Kellert 1994 and Kellert, Smith 2000).

Term	Definition
Aesthetic	Physical attractiveness and appeal of wild animals
Dominionistic	Mastery and control of wild animals
Ecologistic	Interrelationships between wildlife species, natural habitats, humans, and the environment
Humanistic	Emotional affection and attachment to wild animals
Moralistic	Moral and spiritual importance of wild animals
Naturalistic	Direct experience and contact with wild animals
Negativistic	Fear and aversion of wild animals
Scientific	Knowledge and study of wild animals
Utilitarian	Material and practical benefits of wild animals

Lute and Attari (2016) recognize that conflicts with wildlife have been ongoing, especially as humans have made and continue to make substantial modifications to the environment and land uses that have created such conflicts, and that lethal control may be more cost-effective than sweeping habitat protection strategies. Their study suggests that people may rely on default strategies such as habitat and ecosystem protection and moral considerations rather than considering economic and social costs necessary for navigating difficult trade-offs and nuances inherent in decision-making regarding specific situations. Trade-offs can and do occur between different conservation objectives and human livelihoods and conservation (McShane et al. 2011). The authors argue that many options exist in managing wildlife conflict in relation to protection of individual animals, populations, ecosystems, and human physical and economic well-being, and that these choices are "hard" because every choice involves some level of loss.

1.3.1 Summary of Proposed Action

The proposed action is to continue the current portion of the WS-Arizona program that responds to requests for BDM to protect human health and safety, agricultural resources (livestock feed, livestock, livestock health, aquaculture, and crops), property (turf, landscaping, and structures), and natural resources (T&E species, wildlife, and forestry). The primary objective of the WS-Arizona BDM program have been the goal of reducing threats or hazards to human health and safety and damage or the threat of loss to property, Specific BDM activites include protecting aircraft from a multitude of species; reducing property damage from waterfowl; preventing losses of livestock feed and the risk of bird-related livestock health problems presented by starlings and blackbirds at dairies and feedlots; and reducing livestock losses from predatory birds such as ravens.

Program goals are also to minimize damage or the risk of damage from birds to other agricultural resources such as crops, natural resources such as sensitive wildlife species being predated, property, or other public or private resources. To meet these goals WS-Arizona 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 WS-Arizona 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 3.4.1.1), 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. Lethal methods used by WS-Arizona would include shooting, trapping, egg addling/destruction, DRC-1339, Avitrol® (Avitrol Corporation, Tulsa Oklahoma), and live capture by trapping. Many sensitive bird species are live-captured and relocated. Other nonlethal methods used by WS-Arizona may include wire barriers and deterrents such as porcupine wire, netting, and fencing; chemical repellents (e.g., methyl anthranilate, polybutene products), harassment with auditory (e.g., propane cannons, pyrotechnics, distress calls) and visual devices (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. BDM by WS-Arizona would be allowed in the State, when requested, on private property sites or public facilities where a need has been documented, upon completion of a Work Initiation Document and all required state and federal permits. All management actions would comply with appropriate federal, state, and local laws, regulations and policies.

Wildlife may serve as reservoirs for disease and parasites. Diseased animals living near areas of human activity may transmit those diseases to livestock, people, or pets. These diseases may transfer to people directly through physical contact or may be transmitted to people via environmental contamination by feces and tainted food products such as fresh produce or meat products.

Wildlife’s constant ability to adapt to changes in their environment for meeting their own needs for food, water, and shelter can create tension and conflict where human needs for social and economic security and health and safety overlap.

1.3.2 Need for BDM to Protect Property

WS-Arizona has conducted many BDM projects to protect property with 60% of the work tasks conducted from FY16 to FY20 associated with the protection of property. Property encompasses a wide range of human owned resources that are damaged by birds. The majority of bird damage to property in Arizona is to aircraft from bird strikes at airports and airfields (97% of the work tasks and 93% of the value) which resulted in an average of $720,926 in damages annually from FY16 to FY20 from the 10,551 average number of work tasks that were recorded by WS-Arizona (Table 3). Damage to buildings (residential and non-residential) accounted for an average of 128 work tasks and $12,370 in damages annually. Rock Pigeons congregate under bridges and on buildings causing damage to these structures. Utility towers are sometimes used by turkey vultures 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 such as landscaping, grass, and flowers may be used as a food source for birds that results in significant losses. 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 that are generally not recorded include labor and disinfectants to clean and sanitize fecal droppings, implementation of nonlethal BDM methods, and loss of property use.

Aircraft

Aircraft collisions with birds (bird strikes) and other wildlife are a serious economic concern and public safety concern. Wildlife strikes have increased in the past 25 years because many bird species populations that are hazardous to aviation have increased significantly (Dolbeer et al. 2016). 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. Finally, air traffic and strike reporting has increased over the last 25 years and all of these factors equate to higher numbers of strikes.

About 14% of all bird strikes cause damage. Of the known waterfowl, raptor, and gull strikes, 28%, 23%, and 18%, respectively, caused damage (FAA 2021a). These species, in particular, are of greatest concern at airports because they cause a significant number of strikes (about 70% 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. Cleary et al. (2002) estimated wildlife strikes (98% involving birds) cost the civil aviation industry in the U.S. $470 million annually from 1990 to 2001. 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 et al. 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 (2021) bird strike reports (132,712) on civilian and military airports from FY11 to FY20 had an average of $17.8 million annual damage to aircraft with 1,089 strikes with noted damage (damage was not estimated for all strikes on reports – several significant damage had no cost estimate such as lost aircraft or engines). WS-Arizona reported an average of 10,253 work tasks associated with aircraft protection with an average of $677,646 in damage from FY16 to FY20 (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 (2003) 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 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 damage structures such as houses on private property or public buildings and bridges with fecal contamination. Accumulated bird droppings can reduce the functional life of some building roofs by 50% (Weber 1979). Woodpeckers sometimes cause structural damage to wood siding and stucco on homes. From FY16 to FY20, damage to buildings (residential and non-residential) by birds in Arizona averaged 128 work tasks per year with an average annual value of $12,370 (Table 3). The Rock Pigeon was the most frequent species involved in these damage complaints

Landscaping and Golf Courses

Feral domestic and wild waterfowl sometimes congregate at golf courses, parks, and other recreational areas that have ponds or watercourses and cause damage by grazing on turf and the accumulation of droppings. The greens on a golf course are particularly vulnerable and very costly to repair. Additionally, small to large flocks of Canada Geese are common at golf courses throughout Arizona. On average, WS-Arizona had 18 work tasks annually associated with protecting landscaping and golf courses averaging $470 in damage annually from FY16 to FY20 (Table 3).

Heavy Equipment, Automobiles, Boats, and Other Equipment

Bird droppings cause damage because they are acidic and have ammonia. Once dried, they become salts which react with water. Corrosion damage to metal structures and painted finishes, including those on automobiles and aircraft, can occur because of uric acid from bird droppings. Several incidents involving bird droppings on vehicles, equipment, and aircraft in storage buildings at airports and airbases have created concern. Estimates of damage to aircraft at an airbase in Oklahoma have been made (WS 2003b) for repairing aircraft skin on a KC-135 damaged from bird droppings (primarily roosting starlings, pigeons, and House Sparrows) and ranged from $10,000-$15,000 in replacement materials with an additional estimated 100 hours labor at $95/hr. required for a full wing repair for a total cost of over $20,000. Spot repairs can be expected to require $3,000-$4,000 in materials with approximately 50 hrs. labor at $95/hr.

Natural Resources

Rookeries, or nesting colonies, are established by egret and heron species, including Cattle Egrets, Great Egrets, Great Blue Herons, and Snowy Egrets. These species and their nesting colonies are found in Arizona. These nesting sites can encompass areas between 0.1 and 5 ha in size. Egret and heron activities can be destructive to desirable trees, shrubs, and other vegetation at these sites. Defoliation of the plants by bird movements through the canopy, removal of plant material for nest building, covering of leaves by droppings, and drastic increases in soil nutrients from bird droppings will destroy the vegetative community in 1-12 years depending on the plant species present and the number of birds (Telfair and Thompson 1986, Telfair 2006). There are several avain species that depredate the eggs, young and adult threatened and endangered species. WS-Arizona had 26 work tasks annually associated with protecting natural resources annually from FY16 to FY20 (Table 3).

Pets and Zoo Animals

Finally, as discussed for livestock, birds can depredate pets and zoo animals or potentially be involved in the transmission of disease to them. Small zoo animals, depending on size, are also vulnerable to attack by raptors. Small dogs and cats can be killed by large raptors such as the Great Homed Owl (Washburn 2018). WS-Arizona received an annual average of 102 requests for assistance with predation threat to pets and zoo animals from raptors averaging $1,000 damage annually from FY16 to FY20 (Table 3).

1.3.3 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 2) 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. 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, European 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).

WS-Arizona responded to an annual average of 6,764 human health and safety complaints (Table 3) involving birds from FY16 to FY20, but not including work tasks associated with disease surveillance. Of these, 6,262 were work tasks associated with protection of people at airports. Species that typically cause most complaints in Arizona are hawks, owls, pigeons, vultures, blackbirds/starlings, wading birds/cormorants, waterfowl, and small flocking birds attracted to airfields (*e.g.*, Horned Larks).

Bird-Aircraft Hazards to Humans

An increase in air traffic (Federal Aviation Administration (FAA) 2011b) along with increases in certain wildlife species that are commonly involved in bird strikes (waterfowl, gulls, raptors, blackbirds/starlings, and other species) have contributed greatly to the increase in the number of reported strikes (Dolbeer 2006). From FY11 to FY20, Arizona aviation officials reported 1,427 strikes (Appendix D - FAA 2021). From FY16 to FY20, 1 strike caused significant damage: 1 unknown large-sized birds (FAA 2021). From FY16 to FY20, 30 strikes caused minor damage: 1 Collared Peccary, 1 Cooper's Hawk, 1 Eurasian Collared Dove, 1 Euphonias Finch, 1 unknow goose, 1 Green-tailed Towhee, 1 unknown hawk, 1 Mourning Dove, 1 Peregrine Falcon, 2 Red-tailed Hawks, 1 Short-eared Owl, 1 Western Bluebird, 1 White-crowned Sparrow, 1 White-throated Swift, and 15 unknown birds. Several significant and minor strikes that occurred in Arizona are given.

In FY16, six bird strikes causing minor damage were reported at Arizona airports:

- In October, a BE-1900 struck a Western Bluebird damaging the landing light lens shattering the lens. Cost of repairs reported at $1150.00.
- In February, a BE-33 made a precautionary landing after striking an unknown bird causing a small dent on the right wing.
- In May, an A-321 made a precautionary landing after striking an unknown bird causing four dents below the cockpit windows.
- In April, a B-767-300 struck a White-crowned Sparrow. Evidence of the struck was found during the post flight inspection.
- In September, a PA-28 struck an unknown bird denting the fresh air inlet.
- In September, a MD-30-90 ingested a flock of Mourning Doves in the engine causing the core blade to be damaged. The aircraft was forced to land.

In FY17, three bird strikes causing minor damage were reported at Arizona airports:

- In July, a C-172 struck an unknown bird damaging the left wing.
- In January, a C-172 struck a Red-tailed Hawk on the leading edge of the right wing.

- In November, a B-737-800 struck a Peregrine Falcon damaging the right engine forcing an emergency landing. Cost of repairas reported at $168,112.00.

In FY18, eight bird strikes causing minor damage and one bird strike causing significant damage were reported at Arizona airports.

- In September, a C-172 struck an unknown bird leaving a dent on the left wing.
- In August, an A-320 struck an unknown bird denting the right engine cowling. The aircraft was found not to be flight worthy due to a bent outer fan blade.
- In June, an A-320 struck an unknown bird leaving a large in the right engine cowling. Cost of repairs reported at $101,800.00.
- In April, a C-172 struck a Red-tailed Hawk denting the right wing just above the strut. Cost of repairs reported at $2,545.00
- In October, an A-321 struck an Eurasian Collared Dove breaking the nose gear lens.
- In October, a PA-28 struck an unknown bird leaving a small dent on the leading edge of the right wing.
- In October, a PA-28 struck an unknown bird causing minor damage to the right wing.
- In October, a C-172 struck a Coopers Hawk.
-

In FY19, ten bird strikes causing minor damage were reported at Arizona airports:

- In September, a B-737-800 struck a Green-tailed Towhee causing damage to the windscreen.
- In September, an unknown bird struck the lowere right side of the randome.
- In July, an A-320 struck an unknown bird causing damage to a fan blade.
- In March, a B-737-700 struck an unknown goose causing significant damage to the randome.
- In March, an A-320 struck a Short-eared Owl causing damage to the inner cowling of the engine.
- In February, a PA-44 Seminole struck an unknown bird.
- In February, a PA-44 Seminole struck an unknown hawk sdamaging the left side of the windshield.
- In November, a BE-90 King struck a White-throated Swift denting the leading edge of the left wing.
- In October, AEROS 350 struck an unknown bird chipping the paint where the bird struck the nose.

In FY20, two bird strikes and one mammal strike causing minor damage were reported at Arizona airports:

- In July, a C-206 struck a Collared Peccary.
- In March, a PILATUS PC-12 struck an unknown bird.
- IN March, a B-737-700 struck an unknown bird denting the left leading edge slat and damaging the top of wing.

To date, no documented bird strikes have resulted in loss of human life in Arizona; however, strikes continue to occur, increasing the risk for a catastrophic event. Such was the case at Elmendorf Air Force Base, Alaska in September 1995 where 24 human lives were lost when an “AWACS” aircraft crashed after ingesting four Canada Geese during takeoff (Cleary and Dolbeer 1999).

Few birds fly more than 2,000 feet above ground; for this reason, 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). WS-Arizona routinely receives requests to conduct BDM at, or near, airports or airbases. Most airport related requests are responded to by WS 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. WS-Arizona has agreements for the management of bird hazards at five airports and 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 under CFR 14 - Part 139.337 or from an airbase Bird Air Strike Hazard (BASH) team. WS 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, a Memorandum of Understanding (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). The current MOU between WS and the FAA was signed in 2013.

WS-Arizona has three operational airbase programs at Luke Air Force Base; Davis Monthan Air Force Base; and Sierra Vista Municipal Airport – Libby Army Airfield joint-use facility. The species that have been identified to cause the most strikes in Arizona from FY11 to FY20 (Appendix D) are Mourning Doves (246 - 17%), unknown dove species (116 – 8%), Rock Pigeon (32– 2%), and American Kestrel (37 – 3%) causing 30% of the known bird species strikes; 46% of the strikes in Arizona are reported as unknown. Take of these species occurs at these airports, but the majority of birds are hazed from the air operating area.

Avian Diseases Transmittable to Humans

Rock 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 2). As many as 65 different diseases transmittable to humans or domestic animals have been associated with Rock Pigeons, European Starlings, and House Sparrows (Weber 1979). Rosy-faced Lovebirds and Rock Pigeons visiting backyard bird feeders may be rise for concern for zoonotic transmission of Chlamydia psittaci (Dusek et al 2018). The risk of disease transmission from birds is often the underlying reason people request assistance from WS-Arizona.

Many times, individuals or property owners that request assistance with Rock Pigeons or nuisance blackbird or starling roost problems are concerned about potential disease risks but are unaware of the types of diseases that can be associated with these birds. In most such situations, BDM is requested because the droppings left by concentrations of birds is aesthetically displeasing and can result in continual clean-up costs.

West Nile Virus (WNV) causes sporadic outbreaks of human encephalitis. House Sparrow (*Passer domesticus*), House Finch (*Haemorhous mexicanus*), Great-tailed Grackle (*Quiscalus mexicanus*), and Mourning Dove (*Zenaida macroura*) account for most WNV infections among local resident birds. These species roost communally after early summer breeding. Highly competent sparrows, finches, and grackles are predicted to be key amplifying hosts for WNV (Komar et al 2013).

Further problems arise as resident Canada Geese and other waterfowl have become accustomed to and are successful in suitable urban habitats. These resident birds are becoming more and more of a nuisance around public parks, lakes, housing developments, and golf courses as they leave fecal matter, damage turf and sometimes attack humans. The threat to human health from high fecal coliform (e.g., *Escherichia coli*) levels and other pathogens including *Cryptosporidium parvum*, *Giardia lambia*, and *Salmonella spp*. is also associated with large amounts of droppings (Clark 2003).

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
Escherichia coli	diarrhea, stomach cramping, nausea and vomiting	possible, young children are more likely to have severe problems including kidney failure and possible death.	possible diarrhea
	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	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 2. Diseases transmittable to humans and livestock associated with Rock Pigeons, starlings and House Sparrows (*copied from* Weber 1979).

Avian Influenza (AI). WS is 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 (HP H5N1 AI). Both WS and USFWS are collecting samples to test for the presence of this disease in western states. Samples are obtained from live and dead birds, and droppings, and often certain species are targeted.

The EA discusses the need to monitor, and possibly manage, wild and feral birds to reduce the risk of disease transmission to humans and livestock. WS is receiving increasing requests for assistance with disease surveillance in wild and feral birds. WS is one of several agencies and organizations participating in surveillance for the AI virus in North American migrating birds.

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 nationwide surveillance effort has detected some instances of low pathogenic AI viruses, as was expected given that waterfowl and shorebirds are considered natural reservoirs for AI. Tens of thousands of birds have been tested, but there has been no evidence of the HP H5N1 AI virus in North America.

WS-Arizona has been involved in the nationwide surveillance effort for the HP H5N1 AI virus. The focus of surveillance in Arizona has concentrated on waterfowl and shorebirds and began in FY06. From FY16 to FY20, WS-Arizona collected an annual average of 121 samples from 17 known species (droppings sampled are not identified to bird in the MIS) in Arizona.

Bird Attacks on People

Another type of human safety problem that occurs with birds in Arizona is attacks on people by nesting waterfowl, raptors, and passerines. Common species which attack people that WS-Arizona receives complaints involve Canada Geese, feral Mute Swans, Northern Mockingbirds, Brewer's Blackbirds, and Northern Cardinals. Additionally, crows that have been hand-raised and subsequently released are serious problems and often find children at elementary schools easy to terrorize taking barrettes and pins to cache. In Denver County for example, Canada Geese have attacked employees while nesting outside the entrance to a federal facility. One blind employee was struck and injured when he tripped and fell to the ground trying to get away from an aggressive adult male defending his nest. After several repeated attacks and threats to individuals nearby, WS-Arizona personnel resolved the problem by coordinating the hand capture of the male goose. Once the male was removed, the aggressive, defensive behavior of the parent birds ceased and the problem was resolved.

1.3.4 Need for BDM to Protect Wildlife Including T&E Species

Some species of wildlife including those listed as T&E under the Endangered Species Act (ESA) of 1973 are preyed upon or otherwise adversely affected by certain bird species. Direct predation has been shown to seriously limit the recovery of T&E and sensitive bird species. Yuma Clapper Rails, Southwestern Willow Flycatcher, and the Yellow-billed Cuckoo are examples of species that breed in Arizona that could be subjected to damage from predatory birds. Birds of prey, as well as mammalian carnivores, and snakes kill adult rails, flycatchers and cuckoos and their young, and destroy nests in nesting colonies of these endangered species. Bird species documented as potential threats to the long term nesting success of threatened and endangered species include Red-tailed Hawks, Cooper's hawk, Great Horned Owls, American Kestrels, Northern Harriers, and Burrowing Owls (species accounts LCR MSCP 2018).

Inter-specific nest competition has been well documented in European 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. Management 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.

The nests of several endangered birds are frequently parasitized by Brown-headed Cowbirds. An endangered bird that has been negatively affected by Brown-headed Cowbirds is the Black-capped Vireo (Brown 1994, Grzybowski 1995). The cowbirds lay their eggs in active nests of other bird species. Cowbirds are known to lay eggs in the nests of more than 100 different bird species. Each female will lay as many as 40 eggs per year in surrogate nests (Lowther 1993). The cowbird eggs hatch first and the young are cared for by the host bird as if they were its own. By the time that the host birds' own eggs hatch, the cowbird nestlings are already much larger, out-competing the host birds' young for food and frequently pushing them out of the nest. With endangered bird species, such parasitism can cause enough nest failures to jeopardize the host species. A number of Wildlife Services state programs, including Arizona, California, Michigan, and Texas, have historically conducted cowbird trapping and other population control measures in certain areas (e.g., at feedlots and roost locations) to successfully reduce nest parasitism in areas where the host birds have been impacted. Cowbird trapping is not currently being conducted in Arizona, but is available as an option in the future if needed.

Another natural resource protection activity is the protection of T&E fish and fisheries from fish-eating birds, especially where piscivorous birds congregate in large numbers. Several piscivorous bird populations have escalated significantly over the last 40 years and can deplete fisheries in local areas.

1.3.5 Need for Bird Damage Management to Protect Agriculture

Arizona grows a variety of agricultural products that had an annual average sales valued at $4.3 million from 2015 to 2019 (National Agricultural Statistics Service (NASS) 2019). Two primary areas of agriculture production are protected by WS-Arizona BDM, livestock and crops. Livestock accounts for 39% of sales while crops account for 61%. The primary livestock protected by WS-Arizona BDM are cattle, sheep, poultry, and, to a minor extent, all other hoofed stock. Crops protected by WS BDM include primarily grain, feed, seed oil, vegetable, and fruit/nut crops. WS-Arizona BDM works to protect feed and vegetable crops. Livestock, and crops can be damaged by birds and WS-Arizona had an average of 158 work tasks associated with $81,766 annual lost from FY16 to FY20 (Table 3). Many requests are received prior to the occurrence of damage, especially in areas with historic damage occurrence. Much of the assistance given is with the use of hazing methods to reduce damage.

Verified losses are defined as those losses examined by a WS-Arizona specialist during a site visit and identified to have been caused by a specific bird species or group of birds. Often a WS-Arizona 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 WS-Arizona 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 WS-Arizona Specialist must observe the birds in the area. However, a few species have 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 theBDM necessary to resolve the problem. A WS-Arizona 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.

Livestock

Livestock production in the United States contributes greatly to local economies. Arizona produces a wide variety of livestock. Cattle and calf production in Arizona had an annual average from 2015 to 2019 of $806,160 in sales from 984,000 cows (NASS 2019). Other livestock and products that annually contributed significant sales from 2015 to 2019 (annual average) in Arizona included hogs ($39,754) and other livestock and products ($864,100). Livestock along with 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 livestock feed by birds reported to or verified by WS-Arizona is unknown between FY16 and FY20 and resulted in an average of 146 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. WS-Arizona 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, chiefly livestock injury or fatality, have been primarily attributed to Chihuahuan Ravens, Common Ravens, American Crows, Golden Eagles, Bald Eagles, Great-Horned Owls, and Red-tailed Hawks. To a lesser extent, other owls, falcons, and other species have also impacted livestock resources. Predatory birds mostly kill or injure small (i.e., rabbits, poultry) or young livestock, or incapacitated (i.e., injured, calving) adult hoof-stock. Domestic fowl (i.e., chickens, ducks, geese, guineas) are reported as livestock and are included in this discussion as well.

WS-Arizona considers non-lethal 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 non-lethal 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. WS-Arizona 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., turkey vulture, raven). Avian depredation is often difficult to control, but eagle depredation can be particularly problematic due to additional protective laws. From FY16 to FY20, WS-Arizona reported an average of 1 request for assistance of livestock depredation annually (Table 3).

Livestock Feed Losses at Confined Animal Feeding Operations (CAFOs). Starlings, blackbirds, House Sparrows, Rock Pigeons and, to a lesser extent, American Crows and Common 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. Livestock and dairy production in Arizona contributes substantially to local economies. In 2020, the cattle inventory in Arizona was 970,000 with 255,000 head of cattle on feed in feedlots and 193,000 milk cows (NASS 2019). While not every operation experiences heavy infestations of birds with associated damage, some will, and some of those request assistance from WS-Arizona. Technical assistance and direct control is used to provide a comprehensive BDM plan which may include both lethal and non-lethal BDM approaches. WS-Arizona personnel responded to an average of 145 complaints involving livestock feed annually from FY16 to FY20 (Table 3). European Starlings, American Crows, and Rock Pigeons were the primary cause of the damage, especially in the eastern region of Arizona.

The problem of European 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). The concentration of larger numbers of cattle eating huge quantities of feed in confined pens results in a tremendous attraction to starlings, blackbirds, and Rock 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.

An analysis of blackbird and starling depredation at 10 cattle feeding facilities in Arizona that used WS-Arizona BDM services conservatively estimated that the value of feed losses on the 10 facilities would have been about $120,000 without WS-Arizona BDM services which was reduced to $40,000/yr. (WS 1996) with operational assistance. Similar results conducting BDM at CAFOs was achieved in Nevada and Kansas and (WS 2006, 2008).

Livestock Health Problems. Pathogens of livestock disease (*e.g.,* Escherichia coli, 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 3. A number of diseases that affect livestock have been associated with Rock Pigeons, starlings, various 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.

WS often receives requests from CAFO operators to conduct BDM to protect their herds from the potential for disease. In FY06, a coccidiosis outbreak occurred in sheep from Rock Pigeons resulting in the loss of 50 sheep valued at $6,000. Because disease has the potential for catastrophic results at a facility, this is a real concern and WS assists those that request BDM for livestock protection where congregations of birds amass. Livestock health is a concern to Arizona cattle and other livestock producers since many requests for assistance to WS-Arizona are to reduce the potential for disease transmission, especially at CAFOs (Table 3).

Crops

Arizona produces a wide variety of crops and many of them are damaged by birds. Wheat that is used for a food grain, and hay, which is used for feed crops, are the leading crops sold in Arizona, generating about $320,215 in sales for 2019 (NASS 2019); however, BDM is only requested occasionally to protect this resource and from FY16 to FY20. Of the crops, WS-Arizona documented most damage during FY16 through FY20 were lettuce, pecans, and citrus from a variety of birds including house sparrows, common ravens, and starlings.

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. WS-Arizona has recorded an average of 3 work tasks associated with protecting crops in Arizona annually resulting in about $81,766 damage by birds (Table 3) from FY16 to FY20. Producers were primarily given technical assistance support.

Canada Geese can cause considerable damage to crops, particularly alfalfa, winter wheat, and pasturelands. The overall population of Canada Geese in North America has experienced drastic increases over the last few decades. Large goose flocks often congregate in Arizona on croplands to feed and take advantage of the large open spaces that the fields offer as a safety strategy. Damage to these crops during feeding by geese can be quite extensive; these species often pluck younger plants from the ground during feeding rather than clip off the vegetative portion of the older plants.

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 sunflowers and milo. Blackbirds congregate in fields where they can cause significant damage to individual producers who then seek assistance from WS. 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 MBTA when they cause or threaten damage to crops (see 50 CFR, Part 21.43). No one blackbird control method has proven to be entirely satisfactory in alleviating rice or other crop damage. Hence, WS currently recommends and uses the IWDM approach to blackbird damage management, and IWDM methodologies are continuously updated as new blackbird management tools become available.

Aquaculture

In 2018, 6 aquaculture facilities in Arizona had $3.6 million in total aquaculture sales (NASS 2019). Additional aquaculture facilities are managed by the state through AZGFD. Occasionally, fish-eating birds such as herons, egrets, Double-crested Cormorants, Ring-billed Gulls, Ospreys, and other piscivorous bird species prey on young fry, fingerlings, adult fish ready for stocking, or brood fish at these fish rearing facilities. In most cases, WS-Arizona only provides advice (technical assistance) to the facility operators on how to resolve such problems through primarily nonlethal means such as barriers, deterrent wires, or harassment. In some cases, the producer or facility might obtain a depredation permit from USFWS to euthanize a few of the birds to reinforce the remaining birds' fear of harassment and exclusionary techniques. Under the proposed action, WS 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. WS-Arizona didn't receive any requests for assistance at aquaculture facilities between FY16 and FY20 to protect fish.

1.4 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

WS-Arizona has covered BDM activities under a previous EA, Finding of No Significant Impact (FONSI), and Decision for BDM in Arizona (WS 1996). This EA will supersede that Decision.

1.5 DECISION TO BE MADE

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

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

1.6 SCOPE OF THIS EA ANALYSIS

1.6.1 Actions Analyzed

This EA evaluates WS-Arizona BDM to protect human health and safety, agricultural resources, property, and natural resources on private or public lands throughout Arizona wherever such management is requested, and bird management for disease monitoring and surveillance purposes.

1.6.2 American Indian Lands and Tribes

WS-Arizona only conducts BDM at a Tribe's request. Since tribal lands are sovereign and the methods employed are the same as for any private land upon which WS-Arizona provides services, tribal officials would determine if BDM is desired and the BDM methods that would be 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

Arizona has a number of different federal lands (e.g., Bureau of Land Management, U.S. Forest Service, National Park Service) within its boundaries and WS-Arizona could be requested to conduct BDM on any of them. The methods employed and potential impacts are the same on these lands as they would be on private lands upon which WS-Arizona provides service. Therefore, if WS-Arizona were requested to conduct BDM on federal lands for the protection of agriculture, property, human health and safety, or natural resources, this EA would cover the BDM actions implemented. NEPA compliance for BDM conducted to protect property or natural resources such as T&E species at the request of USFWS or other federal agency is the requesting agency's responsibility. However, WS-Arizona could accept the NEPA responsibility at the request of another agency, but that agency would still be responsible for issuing a NEPA decision. WS-Arizona's NEPA responsibilities align with the APHIS NEPA implementing procedures.

1.6.4 Period for which this EA is Valid

This EA will remain valid until WS-Arizona determines that new needs for action or new alternatives having different environmental effects must be analyzed. If a new issue arises or the analysis in monitoring reports concludes that WS-Arizona BDM activities are outside the scope of this EA, the EA would be supplemented to include the new information and sent out for public review. This EA will be reviewed each year to ensure that it is complete and still appropriate for the scope of the BDM activities conducted by WS-Arizona.

1.6.5 Public Involvement

WS-Arizona provided a draft for review to agencies and tribes in Arizona in August 2022. WS-Arizona also made the EA available to the public for review and comment through notices published in local media and through direct notification of interested parties. WS-Arizona made the EA available to the public for review and comment by a legal notice published in the *Arizona Republic Newspaper* on January 24, 2022, on the APHIS website on January 12, 2022, and on the federal e-rulemaking portal at the regulations.gov website beginning on January 12, 2022. The opportunity for public comment closed on February 28, 2022.

During the public comment period, WS-Arizona received 13,738 comment submissions on regulations.gov. We provided responses to substantive comments in section 5.4 of the final EA. Comments that are individual opinions or comments that oppose or support an agency action without any substantive information included in the comment do not warrant an agency response.

1.6.6 Site Specificity

This EA analyzes potential impacts of BDM on the human environment as required by NEPA and addresses WS-Arizona BDM activities on all lands under Cooperative Agreement or as otherwise covered by WS-Arizona Work Plans (e.g., on federal public lands) within Arizona. It also addresses the impacts of BDM on areas where additional agreements with WS-Arizona may be written in the reasonably foreseeable future in Arizona. 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.

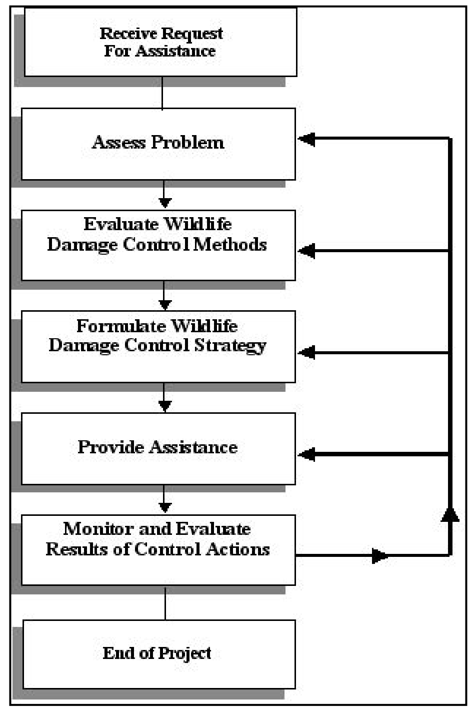

Figure 3. WS Decision Model used at the field level to evaluate a wildlife damage problem (*copied from* Slate et al. 1992).

Planning for BDM 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 WS-Arizona 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 WS Decision Model (Figure 3), WS Directive 2.201 is the site-specific process for determining methods and strategies to use or recommend for individual actions conducted by WS. 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., AZGFD game management units). WS-Arizona monitors target bird and nontarget take within Arizona by county. The game management units and counties do not correspond to each other in Arizona, 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. Waterfowl harvest by sportsmen in Arizona is estimated by AZGFD and USFWS from mail and internet 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 or Flyway level and, therefore, much more reliable. Estimated cumulative impacts, therefore, are more accurate, especially for migratory birds on a broader level and the statewide level is often used.

1.7 AUTHORITY AND COMPLIANCE

1.7.1 Authority of Federal and State Agencies for BDM in Arizona

1.7.1.1 WS Legislative Authority

USDA is authorized by law to protect American agriculture and other resources from damage associated with wildlife. WS has legislative authority to conduct WDM in Arizona.

The primary statutory authorities for the APHIS-WS program are the Act of March 2, 1931 (46 Stat. 1468; 7 United States Code (USC) 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 USC 426c). The Act of March 2, 1931, as amended in the Fiscal Year 2001 Agriculture Appropriations Bill, provides that:

> "*The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program. The Secretary shall administer the program in a manner consistent with all of the wildlife services authorities in effect on the day before the date of the enactment of the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2001.*"

The Act of December 22, 1987 provides in part:

> "*That hereafter, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with States, local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammals and birds species that are reservoirs for zoonotic diseases, and to deposit any money collected under any such agreement into the appropriation accounts that incur the costs to be available immediately and to remain available until expended for Animal Damage Control activities*."

WS-Arizona conducts WDM in cooperation with and under the authorities of Arizona Department of Agriculture (ADA) and AZGFD. WS-Arizona 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. The BDM methods that can be used in Arizona are discussed in Section 3.4 and each bird damage operational project may require the use of one or more of these.

1.7.1.2 U.S. Fish and Wildlife Service.

USFWS is responsible for managing and regulating take of migratory bird species listed under the MBTA. They are also responsible for regulating T&E species under ESA. Sections 1.7.2.2 and 1.7.2.3 below describe WS's interactions with the USFWS under these two laws.

1.7.1.3 Arizona Game and Fish Department.

AZGFD has the responsibility to manage all protected and classified wildlife in Arizona regardless of the land class on which the animals are found (ARS 17-201), except federally listed T&E species. WS-Arizona has an MOU with AZGFD that details the responsibilities of each agency and the cooperative relationship. WS-Arizona conducts activities in accordance with ARS 17-239, Wildlife Depredations. Landowners, lessees or any other person can resolve wildlife depredations non-lethally or may obtain a permit (ARS 17 239:R12-4-113) to take any wildlife species causing damage to property in Arizona (ARS 17-239). WS-Arizona is considered an agent of the landowner for the purpose of this section, but does not need a wildlife service license required for private animal control operators (ARS 17-201: R12-4-421). A letter of authorization, which constitutes a permit to take state-protected bird species for depredation purposes, is issued by AZGFD annually to WS-Arizona. A scientific collecting permit allows for the take of wildlife specified on the permit. Under this permit, AZGFD authorizes WS-Arizona employees under the supervision of the state director to handle, move, or otherwise take wildlife pursuant to Cooperative Agreements (17-7304-6448-RA, 17-7304-5108-RA, 17-7304-6449-RA) between AZGFD and WS-Arizona (Arizona Revised Statutes [ARS] 17-201:R12-4-418).

1.7.1.4 Arizona Department of Agriculture.

ADA is responsible for regulating pesticide use in Arizona under Title 3 Articles 5 and 6. WS-Arizona registers pesticides with ADA and has several registrations for DRC-1339. Additionally, WS-Arizona uses other pesticides such as Avitrol® and potentially restricted-use repellents which are also registered with them. WS-Arizona personnel that use restricted-use pesticides in their job duties must become a certified pesticide applicator by ADA to use them, or be supervised by a certified applicator. ADA has an MOU with WS-Arizona and under the authority of ARS 3-2401 cooperates with WS-Arizona to alleviate wildlife depredations. The MOU establishes a cooperative relationship between WS-Arizona and ADA, outlines responsibilities, and sets forth objectives and goals of each agency for resolving WDM conflicts in Arizona.

1.7.1.5 U.S. Environmental Protection Agency (EPA).

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

1.7.1.6 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 is to protect the public health by assuring that drugs on humans or on animals intended for human consumption are safe and effective.

1.7.2 Compliance with Federal Laws

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

1.7.2.1 National Environmental Policy Act (NEPA)

Federal actions with the potential to affect the human environment 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). WS 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 Arizona. In addition, WS follows USDA (7 CFR 1b) and APHIS (7 CFR 372) NEPA implementing regulations as a part of the decision-making process.

1.7.2.2 Endangered Species Act

The ESA recognizes that our natural heritage is of *"esthetic, ecological, educational, recreational and scientific value to our Nation and its people*." The purpose of the Act is to protect and recover species that are in danger of becoming extinct. Under the ESA, species may be listed as endangered or threatened. Endangered is defined as a species that is in danger of becoming extinct throughout all or a significant portion of its range, while threatened is defined as a species likely to become endangered in the foreseeable future. Under the ESA, "*all federal departments and agencies shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act"* (Sec.2(c)). Additionally, the Act requires that, *"each Federal agency shall in consultation with and with the assistance of the Secretary, insure 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 or result in the destruction or adverse modification of habitat of such species...each agency will use the best scientific and commercial data available"* (Sec.7 (a) (2)). WS obtained a Biological Opinion (BO) from USFWS in 2018 describing potential effects on T&E species and prescribing reasonable and prudent measures for avoiding jeopardy.

1.7.2.3 Migratory Bird Treaty Act (MBTA)

The Migratory Bird Treaty Act of 1918 (16 USC 703-711; 40 Stat. 755), as amended, provides USFWS regulatory authority to protect species of birds classified as "migratory" and are listed in 50 CFR 10.13 (most all bird species except gallinaceous (e.g., Wild Turkey, grouse) and introduced birds (e.g. Rock Pigeon, starling). 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, the USFWS issues permits to private and public entities, including WS, for BDM. APHIS-WS and USFWS have a 2012 MOU for the purpose of migratory bird conservation to comply with Executive Order 13186 of January 10, 2001, the Responsibilities of Federal Agencies to Protect Migratory Birds (see Section 1.7.2.7 below).

WS may provide on-site assessments for persons experiencing migratory bird damage to obtain information on which to base damage management recommendations. BDM recommendations could be in the form of technical assistance or operational assistance. When appropriate, WS 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). European Starlings, Rock 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, cowbirds, all grackles, crows, or magpies in Arizona 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. 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).

1.7.2.4 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The EPA is responsible for implementing and enforcing FIFRA. All chemical methods used or recommended by WS are registered with and regulated by the EPA, ADA, and are used by WS in compliance with labeling procedures and requirements.

1.7.2.5 Food, Drug, and Cosmetic Act

This Act, as amended, gives the FDA the authorization to regulate the study and use of animal drugs. The FDA regulates immobilization drugs used by WS under this Act.

1.7.2.6 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 Native American Tribes to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings. Tribe's request WS BDM and sign agreements for WS to conduct BDM on their lands; thus, tribes have control over any potential conflict with cultural resources on tribal properties. WS 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.

1.7.2.7 Bald and Golden Eagle Protection Act

Under the Bald and Golden Eagle Protection Act (16 USC 668-668c), the take of an eagle, any part, egg, or nest is prohibited without a permit from the USFWS. Under the Act, the definition of "*take*" includes actions that can "*molest*" or "*disturb*" eagles. For the purposes of the Act under 50 CFR 22.3, the term "*disturb*", as it relates to take, has been defined as "*to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior*." The regulations authorize the USFWS to issue permits for the take of bald eagles and golden eagles on a limited basis (see 81 FR 91551-91553, 50 CFR 22.26, 50 CFR 22.27). As necessary, WS would apply for the appropriate permits as required by the Bald and Golden Eagle Protection Act.

Final Environmental Impact Statement: Programmatic Environmental Impact Statement for the Eagle Rule Revision

Developed by the USFWS, this EIS evaluated the issues and alternatives associated with the promulgation of new regulations to authorize the "*take*" of Bald Eagles and Golden Eagles as defined under the Bald and Golden Eagle Protection Act. The preferred alternative in the EIS evaluated the management on an eagle management unit level (similar to the migratory bird flyways) to establish limits on the amount of eagle take that the USFWS could authorize in order to maintain stable or increasing populations. This alternative further establishes a maximum duration for permits of 30 years with evaluations in five-year increments (USFWS 2016). A Record of Decision was issued for the preferred alternative in the EIS. The selected alternative revised the permit regulations for the "*take*" of eagles (see 50 CFR 22.26 as amended) and a provision to authorize the removal of eagle nests (see 50 CFR 22.27 as amended). The USFWS published a Final Rule on December 16, 2016 (81 FR 91551-91553).

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 Arizona. Generally, depredation to livestock is associated with Golden Eagles. Any interaction with eagles by WS is further tempered by WS Policy (WS Directive Eagle Damage Management 2.315 9/18/2014).

1.7.2.8 Executive Order 13186 - Responsibilities of Federal Agencies to Protect Migratory Birds

Executive Order 13186 requires each federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement a MOU with the USFWS that shall promote the conservation of migratory bird populations. APHIS has developed a MOU with the USFWS as required by this Executive Order and WS would abide by the MOU.

1.7.2.9 Executive Order 13112 - Invasive Species

Executive Order 13112 establishes guidance to federal agencies to prevent the introduction of invasive species, provide for the control of invasive species, and to minimize the economic, ecological, and human health impacts that invasive species cause. The Order states that each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law: 1) reduce invasion of exotic species and the associated damages, 2) monitor invasive species populations and provide for restoration of native species and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control and promote public education of invasive species.

1.7.2.10 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.

1.7.3 Compliance with State Laws

Several Arizona laws and rules regulate WS-Arizona and BDM. WS-Arizona complies with these laws and rules as applicable, and consults and cooperates with State agencies as appropriate.

Arizona Game and Fish Laws and Rules

ARS 17-235. Migratory Birds. This statute defines regulations pertaining to taking migratory birds in accordance with the MBTA.

ARS 17-236. Taking Birds. This statute defines the unlawful take, injury or harassment of any birds, or removal of nests or eggs of any bird, except as authorized by commission order.

ARS 17-239. Wildlife depredations; investigations; corrective measures; disposal; reports; judicial review. This statute explains AZGFD's procedure for managing wildlife damage to property.

ARS 17-201:R12-4-418. Scientific Collecting Permit A scientific collecting permit allows for the take of wildlife specified on the permit. Under this permit, AZGFD authorizes WS-Arizona employees under the supervision of the state director to handle, move, or otherwise take wildlife pursuant to Cooperative Agreements (17-7304-6448-RA, 17-7304-5108-RA, 17-7304-6449-RA) between AZGFD and WS-Arizona.

1.7.4 Compliance with Tribal Laws

WS-Arizona recognizes the rights of sovereign tribal nations, the unique legal relationship between each Tribe and the Federal Government, and the importance of strong partnerships with Native American communities. WS-Arizona is committed to respecting tribal heritage and cultural values when planning and initiating wildlife damage management programs as requested by Tribal governments and/or residents or permittees. Timely and meaningful consultation and coordination with tribal governments, to the greatest extent practicable and permitted by law, are conducted consistent with Executive Order (EO) 13175 and APHIS-WS' plan implementing the executive order, including implementing the government-to-government relationship.

1.8 A PREVIEW OF THE REMAINING CHAPTERS IN THIS EA

This EA is composed of 5 chapters and appendices. Chapter 2 discusses and analyzes the issues and affected environment. Chapter 3 contains a description of each alternative, alternatives not considered in detail, and SOPs to reduce potential problems associated with implementing BDM. 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.

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), 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 factor in determining which issues to include for analysis of the potential environmental impacts of WS involvement in BDM in Arizona is that if, for whatever reason, the BDM conducted by WS 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 Arizona, except that, based on WS employees' years of professional expertise and experience in dealing with BDM actions, WS is likely to have lower risks to nontarget species and the human environment than some other programs or alternatives available to State agencies and private landowners. Therefore, WS has a less likely chance of negatively affecting the human environment affected by BDM actions than would non-federal or private entities. The 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 this EA.

2.1 ISSUES

The following issues or concerns about BDM have been identified through interagency planning and coordination, from the EA that preceded this document (WS 1999), WS EAs in other states (WS 2013, WS 2017) 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
- Humaneness of BDM

2.1.1 Effects of BDM on Target Bird Species Populations

WS monitors target bird take in BDM to determine if take has remained within the range analyzed by the EA. Thus far, WS has not exceeded a significant level of take for any bird species which was analyzed in the prior EA (WS 1996). 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. WS SOPs, discussed in Section 3.5, ensure that the take of birds remains below a sustainable harvest, unless the managing agency has different management goals.

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 WS's BDM activities, especially those species that more than just a few individuals would likely be killed by WS' use of lethal control measures under the proposed action in any one year. From FY16 to FY20, species taken lethally included three nonindigenous species, the Rock Pigeon, European Starling, and House (English) Sparrow, various blackbird species (Red-winged, Yellow-headed, Brewer's Blackbirds, Great-tailed Grackles, and Brown-headed Cowbirds), American Coot, cormorants (Double-crested and Neotropic), Long-billed Curlews, doves (Mourning, Eurasian Collared, and White-winged), Gadwall, Canvasback, Mallard, Common Merganser, Redhead, Ring-necked Duck, Ruddy Duck, Northern Shoveler, Cinnamon Teal, Blue-winged Teal, Green-winged Teal, Black-bellied Whistling Duck, American Wigeon, Wood Duck, Northern Pintail, geese (Canada, Ross, and feral), egrets (Great, Snowy, and Cattle), sandpipers (Least and Western), Black-necked Stilt, herons (Great Blue, Green, and Black-crowned Night), Killdeer, Greater Yellowlegs, Long-billed Dowitcher, Whimbrel, Willet, American Kestrel, Peregrine Falcon, Prairie Falcon, Merlin Falcon, Coopers Hawk, Ferruginous Hawk, Harris Hawk, Northern Harrier, Red-tailed Hawk, Swainson's Hawk, Zone-tailed Hawk, Lesser Nighthawk, Nighthawks (all), Common Black Hawk, Osprey, Burrowing Owl, Common Barn Owl, Great Horned Owl, Short-eared Owl, hummingbirds (Costa's, Anna's, and Black-chinned), Wild Turkey, vultures (Black and Turkey), Gambel's Quail, Roadrunners, woodpeckers (Acorn and Gila), Northern Flicker, House Finch, Ash-throated Flycatcher, Black-headed Grosbeaks, Western Kingbird, Horned Lark, meadowlarks (Western and Eastern), American Pipit, Common Raven, swallows (Barn, Cliff, and Violet-green), Say's Phoebe, White-throated Swift, buntings (Lark and Lazuli), Curve-billed Thrasher, Cactus Wren, Verdin, Dark-eyed Junco, goldfinches (American and Lesser), warblers (Wilsons, Black-throated Gray, Orange-crowned, Yellow, and Townsend's), towhees (Canyon and Green-tailed), sparrows (Lincoln's, Vesper, Black-chinned, Brewer's. Lark, and Savannah), Common Poorwill, Northern Mockingbird, feral ducks, feral chickens and feral guinea fowl.

Maintaining viable populations of all native species is a concern of the public and of biologists within the State and Federal land and wildlife management agencies, including WS. Other species take has been minimal, but will be discussed briefly along with species that have the potential to be taken. Additionally, some birds addressed in this EA are taken by other entities and private parties for depredation and harvested by hunters. Where data is available, other take will be used with WS take to determine cumulative impacts.

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 Arizona covered by this EA, especially information pertaining to their range and seasonal movements in Arizona. Species are primarily given in order of WS-Arizona BDM efforts directed towards them, their subsequent take, and the occurrence and value of damage that the species cause in Arizona. 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 AZGFD which was discussed in Section 1.7.1.2 and 1.7.1.3.

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 and not the entire family Icteridae which also includes meadowlarks and orioles), introduced/invasive commensal birds (Rock Pigeons[1], Eurasian Collared-Dove, European Starlings (also just starlings in this document for brevity), House Sparrows, feral poultry (emus, chickens, peafowl, and guineas), 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

[1] 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 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 Arizona of these two species).

(meadowlarks, Lark Buntings, kingbirds, Horned Larks, pipits, Dickcissels, Bobolinks, longspurs, orioles, and goldfinches), native doves, aerialists (swifts, nightjars, and swallows), woodpeckers, gallinaceous birds (pheasant, prairie-chicken, turkey, and quail), frugivorous birds (robins, waxwings, and finches), and other miscellaneous birds such as mockingbirds and roadrunners that can cause damage and hummingbirds and wrens which usually are not involved 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 passer byes 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).

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. Arizona has 3 species of vultures, 2 eagles, 20 hawks, 7 owls, and the Loggerhead Shrike that have the potential to be involved in BDM projects. Four species of owls are found in Arizona that will not likely be the focus of BDM because these are found in habitat not conducive to causing damage, including airports. The Burrowing Owl has the potential to be involved in BDM projects. Lastly, 9 species of raptors have been found in Arizona only rarely and, as a result, are not likely to be the focus of a BDM project. From FY16 to FY20, raptors were responsible for an average of 6,283 work tasks and $517,733 in damage (Table 2b). Turkey Vultures, Northern Harrier, Red-tailed Hawks, and American Kestrels were responsible for 634, 751, 895 and 809 work tasks respectively (Table 2b). 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. The estimated population of Turkey Vultures, Northern Harrier, Red-tailed Hawks, American Kestrels, Burrowing Owls, and Swainson's Hawks in Arizona is 360,000, 1,400, 100,000, 110,000, 29,000, and 14,000, respectively (Partners In Flight [PIF] 2020).

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 such as the Burrowing Owl and American Kestrel to large such as Golden Eagles. Most species have typical hunting styles including soaring (vultures, eagles, red-tailed hawks), low-flying ambush (harriers), dense forest ambush (accipiters), hovering (kestrel), 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. 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. However, this problem infrequently occurs in Arizona. Most raptors represent a significant hazard to aircraft due to their larger sizes and hunting over open spaces such as airfields.

Raptors are protected as migratory birds. Eagles are specifically protected under their own Act and a permit is required to disturb or take them. WS-Arizona personnel avoid disturbing 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. Of the common species found in Arizona, the Bald Eagle, Common Black-Hawk, Swainson's Hawk, Ferruginous Hawk, Golden Eagle, Peregrine Falcon, Prairie Falcon, Burrowing Owl, and Short-eared Owl are species of conservation concern (ACAD 2019, SWAP 2012, USFWS 2008) and considered accordingly.

Native Doves and Pigeons. Mourning, White-winged, and Inca Doves, Band-tailed Pigeons, and Common Ground-Doves are native to Arizona (Appendix C, Table C1) with Mourning and White-winged Doves being the most numerous. Another species has been documented in Arizona, the Ruddy Ground-Dove, but is on the periphery of its normal range (Appendix C, Table C3). From FY16 to FY20, pigeons and doves caused an annual average of 1,758 work tasks with damage documented at $75,566 (Table 2b) with almost all associated with Mourning Doves at airports. Several BDM methods are used to manage damage caused by doves and pigeons (see Section 3.3.1.3), especially dispersing birds from damage situations such as crop fields and airports (Booth 1994, Godin 1994).

Rock Pigeons, are a non-indigenous species that European settlers first introduced into the United States as a domestic bird for sport, carrying messages and as a source of food (USFWS 1981). Many of those birds escaped and eventually formed the Rock Pigeon populations that now occur throughout the United States, southern Canada and Mexico (Williams and Corrigan 1994). As an identified invasive species, they are neither federally nor State protected.

Pigeons are non-migratory and closely associated with people, where man-made structures and activities provide them with food and sites for roosting, loafing and nesting (Williams and Corrigan 1994, Lowther and Johnston 2014). Thus, pigeons commonly occur around city buildings, bridges, parks, farmyards, grain elevators, feed mills and other manmade structures (Williams and Corrigan 1994). Additionally, although pigeons are primarily grain and seed eaters, they will readily feed on garbage, livestock manure, spilled grains, insects and any other available bits of food (Williams and Corrigan 1994). Pigeons occur throughout the year in all 50 states, including Arizona (Lowther and Johnston 2014).

Band-tailed Pigeons are mid-sized, stocky birds that look similar to 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 and will sometimes frequent orchards.

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 populations of pigeons and doves in Arizona are 5.5 million Mourning Doves, 2.9 million White-winged Doves, 33,000 Inca Doves, 40,000 Band-tailed Pigeons, and 70,000 Common Ground-Doves (PIF 2020). Western BBS Region data for 1966 to 2019 shows a significant decrease ($P < 0.01$) of -1.7%/year for Mourning doves, -0.26%/year for White-winged doves, -2.5%/year for Inca Doves, -1.93/year for Band-tailed Pigeons, and -1.91%/year for Common ground doves (Sauer et al. 2020). Mourning and White-winged Doves and Band-tailed Pigeons are migratory game birds and have established seasons with bag limits.

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 (Invasive Species Council 2001). These species often compete with native wildlife (see

Section 1.3.4) and cause billions of dollars of damage in the United States annually (Pimentel et al. 2000). Many different exotic species have been found in Arizona. Some species have been established for many decades with established breeding populations throughout the United States such as Rock 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 in cities such as Phoenix (Orange Bishop and Peach-faced Lovebirds). Others are escaped domestic species such as feral waterfowl and other poultry. Appendix C lists many introduced species, but 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 Invasive Species Council (2001) such as Ring-necked Pheasants and Peach-faced Lovebirds.

European Starlings. As their common name implies, European Starlings are native to Europe. Colonization of North America by the European Starling began in 1890 when 80 starlings were released into New York City's Central Park (Bump and Robbins 1966). The released birds were able to exploit the resources in the area and have since spread throughout the continent. Eighty years after the initial introduction, they are one of the most common birds in North America (Feare 1984). Because European Starlings are an introduced species and not native to North America, the MBTA does not provide the starling protection from take. Arizona State Law requires a hurting license for take of starlings. The season is year round and the take is unlimited.

European Starlings are highly adaptable and occur in a wide range of habitats; however, they are most often associated with disturbed areas created by people (Cabe 1993, Johnson and Glahn 1994). European starlings prefer to forage in open country on mown or grazed fields (Cabe 1993, Johnson and Glahn 1994). Their diet consists of insects, fruits, berries, seeds and spilled grain (Cabe 1993, Johnson and Glahn 1994). European Starlings are highly social birds feeding, roosting and migrating in flocks at all times of the year (Cabe 1993). European Starlings are aggressive cavity nesters that can evict native cavity nesting species (Cabe 1993, Johnson and Glahn 1994). In the absence of natural cavities, European Starlings will nest in manmade structures, such as streetlights, mailboxes and attics (Cabe 1993, Johnson and Glahn 1994). Although few conclusive studies exist, evidence suggests European Starlings can have a detrimental effect on native species (Cabe 1993, Johnson and Glahn 1994).

European Starlings are common residents and migrants in Arizona. 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 survey-wide 1966 - 2019 has been declining at a significant (*P* < 0.01) rate of -1.44% annually (Sauer et al. 2020). However, during winter the population increases with migrants from northern states. They often concentrate in feedlots. BDM methods to control starlings are discussed in Johnson and Glahn (1994) and Section 3.3.1.3.

Pursuant to EO 13112, the National Invasive Species Council (NISC) has designated the European Starling as meeting the definition of an invasive species. Lowe et al. (2000) ranked the European starling as one of the 100 worst invasive species in the world. Activities associated with starlings would occur pursuant to EO 13112, which states that each federal agency whose actions may affect the status of invasive species shall reduce invasions of exotic species and the associated damages. European Starlings are not federally or State protected. They may be taken by anyone at any time by any legal means.

Rock Pigeons and Eurasian Collared-Doves. Rock Pigeons and Eurasian Collared-Doves are found throughout Arizona. The Rock Pigeon has been established in Arizona for many decades and have 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 African Collared Doves can also be found in Arizona periodically. This species is typically not associated with damage as often as the other species and rarely establish a self-sustaining population. Rock Pigeons are mid-sized familiar urban birds. Eurasian Collared-Doves are smaller, but larger than most other doves. African Collared Doves are smaller, but similar to the collared-dove. These birds have robust bodies with small heads and short beaks, and are powerful fliers. Rock 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. African Collared Doves are usually found in urban areas for the most part.

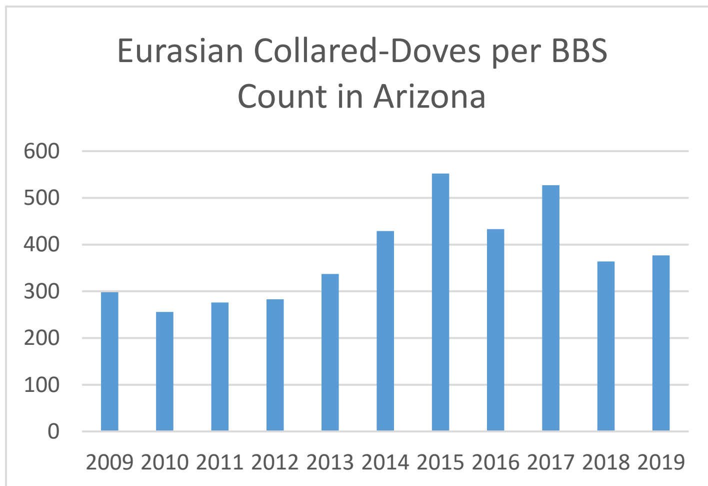

Figure 4. Eurasian Collared-Dove population growth in Arizona documented in the BBS (Pardieck et al. 2020).

Pigeons are non-migratory and closely associated with people, where man-made structures and activities provide them with food and sites for roosting, loafing and nesting (Williams and Corrigan 1994, Lowther and Johnston 2014). Thus, pigeons commonly occur around city buildings, bridges, parks, farmyards, grain elevators, feed mills and other manmade structures (Williams and Corrigan 1994). Additionally, although pigeons are primarily grain and seed eaters, they will readily feed on garbage, livestock manure, spilled grains, insects and any other available bits of food (Williams and Corrigan 1994). Pigeons occur throughout the year in all 50 states, including Arizona (Lowther and Johnston 2014).

Rock Pigeons and Eurasian Collared-Doves cause a wide variety of damage and are a threat to aviation due to size and flocking behavior, abundance, and medium size. Rock Pigeons have an impact on property from their droppings; their droppings will deface buildings and paint on airplanes in hangars. Rock Pigeons and their droppings, if allowed to build up, are a source of several diseases such as psittacosis that can infect people. From FY16 to FY20, Rock Pigeons had an annual average of 220 work tasks associated with them for an average of $40 damage and Eurasian Collared-Doves had 141 work tasks associated with them and no damage (Table 2b). However, this is expected to increase drastically over the next few years as their population has increased exponentially across the Country as is seen in Figure 4.

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). Rock Pigeons are not regulated by federal or Arizona laws. State law requires a hunting license for the ake of Eurasian Collared-Doves. The season is year round and the take ios unlimited. The estimated population of Rock Pigeons in Arizona is 89,000 (PIF 2020) which is mostly stable to increasing for the last 30 years. The rate of population increase of Rock Pigeons has not been significant in Arizona BBS survey-wide counts, increasing 0.73% annually from 1966 to 2019 (Sauer et al. 2020). This potential increase could mostly be attributed to urbanization occurring in Arizona. The Eurasian Collared-Dove is a recent arrival in Arizona, being recorded in the BBS for the first time in 2003. Since then the count has risen in 2009 to an average of almost 6 seen/BBS survey which is rather phenomenal.

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 Arizona. 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 but State Law requires a hunting license for their take. The season is year round and the take is unlimited. Their estimated population in Arizona is 2.6 million using population parameters from PIF (2020). The rate of population decrease of House sparrows in Arizona BBS survey-wide 1966 – 2019 counts data does not reflect an increase, but suggests that the population was significantly (P <- 0.03) declining at -2.61% annually in Arizona. Their population, elsewhere has been declining and is thought to be from a reduction in habitat and feed such as seed gleaned from horse droppings. BDM methods for House Sparrows are discussed in Fitzwater (1994) and Section 3.3.1.3. In Arizona, from FY16 to FY20, House Sparrows were responsible for an annual average of 173 work tasks and $0 in damage (Table 2c).

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 Arizona, especially in urban area parks. WS-Arizona had an annual average of 2 work tasks associated with feral domestic waterfowl from FY16 to FY20, the damage amount is unknown (Table 2a). 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 WS-Arizona had a total of 1 work tasks associated with them from FY16 to FY20 with damage typically very low, $0 (Table 2b). Some poultry are more of a nuisance to homeowners in urban areas.

Exotic Birds. Arizona has some exotic birds that have escaped captivity or intentionally released. The most common are the Orange Bishop, Cockatiels, and Peach-faced Lovebirds. Currently their populations are minimal and it is unlikely that they will cause many problems unless their populations increase. Orange Bishops have the potential of cause crop damage. A Cockatiel was struck at Luke Air Force Base. Thus, damage could arise for these species, but WS-Arizona did not receive requests to conduct BDM for any of these species from FY16 to FY20. However, a primary concern to most biologists is the potential impact to native species from the exotics.

Blackbirds. Six species of blackbirds are commonly found in Arizona at some time during the year (Appendix C), the Red-winged, Yellow-headed, and Brewer’s Blackbirds, the Great-tailed Grackle, and Brown-headed and Bronzed Cowbirds. All of these species are abundant seasonally, except the Bronzed Cowbird. Additionally, Rusty Blackbirds and Common Grackles have been documented in the State, but are accidentals. From FY16 to FY20, blackbirds, sometimes mixed with starlings (Table 2c), had an average of 1216 work tasks associated with them and an average of about $300 damage (attributing much of the value to mixed flocks of starlings and 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 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 are attracted to croplands and weedy fields, and roost and nest in marshy areas, especially cattails. It should be noted that the Rusty Blackbird, though only accidental in Arizona, but a species of conservation concern (USFWS 2008), 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.

The Red-winged, Yellow-headed, Brewer’s Blackbirds, Great-tailed Grackle, and Brown-headed Cowbird are found in Arizona year-round with estimated breeding populations, using PIF (2020) Population Estimates Database, of 3.5 million, 120,000, 92,000, 790,000, and 1.3 million respectively. The Red-winged Blackbird, Great-tailed Grackle, and Brown-headed Cowbird are found throughout Arizona, but the wintering population of Brown-headed Cowbirds is reduced. The Yellow-headed and Brewer’s Blackbirds are found mainly in northern Arizona during summer and southern Arizona in winter. The Bronzed Cowbird summers in the southern half of the state. The Common Grackle is in very low numbers in primarily the northeastern part of the state, mostly during summers.

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 will likely be 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 Southwestern Willow Flycatcher and 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. Nests, though, are much easier to locate as habitat becomes more "island-like."

Wading Birds. Waders include herons, egrets, ibis, and bitterns. Wading birds in Arizona include 9 species commonly found in Arizona and 8 others species that have only been occasionally to accidentally found. The Great Blue Heron and Snowy Egrets are somewhat common with estimate continental populations of 124,000, and 215,000 respectively (Wetlands International 2021). The others are present, but not as common. 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, 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 and to aircraft because of their size and slower flight speeds; 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. From FY16 to FY20, wading birds were responsible for an average of 965 work tasks annually with damage averaging $0 a year (Table 2a). Wading birds are protected as migratory non-game birds. BDM methods for use at aquaculture facilities are discussed in Gorenzel et al. (1994) and, for general use, in Section 3.4.1.3.

Grassland Species. Horned Larks, kingbirds and other flycatchers (8), meadowlarks (2), pipits (2), Lark Buntings, and goldfinches (3) are often found in grasslands or semi-open country and are common grassland species in Arizona. Other rare species in Arizona include longspurs, Dickcissel, and Bobolink. Horned Larks, pipits, longspurs, and Lark Buntings are slender, sparrow sized ground dwellers. 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. These species, with the exception of the kingbirds, phoebes, and flycatchers, form mostly loose-knit flocks, especially 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. These species are often abundant at airports where they are struck by aircraft. 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 often congregating together) 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. All of these species are migratory nongame birds. These species accounted for an annual average of 1,489 work tasks. The estimated population for Horned Larks in Arizona is 2.9 million (PIF 2020). Horned Larks accounted for 583 work tasks and $40,203 in damage annually (Table 2c). BDM methods for grassland birds are discussed in Section 3.3.1.3 and for Horned Larks, specifically, in Clark and Hygnstrom (1994).

Waterfowl. Waterfowl primarily refers to ducks, geese, and swans, but also cranes, moorhens, and coots 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. Ten species of surface feeding ducks, 10 species of diving ducks, 4 geese, a swan, a crane, a moorhen, and a coot can be found in Arizona. Most are only common seasonally, with many migrating through or wintering in Arizona. Of all of the species, Canada Geese, Mallards, Gadwalls, and feral domestic ducks and geese are the only waterfowl common in Arizona year-round and cause many damage concerns. 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 with short tails and stubby, rounded wings; they have lobed toes and a short, whitish beak with a black band near the tip. In addition to those given, Arizona has also documented 14 other species of ducks and geese and the Purple Gallinule in Arizona which are only infrequently found or accidental. Finally, several feral or escaped waterfowl can be found in Arizona and the most common problems arise from feral domestic ducks and geese (Appendix C: Table C4). From FY16 to FY20, waterfowl were responsible for an annual average of 1,057 work tasks with damage valued at $1,470 (Table 2a). Several BDM methods are used to manage damage caused by waterfowl (see Section 3.4.1.3) 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 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. Hunting 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.

Canada Geese are classified as migratory game birds, but destruction of resident Canada Goose nests and eggs be taken under a USFWS Depredation Order. Canada Goose nest and egg destruction has been an effective tool in reducing local conflicts and damages caused by resident Canada geese. Canada Geese are considered a great threat to aviation because of their large size and the large flocks they form.

Woodpeckers. Woodpeckers and flickers have strong bills for drilling into trees in search of worms and grubs under bark. They also use their bills to drum on trees, to mark their territory and attract a mate during the mating. These birds are cavity nesters and will hollow out a section of a tree within which they will build their nest. These birds frequent residential areas where they may sometimes seek bugs or build nests within the walls of homes. When they do this to buildings, they can cause thousands of dollars of damage due to their persistence in searching and creating multiple holes in the walls, generally in homes constructed with stucco or wood shingle walls. These birds seldom inhabit airport property but may travel across airports where they may be struck by departing or arriving aircraft. These birds are of sufficient size that they may damage the aircraft presenting a threat to human health and safety.

Twelve species of woodpeckers are normally found in Arizona and an additional 3 have been seen accidentally. Most are fairly common. 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 flight is undulating, a very 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, typical of flocking birds. Woodpeckers are protected as migratory non-game birds. The Lewis Woodpecker, Gila Woodpecker, Arizona Woodpecker, and Gilded Flicker are species of conservation concern (ACAD 2019, SWAP 2012, USFWS 2008). Of all the woodpeckers found in Arizona, the Northern Flicker and Gila Woodpecker are responsible for the most damage. From FY16 to FY20, woodpeckers were responsible for an average of 98 work tasks annually with damage averaging $41,760 (Table 2b). Northern Flickers and Gila Woodpeckers have an estimated population in Arizona of 210,000 and 560,000 respectively (PIF 2020). BDM methods for woodpeckers are discussed in Marsh (1994) and Section 3.3.1.3.

Shorebirds. Arizona hosts 25 species of shorebirds including avocets, stilts, plovers, sandpipers, and phalaropes. Most only migrate through Arizona with only a few actually nesting. Additionally, 18 species of shorebirds are accidental or rare in Arizona. 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. Killdeer, a member of the plover family, are a common aviation threat in Arizona. An estimated continental bird population of 1,000,000 Killdeer (WI 2021). Shorebirds in Arizona represented an average of 1,392 work tasks annually from FY16 to FY20, but had no estimated damage (Table 2a). 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 3.4.1.3. Shorebirds are protected as migratory non-game birds. The Eskimo Curlew is listed as endangered, although it is likely extinct. The California Least Tern, listed as threatened, very rarely migrates through Arizona. Additionally, USFWS (2008) lists the Snowy Plover, Mountain Plover, Long-billed Curlew, and Marbled Godwit as birds of conservation concern.

Corvids. Corvids are jays, magpies, crows, and ravens, and are represented by 10 species in Arizona and 1, the Blue Jay, seen accidentally. The Mexican Jay is an abundant corvid in Arizona with an estimated population 140,000 based on PIF (2020) detectability parameters. However, WS did not conduct WDM for the Mexican Jay between FY16 and FY20. Trend data is unavailable for the Mexican Jay (Sauer et al. 2020), but its population appears to be increasing over the last 40 years. They have rarely caused damage in Arizona and are not likely to be the focus of BDM, except in orchards and at airports. The Steller's Jay and Clark's Nutcracker with estimated populations of 200,000 and 8,300 (PIF 2020), also typically do not cause much damage because these species are found in high elevation coniferous forests not associated with crops. Species of corvids that commonly inflict damage are the ravens, crows, and magpies. The Common Raven has an estimated population of 240,000 (PIF 2020). However, we believe that the population is at least double that estimate as discussed in Appendix A. The Chihuahuan Raven and American Crow have estimated populations in Arizona of 13,000 and 26,000 (PIF 2020). Black-billed Magpies do not breed in Arizona, per se, but winter especially in the northern part of the State. From FY16 to FY20, Common Ravens were responsible for an annual average of 363 work tasks with damage valued at $81,766 (Table 2c). 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 1994). 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).

Corvids are well-known, boisterous birds. Crows and ravens are medium sized black birds that are slightly iridescent in sunlight. Magpies are black and white birds that appear medium-sized because of their relatively long tail. Jays have blue in varying amounts, except the Gray Jay, 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.

Loons, Grebes, Pelicans, Cormorants, and Other Fish-Eating Birds. These birds are grouped within this guild due to their natural tendency to feed upon fish. These birds can cause a significant amount of damage at fish hatcheries and aquaculture facilities that produce fish for marketing and population restocking purposes. Some of these birds also are associated with airports and airfields. Airport environments can provide habitats that at times may support fish population through the airport's utilization of water retention and detention basins that store rain and snow melt runoff.

Arizona has one species of loon, 4 grebes, 4 terns, the American White and Brown Pelicans, Double-crested and Neotropic Cormorants, and Belted and Green Kingfishers that are found in Arizona with most only migrating through the State. None of them is particularly common. In addition, 26 other species have been documented in the state with 12 of these being birds considered mostly pelagic birds (found at sea). 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. Terns are typically similar to gulls, except that they are smaller and slimmer with long narrow wings, forked tails, and pointed beaks. Pelicans are large, white or brown water birds with black wing tips, a massive bill, and throat pouch. Cormorants are large, black birds with set back legs, a hooked bill, and reddish-orange facial skin and throat pouch. All form small flocks. Kingfishers are smaller stocky birds with a slate blue back and breast band. Terns, pelicans, and kingfishers dive from the air and cormorants from the water's surface to catch fish. Pelicans and terns primarily roost and nest on the ground, cormorants in trees that are submerged in water, and kingfishers 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. All of these species cause damage at aquaculture facilities and to native fisheries and applicable BDM methods used to protect aquaculture are discussed in Gorenzel et al. (1994) and Section 3.3.1.3. Pelicans and cormorants both represent significant hazards to aircraft because of their size and flocking behavior. They also fly at higher altitudes while traveling to and from feeding areas. Terns are only a problem at airports where good fishing waters are present. Kingfishers are usually not much of a problem because of habitat preference. These species are migratory non-game birds. The Least Tern's interior population and the Brown Pelican's eastern population are listed as endangered and the Gull-billed Tern is listed as a bird of conservation concern (USFWS 2008). None of these species is likely to be found in the State.

Many of these species, especially cormorants and pelicans, depredate fish at aquaculture facilities. Most of these species do not represent 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 and slow flight. They frequently fly at night creating more concern. Loons, pelicans, and cormorants have been struck by aircraft, though infrequently, and have the potential to cause severe damage. These species are classified as migratory non-game birds.

The Double-crested Cormorant breeds in south central area of Arizona. Four species of grebes breed in the state, primarily in the south central area. Five additional species of terns, the Anhinga, and Magnificent Frigatebird have also been documented to occur in the State. From FY16 to FY20, only two water birds, the Double-crested and the Neotropic Cormorant, were the focus of BDM projects being responsible for an annual average of 318 work tasks and $100 in damage (Table 2a).

Forest Passerines. Several fruit and seed eating birds are found in Arizona and cause damage. The most notable of these, other than those discussed above such as starlings, are the American Robin, Cedar Waxwing, finches, especially the House Finch, Northern Cardinal, and Black-headed Grosbeak. 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. House and Cassin's Finches are small brownish sparrow-sized birds; males have a bright red forehead, breast, and rump. The cardinal is a familiar bird that and the males are red with the females being brownish. The goldfinches are colorful birds with varying amounts of yellow. The Red Crossbill male is red and females semi-golden. The Evening, Black-headed, and Rose-breasted Grosbeaks are just smaller than a robin, but have very stout beaks; they all are black with white in their wings and sport a variety of colors. These species are attracted to trees that have fruits or nuts (including pine cones), 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, especially robins, waxwings and house finches. Crossbills have only been identified as a problem at tree seed growers (cone crops). Other than agricultural damage, robins and finches can form nightly roosts in residential areas causing some nuisance problems. Northern Cardinals often see their reflection in windows and incessantly attack the window, becoming a nuisance or sometimes damaging screens. These species are migratory nongame birds and can be taken with a federal permit. These species were responsible for an average of 261 work tasks annually and no dollar damage from FY16 to FY20 (Table 2c). BDM methods for frugivorous birds are discussed in Section 3.3.1.3. Clark and Hygnstrom (1994) discuss methods specifically for to address House Finch damages. Typically, most of these species, with the exception of the robin, waxwing, and House Finch, cause relatively few problems and WS-Arizona has responded to only a few requests for assistance involving any of these birds over the last 15 years.

Gallinaceous Birds. The Gambel's Quail, Scaled Quail, Mearns Quail, and Wild Turkey are found in Arizona having the potential to cause conflicts and are collectively known as gallinaceous birds. Additionally, the less common California Quail, Ring-necked Pheasant and Chukar, both introduced, are also found in parts of Arizona. 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. Turkey, 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 pheasant is found mostly in 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. However, their damage is often tolerated because they are highly sought after game birds. Additionally, these species can be hazardous to aircraft when found on or around airports. Gallinaceous birds are protected as resident game birds by AZGFD and have hunting seasons. These birds are non-migratory and not protected by federal laws. These species were responsible for an average of 152 works tasks annually and no damage from FY16 to FY20 (Table 2b). BDM methods for gallinaceous birds are discussed in Section 3.3.1.3.

Aerialist. Six species of swallows, the Purple Martin, 2 swifts, 2 nighthawks, and 3 nightjars (Whip-poor-will, Poor-will, and Buff-collared Nightjar) are found in Arizona. 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. The primary damage from 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, a rarity in Arizona, can also cause damage from their twig nests in chimneys and other structures. The nightjars are typically not associated with damage because of habitat preference. 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. From FY16 to FY20, WS-Arizona completed an average of 212 work tasks annually for these species, swallows in particular, averaging $44,432 damage (Table 2c). 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.

Gulls. Gulls are familiar birds. Only 4 species are consistently found in Arizona in any numbers, the Ring-billed, California, Bonaparte's, and Franklin's Gulls. Additionally, a number of other gull species can be seen irregularly in very low numbers. The majority of gulls in Arizona are seen during migration or winter months. Gulls 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. 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. As a group, gulls caused 27% of the strikes at civil airports in the United Sates from 1990 to 2004 where the species was identified (4,582 out of 16,727) with most strikes (89% occurred at less than 500 feet above ground) occurring at or near the airport (Dolbeer 2006). Gulls have not been responsible for any work tasks or damage from FY16-FY20. 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. Gulls are protected as migratory birds under the Migratory Bird Treaty Act by USFWS, and are classified as migratory nongame birds by AZGFD. BDM methods for gulls are discussed in Solman (1994) and Section 3.3.1.3.

Other Birds. A few other birds (Appendix C: Table C1) in Arizona cause damage, though only infrequently. 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. White-crowned Sparrows can cause damage to landscaping and crops, especially in those fields and gardens adjacent to river bottoms (Clark and Hygnstrom 1994). Finally, Greater Roadrunners are somewhat common in the southern counties of Arizona where they prey on lizards and the eggs and nestlings of birds. Several other birds are commonly found in Arizona (Appendix C: Table C2), but few cause, or are expected to cause, damage.

2.1.1.2 Bird Population Estimates.

To determine impacts from WS-Arizona BDM lethal activities, a reasonable quantitative estimate of a bird population provides the best reference for impacts from WS-Arizona and others. 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 Arizona. For migratory birds, it is important to know when birds are present that cause damage and when the BDM projects are conducted. However, most estimates can only encompass the overall population of birds that are likely to cause damage because data is unavailable for specific populations and impacts to the overall population within a large geographic area are most meaningful statistically.

Analyses of magnitude of impact on the populations of those species addressed in the EA are based on a measure of the number of individual birds affected by WS-Arizona from each species in relation to that species' abundance. Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations would be based on population estimates, allowable harvest levels and actual harvest data. Qualitative determinations would be based on population trends and harvest trend data, when available. Management actions would be monitored by comparing the number removed with overall populations or trends in the population. Generally, WS-Arizona only conducts damage management on species whose population densities are high or concentrated and usually only after they have caused damage. Potential impacts of the 3 alternatives on populations of target bird species addressed in this EA are analyzed for each alternative below.

Information on bird populations and trends are often derived from several sources, including the Breeding Bird Survey (BBS), Partners in Flight Science Committee's (PIFSC) Landbird Population database, Christmas Bird Count (CBC), harvest data and published literature, which includes studies of species by Bird Conservation Region. Further information on those sources of information is provided below.

Breeding Bird Survey (BBS)
Bird populations can be monitored by estimating trends derived from data collected during the BBS. Under established guidelines, observers count birds at established survey points for a set duration along a pre-determined route, usually along a road. Routes are 24.5 miles long and are surveyed once per year with the observer stopping every 0.5 miles along the designated route. The numbers of birds observed and heard within 0.25 miles of each survey point during a 3-minute sampling period are recorded. Surveys were started in 1966 and are conducted in June, which is generally considered as the period of time when those birds present at a location are likely breeding in the immediate area. The BBS is conducted annually in the United States, across a large geographical area, under standardized survey guidelines. The BBS is a large-scale inventory of North American birds coordinated by the United States Geological Survey (USGS), Patuxent Wildlife Research Center (Sauer et al.2020). The BBS is a combined set of over 3,700 roadside survey routes primarily covering the continental United States and southern Canada. The primary objective of the BBS has been to generate an estimate of population change for all breeding birds. Populations of birds tend to fluctuate, especially locally, because of variable local habitat and climatic conditions. Trends

can be determined using different population equations and tested to identify whether it is statistically significant.

Current estimates of population trends from BBS data are derived from hierarchical model analysis (Link and Sauer 2002, Sauer and Link 2011) and are dependent upon a variety of assumptions (Link and Sauer 1998). The statistical significance of a trend for a given species is also determined using BBS data (Pardieck 2020) Breeding Bird Survey (BBS) population trends from 1966 to 2019 for the strata that the State falls within (i.e., Northern Rockies and Great Basin) are listed for each species when Arizona specific trend data is not available (Sauer et al. 2020).

Partners in Flight (PIF) Landbird Population Estimate

The BBS data are intended for use in monitoring bird population trends, but it is also possible to use BBS data to develop a general estimate of the size of bird populations. Using relative abundances derived from the BBS, Rich et al. (2004) extrapolated population estimates for many bird species in North America as part of the Partners in Flight (PIF) Landbird Population Estimate database. The Partners in Flight system involves extrapolating the number of birds in the 50 quarter-mile circles (total area/route = 10 mi^2) survey conducted during the BBS to an area of interest. The model used by Rich et al. (2004) makes assumptions on the detectability of birds, which can vary for each species. Some species of birds that are more conspicuous (visual and auditory) are more likely to be detected during bird surveys when compared to bird species that are more secretive and do not vocalize often. Information on the detectability of a species is combined to create a detectability factor, which may be combined with relative abundance data from the BBS to yield a population estimate (Rich et al. 2004). The PIFSC updated the database in 2020 to reflect current population estimates.

Christmas Bird Count (CBC)

The CBC is conducted in December and early January annually by numerous volunteers under the guidance of the National Audubon Society (NAS). The CBC reflects the number of birds frequenting a location during the winter months, after migratory birds have migrated to their southern wintering grounds. Participants count the number of birds observed within a 15-mile diameter circle around a central point (177 mi^2). The CBC data does not provide a population estimate, but the count data can be used as an indicator of trends in the population of a particular bird species over time. Researchers have found that population trends reflected in CBC data tend to correlate well with those from censuses taken by more stringent means (NAS 2020).

Bird populations that are affected by BDM are either migratory or resident with some bird species having populations that are both (e.g., Canada Geese). The majority of WS BDM projects involving migratory birds come from the Western BBS Region, or a combination of the eastern Pacific Flyway and western Central Flyway, but some could come from the other flyways in North America (Figure 5). Several migratory species are found in Arizona year round, but the population may actually shift during the year (e.g., Red-winged Blackbirds, European Starling). Additional birds may come into Arizona for the winter while some that summer in Arizona may leave. Some species only nest in Arizona and migrate out of the State from fall through spring (e.g., Turkey Vulture, Snowy Egret), 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 Arizona (e.g. Rough-legged Hawk, White-crowned Sparrow). Of the species that typically are involved in BDM, starlings, Rock Pigeons, House Sparrows, and Common Ravens have resident populations with some migrating into the State in winter from northern states. Canada Geese have a "resident" population and have migrants that pass through or winter in the State, but most all lethal BDM for Canada Geese invariably involves the "resident" geese as WS lethal BDM activities for Canada Geese have occurred from spring through summer with nesting geese (WS does conduct nonlethal harassment of migratory flocks to protect 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 non-colonial land birds, is trend data from the Breeding Bird Survey (BBS). The BBS is a long-term (1966-2019), large-scale inventory of North American birds, coordinated by the U.S. Geological Survey, Patuxent Wildlife Research Center, which combines a set of over 3,500 roadside survey routes primarily covering the continental United States and southern Canada (Pardieck 2020). 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. BBS trends are available for 1966 to 2019, or can be analyzed for any set of years desired. BBS data can be summarized for Arizona, the Central or Pacific Flyways (the northern limit of the BBS is in central Alberta, British Columbia, and Saskatchewan, and southern limit Mexico), or survey-wide 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, PIF 2020). 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 (Sauer et al. 2020). 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 PIF (2020) were derived using BBS data from 1966 – 2019 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. PIF (2020) looked at several factors to estimate bird populations.

However, some populations have changed since the 1966 – 2019 time frame, the data used for PIF (2020). 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 (2016 to 2020) because 5 FYs are used to look at impacts (FY16 to FY20). This estimate would lack some of the complicated formulas PIF (2020) used to make their estimate. A population estimate will be calculated for the analysis using 2016-2020 data (USGS 2018), but mostly presented with the PIF (2020) 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, Rock Pigeons, starlings, and raven populations are estimated at the statewide level since the majority of lethal BDM projects in Arizona involve resident birds. For most other species, except the Rusty Blackbird, the states encompassed in Figure 5 in the Central and Pacific Flyway population is estimated and used for analysis. However, the BBS physiographic areas shaded in Figure 5 would likely provide the best estimate for the population of migratory birds affected by BDM in Arizona; 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, other USFWS permitted depredation take, and sports harvest, but less so by others, especially in Canada. Thus, only the Rocky Mountain States (RMS) will be used.

Using methods adopted by PIF to estimate population size with BBS data (Rich et al. 2004, PIF 2020), 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 bird, 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 seen/route/9.8 mi^2 * area of concern * detection parameters (distance, pair, and time). PIF (2020) discusses the detectability parameters in detail.

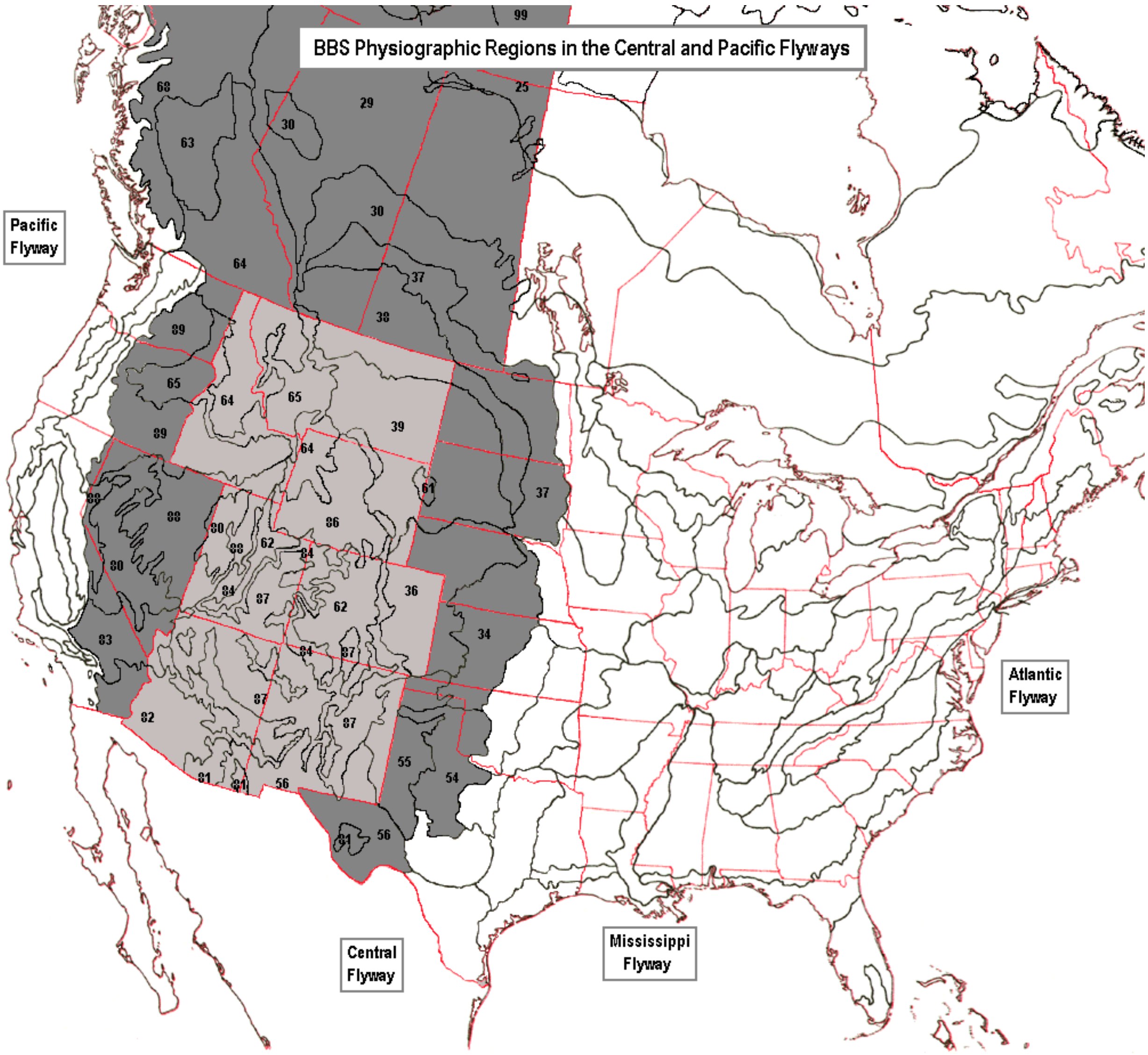

Figure 5. BBS physiographic regions in the Central and Pacific Flyways (shaded light gray) that encompass the population of birds that could be impacted by BDM in Arizona, especially those during migration and winter. The shaded area includes BBS regions 34, 36, 37, 38, 39, 54, 55, 56, 61, 62, 63, 64, 65, 80, 81, 82, 83, 84, 86, 87, 88, 89 and that portion of region 30 in Canada excluding Manitoba. This area excludes the eastern portion of the Central Flyway (eastern Great Plains), western portion of the Pacific Flyway (coast and coastal mountains), and birds from the Canadian boreal forest and Arctic tundra (BBS regions 25, 29, 68, and 99) which are mostly north of the BBS boundary limit. Migratory bird population estimates for the EA will be derived from the light gray shaded area or the RMS of Arizona, Colorado, Idaho, Montana, New Mexico, Utah, and Wyoming using BBS raw data for those states.

WS-Arizona will use BBS data, averaging the relative abundance for geographic areas from 2016 to 2020, to estimate populations that are impacted lethally by WS-Arizona BDM (Table 5). The migratory bird populations would be estimated from the RMS region determined to likely produce birds that could potentially be taken by BDM in Arizona. This RMS region covers Arizona, Colorado, Idaho, Montana, New Mexico, Utah, and Wyoming.

To determine impacts, all known take in the area used to estimate the population is analyzed in Section 4.1.1.1. WS-Arizona 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, Rock 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 5. Population estimates for those species that WS-Arizona takes the most during BDM operations in Arizona from BBS data for 2015-2019 raw data (Pardieck 2020). (see Appendix A for details).

Species	PIF Breeding Pop. Estimate ^	AZ BBS Ave. Birds/Count 2015-2019^^	Arizona Pop. Estimate ^^^
Land Birds*			
Mourning Doves	150,000,000	1,405	5,500,000
White-winged Dove	14,000,000	1,239	2,900,000
Great-tailed Grackle	30,000,000	479	790,000
Gila Woodpecker	1,500,000	542	560,000
Horded Lark	140,000,000	458	2,900,000
American Kestrel	9,200,000	45	110,000
Red-tailed Hawk	3,100,000	114	100,000
Western Meadowlark	100,000,000	-	430,000
Common Raven	29,000,000	659	240,000
Water Birds**			
American Coot	6,000,000	20	-
Mallard	9,180,000	29	-
Great Blue Heron	124,000	14	-
Killdeer	1,000,000	58	-

* PIF (PIF 2020) provided estimates for land birds only.
** Wetlands International (2021). "Waterbird Population Estimates". Retrieved from wpe.wetlands.org on Thrusday18 March 2021. Provided estimates for water birds only.
^ Estimates using PIF breeding population data (PIF 2020) for the United States and Canada.
^^ Estimates from 2015-2019 AZ BBS raw data (Pardieck 2020) with point counts covering 9.82 mi^2
^^^ Estimates using PIF breeding population data (PIF 2020) for Arizona.
-No data available

Many of the requests for assistance that WS-Arizona receives occur during winter when migratory birds have come into Arizona, 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 2019a) reflects the number of birds in Arizona 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 WS-Arizona and others are BDM activities directed at T&E, and sensitive species which have limited populations. Some federal 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 States permit under ESA, Arizona 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.

Of the federal listed T&E bird species, three species could be the target of BDM (Table 6 and Appendix C: Table C1). The California Least Tern could potentially need to be hazed from aquaculture facilities where they are taking fish. The California Condor, Northern Aplomado Falcon, and California Least Tern may need to be hazed from the air operating area of an airport to reduce the possibility of a bird-aircraft strike. However, most listed species rarely cause damage, especially because they are rare in the State and rarely inhabit areas where they would be perceived as a problem. WS BDM could have a positive effect on these species, especially if they are hazed from the air operating area of an airport where they could be struck and killed.

Similar to federal listed T&E species, some sensitive species could also be the focus of BDM projects. The USFWS (2008), the Partners in Flight Watch List Species (ACAD 2019), and AZGFD (SWAP 2012) list species of greatest conservation need (SGNC: USFWS lists Birds of Conservation Concern, ACAD has a “Watch List” and lists the species with the greatest conservation concern as red, yellow and common birds in steep decline (CBSD), and AZGFD lists Species of Greatest Conservation Need in Arizona’s State Wildlife Action Plan (SWAP 2012) (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 (ACAD and AZGFD list T&E species in their lists (ACAD 2019, SWAP 2012)). 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), ACAD (2019), and AZGFD list an additional 121 SGNC bird species in Arizona which are not listed as federal or state T&E, proposed, or candidate species. Of these, 42 of the regularly occurring species in Arizona could be the focus of a BDM project with 27 of these only at airports. Similarly, 28 of the 49 accidental species could be the focus of a BDM project with many of these only at airports. Most SGNC species would only be hazed from the resource being protected.

2.1.2 Effects of BDM 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 WS 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 AZGFD biologists. WS SOPs include measures intended to reduce the effects of BDM on nontarget species populations, especially T&E species, and are presented in Section 3.5.

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. WS's SOPs include measures intended to reduce the effects of BDM activities on nontarget species populations and are presented in Chapter 3. From FY16 to FY20, WS-Arizona trapped and released 3 nontarget birds (2 Common Gallinules and 1 Aberts Towhee) during BDM activities. This was a minor take of nontargets, especially when compared to target take.

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.

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 and the establishment of special restrictions or mitigation measures. WS received a Programmatic Biological Opinion from the USFWS in 2018 on the potential for WDM, in general and including BDM methods currently used, to impact the species listed nationwide and completed a Section 7 consultation in Arizona (USFWS 2018a). USFWS was consulted under Section 7 of the ESA and issued BOs on the species that WS may potentially affect. USFWS provided conservation measures to WS-Arizona in order reduce the potential of adversely affecting the included species (USFWS 2018a). By adhering to the conservation measures provided in the BO, the USFWS determined that WS actions may affect but are not likely to adversely affect any of the listed bird species in Arizona. These will be discussed in the following individual accounts for listed species that could be affected by BDM.

In all, the Federal T&E, and candidate species list for Arizona includes 7 mammals, 8 birds, 5 reptiles, 2 amphibians, 19 fish, 2 invertebrates, and 23 plants. WS BDM will have no effect on listed reptiles, amphibians, fish, invertebrates, and plants and little potential to adversely affect mammals or birds. USFWS provided conservation measures for WS–Arizona to avoid potential affects from BDM on listed species of Arizona in their 2018 BO. No species listed since that decision would be similarly affected and most of these were evaluated in a Biological Assessment (USFWS 2017) with USFWS concurrence; a few species have been delisted and added since that assessment. However, none of the species added would likely be adversely affected by WS-Arizona BDM.

Wildlife Services determined that BDM activities will have no effect on the New Mexico meadow jumping mouse or its proposed critical habitat. The effects determination and conservation measures for beaver damage management activities and the use of redenticidies related to the critical habitat of the New Mexico meadow jumping mouse are outside of the scope of this EA and will be addressed in other NEPA documents as appropriate.

Of the mammalian and avian species listed federally, the black-footed ferret, lesser long-nosed bat, Yuma Ridgway's Rail, Southwestern willow flycatcher and yellow-billed cuckoo could potentially be affected, as defined under the ESA, by BDM where noise harassment is used to protect 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. It should be noted that Arizona is concentrating on waterfowl and not shorebirds at this point and use methods such as rocket nets that are activated by the user and not passive like mist nets. 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-Arizona has consulted 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.

WS-Arizona will contact the USFWS prior to conducting BDM in Yuma Ridgway Rail, Southwestern Willow Flycatcher and Yellow-billed Cuckoo habitat. WS and the USFWS will discuss the proposed action, location on known breeding birds, habitat quality, and measures to ensure that adverse effects are avoided. If it is determined that harm, harassment, or other types of incidental take may be likely, alternative measures, such as timing of project implementation will be discussed to prevent or minimize adverse effects and incidental take. WS personnel will minimize activities in riparian habitat from April 15 through September 30 to ensure that human presence does not interrupt Southwestern Willow Flycatcher and Yellow-billed Cuckoo breeding. WS personnel will not use pyrotechnics or other noisemaking devices from April 15 to September 30 within 0.25 mile of riparian habitat, and from May 15 through September 30 within 0.25 mile of Madrean evergreen woodland drainages, without further coordination with the USFWS (USFWS 2018a).

On the other hand, some T&E species could unintentionally benefit from BDM. The Southwestern Willow Flycatcher could benefit from Brown-headed Cowbird control where their nests were significantly parasitized by the cowbirds. The Brown Pelican, Aplomado Falcon, and California Least Tern would benefit from being hazed away from the air operating area of an airport where they could potentially be struck by aircraft. 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.

Table 6. Federal listed mammalian and avian T&E and candidate species in Arizona and potential impact as nontargets of BDM (ECOS USFWS 2020).

Species	Scientific Name	Status	Locale	Habitat	BDM
Mammals					
Black-footed Ferret	*Mustela nigripes*	E	WF	R	0
Mexican Wolf	*Canis lupus baileyi*	E	WF	FGR	0
Jaguar	*Panthera onca*	E	WF	DF	0
Mount Graham Red Squirrel	*Tamiasciurus hudsonicus grahamensis*	E	WF	F	0
New Mexican Meadow Jumping Mouse	*Zapus hudsonius luteus*	E	WF	G	0
Ocelot	*Leopardus pardalis*	E	WF	D	0
Sonoran Pronghorn	*Antilocapra americana sonoriensis*	E	SW	D	0
Birds					
California Condor	*Gymnogyps californianus*	E	USA	R	-
California Least Tern	*Sterna antillarum browni*	E	WF	W	-
Masked Bobwhite	*Colinus virginianus ridgwayi*	E	WF	F	0
Mexican Spotted Owl	*Strix occidentalis lucida*	T	WF	F	0
Northern Aplomado Falcon	*Falco femoralis septentrionalis*	XE	SW	GR	-
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E	WF	F	0
Yellow-billed Cuckoo	*Coccyzus americanus*	E	WUS	W	0
Yuma Ridgway's Rail	*Rallus longirostris yumanensis*	E	WF	W	0

STATUS	**LOCALE**	**HABITAT (primary)**	**BDM – Impacts**
F - Federal	WF – Wherever found	**F** - Forests/riparian borders/alpine	**(-)** - Negative
E - Endangered	WUS – Western U.S.	**G** - Grassland/meadow	**0** - none
T - Threatened	SW – AZ and NM	**R** - Range/sage/high desert	**(+)** - Positive
C - Candidate	USA	**W** - Wetland/marsh/sandbar	
XE – Experimental		**L** - Lakes, Rivers	
		D-Desert	

2.1.2.2 State Listed T&E Species.

Since 1996, AZGFD has designated the federal list of T&E species to be the official list for Arizona and eliminated the designation of T&E species that are not on the federally listed T&E species list. Thus the T&E list for Arizona is the same as the USFWS T&E list.

2.1.2.3 Sensitive Species.

WS-Arizona also monitors potential impact to ECOS USFWS (2020), USFWS (2008), ACAD (2019), and AZGFD (2012) SGNC birds. Of the 121 additional species listed, only a few have the potential of being taken lethally. These species will be analyzed to determine the potential for impact on them in Section 4.

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

WS Specialists have SOPs to reduce potential safety impacts from BDM to the public, pets, and the environment. WS 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. WS 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. WS has 2 work tasks for known impacts from BDM on pets from FY16 to FY20.

One peripheral factor pertinent to assessing the risk of adverse effects of WS BDM activities is the potential for adverse effects from not having professional assistance from programs like WS available to private entities that express needs for such services. WS 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). The Texas Department of Agriculture (2006) has a website and brochure devoted solely to preventing pesticide misuse in controlling agricultural pests. Similarly, the Department for Environment, Food and Rural Affairs (2004) in Britain has a "Campaign against Illegally Poisoning of Animals." Therefore, WS 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).

Some individuals have expressed concerns that they believe that chemical BDM methods 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 WS could use are DRC-1339, an avicide used to remove damaging Rock Pigeons, starlings, crows, blackbirds, or gulls, and Avitrol for House Sparrows, blackbirds, and Rock Pigeons. 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, methiocarb (Mesurol® - Gowan Co., Yuma, AZ) used in eggs to repel corvids from raiding nests of other birds, 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 Rock Pigeons from perching. Avicides and chemical repellents are regulated under FIFRA and Arizona pesticide laws by EPA and ADA, and applied by WS-Arizona under their management and in accordance with labeling and WS-Arizona Directives. WS-Arizona applicators are certified by the State and must complete a written examination and undergo recurrent training. Other chemical methods that could be used are euthanizing drugs such as Fatal Plus®. These drugs are regulated by FDA under the Food, Drug, and Cosmetic Act and WS policy. The chemicals used by WS-Arizona from FY16 to FY20 are shown in Table 7. WS-Arizona used an average of about 2.17 grams of DRC-1339. This is a minimal use of chemicals.

Some people may be concerned that WS's use of firearms and pyrotechnic bird scaring devices could cause injuries to people. WS personnel occasionally use small caliber firearms or air rifles and shotguns to remove Rock 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, 04/19/16). 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 Arizona WS' 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. WS-Arizona personnel fired an average of 1,032 pyrotechnics from FY16 to FY20.

Table 7. Chemicals used by WS-Arizona in BDM from FY16 to FY20. Avian toxicants (DRC-1339 and Avitrol) are registered for use by EPA. WS did not use Avitrol or other drugs from FY16 to FY20, but have in previous years.

Chemical	FY16	FY17	FY18	FY19	FY20	Ave.
DRC-1339 (g)	0	0	2.85	4.8	3.2	2.17

DRC-1339 is a highly selective, slow acting avicide that is registered with the EPA for reducing conflicts with several species of birds, including blackbirds, starlings, pigeons, crows, ravens, magpies and gulls. It has proven to be an effective method of starling, blackbird, gull and pigeon removal at feedlots, dairies, airports and in urban areas (DeCino et al. 1966, Besser et al. 1967, West et al. 1967). Studies continue to document the effectiveness of DRC-1339 in resolving blackbird/starling problems at feedlots (West and Besser 1976, Glahn et al. 1981, Glahn et al. 1987) and dispersing crow roosts in urban/suburban areas (Boyd and Hall 1987). Glahn and Wilson (1992) noted that grain baiting with DRC-1339 is a cost-effective method of reducing conflicts with blackbirds to sprouting rice.

Under the proposed action, WS could use DRC-1339, Avitrol, euthanasia drugs such as Fatal Plus®, and chemical repellents. From FY16 to FY20 WS used an annual average of 2.17 grams of DRC-1339, a very minimal use of chemicals. WS chemical methods including those referenced above are used in accordance with label directions, they are highly selective for the target individuals or populations. WS use of these pesticides in BDM has negligible impacts on the environment and do not represent a risk to the public.

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.

2.1.4 Effects of BDM on Aesthetics

One issue is the concern that the proposed action or the other alternatives would result in the loss of aesthetic benefits of target birds to the public, resource owners, or neighboring residents in the area where damage management activities occur. Wildlife generally is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987). The mere knowledge that wildlife exists is a positive benefit to many people. Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature, dependent on what an observer regards as beautiful.

Wildlife populations provide a wide range of social and economic benefits (Decker and Goff 1987). Those benefits include direct benefits related to consumptive and non-consumptive uses, indirect benefits derived from vicarious wildlife related experiences, and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (Bishop 1987). Direct benefits are derived from a personal relationship with animals, which may take the form of direct consumptive use (*e.g.*, using parts of or the entire animal) or non-consumptive use (*e.g.*, viewing the animal in nature) (Decker and Goff 1987).

Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

WS'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 Rock Pigeons would be viewed by those people as an aesthetic improvement. Concentrations of roosting birds have resulted in calls to the WS office in Arizona concerning nuisance noise, odor, and fecal contamination. Some towns in Arizona have had active harassment programs in order to move birds from urban areas.

Some individual members or groups of wild and feral domestic bird species have adapted 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. Some of them are concerned that their ability to view migratory birds is lessened by WS nonlethal harassment activities and lethal control projects. The public's ability to view wild birds in a particular area would be more limited if the wildlife are removed or relocated. However, immigration of wildlife from other areas could possibly replace the animals removed or relocated during (negating the effectiveness of the action) or following a damage management action. Thus, viewing may still be an opportunity. However, if the program is successful and birds can no longer be found at a project site, the opportunity to view or feed wildlife is often available if an individual makes the effort to visit 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.

Under the proposed action, WS 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.

Measures and policies are in place to help minimize the effects of WS activities on aesthetics as much as possible. WS 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, WS abides by all applicable laws and regulations regarding the use of different BDM methods. WS coordinates with the different land management agencies to determine high-use public areas and times of the year. WS 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.

Thus, aesthetics is an issue that has very opposing views. The alternative selected must be able to accommodate the widest array of these views.

2.1.5. Humaneness of BDM

The issue of humaneness as it relates to the killing or capturing of wildlife is an important but very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate 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."*

The American Veterinary Medical Association (AVMA) states *"... euthanasia is the act of inducing humane death in an animal*" and *"...that if an animal's life is to be taken, it is done with the highest degree of respect, and with an emphasis on making the death as painless and distress free as possible"* (AVMA 2020). Additionally, euthanasia methods should minimize any stress and anxiety experienced by the animal prior to unconsciousness. Although use of euthanasia methods to end an animal's life is desirable, as noted by the AVMA, *"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 terms such as killing, collecting, or harvesting, recognizing that a distress- free death may not be possible"* (AVMA 2001).

AVMA (2020) notes, "*While recommendations are made, it is important for those utilizing these recommendations to understand that, in some instances, agents and methods of euthanasia identified as appropriate for a particular species may not be available or may become less than an ideal choice due to differences in circumstances. Conversely, when settings are atypical, methods normally not considered appropriate may become the method of choice. Under such conditions, the humaneness (or perceived lack thereof) of the method used to bring about the death of an animal may be distinguished from the intent or outcome associated with an act of killing. Following this reasoning, it may still be an act of euthanasia to kill an animal in a manner that is not perfectly humane or that would not be considered appropriate in other contexts. For example, due to lack of control over free-ranging wildlife and the stress associated with close human contact, use of a firearm may be the most appropriate means of euthanasia. Also, shooting a suffering animal that is in extremis, instead of catching and transporting it to a clinic to euthanize it using a method normally considered to be appropriate (e.g., barbiturates), is consistent with one interpretation of a good death. The former method promotes the animal's overall interests by ending its misery quickly, even though the latter technique may be considered to be more acceptable under normal conditions (Yeates 2010). Neither of these examples, however, absolves the individual from her or his responsibility to ensure that recommended methods and agents of euthanasia are preferentially used.*"

Suffering has previously been described by the AVMA as a *"…highly unpleasant emotional response usually associated with pain and distress"* (AVMA 1987). However, suffering *"…can occur without pain…,"* and *"…pain can occur without suffering…"* because suffering carries with it the implication of occurring over time, a case could be made for *"…little or no suffering where death comes immediately…"* (California Department of Fish and Game 1991). Pain and physical restraint may cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when action is not taken to alleviate conditions that cause pain or distress in animals.

Defining pain as a component in humaneness appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain. However, pain experienced by individual animals probably ranges from little or no pain to considerable pain (California Department of Fish and Game 1991).

Pain and suffering, as it relates to methods available for use to manage birds 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, because *"…neither medical nor veterinary curricula explicitly address suffering or its relief"* (California Department of Fish and Game 1991). Research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness (Bateson 1991).

The decision-making process can involve trade-offs between the above aspects of pain and humaneness. Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal, and 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.

In comparison, under the No Federal Program Alternative, the federal portion of WS would not employ methods viewed by some as inhumane and, thus, have no program effect on humaneness. AZGFD, ADA, 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 non-lethal methods. Private individuals that have experienced resource losses, but are no longer provided professional assistance from WS, 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 1999). 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 the proposed action Alternative 1. . WS is accountable to public input and humane interest groups that often focus their attention and opposition on BDM activities employed by WS. 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 WS. 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 the previous EA (WS 1999) 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 WS and is a criteria used to help determine the appropriate SOPs to maximize method selectivity and humaneness. The current program conducted by WS has caught and freed 3 nontarget birds from FY16 to FY20. Thus, WS's SOPs have been very effective at minimizing the take of nontargets.

The issue of humaneness, as those concerns relate to the methods available is fully discussed for each alternative in Chapter 4. SOPs to alleviate pain and suffering are discussed in Chapter 3.5.

2.2 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

Following are additional issues that that have been discussed during the preparation of this EA but will not be considered for inclusion under the alternatives in this EA with rational.

2.2.1 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 Arizona 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, WS can predict the types of locations or situations where damage is likely to occur. However, due to any number of variable circumstances, WS has no absolute control over when a request for BDM assistance will be received nor can WS predict specific individual times and locations of most bird damage situations. Therefore, WS must be ready and able to provide assistance on short notice about anywhere in Arizona 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, WS believes this EA addresses most potential needs and issues associated with providing BDM at any given location in Arizona. 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.

2.2.2 Effects from the Use of Lead in Ammunition

Effects to the environment include important factors such as lead used in ammunition as part of BDM activities. WS-Arizona has imposed a policy of using only non-lead shot statewide and non-lead bullets north of I-40 in Arizona for more than a decade, effectively prohibiting the use of lead ammunition by Wildlife Services within the range of the condor in Arizona and eliminating the threat of lead poisoning by Wildlife Services in this area. To address even the most remote concerns raised regarding this issue, detailed scientific facts and data related to any potential exposure of lead resulting from the lead used by WS-Arizona in WDM activities are presented here. USDA APHIS WS has conducted a risk assessment to address the use of lead in WDM activites (Appendix E).

Agencies and members of the public have expressed concerns regarding the potential for adverse environmental impacts and risks to human and wildlife health and safety and environmental contamination from the use of lead ammunition by APHIS-WS. The majority of concerns expressed pertain to the use of lead ammunition and this section correspondingly focuses on risks associated with lead (Watson et al. 2009). However, it should be noted that some of the non-lead materials used in ammunition and lead-free ammunition (arsenic, nickel, copper, zinc, tungsten) are also known to pose environmental risks (Clausen and Korte 2009, EPA 2005, Beyer et al. 2004, Eisler 1998). Exposure and risk to non-target animals would be greatest for wild and domestic animals that consume carcasses containing lead ammunition from BDM actions. There is also the potential for lead exposure to non-target mammals and birds from consumption of lead bullet fragments in the soil. The potential for lead exposure and risk to these types of scavengers would be reduced in situations where carcasses are removed or otherwise rendered inaccessible to scavengers through burial or State, territory or tribally-approved carcass disposal practices. Lead exposure and risk would also be further reduced in cases where the use of non-lead shot can be effectively, safely and humanely used to remove target animals.

WS uses non-lead ammunition (shot and bullet) to mitigate and/or minimize the effects of its use of lead ammunition on the environment, wildlife and public health and to comply with federal, State, territory or tribal regulations on the use of lead ammunition. WS does not use lead ammunition in areas where it is prohibited by law, prohibited by permit, or where prohibited by the landowner/manager (e.g., National Park Service). WS uses non-lead ammunition (shot and bullet) to remove birds for MBTA permitted activities, including activities in waterfowl production and wintering areas. When managing non-migratory birds (Rock Pigeons and starlings), WS-Arizona uses pneumatic rifles (i.e., air guns) with non-lead pellets in lieu of other high-powered rifles. These are used in buildings or feedlot settings where more powerful rifles are not practical. Additionally, using pneumatic rifles allow WS-Arizona to easily recover carcasses and dispose of them which prevents opportunities for scavengers to feed upon them. This is a minimal part of WS-Arizona’s operational activities.

Humans and the environment have been, and can be, exposed to lead from a variety of sources. The primary sources today are lead-acid batteries, lead-based chemicals, and to a lesser extent, construction materials. Lead poisoning has been documented in humans for at least 2,500 years, and in waterfowl from spent lead for over 100 years (Golden et al. 2016). Metallic lead released into the environment can be readily released for transport through the environment and bio-accumulated into living plants and beings when fragmented into small pieces or under strong acidic conditions in water, soils, or digestive systems (Golden et al. 2016, TWS 2009).

Efforts to reduce environmental concentrations of lead, predominantly through phasing out the use of leaded gasoline, have resulted in substantial decreases in the introduction of lead into the environment (IARC 2006). Lead, however, is retained in soils and sediments, where it can be stable and intact for long periods of time, re-suspended and re-deposited multiple times before further transport becomes unlikely, and released for transport through environmental and biological systems under certain conditions (EPA 2013).

Additional, but substantially smaller and more localized sources of lead in the environment and human exposure involve the use of leaded ammunition and fishing sinkers. Bullets and sinkers can be directly introduced into the terrestrial and freshwater environment, where it can potentially be transported, and to humans through ingestion of game meat shot with leaded ammunition (TWS 2009).

WS uses non-lead shot and bullet 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.

No evidence has been brought forth to indicate that any animals killed during BDM by WS-Arizona have resulted in any indirect lead poisoning of condors, eagles, or other scavenging animals. Since WS-Arizona uses non-lead shot for BDM, non-lead shot for aerial gunning and non-lead bullets north of Interstate 40, in the range of the condor. We believe this adaptive management approach should be sufficient to avoid lead toxicity effects on reintroduced condors. Therefore, Arizona Wildlife Services would have no effect on listed scavengers.

2.2.3 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. WS 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.

2.2.4 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 WS 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 WS employee locates a burial site, the employee would notify the appropriate Tribe or official. WS 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 WS.

2.2.5 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 WS 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. New Mexico'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 AZGFD is to preserve, protect, and perpetuate all the wildlife in the United States and Arizona. Therefore, USFWS and AZGFD 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 WS-Arizona takes in BDM will continue to sustain viable populations. Thus, losses due to human-caused mortality are not "irreparable."

2.2.6 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)[2]). As was noted in the previous FONSI for the prior EA (WS 1999), "*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.

2.2.7 Climate Change Consideration

The State of the Climate in 2012 report indicates that since 1976, every year has been warmer than the long-term average (Blunden and Arndt 2013). Global surface temperatures in 2012 were among the top ten warmest years on record with the largest average temperature differences in the United States, Canada, southern Europe, western Russia and the Russian Far East (Osborne and Lindsey 2013). Impacts of this change will vary throughout the United States, but some areas will experience air and water temperature

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

increases, alterations in precipitation and increased severe weather events. The distribution and abundance of a plant or animal species is often dictated by temperature and precipitation. According to the EPA (2013), as temperatures continue to increase, the habitat ranges of many species are moving into northern latitudes and higher altitudes. Species adapted to cold climates may struggle to adjust to changing climate conditions (e.g., less snowfall, range expansions of other species).

Climate change consideration, especially the emissions of gases responsible for global warming, is a concern of the public. WS-Arizona has little carbon emissions that contribute to climate change. WS-Arizona has 1 office in Phoenix and an inventory of 22 vehicles statewide. The Arizona State Office staffs 8 people. Therefore, WS contributes some greenhouse gases that could impact global warming, but the sum would be negligible. CEQ's suggested guideline of whether or not to discuss greenhouse gas emissions in EAs as an issue is the production of 25,000 metric tons of carbon dioxide equivalents (CDE). The average person in a home uses 4 metric tons CDE annually (EPA 2010). An office would be similar, but probably less because little electricity is used at night and on weekends. Thus, it is likely that less than 40 CDE are generated by the WS-Arizona State Office annually. The average estimated mileage for all WS-Arizona vehicles in Arizona is 240,000 (likely less than 400,000 in a high mileage year) with vehicles that at least average 15 miles per gallon (conservative estimate for analysis). A gallon of fuel contributes 19.4 lbs CDE (EPA 2005). Thus, WS-Arizona vehicle use contributes approximately 155 metric tons of CDE or 0.62% of CEQ's minimum guideline, and possibly as high as 258 metric tons CDE. However, at a maximum, WS-Arizona produces about 300 metric tons CDE annually or 1.2% of CEQs threshold for discussion as an issue. Thus, this issue will not be considered in detail.

2.2.8 Impacts on the Natural Environment Not Considered

Additional issues were identified by WS-Arizona and the USFWS during the scoping process of this EA. The following resource values are not expected to be impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, visual resources, air quality, prime and unique farmlands, aquatic resources, timber and range. Those resources will not be analyzed further.

Effects of BDM on Water Quality and Wetlands.

Two issues arose regarding water quality and wetlands in WS EAs (WS 2013 and WS 2017) 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. It should be noted that Arizona WS uses much less of the chemicals and conducts far less starling and blackbird damage management than that discussed in WS (2001), and therefore, Arizona WS anticipates that these issues are even less likely in Arizona.

Potential for BDM Chemicals to Run off site and Affect Aquatic Organisms.

An issue that was raised during interagency discussions while working on previous EAs (WS 2013 and WS 2017) 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 WS BDM program, WS would use DRC-1339 in accordance with EPA-approved label directions. 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 is moderately toxic to aquatic and invertebrate organisms (USDA NWRC 2001). Aquatic toxicity of DRC-1339 to water fleas occurred at 0.079 ppm (USDA NWRC 2001). 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 sunfish and rainbow trout ranged from 9.7 to 11 ppm (USDA NWRC 2001). The greatest quantity that might be used by WS 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 NWRC (2001) concluded moderate risk to aquatic organisms, so direct or indirect application to water is prohibited. 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's (WS 2013 and 2017) that the use of DRC-1339 would not cause runoff problems or affect aquatic organisms.

The other primary chemical used by WS, Avitrol, was not used from FY16 to FY20 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 2007). 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, WS 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. WS-Arizona anticipates that up to 40,000 starlings and 400,000 blackbirds would be killed by use of DRC-1339 which is much less than that analyzed. WS (2001) determined that accelerated eutrophication would not be expected to occur from BDM activities and it would be much less likely in Arizona. Thus, this issue will not be considered further.

2.2.9 Cost Effectiveness of BDM

The CEQ does not require a formal, monetized cost benefit analysis to comply with the NEPA. Consideration of this issue is not essential to making a reasoned choice among the alternatives being considered. However, the methods determined to be most effective to reduce damage and threats to human safety caused by birds and that prove to be the most cost effective will receive the greatest application. As part of an integrated approach, evaluation of methods would continually occur to allow for those methods that were most effective at resolving damage or threats to be employed under similar circumstances where birds are causing damage or pose a threat. Additionally, management operations may be constrained by cooperator funding and/or objectives and needs.

2.2.10 Wildlife Damage Management Should Be Fee Based and Not a Taxpayer Expense.

WS is aware of concerns that WDM should not be provided at the expense of the taxpayer or that it should be fee based. WS was established by Congress as the agency responsible for providing WDM to the people of the United States. Funding for WS 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 project 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 projects, 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.

WS-Arizona is not involved in establishing or approving national policies regarding supporting private livestock operations, or agricultural production but, provides federal leadership in resolving wildlife-human conflicts and supporting coexistence of wildlife and humans. It is publicly accountable for the work that is requested by public and private entities and landowners, state and federal governments, tribes, and the public, and all activities are performed according to applicable laws and its mission and policies.

WS-Arizona is aware of beliefs that federal wildlife damage management should not be allowed until economic losses become “unacceptable,” and that livestock losses should be considered as a cost of doing business by producers. WS-Arizona receives requests for assistance when the operator has reached their tolerance level for damage or worries about safety and health, as well as in circumstances where the threat of damage is foreseeable and preventable. This tolerance level differs among different people and entities, and at different times. Although some losses can be expected and tolerated by agriculture producers and resource owners, WS-Arizona is authorized to respond to requests for assistance with wildlife damage management problems, and it is agency policy to respond to each requester to resolve losses, threats and damage to some reasonable degree, including providing technical assistance and advice. The WS Decision Model (WS Directive 2.201) is used in the field to determine an appropriate strategy on a case-by-case basis. The WS authorizing legislation does not require an economic analysis at any scale of operation.

This issue is appropriately addressed through political processes at the state and federal levels.

CHAPTER 3: ALTERNATIVES INCLUDING THE PROPOSED ACTION

3.1 ALTERNATIVES ANALYZED IN DETAIL

Four alternatives will be analyzed in detail in this EA:

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, WS-Arizona will continue to provide an integrated BDM program.

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

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

Alternative 4 - No Federal WS-Arizona BDM. This alternative would eliminate WS-Arizona’s involvement in all aspects of BDM in Arizona.

3.2 DESCRIPTION OF THE ALTERNATIVES

3.2.1 Alternative 1 – Continue the Current WS-Arizona 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 to the other alternatives. The proposed action is to continue the current portion of WS 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 is the protection of human health and safety and property from Rock Pigeon damage. The program would also operate to reduce or minimize the loss of livestock feed and the risk of bird-related livestock health problems presented by starlings and blackbirds at requesting dairies and feedlots, and to meet requests to minimize bird damage or the risk of damage to all other resources. To meet these goals WS 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 WS 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 WS would include shooting, trapping, egg addling/destruction, DRC- 1339, Avitrol, and euthanasia following live capture with trapping, hand capture, nets. 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, 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, WS's primary function would be to implement other nonlethal or lethal methods, if any were determined to be necessary to resolve a damage problem. BDM by WS would be allowed in Arizona when requested to conduct such activities to protect resources on private and public property where a need has been documented following the completion of an Agreement for Control. All management actions would comply with applicable federal, state, and local laws including obtaining the necessary permits to take birds. A detailed description of the methods that could be used in BDM is given in Section 3.4. NWRC would continue to conduct research on BDM methods with more than 75% of the budget being spent on non-lethal control methods.

3.2.2 Alternative 2 – WS-Arizona Provides Nonlethal BDM Only

This alternative would require WS 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 is currently only available for use by WS employees and could not be used by private individuals. Section 3.4 describes nonlethal methods available for use by WS 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 – WS-Arizona Provides Technical Assistance Only for BDM

This alternative would not allow for WS operational BDM in Arizona. WS 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 is only available for use by WS employees and could not be used by private individuals. Section 3.4 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 IWDM BDM methods.

3.2.4 Alternative 4 - No Federal WS-Arizona BDM

This alternative would eliminate federal involvement in BDM in Arizona. WS would not provide direct operational or technical assistance and requestors of WS services would have to conduct their own BDM without WS-Arizona involvement. Section 3.4 describes BDM methods that could be employed by private individuals or other agencies under this alternative, except that DRC-1339 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 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

Several alternatives were considered but not analyzed in detail, these will only be listed here.

- Lethal BDM only
- 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.

3.3.1 Translocation 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, Great-tailed Grackles) are relatively abundant or are not native (e.g. starlings) and translocation is not necessary for the maintenance of viable populations. Translocation may also result in future depredations if the relocated animal encounters protected resources, and in some cases could require payment of damage compensation claims. Additionally, animals that are relocated become stressed and there is a potential for disease transmission into healthy populations. When dealing with problem wildlife, hazing is always the first option, followed by capture and translocation. Lethal take is conducted when the threat is immenent or hazing and capture and relocation is impractical. Wildlife Services – Arizona Program is currently working with AZGFD on a cooperative translocation program for raptors, wherein the raptors would be transferred to AZGFD or their designee for relocation. Any decisions on relocation of wildlife by WS are coordinated with AZGFD or USFWS and consultation with the appropriate land management agency(ies) or manager associated with proposed release sites. WS considers translocation for some species and conducts such, but does not relocate all damaging species.

3.3.2 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 small 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, WS 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.

3.3.3 Use of Bird-Proof Feeders in Lieu of Lethal Management at Dairies and Cattle Feeding Facilities.

Another alternative to reducing economic losses from starling depredations at livestock feeding operations is to store all feed in "bird-proof" buildings, containers, or feeders. Although this is an effective alternative to lethal management at dairies and cattle feeding facilities, it can be one of the most expensive alternatives and relies on constant and consistent diligence toward bird exclusion. Wright (1973) and Feare and Swannack (1978) found that feeding livestock in bird-proof buildings reduced feed losses to starlings and improved animal weight gain. To alleviate the restrictive properties of conventional screens or doors Feare and Swannack (1978) found that enclosing cattle feeding areas with industrial polyvinyl chloride plastic (PVC) strips allowed livestock, farming equipment, and personnel unrestricted movement while excluding starlings. If producers are unable to supplemental feed their livestock in such restrictive enclosures, bird-proof livestock feeders can reduce feed losses. Bird-proof feeders are offered in both automatic and self-feeding options. Flip top self-feeders protect livestock feed from birds as well as the elements. To access the feed, livestock must use their nose to push the lid of the feeder up, thus restricting access to starling depredation events. Producers using these systems must remain vigilant because the flip-tops frequently become bent, dislodged, or lost. Automatic, electric, or magnetic feeders may also be used in outdoor environments. Although the initial investment is more expensive than other available management options, automatic feeders dispense small amounts of feed to individual cows throughout the day. This limits the amount of time starlings have access and feed on dispensed grain. In many cases, livestock producers tolerate some bird damage throughout the year and only request assistance from WS-Arizona when the damage becomes and economic burden. This damage threshold varies among cooperators, damage situations, and their amount of disposable capital for damage management. For these reasons, WS-Arizona did not carry this alternative forward for further analysis.

3.4 BDM STRATEGIES AVAILABLE TO WS 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 WS technical assistance and operational BDM by WS.

3.4.1 Alternative 1 – Continue the Current WS-Arizona BDM Program

WS-Arizona currently uses a variety of BDM methods as part of their IWDM BDM program throughout the state of Arizona. Some BDM methods are widely used, while others are used infrequently. WS recommends the use of many BDM methods for technical assistance to requestors who are experiencing bird damage issues. The BDM methods available for use are described in Section 3.4.1.3.

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, or any combination of these, depending on the circumstances of the specific damage problem and the species targeted. IWDM is being implemented by WS-Arizona under the current BDM program.

3.4.1.1 The IWDM Strategies That WS Employs

Technical Assistance Recommendations

"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, WS provides supplies or materials that are of limited availability for non-WS 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.

Direct Damage Management Assistance

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 initiated *Work Initiation Documents* 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 WS 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.

3.4.1.2 WS Decision Model.

WS-Arizona 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. WS 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. The following is an example of decision making when selecting BDM methods for the Rock Pigeon, the most common statewide problem specie in Arizona that WS conducts BDM.

Rock Pigeon Problems. Rock Pigeons are responsible for many nuisance bird damage requests for assistance in Arizona. The most common situation 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 Rock 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, low-velocity .22 caliber rifle rounds, shotguns (mostly in rural or semi-rural situations), live capture with cage traps followed by euthanasia, and DRC-1339 and Avitrol applications. Once a population at a particular site is removed, clean-up 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 WS Specialists determining what the best strategy would be to resolve a particular damage situation. In addition, depending on the particular situation, the WS Specialist must determine if the problem should be resolved by the requestor or if assistance is needed.

3.4.1.3 BDM Methods

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. WS 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 WS 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 WS, but WS could assist producers in implementing or recommending 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, can significantly 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. WS 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. WS 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. Border collies and other dogs can sometimes be very effective for Canada goose damage reduction at parks and golf courses. 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.

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 6) 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 WS 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.

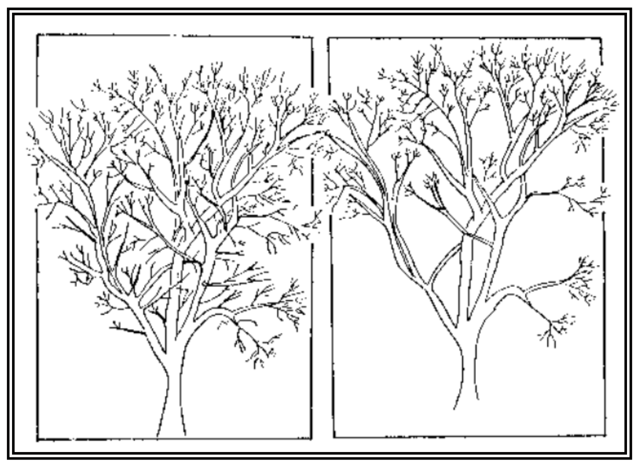
Figure 6. Tree pruning is an example of habitat management.

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 WS 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, WS will ensure that the cooperator is aware for the need to address T&E species impacts. Habitat management instigated by WS 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 WS will commence WDM activities. This will ensure that WS 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 WS in Arizona, it could be, especially to disperse blackbird roosts near crop fields.

Modification of Human Behavior. WS often tries to alter human behavior to resolve potential conflicts between humans and wildlife. For example, WS 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 Black-billed Magpies. This includes inadvertent feeding allowed by improper disposal of garbage or leaving pet food outdoors where wildlife can feed on it. 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, dwellings, and livestock and poultry pens (Johnson 1994). 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.

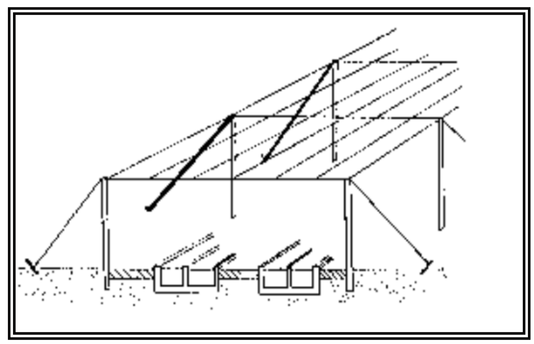

Figure 7. Overhead wire grid to exclude birds.

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 7). 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 8) 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 9) 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.

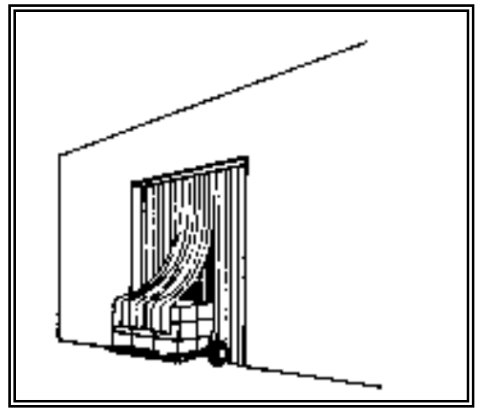

Figure 8. Entrance barricade to deter birds.

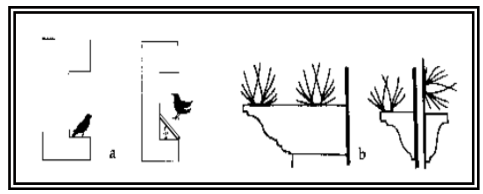

Figure 9. Porcupine wire on ledge to deter birds.

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 (Shivak 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. Scaring devices such as distress calls, helium filled eye spot balloons, raptor effigies and silhouettes, mirrors, and moving disks can be effective but usually for only a short time before birds become accustomed and learn to ignore them (Schmidt and Johnson 1984, Bomford 1990, Rossbach 1975, Graves and Andelt 1987, Mott 1985, Shirota et al. 1983, Conover 1982, Arhart 1972). 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, and 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.

Falconry is the hunting of wild animals in their natural state and habitat by means of a trained bird of prey. Small and larger animals are hunted; squirrels and rabbits often fall prey to these birds. There are two traditional terms used to describe a person involved in falconry: a falconer flies a falcon. In modern falconry, the red-tailed hawk, the Harris's hawk, and the peregrine falcon are some of the more commonly used birds of prey. The practice of falconry is not consider further for the purposes of this EA because not practical in urban environments and falcons can be a hazard to aviation environments.

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 records 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 10) 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. Exploders can be left in an area after dispersal is complete to discourage animals from returning.

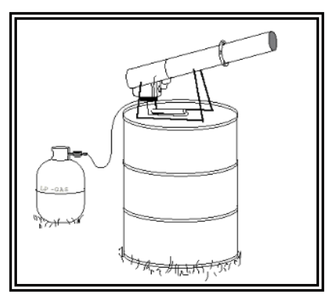

Figure 10. Propane exploder.

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, 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.

Paintball guns are used as a non-lethal harassment method to disperse birds from areas using physical harassment. Paintballs are seldom used by WS-Arizona, but are occasionally used to harass waterfowl. Paintballs can be used to produce physically and visually negative-reinforcing stimuli that can aid in the dispersal of birds from areas where conflicts or threats of conflict are occurring. With regards to using this method on birds protected under the MBTA, the Act protects against take; therefore, there is no prohibition on using paintballs to disperse birds provided birds are not injured or killed. However, due to the high potential for injury or death, the USFWS does NOT recommend paintballs come in contact with birds. Among other reasons, it would be difficult to determine if an injury occurs, as tissue may die hours or days later. If paintballs must be used, they should be aimed at the feet or vicinity of the bird to feel the splash but not the impact of the paintball. WS-Arizona does not recommend this method to the general public.

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 State game and fish agencies 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. Trapped raptors can be given to a licensed falconer at the discression of AZGFD.

The AVMA, The National Association of State Public Health Veterinarians, and the Council of State and Territorial Epidemiologists all oppose relocation 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, WS-Arizona would consult with the USFWS or AZGFD 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 WS.

Effective and practical chemical repellents should be nonhazardous to wildlife; non-toxic 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®), methiocarb (i.e., Mesurol), or polybutenes (i.e., Tanglefoot® - Tanglefoot Co., Grand Rapids, MI). These compounds are relatively non-toxic 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 non-toxic. Most repellents have only "Caution" on the labels because they are relatively non-toxic. These can typically be purchased by the public. An exception is methiocarb which is discussed below. 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 WS 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 RejexIt® (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 non-toxic to bees (LD_{50} > 25 micrograms/bee[3]), non-toxic to rats in an inhalation study (LC_{50} > 2.8 mg/L[4]), 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 retreating 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 treatment for material alone. 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.

Methiocarb is a chemical repellent used for nonlethal taste aversion and was first registered as a molluscicide, but found to have avian repellent properties. Mesurol®, the trade name, is registered with EPA (EPA Reg. No. 56228-33) as an aversive-conditioning egg treatment to reduce predation from Common Ravens, Chihuahuan Ravens, and American Crows on the eggs of T&E species or other wildlife species determined to be in need of special protection. Mesurol is registered for WS use only. The active ingredient is methiocarb which is a carbamate pesticide which acts as a cholinesterase inhibitor. Species which feed upon treated eggs may show signs of toxicity (e.g., regurgitation, lethargy, or temporary immobilization). Occasionally, birds may die after feeding upon treated eggs, but most birds exposed to treated eggs survive. Avery et al. (1995) examined the potential of using eggs injected with 30mg of methiocarb to condition common ravens from preying on eggs of endangered California Least Terns. Results showed that proper deployment of treated eggs can be a useful, nonlethal method for reducing raven predation at Least Tern colonies. Avery and Decker (1993) evaluated whether predation might be reduced through food avoidance learning. They used captive Fish Crows to examine avoidance response from methiocarb

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[3] 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.

[4] 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.

(18mg/egg) and methyl anthranilate (100mg/egg). Their study showed that some crows displayed persistence to the 5-day exposure and that successful application may require an extended period of training for target predators to acquire an avoidance response. During the spring of 2001, WS conducted a field test on the Sterling Wildlife Management Area in Arizona, where Mesurol treated eggs were exposed to Black-billed Magpies to evaluate aversive conditioning to eggs of waterfowl and upland game birds. The number of magpies feeding on treated eggs decreased after a period. However, their feeding behavior switched to pecking holes in eggs, possibly trying to detect treated eggs before consuming them. This behavior may suggest that at least some magpies experienced the ill effects of Mesurol, but the *"tasting"* of eggs may result in increased predation (Maycock and Graves 2001).

Other chemical repellents. A number of other chemicals have shown bird repellent capabilities. Anthraquinone, a naturally occurring chemical found in many plant species and in some invertebrates as a natural predator defense mechanism, has shown effectiveness in protecting rice seed from red-winged blackbirds and boat-tailed grackles (Avery et al. 1997). It has also shown effectiveness as a foraging repellent against Canada goose grazing on turf and as a seed repellent against brown-headed cowbirds (Dolbeer et al. 1998). A recent review states anthraquinone is effective in managing conflicts with Canada geese, ring-necked pheasants, sandhill crane, pigeons, red-winged blackbirds, grackles, brown-headed cowbirds, house sparrows, mallards, starlings and wild turkeys (DeLiberto and Werner 2016).

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.

Foothold traps are versatile and widely used by WS for capturing many species. These traps can be utilized to live-capture a variety of animals but are most often used by WS to capture mammals. Birds are rarely targeted with foot-hold traps, except padded jaw foot-hold 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 foot-hold 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 foot-hold 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. WS 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. USFWS BOs (USDA 2018) 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. WS 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 monitored at a minimum of every 30 minutes 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 WS 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. WS 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. The majority of raptors captured in these have been banded and relocated. Raptor traps are also used to remove birds from areas around nesting T&E shorebirds. WS – Arizona Program is working with AZGFD to band and relocated most raptors and SGNC.

Padded-jaw pole traps (Figure 11) are modified No. 0 or 1 coil spring foot-hold 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 AZGFD and USFWS.

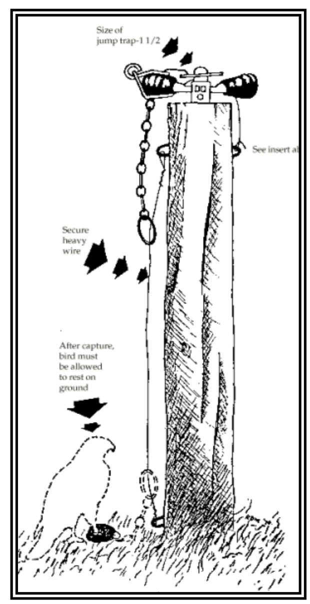


Figure 11. Padded-jaw pole trap.

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 Rock 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.

Sport hunting is sometimes recommended by WS 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 AZGFD 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.

Cervical dislocation is sometimes used to euthanize birds which are captured in cage traps. The bird is stretched and the neck is hyper-extended and dorsally twisted to separate the first cervical vertebrae from the skull. The American Veterinary Medical Association (AVMA) approves this technique as a humane method of euthanasia and states that cervical dislocation when properly executed is a humane technique for euthanasia of poultry and other small birds (Beaver et al. 2001). Cervical dislocation is a technique that may induce rapid unconsciousness, does not chemically contaminate tissue and is rapidly accomplished (Beaver et al. 2001).

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 Arizona, 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, WS 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 re-nest 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.

WS personnel will abide by policies outlined in WS Directive 2.401 for all pesticide use operations. Animals euthanized with drugs that may pose secondary hazards to scavengers must be disposed of according to Federal, state, county, and local regulations, drug label instructions, (WS Directive 2.515)

Chemical immobilizing and euthanizing drugs are important tools for managing wildlife. Under certain circumstances, WS 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. WS 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." 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 WS does hold.

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.

Carbon Dioxide (CO2). Although not a registered pesticide, CO2 is a chemical method. Carbon dioxide is sometimes used to euthanize birds which are captured in live traps. Live birds are placed in a container such as a plastic five-gallon bucket or chamber which is then sealed. CO2 gas is released into the bucket or chamber and birds quickly die after inhaling the gas. This method is approved as a euthanizing agent by the American Veterinary Medical Association (Beaver et al. 2001). CO2 gas is a by-product of animal respiration, is common in the atmosphere, and is required by plants for photosynthesis. It is used to carbonate beverages for human consumption and is also the gas released by dry ice. The use of CO2 by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society. Euthanasia conducted by WS would be done in accordance with WS Directive 2.505.

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 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 CDA would register a chemical that had not undergone rigorous environmental testing to determine its potential effects on humans and the environment including risks to non-target 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 WS in BDM.

DRC-1339 (EPA. Reg. Nos. 56228-29 and 56228-63), 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, 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 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. 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. 1968). 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.

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. It 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.

DRC-1339 is the primary and almost exclusive toxicant used at dairies, feedlots and CAFOs to treat starlings, pigeons and other target birds. The birds are pre-baited for a couple days up to two weeks with the same bait that will be treated with DRC-1339 and applied later. The baits usually are placed in trays and inside barns or other buildings containing livestock but out of reach of the livestock where the birds feed. The trays may be placed on elevated platforms inside the buildings or on the floor in isles where livestock are excluded. Trays containing pre-bait and treated bait may be placed on the ground adjacent to bunkers where starlings, pigeons and othe birds feed with the livestock. The feed locations are monitored for non-target species. If non-target species are observed feeding on pre-bait or treated bait then the damage management program is discontinued or modified.

The use of DRC-1339 as per label instructions will have little effect on non-target species in Colorado. 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 non-target 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). Use of Avitrol by WS 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 WS.

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 sterilants 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 Arizona before WS 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 Arizona, the use of this bait would have no effect on T&E or sensitive species, people, pets, or the environment. WS has not used OvoControl™ G in Arizona. It is expected that this chemical would have minimal effect on the resident Canada goose population in Arizona in the short-term because geese are long-lived. However, combined with culling, it would be effective at keeping local populations at manageable numbers.

3.4.2 Alternative 2 – WS-Arizona Provides Nonlethal BDM Only

This alternative would require that WS 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 chemical DRC- 1339 is currently only available for use by WS employees. Therefore, the use of this 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.

3.4.3 Alternative 3 – WS-Arizona Provides Technical Assistance Only for BDM

Under this alternative, WS would only provide technical assistance and make recommendations when requested to resolve bird damage problems. This alternative would not allow WS 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 is currently only available for use by WS employees and could be the optimal method to resolve a bird damage situation. However, DRC-1339 could not be used by private individuals or State personnel, but Avitrol and Starlicide Complete could be.

3.4.4 Alternative 4 - No Federal WS-Arizona 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 WS 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 is currently only available for use by WS employees. Therefore, use of DRC-1339 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.).

3.5 WS SOPs INCORPORATED INTO BDM STRATEGIES

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 Arizona, 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 conservation measures to protect resources such as T&E species that are managed by WS's cooperating agencies (USFWS and AZGFD) are included in the lists below.

3.5.1 General SOPs Used by WS in BDM

- The WS Decision Model (Slate et al. 1992, WS Directive 2.201), which is designed to identify effective wildlife damage management strategies and their impacts, would be consistently used and applied when addressing bird conflicts.

- EPA-approved label directions would be followed for all pesticide use. The registration process for chemical pesticides is intended to assure minimal adverse effects occur to the environment when chemicals are used in accordance with label directions.

- Safety Data Sheets (formerly known as Material Safety Data Sheets) for pesticides would be provided to all WS-Arizona personnel involved with specific conflict management activities.

- All personnel who would use chemicals are trained and certified to use such substances or would be supervised by trained or certified personnel.

- All personnel who use firearms would be trained according to WS Directive 2.615.

- Management actions would be directed toward specific birds causing conflicts with agriculture, property, or natural resources or posing a threat to human health and safety.

- Personnel would be trained in the latest and most humane devices/methods for resolving bird conflicts.

- WS-Arizona's use of euthanasia methods would comply with WS Directives 2.430 and 2.505.

- Carcasses of birds retrieved after conflict management activities have been conducted would be disposed of in accordance with WS Directive 2.515, including any permits required by the USFWS and AZGFD.

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

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

- WS 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.

3.5.2 WS SOPs Specific to the Issues

The following is a summary of the SOPs used by WS 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.

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

- WS BDM take is monitored. Both "Total Harvest" and estimated population numbers of key species are used to assess cumulative effects of harvest. WS 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 AZGFD, as appropriate. WS provides data on total take of target animal numbers to other agencies (i.e., USFWS, AZGFD) as appropriate.

- WS currently has agreements for BDM on less than 5% of the land area in Arizona. 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.

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

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

- WS 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 WS Specialists that the animal is not capable of surviving.

- 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, WS 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 Arizona has little potential to impact T&E species.

- Avian predators of T&E or sensitive species 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 following conservation measures were outlined in the USFWS BO 2018 for each listed T&E bird species**.**

Yuma Ridgway's Rail. WS SOPs to avoid impacts include ensuring WS Specialists are trained in rail species identification, minimize activities in areas known to be inhabited by these T&E species and consulting with USFWS if BDM projects could affect the rail and/or its habitat.

Southwestern Willow Flycatcher and Yellow-billed Cuckoo. WS SOPs to avoid impacts include ensuring WS Specialists are trained in flycatcher and cuckoo species identification, minimize activities in areas known to be inhabited by these T&E species and consulting with USFWS if BDM projects could affect these species and/or its habitat. WS-Arizona will consult with the USFWS if BDM projects are planned within 0.25 mile of riparian habitat or critical habitat during the April 15 through September 15 breeding season of the Southwester Willow Flycatcher or if the project occurring is anticipated to alter habitat quality. WS-Arizona will contact the USFWS id BDM projects are planned within 0.25 mile of riparian habitat or Madrean evergreen woodland during the May 15 through September 30 Yellow-billed Cuckoo breeding season. WS personnel will not use pyrotechnics or other noise-making hazing devices from April 15 through September 15 within 0.25 or riparian habitat and Madrean evergreen woodland drainages.

California Condor. WS SOPs to avoid impacts include ensuring WS Specialists are trained in condor identification. WS-Arizona has imposed a policy of using non-lead bullets north of I-40 in Arizona for more than a decade, effectively prohibiting the use of lead ammunition by WS-Arizona in the range of the condor in Arizona and eliminating the threat of lead poisoning by WS-Arizona in this area. Using non-lead ammunition will prevent condors that may feed on dean animals from acquiring lead poisoning.

California Least Tern. WS SOPs to avoid impacts include ensuring WS Specialists are trained in tern identification. WS-Arizona will not intentionally haze a California Least Tern from an airfield without a Section 10 permit unless there is an imminent threat of an aircraft striking the bird. The BA noted that if a California Least Tern became a persistent known threat at an airfield, WS-Arizona would obtain the appropriate ESA permit to target the bird with harassment devices to scare it away from the airfield.

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

- BDM activities would be conducted professionally and in the safest manner possible. These activities would be conducted away from areas of high human use. If this were not possible, then activities would be conducted during periods when human use is low (e.g., early morning) whenever possible.

- BDM shooting would be conducted during times when public activity and access to the specific areas are reduced/restricted.

- All chemical methods used by WS-Arizona or recommended by WS-Arizona would be registered with the EPA and the ADA.

- Pesticides would be stored, used and disposed of in accordance with EPA-approved label directions, WS Directive 2.401 and other applicable laws and regulations and Executive Orders 12898 and 13045.

- WS-Arizona would adhere to all established withdrawal times when using immobilizing drugs for the capture of waterfowl that are agreed upon by WS-Arizona, USFWS, AZGFD and veterinarian authorities. Although unlikely, in the event that WS-Arizona is requested to immobilize waterfowl either during a period of time when harvest of waterfowl is occurring or during a time where the withdrawal period could overlap with the start of a harvest season, WS-Arizona would euthanize the animal or mark the animal as not safe for human consumption.

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

- WS personnel who 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 ADA approved programs. WS personnel who use chemicals participate in continuing education programs to keep abreast of developments and to maintain their certifications.

- WS personnel who use firearms and pyrotechnics are trained and certified by experts in the safe and effective use of these tools. WS policy has requirements for training, safe use, storage and transportation of firearms and pyrotechnics (WS Directives 2.615 and 2.627)

3.5.2.4 Effects of BDM on the Aesthetic Values of Birds

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

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

- WS 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.

- All methods or techniques applied to resolve conflicts or threats to human health and safety would be agreed upon by entering into a Work Initiation Document, Annual Work Plan, MOU or comparable document allowing landowners/managers to select from the methods available for use.

- BDM activities would be conducted away from areas of high human use. If this were not possible, then activities would be conducted during periods when human use is low (e.g., early morning) whenever possible.

- WS-Arizona take of birds would be reported to the USFWS and AZGFD, as appropriate, for monitoring the potential impacts to bird populations or trends in populations to assure the magnitude of take is maintained below the level that would cause adverse impacts to the viability of native bird populations.

3.5.2.5 Humaneness of BDM Methods Used by WS

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

- Cage and padded-jaw foot-hold traps are set and inspected according to WS policy.

- Water and food are replenished frequently as necessary in decoy traps.

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

- Research on selectivity and humaneness of management practices would be adopted as appropriate.

- Euthanasia procedures approved by the AVMA would be used as appropriate.

- The use of newly developed, proven non-lethal methods would be encouraged when appropriate.

- WS-Arizona personnel would be present during the use of most live-capture methods (e.g., mist nets, cannon nets, drop nets) to ensure birds captured would be addressed in a timely manner to minimize the stress of being restrained.

- Cage traps would be checked frequently to ensure non-target species are released immediately or are prevented from being captured.

- All cage traps would be maintained with food and water.

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 proposed action to determine if the real or potential impacts would be greater, lesser, or the same. Therefore, the proposed action or current program 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 FOR EACH ALTERNATIVE

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 WS-Arizona 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 Arizona as identified in Chapter 1.

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, WS-Arizona 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 AZGFD. AZGFD 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 typically 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, WS conducts BDM on bird species in Arizona causing problems or concerns with IWDM lethal and nonlethal BDM methods and technical assistance. Lethal take by WS-Arizona and others will be considered Statewide providing a more comprehensive picture of impacts to bird populations. Analyzing impacts of bird species at the Statewide and Central/Pacific Flyways area 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 analyzed to determine the relative significance of impacts. Management direction from the responsible agency (USFWS and AZGFD) is a determining factor for permitting. From a NEPA standpoint, justification for a finding of "*no significant impact on the quality of the human environment*" with respect to WS-Arizona's take of most birds in Arizona is the fact that WS's involvement has no adverse effect on the *status quo* because, if WS-Arizona was not available, under USFWS or AZGFD authority, virtually the same birds that are taken by WS-Arizona could be taken by other agency or private actions. This suggests that, if WS-Arizona 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 Arizona, even if a sustainable harvest rate is exceeded in the short term in areas where the objective is to maintain the population.

In 2019, Rosenberg (et al.) indicated a net loss of 29% (2.9 billion) of North American bird populations since 1970. Grassland bird species exhibited the largest decline with more than 700 million breeding individuals lost (Rosenberg et al. 2019). All forest breeding biomes similarly experienced population declines with and overall reduction of more than 1 billion birds (Rosenberg et al. 2019). Introduced (invasive species, non-native to North America) species, those not protected by the Migratory Bird Treaty Act, exhibited a net loss of 63% across 10 species (Rosenberg et al. 2019). Interestingly, wetland biomes showed an overall net gain in bird populations (13%). Waterfowl species (e.g. ducks, geese) within these areas increased by 56% (Rosenberg et al. 2019).

Steep declines seen in North American bird populations, mirror those seen globally (Rosenberg et al. 2019). These declines are the result of habitat loss, unregulated toxic pesticide use (e.g. breeding and wintering areas), competition with introduced species, urbanization and agricultural intensification, and predation by introduced species (domestic cats) (Rosenberg et al. 2019). As we move forward, targeted research identifying the scope of these declines will be needed to inform and educate conservation actions and societal and legislative policy changes. Ultimately, the US Fish and Wildlife Service and Congress hold the authority for implementing these changes, as it relates to bird populations within the United States.

The methods used by WS-Arizona 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 3.4. The methods used in each damage situation depend on the species causing damage and other factors including location (public versus private lands), weather, and time of year as discussed in section 3.4. The methods include physical exclusion, frightening devices, shooting, cage traps, padded-jaw pole traps, and avicides. Many BDM methods may be recommended by WS personnel and implemented by the resource owner.

WS-Arizona 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 WS-Arizona BDM; nonlethal BDM will be analyzed for potential impacts as well. Analyses of magnitude of impact on the populations of those species addressed in the EA are based on a measure of the number of individual birds affected by WS-Arizona from each species in relation to that species' abundance. Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations would be based on population estimates, allowable harvest levels and actual harvest data. Qualitative determinations would be based on population trends and harvest trend data, when available. BDM actions would be monitored by comparing the number removed with overall populations or trends in the population. Generally, WS-Arizona only conducts BDM on species whose population densities are high or concentrated and usually only after they have caused damage. Potential impacts of the 4 alternatives on populations of target bird species addressed in this EA are analyzed for each alternative below.

Impacts on Bird Populations from Lethal Take in BDM

WS-Arizona conducted lethal BDM to protect resources and for disease surveillance from FY16 to FY20 involving 70 bird species in Arizona (Table 8), but had the potential for taking several others (Table 9 and 10). The average annual take from FY16 to FY20 for these species involved 8 with take of 100 or more, 16 with take from 10-99, and 46 with minimal take (less than 10). The species that caused the most damage from FY16 to FY20 are listed in Table 1 (Section 1.3.1) with general information about them given in Section 2.1.1.1 and the agency, USFWS, AZGFD, or WS, that has primary responsibility for responding to damage complaints involving them. A few target species taken in Arizona are introduced commensal species (Rock Pigeons, feral ducks, feral geese, guinea fowl, Eurasian Collared-Doves, European Starlings and House Sparrows) which are not protected by any agency. Most species of blackbirds and American Crows can be taken under a USFWS depredations order. The remaining species are protected by USFWS and AZGFD. Of the annual take of birds from FY16 to FY20, 85% of the take were 8 species: Mourning Doves 55%), Eurasian Collared Doves (8%), Rock Pigeons (7%), Great-tailed Grackles (5%), American Coots (3%), Gila Woodpeckers (3%), House Sparrows (2%), and Horned Larks (2%). The remaining 62 species combined accounted for about 15% of WS's lethal take.

The euthanasia methods being considered for use under the proposed action for live-captured birds are cervical dislocation, carbon dioxide and shooting. The AVMA guidelines on euthanasia list cervical dislocation and carbon dioxide as acceptable methods of euthanasia for free-ranging birds (Leary et al. 2013). The use of cervical dislocation or carbon dioxide for euthanasia would occur after the animal has been live-captured and away from public view. Although the AVMA guidelines also list gunshot as a conditionally acceptable method of euthanasia for free-ranging wildlife, there is greater potential the method may not consistently produce a humane death (Leary et al. 2013). WS-Arizona personnel that employ firearms to address bird damage or threats to human safety would be trained in the proper placement of shots to ensure a timely and quick death.

Some members of the public have stated that DRC-1339 is a slow, inhumane toxicant and should not be used. WS-Arizona recognizes that any use of lethal methods, toxicants in particular, is considered by many individuals to be inhumane even if time until death and pain experienced appear to be minimal. The majority of birds that consume the bait die within 24 hours, but most within 4 to 12 hours (DeCino et al. 1966, Cunningham et al. 1979). There are no reports available on the pain experienced by birds treated with DRC-1339. Convulsions, spasms, or distress calls have not been observed in birds receiving a lethal dose, rather the birds die a quiet death (Schwab et al. 1964, Timm 1994, Cowan et al. 2010). About 4 hours before death, the birds cease to eat or drink and become listless and inactive. They perch with their feathers ruffled (as if cold) and appear to doze. DRC-1339 causes renal failure in treated birds (Decino et al 1966, Felsenstein et al. 1974) through irreversible necrosis of the kidney. The affected bird is subsequently unable to excrete uric acid with death occurring from uremic poisoning and congestion of major organs (DeCino et al. 1966, Knittle et al. 1990). Information on acute kidney failure in people indicates that it may be erroneous to assume that birds treated with DRC-1339 experience a very painful death. Symptoms of renal failure vary among individuals, with some people experiencing no symptoms while others may experience symptoms such as fluid retention, headache, nausea, fatigue and/or chest pain or pressure, and/or seizures (Mayo Clinic 2011, American Urological Association 2016). This method appears to result in a less stressful death than which probably occurs by most natural causes, which are primarily disease, starvation and predation. DRC-1339 is the only lethal method that would not be available to other entities under the other alternatives. However, Starlicide Complete™ uses the same active ingredient as DRC-1339 and would be available to certified pesticide applicators for most situations in Arizona where WS-Arizona would propose use of DRC-1339.

There are also concerns that the repellant Avitrol®, another registered chemical available to WS-Arizona and non-WS applicators which causes birds that ingest the active ingredient to emit a distress call, is inhumane. The active ingredient in Avitrol baits, 4-aminopyridine, is an acute oral toxicant which acts on the central nervous system and the motor nervous system. Its action on the motor nervous system usually causes behaviors characteristic of those seen in an epileptic seizure. Birds eating the treated bait will be affected in a manner that, varying by species, will artificially cause them to emit distress and alarm cries and visual displays used by their species when they are frightened or injured. This may include flying erratically, vocalizing, trembling, dilation of the pupils and other symptoms indicative of loss of motor control. This will frighten the flock and cause it to leave the site. In laboratory testing, if the dose is lethal, death will usually occur within an hour following administration. If the dose is sub-lethal, there will be a recovery period which may be 4 to 5 hours. Surviving birds have no lasting effects from 4-aminopyridine (Avitrol Inc. 2011). A study conducted by Rowsell et al. (1979) found that "although the result of ingestion of this product is visually repugnant, our studies suggest that the chemical does not cause pathological changes in the organs or tissues capable of causing pain or distress. Before the onset of convulsions electroencephalographic changes are similar to those produced by dissociative anesthetics; during this phase it is considered the bird cannot feel pain." Avitrol® has been shown to not produce secondary toxicity risks to scavenging mammals and birds (Schafer, Jr. 1979).

The challenge in coping with this issue is how to achieve the least amount of animal suffering with the constraints imposed by current technology. WS-Arizona personnel are concerned about animal welfare. WS-Arizona is aware that techniques like traps are controversial, but also believes that these activities are being conducted as humanely and responsibly as practical. WS and the NWRC are striving to bring additional BDM alternatives into practical use and to improve the selectivity and humaneness of management devices. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in situations when non-lethal damage management methods are not practical or effective. WS-Arizona supports the most humane, selective and effective damage management techniques and would continue to incorporate advances into program activities. WS-Arizona Specialists conducting BCM are highly experienced professionals skilled in the use of management methods and committed to minimizing pain and suffering. WS program directives, SOPs (see Section 2.2) and training work to ensure that WS-Arizona's BDM methods are used in a manner that is as humane as possible and selective.

Table 8. Birds removed by WS-Arizona in BDM from FY16 to FY20.

Species	FY16	FY17	FY18	FY19	FY20	Ave
Introduced Commensal Birds						
European Starling	90	13	42	85	69	60
Rock Pigeon	416	301	252	159	642	354
Eurasian Collared-Dove	416	248	457	235	503	372
Feral Duck	4	0	0	0	0	1
Feral Helmeted Guinea Fowl	0	1	0	0	0	1
House Sparrow	84	43	158	47	223	111
Feral Chicken	2	0	0	0	0	1
Blackbirds						

Brewer's Blackbird	0	0	7	22	31	12
Red-winged Blackbird	16	16	6	18	5	12
Great-tailed Grackle	242	99	256	284	258	228
Brown-headed Cowbird	0	0	0	0	11	2
Corvids						
Common Raven	22	5	10	14	6	57
Raptors						
Red-tailed Hawk	24	26	94	96	141	76
Turkey Vulture	13	2	14	21	23	15
American Kestrel	48	60	157	133	94	98
Merlin	0	0	0	0	1	1
Peregrine Falcon	0	0	1	3	0	1
Prairie Falcon	0	0	0	3	0	1
Burrowing Owl	0	3	4	5	3	3
Common Barn Owl	0	0	1	1	10	2
Great Horned Owl	0	1	0	3	1	1
Northern Harrier	3	9	10	10	13	9
Ferruginous Hawk	0	2	1	4	2	2
Swainsons Hawk	7	0	16	15	14	10
Harris Hawk	0	0	0	1	0	1
Cooper's Hawk	0	0	0	4	6	2
Osprey	0	0	0	0	1	1
Shorebirds						
Killdeer	43	25	28	30	53	36
Long-billed Curlew	0	0	0	0	2	1
Black-necked Stilt	0	0	0	0	17	3
Greater Yellowlegs	0	0	0	0	2	1
Wading Birds						
Great Blue Heron	8	1	6	11	24	10
Green Heron	0	0	0	0	2	1
Black-crowned Night Heron	1	0	0	1	4	1
Great Egret	9	6	21	7	15	12
Cattle Egret	0	0	0	0	2	1
Snowy Egret	1	0	0	0	0	1
Waterfowl						
Canada Goose	25	15	68	2	11	24
Mallard	94	15	32	19	72	46
American Coot	577	142	57	16	1	159
Ring-necked Duck	0	0	8	0	0	2
American Wigeon	3	0	1	0	0	1
Cinnamon Teal	0	0	0	0	1	1
Common Merganser	2	4	0	0	0	1
Black-bellied Whistling Duck	0	4	0	0	0	1
Grassland Passerines						
Lark Bunting	0	0	0	0	2	1
Horned Lark	78	58	53	136	193	104
Western Meadowlark	61	31	40	60	117	62
Eastern Meadowlark	0	0	0	0	24	5
Western Kingbird	0	0	6	5	6	3
Northern Mockingbird	0	0	0	1	0	1
Say's Phoebe	0	0	0	0	1	1
American Pipit	0	13	0	24	6	9
Black-chinned Sparrow	0	0	0	0	1	1
Brewer's Sparrow	0	0	0	2	0	1
Lark Sparrow	0	0	0	1	0	1
Vesper Sparrow	0	0	0	0	1	1
Frugivorous Birds						
House Finch	0	0	0	4	0	1
Native Doves and Pigeons						
Mourning Dove	691	1,454	2,073	3,922	5,130	2,654
White-winged Dove	0	0	4	11	104	24
Gallinaceous Birds						
Gambel's Quail	0	0	0	10	0	2
Woodpeckers						
Gila Woodpecker	123	78	167	105	131	121
Northern Flicker	2	2	19	5	7	7
Fish Eating Birds						
Double-crested Cormorant	6	8	5	47	15	16
Neotropic Cormorant	0	0	0	25	0	5
Aerialist						
Lesser Nighthawk	0	0	0	0	3	1
Cliff Swallows	4	17	0	5	8	7
Barn Swallow	0	0	0	2	0	1
Violet-green Swallow	3	0	0	0	0	1

Birds Other						
Greater Roadrunner	0	0	0	0	20	4

Impacts on Bird Populations from Nonlethal Methods in BDM

WS-Arizona dispersed, captured and released (disease monitoring) or relocated 80 species (Table 9 and 10) (some species were in mixed flocks and the species present was not recorded) that had the potential to cause or were causing damage, or were involved in disease monitoring from FY16 to FY20. 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 Arizona are listed in Section 1.2 with general information about them and the agency, USFWS, AZGFD, or WS, that has the primary responsibility to assist with damage complaints from these species.

WS-Arizona averaged about 56,441 birds hazed annually of 71 species from FY16 to FY20 (Table 9); it should be noted that many birds that are hazed are hazed several times before they are successfully moved and are reported every time they are hazed. WS-Arizona conducted most hazing in conjunction with projects on airports. The primary target species hazed by WS-Arizona annually in Arizona have been Mourning Doves (72%), White-winged Doves (6%), Brewer's Blackbirds (5%), Horned Larks (5%) and Western Meadowlarks (3%). The remaining 67 species combined accounted for 9% of the nonlethal hazing conducted by WS-Arizona. Hazing birds by WS 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.

WS also captures and relocates birds and frees nontarget species (Table 10). Species that would most likely be involved in relocation would be several raptors such as Red-tailed Hawks, Swainson's Hawks, Cooper's Hawks, American Kestrels, Common Barn Owls, and Great Horned Owls, other less numerous species, and species at the request of AZGFD and USFWS.

Table 9. Birds dispersed (hazed with frightening devices or other nonlethal method) from damage situations from FY16 to FY20 by WS-Arizona.

Species	FY16	FY17	FY18	FY19	FY20	Ave
Introduced Commensal Birds						
House Sparrow	0	0	85	200	0	57
European Starling	0	100	0	2,044	10	431
Rock Pigeon	12	258	45	9	50	75
Blackbirds						
Brewer's Blackbird	2,900	4,400	400	2,805	4,424	2,986
Red-winged Blackbird	100	338	0	29	1,818	457
Great-tailed Grackle	375	926	461	754	1,044	712
Yellow-headed Blackbird	0	1,000	0	0	100	220
Corvids						
Common Raven	42	130	138	135	84	106
Raptors						
Turkey Vulture	160	106	156	205	291	184
Red-tailed Hawk	147	111	227	250	368	221
American Kestrel	158	183	351	181	303	235
Northern Harrier	116	150	143	124	166	140
Swainsons Hawk	9	1	29	57	59	31

Ferruginous Hawk	2	4	3	5	3	17
Osprey	1	6	3	6	12	6
Peregrine Falcon	0	2	11	10	36	12
Prairie Falcon	35	1	30	45	21	26
Harris Hawk	0	0	0	1	2	1
Zone Tailed Hawk	1	0	0	0	0	1
Cooper's Hawk	1	0	2	6	2	2
Common Black Hawk	0	0	0	0	1	1
Burrowing Owl	0	0	1	2	9	2
Short-eared Owl	0	0	0	1	0	1
Common Barn Owl	0	0	0	0	4	1
Great-horned Owl	0	0	0	0	3	1
Fish Eating Birds						
Double-crested Cormorant	254	8	44	204	1,206	343
Neotropic Cormorant	0	0	0	925	0	185
Shorebirds						
Killdeer	308	160	175	216	284	229
Black-necked Stilt	14	0	16	2	104	27
Least Sandpiper	0	0	8	60	25	19
Western Sandpiper	0	0	0	18	0	4
Long-billed Curlew	0	0	10	0	3	3
Long-billed Dowitcher	0	0	0	2	0	1
Whimbrels	0	0	0	2	3	1
Willet	0	0	0	4	0	1
Greater Yellowlegs	0	0	0	0	8	2
Wading Birds						
Great Egret	99	60	487	198	289	227
Cattle Egret	0	0	0	0	33	7
Great Blue Heron	34	24	53	83	118	62
Snowy Egret	0	0	1	10	0	2
Green Heron	1	0	0	0	25	5
Black-crowned Night Heron	2	1	21	0	17	8
Waterfowl						
Mallard	86	47	57	294	638	224
Canada Goose	35	32	55	149	65	67
Northern Shoveler	0	22	0	0	0	4
American Wigeon	38	12	0	176	0	45
Canvasback	0	0	30	110	4	29
Gadwall	0	0	0	0	140	28
Ruddy Duck	0	8	0	0	0	2
American Coot	26	0	0	2	0	6
Black-bellied Whistling Duck	0	4	0	0	8	2
Common Merganser	0	300	90	91	13	99
Redhead	0	0	30	0	0	6
Cinnamon Teal	0	0	0	0	3	1
Wood Duck	0	0	0	0	5	1
Ross's Goose	4	6	0	0	0	2
Grassland Passerines						
Horned Lark	1,452	745	1,526	1,995	7,988	2,741
Western Meadowlark	1,406	327	909	1,981	2,453	1,415
Western Kingbird	1	50	10	1	0	12
American Pipit	650	0	0	700	510	372
Northern Mockingbird	0	0	0	1	0	1
Brewer's Sparrow	0	0	0	12	0	2
Lark Bunting	0	0	0	0	93	19
Native Doves and Pigeons						
Mourning Dove	5,027	97,138	16,157	47,252	37,153	40,545
White-winged Dove	280	0	12	2,072	14,179	3,309
Aerialist						
Barn Swallow	0	0	0	27	0	5
Cliff Swallow	190	405	0	130	610	267
Violet-green Swallow	70	0	0	0	0	14
Lesser Nighthawk	0	0	0	0	40	8
Gallinaceous Birds						
Gambel's Quail	0	0	0	5	22	5
Frugivorous Birds						
House Finch	200	190	150	95	140	155
Birds Other						
Greater Roadrunner	0	0	2	0	15	3

Table 10. Birds released and relocated away from damage situations in operations conducted by WS-Arizona from FY16 to FY20. In addition, nontargets taken in BDM are included that were freed on-site.

Species	FY16	FY17	FY18	FY19	FY20	Ave
Blackbirds						
Great-tailed Grackle	1	0	0	0	0	1
Raptors						
Black Vulture	0	0	0	1	0	1
American Kestrel	8	0	7	5	31	10
Red-tailed Hawk	0	1	0	0	0	1
Prairie Falcon	0	0	0	0	1	1
Great Horned Owl	1	3	0	0	4	2
Common Barn Owl	0	1	0	0	1	1
Burrowing Owl	1	0	0	0	0	1
Shore Birds						
Killdeer	0	0	1	0	0	1
Waterfowl						
Common Gallinule	0	0	0	2	0	1
Canada Geese				7		
Grassland Passerines						
Cactus Wren	0	1	0	0	0	1
Wilson's Warbler	1	0	0	0	0	1
Say's Phoebe	0	1	0	1	1	1
Abert's Towhee	0	1	0	0	0	1
Common Poorwill	0	0	1	0	0	1
Native Doves and Pigeons						
Mourning Dove	0	0	0	0	1	1
Frugivorous Birds						
American Goldfinch	0	0	0	0	1	1
Aerialist						
Barn Swallow	1	4	0	0	0	1
Birds Other						
Costa's Hummingbird	1	0	0	0	0	1

WS-Arizona conducted disease surveillance from FY16 to FY20. The primary focus of the disease surveillance work was to monitor for the presence of West Nile Virus (WNV) and H5N1 AI. WS-Arizona collected 290 samples in FY16, 243 in FY17, 86 in FY18, and 719 in FY20 for testing from birds being monitored, primarily waterfowl and coots. WS-Arizona collected bird samples from a few birds taken lethally during BDM projects and at waterfowl hunter check stations. Disease sampling from FY16 to FY20 included 587 doves, 579 wild ducks, 60 grackles, 42 pigeons, 14 sparrows, and 10 raptors.

WS 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.

Impacts of Lethal and Nonlethal BDM on Bird Species in Arizona

WS-Arizona conducted both lethal and nonlethal take of birds (Tables 8, 9, and 10). For the analyses in this EA, bird populations were estimated population estimates for either Arizona or the RMS region from BBS surveys conducted between 2015 and 2019 (Pardieck 2020) with adjustment factors based on Sauer et al. (2020) and PIF (2020) as given in Table 5 and Appendix A. Table 8 gives WS-Arizona take. Rocky Mountain States WS take and impacts are listed in Appendix E.

Introduced/Invasive Commensal Birds

Arizona 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. WS took 7 invasive species from FY16 to FY20 (Table 8) with the take of Eurasian Collared-Doves expected to increase as their population expands and they are rapidly becoming a problem at airports and CAFOs. Most damage problems from these species are associated with protecting agriculture and human health and safety. The take of these species by WS-Arizona is considered to be of no significant impact on the human environment since they are not native components of ecosystems in Arizona. Most of these species are not protected by federal and state laws, except for domestic strays which are protected by local laws.

Rock Pigeon Biology and Population Impact Analysis

Rock Pigeons, are a non-indigenous species that European settlers first introduced into the United States as a domestic bird for sport, carrying messages and as a source of food (USFWS 1981). Many of those birds escaped and eventually formed the Rock Pigeons populations that now occur throughout the United States, southern Canada and Mexico (Williams and Corrigan 1994). As an identified invasive species, they are neither federally nor State protected.

Rock Pigeons are non-migratory and closely associated with people, where man-made structures and activities provide them with food and sites for roosting, loafing and nesting (Williams and Corrigan 1994, Lowther and Johnston 2014). Thus, pigeons commonly occur around city buildings, bridges, parks, farmyards, grain elevators, feed mills and other manmade structures (Williams and Corrigan 1994). Additionally, although pigeons are primarily grain and seed eaters, they will readily feed on garbage, livestock manure, spilled grains, insects and any other available bits of food (Williams and Corrigan 1994). Rock Pigeons occur throughout the year in all 50 states, including Arizona (Lowther and Johnston 2014).

The number of Rock Pigeons observed along routes surveyed during the BBS in the State have shown a at 0.73 % annual increase from 1966 to 2019 (Pardieck 2020). Based on data from the BBS, the PIF (2020) estimated the statewide breeding population at 89,000 pigeons. The number of pigeons observed in areas surveyed during the CBC is showing a general increasing trend in the State since 1966; however, since the early 1990s, the number of Rock Pigeons observed during the CBC has been stable (NAS 2019).

Rock Pigeons are afforded no protection under the MBTA because the species is not native to the United States and the take of pigeons to alleviate damage or to reduce threats can occur without the need for a depredation permit from the USFWS. Therefore, take by other entities in Arizona is unknown. Because pigeons are a non-native species that often competes with native wildlife species for food and habitat, any take could be viewed as providing some benefit to the native environment in Arizona. Between FY16 and FY20, WS-Arizona employed non-lethal harassment methods to disperse 374 Rock Pigeons to alleviate damage or threats of damage (Table 11). In addition, WS-Arizona employed methods to lethally remove 1,770 pigeons from FY16 through FY20 to alleviate damage. Requests for assistance received by WS-Arizona often arise from airports where the gregarious flocking behavior of pigeons can pose risks to aircraft at or near airports. Rock Pigeons also cause damaging situations when the buildup of their droppings at nesting and roosting sites poses a health risk to the public, for example at a power plant or other industrial facility.

Table 11 – Number of Rock Pigeons addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	12	416
2017	258	301
2018	45	252
2019	9	159
2020	50	642
TOTAL	**374**	**1,770**

House Sparrow Biology and Population Impacts Analysis
House Sparrows or English Sparrows were introduced to North America from England in 1850 and have spread throughout the continent (Fitzwater 1994). The species is not protected by federal or State laws. House sparrows are found in nearly every habitat except dense forest, alpine and desert environments. They prefer human-altered habitats and are abundant on farms, in cities and suburbs (Lowther and Cink 2006). House sparrows are not migratory in North America and are year-round residents wherever they occur (Lowther and Cink 2006). Nesting locations often occur in areas of human activities, and house sparrows are considered "*...fairly gregarious at all times of year*" with nesting occurring in small colonies or clumped distributions (Lowther and Cink 2006). Large flocks of sparrows can also occur in the winter as birds forage and roost together.

BBS population trends show that House Sparrow populations are decreasing in Arizona (-2.61%) and nationwide (-3.54%) since 1966 (Pardieck 2020). PIF (2020) estimates the population of house sparrows in Arizona at 2.6 million birds.

Between FY16 and FY20, WS-Arizona has employed non-lethal methods to disperse 285 sparrows and lethal methods to remove 555 sparrows in the state to alleviate damage or threats of damage (Table 12). Because House Sparrows are afforded no protection from take under the MBTA, no depredation permits are issued for the take of House Sparrows and there is no requirements to report take of sparrows. Therefore, the number of sparrows lethally removed by other entities in the state is unknown. Based on the gregarious behavior of sparrows and in anticipation of receiving additional requests for assistance, WS-Arizona could take up to 300 House Sparrows in the state annually to alleviate damage or threats of damage.

Although most seed-eating birds are federally protected under the MBTA, house sparrows, like European Starlings and Rock Pigeons, are identified as invasive species and have neither federal nor State protection. Due to their negative impacts and competition with native bird species, house sparrows are considered by many wildlife biologists, ornithologists and naturalists to be an undesirable component of North American ecosystems. Any reduction in house sparrow populations could be considered beneficial to native bird species and consistent with EO 13112 on management of invasive species. However, because WS-Arizona activities are limited to a small portion of the State, the proposed action may temporarily reduce local house sparrow populations but is unlikely to have a substantial impact on the overall State, regional or national house sparrow population.

Table 12 – Number of House Sparrows addressed by WS-Arizona, FY 2016 - FY 2020

Fiscal Year	Dispersed	Take
2016	0	84
2017	0	43
2018	85	158
2019	200	47
2020	0	223
TOTAL	**285**	**555**

Eurasian Collared-Dove Biology and Population Impact Analysis
The Eurasian Collared-Dove is one of the recent introductions to North American fauna. It quickly spread across North America since its release in the Bahamas in the mid-1970s (Romagosa 2012). This species' success is often attributed to backyard bird feeders and urban landscaping. While it is less common in rural areas, it can be found where stored or waste grain is available. This species is non-migratory; food-availability allows it to thrive in colder regions with year-round populations being found in the northern United States and southern Canada.

Since its introduction, the population has grown exponentially (Pardieck 2020). In more recent years the population has continued to grow, but at a slower rate. Since 1966, the BBS has documented a 29.13% increase in the population in the United States (Pardieck 2020). In Arizona, the population has grown 16.35% since its reintroduction (Pardieck 2020). PIF does not report a population estimate for this species in Arizona (PIF 2020). As an invasive species, the Eurasian collared dove is not federally or State protected.

Because Eurasian Collared-Doves are afforded no protection from take under the MBTA, take can occur by any entity in Arizona without a depredation permit issued by the USFWS. Therefore, the take of collared-doves by entities other than WS for damage management purposes is unknown but is likely of low magnitude because doves are not associated with causing extensive damage to resources, except doves can pose threats to aircraft at airports. From FY16 through FY20, WS-Arizona has lethally removed 1,859 Eurasian Collared-Doves in the state to alleviate damage (Table 13). Eurasian Collared-Doves are similar in appearance to Mourning Doves and are often harvested during the regulated hunting season for Mourning Doves. Mourning Doves can be harvested under frameworks established by the USFWS and implemented by the AZGFD. However, because Eurasian Collared-Doves are considered a non-native species, no frameworks for the harvest of collared-doves exists. Therefore, the annual take of Eurasian Collared-Doves during the annual hunting season for Mourning Doves is not currently available.

Table 13 – Number of Eurasian Collared-Doves addressed by WS-Arizona, FY 2016 - FY 2020

Fiscal Year	Dispersed	Take
2016	0	416
2017	0	248
2018	0	457
2019	0	235
2020	0	503
TOTAL	**0**	**1,859**

Native Doves and Pigeons

Arizona commonly hosts 5 species of native doves and pigeons including the Mourning Dove, White-winged Dove, Band-tailed Pigeon, Inca Dove and the Common Ground-Dove. Pigeons are relatively large birds with a square tail. Doves are smaller than pigeons, but possess many of the same physical characteristics, except typically sport a longer tail. All are fast-flying grayish or brown birds that usually feed on seeds or spilled grain. WS-Arizona conducted an average of 944 work tasks annually from FY16 to FY20 for Mourning Doves and 452.6 work task annually for White-winged Doves, but none for the other 3 species (Table 2b). The Mourning Dove and White-winged Dove is abundant in Arizona and the species mostly likely to be involved in BDM at airports, and for the protection of some agricultural crops and property. Inca Doves are much less abundant, and found primarily in the southeastern corner of the State. Band-tailed Pigeons and Common Ground Doves are less common and not as likely to be the focus of a BDM project, but possibly could be.

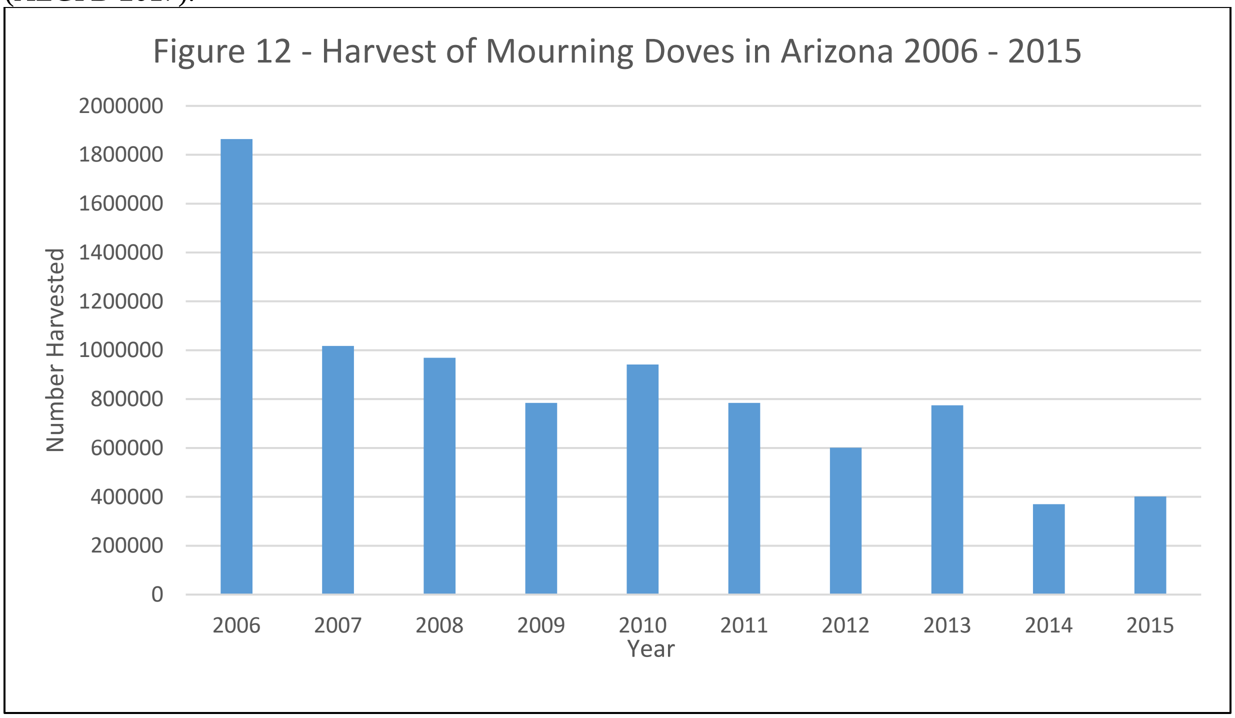
Mourning Dove Biology and Population Impacts Analysis

Mourning Doves are considered migratory game birds with substantial populations throughout much of North America. They occur in all 48 contiguous states of the United States and the southern portions of Canada with the northern populations being more migratory than the southern populations. They are a drab grayish brown with a slender, white edged, pointed tail. Mourning Doves can be found throughout the year over most of the United States, including Arizona (Otis et al. 2008).

According to trend data provided by Pardieck et al. (2020), the number of Mourning Doves observed on routes surveyed has shown an increasing trend in the state estimated at 1.95% annually from 1966 through

2019. The number of doves observed in areas surveyed during the BBS in the state has increased annually estimated at -1.7% (Pardieck 2020). Based on BBS data, the Partners in Flight Science Committee (2020) estimated the statewide breeding population at 5.5 million Mourning Doves.

The number of Mourning Doves observed during the CBC has shown a stable trend in the state since 1966 (NAS 2020). From 2010 through 2019, 27,213 doves have been observed per year on average in areas surveyed during the CBC, with the lowest count occurring in 2016 when 22,451 doves were observed. Many states have regulated annual hunting seasons for doves each year with generous bag limits. Across the United States, the preliminary Mourning Dove harvest in 2015 was estimated at 13.2 million doves with 401,400 doves harvested in Arizona (Raftovich et al. 2016). Figure 12 shows the number of Mourning Doves harvested in Arizona during the annual hunting season from 2006 through 2015 (AZGFD 2017). On average, people have harvested 850,941 Mourning Doves per year from 2006 through 2015 (see Figure 12) (AZGFD 2017).



From FY16 through FY20, WS-Arizona has addressed 215,997 Mourning Doves to alleviate damage and threats (Table 14). Of those doves addressed by WS-Arizona from FY16 through FY20, 13,270 were addressed using lethally methods while 202,727 Mourning Doves were addressed using non-lethal methods. The take of doves by other entities has not occurred in the state previously. Requests for assistance received by WS-Arizona often arise from airports where the gregarious flocking behavior of doves can pose risks to aircraft at or near airports. Based on the number of requests to manage damage associated with doves received previously and based on the increasing need to address damage and threats associated with doves in the state, up to 6,000 Mourning Doves could be lethally taken by WS annually in the state to address damage or threats.

Under the proposed action, the nests and/or eggs of Mourning Doves could be destroyed by WS-Arizona as part of an integrated approach to managing damage. Under the proposed action, up to 50 nests could be destroyed annually by WS-Arizona, including eggs in the nests. WS-Arizona take of active nests would only occur when permitted by the USFWS through the issuance of depredation permits. WS-Arizona take of active nests would not exceed 50 annually and would not exceed the level permitted under depredation permits. Impacts due to nest and egg destruction would have little adverse effect on the Mourning Dove population in Arizona. Local populations of Mourning Doves in the state are likely augmented by migrating birds during the migration periods and during the winter months.

Table 14 – Number of Mourning Doves addressed by WS-Arizona, FY 2016 – FY 2020

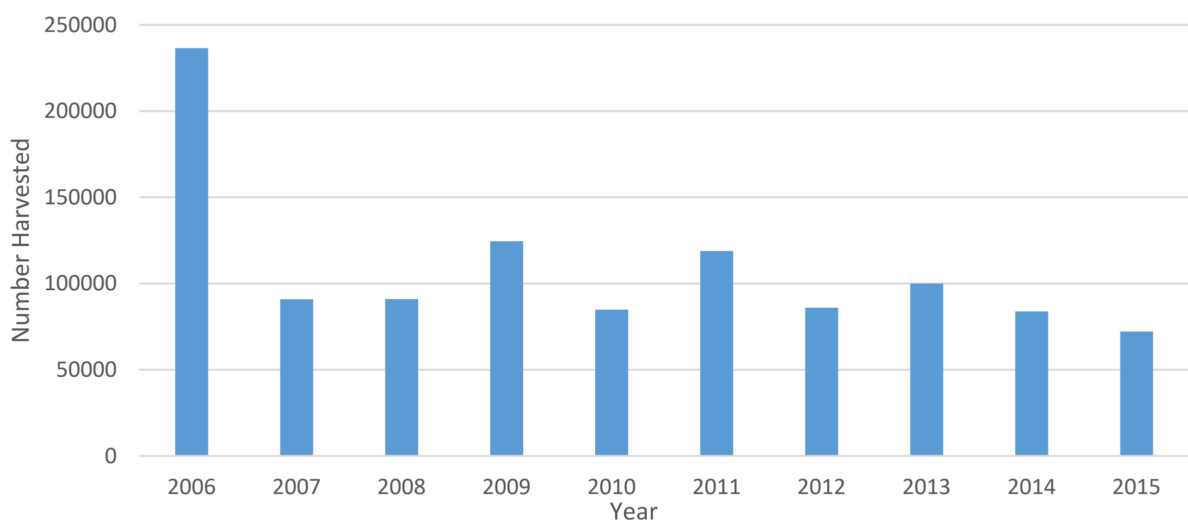
Fiscal Year	Dispersed	Take
2016	5,027	691
2017	97,138	1,454
2018	16,157	2,073
2019	47,252	3,922
2020	37,153	5.130
TOTAL	**202,727**	**13,270**

White-winged Dove Biology and Population Impacts Analysis

Based on BBS data, the Partners in Flight Science Committee (2020) estimated the statewide breeding population at 2.9 million White-winged Doves breeding in Arizona. The estimated annual harvest from the 2006 to 2015 hunting seasons was 108,865 White-winged Doves (Figure 13). The White-winged Dove population is likely very low because BBS routes are not where they are found during the breeding season or they have a reverse migration in fall, moving northward. CBC data (NAS 2012b) first documented White-winged Doves in the 100th CBC and shows an increasing trend since that time, but they are still somewhat rare. This possibly could account for the high estimated level of harvest (USFWS 2018). From 2006 through 2017, the estimated trend of dove abundance, based on BBS data, has increased 1.0% annually in Arizona (Seamans 2016). Based on BBS data, the Partners in Flight Science Committee (2020) estimated the statewide breeding population at 2.9 million White-winged Doves.

The take of 50 White-winged Doves would be significantly less than 10% of hunter harvest and at a level that would not impact their populations, primarily considering the population estimate and hunting harvest for and the northward expansion of White-winged Doves into Arizona.

Figure 13 - Harvest of White-winged Doves in Arizona 2006 - 2015



From FY16 through FY20, WS-Arizona has addressed 16,658 White-winged Doves to alleviate damage and threats (Table 15). Of those doves addressed by WS from FY16 through FY20, 115 were taken using lethal methods while 16,543 White-winged Doves were addressed using non-lethal methods. The take of doves by other entities has not occurred in the state previously. Requests for assistance received by WS often arise from airports where the gregarious flocking behavior of doves can pose risks to aircraft at or near airports. Based on the number of requests to manage damage associated with doves received previously and based on the increasing need to address damage and threats associated with doves in the state, up to 200 White-winged Doves could be lethally taken by WS annually in the state to address damage or threats.

Table 15 – Number of White-winged Doves addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	280	0
2017	0	0
2018	12	4
2019	2.072	11
2020	14,179	104
TOTAL	**16,543**	**115**

<u>Blackbirds</u>

Arizona has 6 species of blackbirds that are common, mostly during the breeding season, the Red-winged, Brewer's, and Yellow-headed Blackbirds, the Great-tailed Grackles, Brown-headed and Bronzed Cowbirds. WS lethally took 4 species from FY16 to FY20 (Table 8). Most damage problems from these species are associated with protecting agriculture such as crops and livestock feed and human health and safety, primarily at airports. WS had an annual average of 946 (Table 2c) work tasks associated with them from FY16 to FY20.

Blackbirds are most commonly observed in rural areas where they nest in cattails and reed grasses that grow in marshes and other wetlands and often feed upon several forms of crops, such as grains, corn and sunflowers. In winter months where they do not travel further south, they may establish extremely large roosts in excess of one million birds. When concentrated like this during the winter months, they often will find food sources at nearby feedlots where they may consume and contaminate great quantities of feed put out for livestock. Blackbirds and European starlings may develop large roost sites within towns where the accumulation of feces is unsightly, smelly and may pose health risks to people. These birds also frequent airport environments where they may gather to feed upon grass seeds inside the relative protection inside of the airport security fences. In doing so, their activities on the airfield may threaten aircraft and public safety.

Based on observations of WS personnel at several affected Arizona feedlots where WS-Arizona starling and blackbird damage management operations are concentrated, the species composition of the birds causing damage has been estimated to typically be a minimum of 95% blackbirds and at most 5% starlings. 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 removed the Rusty Blackbird from the list of species that can be taken under the Depredation Order. In all likelihood, WS in Arizona and the RMS areas has taken relatively few Rusty Blackbirds, if any, and does not anticipate the take of more than a few at most throughout the RMS region. Further information is discussed in this Section.

Arizona's estimated populations of the species regularly found in the State based on BBS data, the Partners in Flight Science Committee (2020) are 3.5 million Red-winged Blackbirds, 92,000 Brewer's Blackbirds, 120,000 Yellow-headed Blackbirds, 790,000 Great-tailed Grackles, 1.3 million Brown-headed Cowbirds and 19,000 Bronzed Cowbirds.

Red-winged Blackbirds Biology and Population Impacts Analysis

The Red-winged Blackbird is one of the most abundant bird species in North America and is a commonly recognized bird that occurs in a variety of habitats (Yasukawa and Searcy 1995). The breeding habitat of red-winged blackbirds includes marshes and upland habitats from southern Alaska and Canada southward to Costa Rica extending from the Pacific to the Atlantic Coast along with the Caribbean Islands (Yasukawa and Searcy 1995). Red-winged Blackbirds are primarily associated with emergent vegetation in freshwater wetlands and upland habitats during the breeding season and will nest in marsh vegetation, roadside ditches, saltwater marshes, rice paddies, hay fields, pastureland, fallow fields, suburban habitats and urban parks (Yasukawa and Searcy 1995). Northern breeding populations of Red-winged Blackbirds migrate south, but Red-winged Blackbirds are common throughout the year in most of the United States (Yasukawa and Searcy 1995). During migration periods, Red-winged Blackbirds often form mixed species flocks with other blackbird species.

Adults have a mean life expectancy of 2.14 years. Predation is a leading cause of mortality for eggs and young. Losses to predation can range from 27 to 53% (Yasukawa and Searcy 1995). Dolbeer (1994) states that this high mortality rate is offset by a reproductive rate of 2 to 4 young fledged per female per year. Modeling by Dolbeer (1994) indicated that killing 3.6% of the wintering blackbird population had no effect on breeding populations the following spring. Dolbeer et al. (1976) constructed a population model which indicated that a reduction of 14.8% of the wintering blackbird population would reduce the spring breeding population by 20% and that a 56.2% reduction in the wintering blackbird population would reduce spring breeding populations by only 33%. In an analysis of North American blackbird populations in 1975, the USFWS concluded that removal of 67.5 million birds would not affect the following years post-breeding population (USDI 1976).

In Arizona, Red-winged Blackbirds are present in the State throughout the year (Yasukawa and Searcy 1995) with a breeding population estimated at 3.5 million birds (PIF 2020). Trend data from the BBS indicates the number of Red-winged Blackbirds observed in the State during the breeding season has not changed significantly either since 1966 or in more recent years since 2003 (Pardieck 2020). The number of Red-winged Blackbirds observed during the CBC in the State has also been relatively stable since 1966 (NAS 2020).

While Red-winged Blackbirds are federally protected, and therefore, also State protected as a migratory nongame bird, under the MBTA, a depredation order for blackbirds (50 CFR 21.43) allows Red-winged Blackbirds depredating on agricultural crops or livestock or congregating in flocks that pose risks to human health and safety or cause a nuisance to be lethally removed without a depredation permit. WS-Arizona has lethally removed 61 Red-winged Blackbirds and non-lethally harassed 2,285 from FY16 – FY20. Based on anticipated increases in requests for WS-Arizona assistance with BDM, WS-Arizona would take up to 500 Red-winged Blackbirds (Table 16). This would represent less than 1% of the current population (Table 16) and would not impact the State's Red-winged Blackbird population.

Table 16 –Number of Red-winged Blackbirds addressed by WS-Arizona, FY 2016 - FY 2020

Fiscal Year	Dispersed	Take
2016	100	16
2017	338	16
2018	0	6
2019	29	18
2020	1,818	5
TOTAL	**2,285**	**61**

Because blackbirds can be lethally removed without the need for a depredation permit, the number of Red-winged Blackbirds lethally taken by other entities in the state has been unknown because reporting of take to the USFWS was not required in the past. However, with the recent updates to the blackbird depredation order, reporting of take to the USFWS is now required. The take of Red-winged Blackbirds by other entities is expected to be of low magnitude when compared to the statewide estimated population for Arizona. Based on the number of requests received to alleviate the threat of damage associated with Red-winged Blackbirds and the number addressed previously to alleviate those threats, WS-Arizona anticipates that up to 500 could be taken annually in the state to alleviate the threat of damage. With a breeding population estimated at 3.5 million Red-winged Blackbirds, take of up to 500 Red-winged Blackbirds by WS-Arizona annually would represent 0.02% of the estimated breeding population in the state.

Brewer's Blackbirds Biology and Population Impacts Analysis

The Brewer's Blackbird breeds in western and northern North America, mostly south of the Rusty Blackbird. Its 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. However, its population increase was followed by a decrease. Its breeding range includes the northern RMS region, including Arizona, and the winter range includes the southern RMS region, including Arizona. The estimated population from PIF data is 92,000 for Arizona (PIF 2020). 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.

Table 17 – Number of Brewer's Blackbirds addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	2,900	0
2017	4,400	0
2018	400	7
2019	2,805	22
2020	4,424	31
TOTAL	**14,929**	**60**

Natural mortality in blackbird populations is between 50% and 65% of the population each year, regardless of human-caused control operations 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 WS-Arizona under the proposed action or Alternative 1 averaged 3,000 annually from FY16 to FY20. These numbers are well within normal mortality levels for this species. Additional human-induced mortality of this species occurs from private individuals and could potentially be 200,000 annually (Brewer's Blackbirds are not as likely to be taken as Red-winged Blackbirds due to foraging habits). 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 take (60) and harassment (14,929) of Brewer's Blackbird by WS-Arizona from FY16 – FY20. WS-Arizona 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 of their preference for 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.

Great-tailed Grackles Biology and Population Impacts Analysis
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. Their range expansion has been credited to their adaptability to altered habitats such as urban and agricultural landscapes with irrigation (Johnson and Peer 2001). Recent BBS data (PIF 2020) estimated a population of 790,000 in Arizona.

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). Of the population, natural mortality in blackbird populations is between 50% and 65% of the population each year, regardless of human-caused control operations and a stable population of Great-tailed Grackles would have a 54% mortality rate under the current assumptions. At the rate of expansion and increase in the grackle's population, it would be expected that the population has even had a lower mortality rate with more surviving annually. This is reflected in Arizona. The numbers that might be taken by WS-Arizona under the proposed action or Alternative 1 are relatively minor (potentially up to 3,000 in any one year) but between FY16 and FY20, 1,139 were taken and 3,560 were non-lethally harassed (Table 18). These numbers are well within normal mortality levels for this species. Additional human-induced mortality of this species occurs from private individuals and could potentially be 100,000 annually. However, WS-Arizona has no way of knowing what the level of take is by private individuals since permits are not required. With this information, Table 18 shows the take and harassment for Great-tailed Grackle by WS-Arizona. WS-Arizona concludes that this is a minor level of take and would not impact the population

Table 18 – Number of Great-tailed Grackles addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	375	242
2017	926	99
2018	461	256
2019	754	284
2020	1,044	258
TOTAL	**3,560**	**1,139**

<u>Grassland Passerine Species</u>

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. The grassland birds were responsible for 80 strikes in Arizona from FY11 to FY20 (Appendix D). We include the open woodland birds, flycatchers/kingbirds, thrashers, and buntings (23 strikes) with this group because they are often 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 confined to airports where the grassland environment is attractive to them. In all, these species were responsible for 103 strikes at Arizona airports from FY11 to FY20 (Appendix D), with all grassland species causing 4 damaging strikes (5.0%), open woodland 0 (0%), of the strikes with information reported on the strike other than the species (Appendix D); in all 5.0%. Of these species, the only species causing other types of damage, primarily to small grain crops, are Horned Larks, Lark Buntings, Dickcissels, and White-crowned Sparrows.

Most grassland species have fairly high breeding populations in Arizona, except those on the edge of their range. Species taken lethally from FY16 to FY20 (Table 8) included two bird species that breed in Arizona both with estimated populations of 430,000 for the Western Meadowlark and 2.9 million for the Horned Lark. Thus, the average take of these species by WS-Arizona was minimal considering their population. . The take of these species by WS-Arizona from FY16 to FY20 was 518 Horned Larks (Table 19) and 126 Western Meadowlarks (Table 20), 2 Lark Buntings, 24 Eastern Meadowlarks, 17 Western Kingbirds, 1 Northern Mockimgbird, 1 Say’s Phoebe, 43 American Pipits, 1 Black-chinned Sparrow, 2 Brewer’s Sparrow, 1 Lark Sparrow and 1 Vesper Sparrow. This level of take would have no perceptible effect on the population estimated. Take would have to increase more than a thousand-fold before an impact from BDM may start to be noticeable, though not likely significant. WS anticipates that, at most, it is perceivable that take could increase a hundred-fold for these species depending primarily on the airports that request assistance from WS-Arizona, or the number of private pest control operators or airport personnel involved in BDM to reduce wildlife hazards. Thus, at current levels of take, and even at potential levels of take, WS will not have more than an imperceptible impact on these species.

Table 19 – Number of Horned Larks addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	1,452	78
2017	745	58
2018	1,526	53
2019	1,995	136
2020	7,988	193
TOTAL	**13,706**	**518**

Table 20 – Number of Western Meadowlarks addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	1,406	61
2017	327	31
2018	909	40
2019	1,981	60
2020	2,453	117
TOTAL	**7,076**	**309**

WS-Arizona did not take any of the other grassland species from FY16 to FY20, but USFWS permitted the take to Luke Air Force Base of no more than 10 of the following grassland species: Bairds’s Sparrows, Five-striped Sparrow, Black-chinned Sparrow, Botteri’s Sparrow, Grasshopper Sparrow, Rufous-winged Sparrow Bendire’s Thrasher, Le Conte’s Thrasher, Buff-breasted Flycatcher, Lawrence’s Goldfinch, Olive Warbler, Red-faced Warbler, Chestnet-collared Longspur and Sprague’s Pipit. The USFWS also permitted the take to David Monthan Air Force Base of no more than 10 of the following grassland species: Baird’s Sparrow, Five-striped Sparrow, Black-chinned Sparrow, Grasshopper Sparrow, Rufous-winged Sparrow, Botteri’s Sparrow, Bendire’s Thrasher, Le Conte’s Thrasher, Olive Warbler, Black-throated Gray Warbler, Grace’s Warbler, Lucy’s Warbler, Red-faced Warbler, Yellow Warbler, Buff-brested Flycatcher, Chestnut-Collared Longspur, Lawrence’s Goldfinch and Sprague’s Pipit. Thus, BDM take has been minimal or nonexistent for all of these species and is expected to continue to be minimal. The take of 1,000 cumulatively of any of these species in Arizona would not impact any of these species’ populations overall. WS-Arizona does not anticipate taking many of these species, especially the Sprague’s Pipit, but expects potential take could possibly reach 5 in a given year. This level of take would have no perceptible impact on the population. The take of 5 would be less than 0.1% of the estimated annual mortality in a stable population, or negligible impact to the population. However, WS-Arizona does not anticipate that this would level of take 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 from that WS-Arizona expects could be part of a BDM project (Appendix C: Table C1), the Bendire's Thrasher, Sprague's Pipit, Cassin's Finch, Lawrence's Goldfinch, and the Lark Bunting 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, the populations will decline if the loss of grasslands continues regardless of any BDM conducted for them because the population is limited by habitat. WS-Arizona concludes that BDM will have no more than an imperceptible impact on any of the grassland species even if take were to increase

Waterfowl

Waterfowl are aquatic birds with most feeding upon wetland grasses and insects. Many of these birds have become habituated to human activity and will readily live in towns, generally at golf courses or city parks. Since many will feed upon grasses, they may cause damage at golf courses. At city parks, their feeding generally does not cause damage, but the accumulation of feces does represent a concern for human health. When they inhabit areas on or near airports, they can cause significant damage to aircraft when struck because of their large body size. Their hazard is exasperated by their propensity to form flocks, increasing the potential of a multiple strike incident.

During FY16 – FY20, WS-Arizona has provided assistance with BDM or disease monitoring for 19 different species of waterfowl. In this EA, WS-Arizona is analyzing take for 4 species, including 1 species of geese and 3 species of ducks (Table 1), in the event management is required to prevent threats to human health and safety at airports. Of these 19 species, WS-Arizona has provided lethal operational assistance for 8 of these species: Mallard Duck, Canada Goose, American Coot, Ring-necked Duck, American Wigeon, Cinnamon Teal, Common Meaganser, and Black-bellied Whistling Duck (Table 8). The impacts of damage management proposed under Alternative 1 for 4 of these species will be analyzed for each individual species below.

While WS-Arizona has not conducted lethal damage management in the 5 years between FY16 and FY20 for 11 species of waterfowl covered under this EA (Ross's Geese, Gadwall, Blue-winged Teal, Green-winged Teal, Northern Shoveler, Northern Pintail, Canvasback, Redhead, Ruddy Duck, Wood Duck and Redhead), under Alternative 1, WS-Arizona would take up to 25 birds of each species annually to address damage to agriculture, property, and natural resources as well as threats to human health and safety caused by these birds. Considering that WS-Arizona has not taken individuals from any of these species in the last 5 years, actual take in most years would likely be far lower than this number. While there are no Arizona specific population estimates available for these 9 species, the USFWS Waterfowl Population Status (USFWS 2016*a*) reports estimated abundance for duck species nationwide. In 2015 estimated abundances of Gadwalls, American Wigeons, Green-winged Teals, and Redheads were above the long-term averages (USFWS 2016*a*).

Table 21 hunter harvest data from 2011 – 2016 for waterfowl taken in Arizona (AZGFD 2017). Waterfowl data is obtained from the Harvest Information Program conducted by the USFWS. The take of waterfowl by WS-Arizona 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 RMS region). The species that WS-Arizona anticipates taking the most are Canada Geese, Mallards, American Wigeon and American Coots.

Table 21 – Hunter Harvest of Waterfowl in Arizona, 2011 - 2016

Year	Ducks	Geese
2011 - 2012	38,300[1]	3,700[2]
2012 - 2013	51,000[1]	1,600[2]
2013 - 2014	68,200[1]	2,700[2]
2014 - 2015	25,600[1]	2,300[1]
2015 - 2016	21,603[2]	2,400[2]
TOTAL	**204,703**	**12,700**

[1]Confidence intervals on duck harvest for the Harvest Information Program: 2011-12 +/- 56%; 2012-13 +/- 23%; 2013-14 +/- 22%; 2014-15 +/- 15%
[2]Confidence intervals on goose harvest from the Harvest Information Program: 2011-12 +/- 56%; 2012-13 +/- 35%; 2013-14 +/- 62%; 2014-15 +/- 62%; 2015-16 +/- 46%

Canada Goose Biology and Population Impact Analysis

Canada Geese are the most widely distributed goose species in North America (Mowbray et al. 2002). Canada Geese occur in a broad range of habitats including prairie, arctic plains, mountain meadows, agricultural areas, reservoirs, sewage lagoons, parks, golf courses, lawn-rich suburban areas or other similar areas not far from permanent sources of water (Mowbray et al. 2002). Their diet consists of grasses, sedges, berries and seeds, including agricultural grain (Mowbray et al. 2002). Canada Geese are highly social birds that often gather and feed in flocks, with some flocks exceeding 1,000 birds (Mowbray et al. 2002).

Overharvest and habitat loss nearly extirpated the native breeding populations of Canada Geese in the United States following settlement in the 19th century (USFWS 2005). In the mid-1900s, State and federal agencies began efforts to restore historic breeding populations and to establish breeding populations of Canada Geese in new locations. Due to those restoration efforts, Canada geese now breed and reside throughout the year in every State, including Idaho (Mowbray et al. 2002, USFWS 2005).

Canada Geese are highly philopatric (propensity to return to) to natal areas (where they hatched). The majority of Canada Geese still nest in localized aggregations throughout Canada and Alaska and migrate annually to the conterminous United States in September to November to winter (migrant Canada geese). Today, Canada Geese can be found nesting in every State, primarily due to translocations and introductions since the 1940's. In recent years, numbers of Canada Geese that nest and/or reside predominantly within the conterminous United States (resident Canada Geese) have undergone dramatic population growth and have increased to levels that are increasingly coming into conflict with people and causing personal and public property damage.

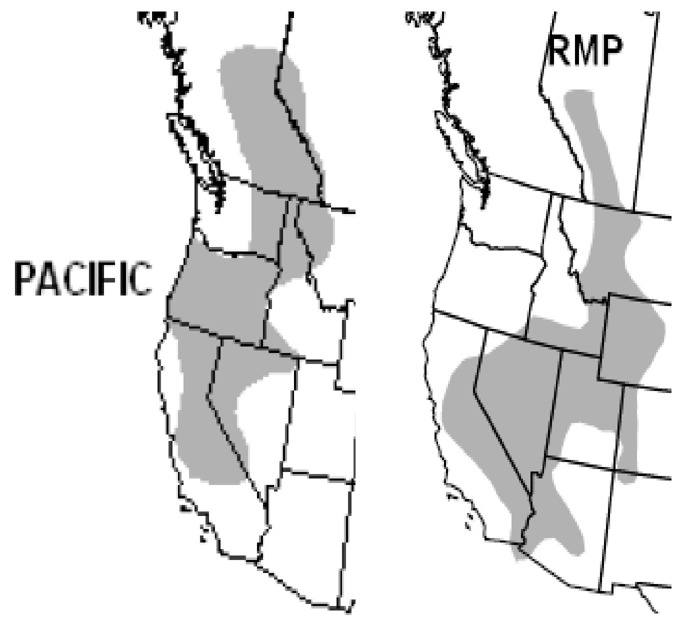
The division of the various subspecies of Canada Geese into management populations based on geographic distribution and philopatry to natal areas began in the 1950's (Hanson and Smith 1950). The delineation of populations by managers is due to the desire to apply management programs (i.e. habitat and harvest management) to specific geographic areas with the intent of managing the numerical abundance of the various populations independently from neighboring or overlapping groups. There are two major management populations of Canada Geese in Arizona: 1) the Rocky Mountain Population; and 2) the Pacific Population (USFWS 2005); both are part of the Pacific Flyway.

The Rocky Mountain Population (RMP) nests from southwestern Alberta southward through the intermountain regions of western Montana, Utah, Idaho, Nevada, Colorado and Wyoming (Krohn and

Bizeau 1980) (Figure 14). Canada Geese winter southward from Montana to southern California, Nevada and Arizona. This highly migratory population has grown from a breeding population of about 14,000 in 1970 (Krohn and Bizeau 1980) to over 130,000 (Subcommittee on Rocky Mountain Canada Geese 2000). The 2004 estimated spring population was 152,000 and has increased 3% annually over the last 10 years; however, mid-winter survey estimates have shown no apparent trend since 1995 (USFWS 2004). The index of breeding RMP geese for 2015 was 169,800 geese; RMP indices exhibited no trend from 2006 to 2015 (USFWS 2016*a*).

The Pacific Population (PP) nests from southern British Columbia southward and west of the Rockies in the States of Idaho, western Montana, Washington, Oregon, northern California and northwestern Nevada (Krohn and Bizeau 1980; Ball et al. 1981) (Figure 14). The PP is relatively non-migratory with most flocks wintering on or near their nesting areas. Reliable survey estimates are not available. The total PP goose index, based on breeding ground surveys in 2015, was 256,800, 59% higher than the 161,800 counted in 2014 (USFWS 2016*a*). There was no trend in the total PP index from 2006 to 2015 (USFWS 2016*a*).

Figure 14. Distribution map showing the Pacific and Rocky Mount Population (RMP) of Canada geese.



BBS data, which do not distinguish between the RMP and PP, indicate the number of Canada Geese in the Western BBS Region has increased by 4.96% annually since 1966 (Pardieck 2020). The trend from 2010 to 2019 BBS data, while still increasing, is not statistically significant. Data from the CBC indicate the population in Arizona has been relatively stable over the same time period. While both of these counts combine geese from the RMP and PP, the overall results are consistent with findings from the Waterfowl Population Status Report (USFWS 2016*a*). No current population estimates are available for the total number of Canada Geese in the State.

Under Alternative 1, all take, nest or egg destruction and relocation of Canada Geese by WS-Arizona would occur under depredation permits issued by the USFWS. With management authority for migratory birds, the USFWS can adjust allowed take through the regulated harvest season and under depredation permits and orders to meet population objectives. Therefore, the USFWS would authorize or restrict all take by WS-Arizona and would have the opportunity to consider cumulative take as part of population objectives for geese. WS-Arizona is authorized to take up to 200 Canada Geese annually under Alternative 1. WS-Arizona could also destroy active nests and relocate Canada Geese, in emergency situations, as part of an integrated approach to manage damage. WS-Arizona would not use nest destruction to decrease local population size (i.e., population of a specific pond where damage is occurring); WS-Arizona would destroy active nests (i.e., those nests containing eggs) in a localized area to inhibit nesting where the nests or the presence of nesting geese were causing damage or posing a threat of damage. Impacts due to nest destruction should have little adverse effect on the goose population in Arizona (Table 22). In general, nest destruction is considered non-lethal when conducted before eggs are laid. Additionally, geese are a long-lived species and have the ability to identify areas with regular human disturbance and low reproductive success, which causes them to relocate and nest elsewhere when confronted with repeated nest failure.

Although there may be reduced fecundity for the individual geese affected, nest removal as proposed in this EA (Table 22) would have no long-term effect on breeding adult geese. In fact, a study by Allan et al. (1995) show that treatment of 95% of all Canada Goose eggs (used in this analysis as a surrogate for nest destruction) each year would result in only a 25% reduction in the population over 10 years. The resident Canada Goose management FEIS developed by the USFWS concluded that a nest and egg depredation order would have minimal impacts on goose populations with only localized reductions in the number of geese occurring (USFWS 2005).

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, Mowbray et al. 2002). 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 geese (Conover and Chasko 1985, Hindman and Ferrigno 1990, Ankney 1996). 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). WS-Arizona 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 WS-Arizona take. WS in many other State Programs have removed hundreds of "resident" geese to resolve conflicts, but Arizona has removed relatively few considering the Arizona "resident" population. 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 impacts on their population, as the population is above the desired number in the RMS region (USFWS 2004, 2005, 2018b).

WS-Arizona has conducted BDM for resident Canada Geese, primarily in urban areas where they were causing excessive damage. However, several projects have also been done for migratory Canada/Cackling Geese, all but a few at airports where they were a wildlife hazard. Other projects involved human safety where nesting geese were attacking pedestrians/bicyclists when they neared the nest. WS-Arizona averaged the take of 24 from FY16 to FY20 (Table 8), a minimal number that would not impact the population. These mostly came from the "resident" population. WS has also hazed Canada Geese from FY16 to FY20, averaging 67 (Table 9) annually, primarily at airports.

Table 22 – Number of Canada Geese addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	35	25
2017	32	15
2018	55	68
2019	149	2
2020	65	11
TOTAL	**336**	**121**

Cumulative impacts of WS-Arizona's anticipated take and hunter harvest are not likely to be adverse. If WS-Arizona was to take the maximum anticipated, that would cumulatively add less than half a percent to the total annual take with hunter harvest. This indicates that Canada Geese are managed at level that WS-Arizona lethal take has no effect on the population.

Mallards, American Wigeons, and Other Ducks Biology and Population Impact Analysis
Found across most of North America, the Mallard is the most abundant and one of the most recognizable waterfowl species (Drilling et al. 2002). Mallards are often associated with wetlands, streams, ponds and lakes; however, Mallards are flexible and adaptable and can occur in a variety of habitats (Drilling et al. 2002) and are common visitors of city parks (Sibley 2003). An omnivorous and opportunistic duck, mallards will consume a wide variety of invertebrates, vegetation, seeds and human provided food (Drilling et al. 2002). With the exception of the mating season, mallards are highly social, congregating in flocks that can number in the thousands during the winter and during the spring and fall migrations (Drilling et al. 2002).

The waterfowl breeding population survey estimated mallard abundance throughout the flyway at 11.6 million in 2015, which was 51% above the long-term average of 7.7 million (USFWS 2016*a*). Across all BBS routes surveyed in the United States, the number of mallards observed annually has increased at an estimated rate of 1.56% annually since 1966 (Pardieck 2020). The number of mallards observed in Arizona during the BBS has not changed significantly since 1966 (Pardieck 2020). Since the mid-1980's the number of mallards observed in Arizona during the CBC has also been stable (NAS 2020). No current population estimates are available for the number of mallards in the State.

Like other waterfowl species, hunters can harvest mallards during a regulated season in the State. Olson (2016) estimated hunters harvested an average 40,941 ducks annually in the State between 2011 and 2016 (Table 21). From FY16 – FY20, 232 Mallards were killed by WS-Arizona and another 1,122 were dispersed (Table 23).

WS-Arizona took minimal numbers of ducks between FY16 and FY20. 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. Mallards (232) and American Coot (793) were the most commonly taken species by WS-Arizona. This is a minimal take compared to their population and hunter harvest. WS-Arizona take, in comparison to hunter harvest is a relatively small percentage of the combined take. It is doubtful that WS-Arizona will ever remove more than a few hundred mallards and fewer wigeons for BDM, but it is anticipated that WS-Arizona could potentially take 1,000 Mallards and 100 wigeons (Table 23). These numbers represent a minimal percentage of their populations and, if taken, would have an unnoticeable effect on their populations. In fact, WS could take increase these maximums at least ten-fold without having an impact on the population. WS has hazed many of these species, but did not capture and release any of these species. WS-Arizona activities had virtually no impact on their populations.

WS-Arizona has lethally taken minimal numbers of other ducks and will have minimal impact on any of these species. For example, WS-Arizona took minimal numbers of Cinnamon Teal, an average of 1 (Table 8). This species is a year-round resident in most appropriate habitat in Arizona. WS-Arizona had a maximum of 1 in FY20. This is negligible in terms of impact to the population. The same is true of the other ducks given in Table 8 and any others given in Appendix C: Tables C1 and C3 that WS-Arizona did not conduct work tasks for or take such as the Northern Pintail or merganser species (WS-Arizona expects that take would ever be minimal for these other species as reflected in none being taken in Table 8 not likely to exceed a few). WS-Arizona is more likely to haze most with taking only a minimal number (Table 9). The anticipated take for the other species of ducks is expected to be a maximum between 10 and 100. This level of take will be insignificant in terms of their respective populations. 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 H5N1 highly pathogenic avian influenza. 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 WS-Arizona harvesting these as has been the methods used to take samples in the last few years.

Table 23 – Number of Mallards addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	86	94
2017	47	15
2018	57	32
2019	294	19
2020	638	72
TOTAL	**1,122**	**232**

From the number of requests received for assistance previously and in anticipation of additional efforts to manage damage, an annual take of up to 200 mallards and/or nests with eggs by WS-Arizona could occur under this alternative. WS-Arizona anticipates the number of airports requesting assistance with managing threats associated with mallards on or near airport property will increase. All lethal take or destruction of nests/eggs by WS-Arizona would occur pursuant to depredation permits issued by the USFWS, which would ensure the USFWS had the opportunity to evaluate the cumulative take of mallards from all known sources when establishing population objectives. WS-Arizona would also continue to use non-lethal harassment methods to disperse mallards to alleviate damage. In addition, annual take by WS-Arizona would not limit the ability of hunters to harvest mallards in the State. WS-Arizona's proposed take would continue to be a limited component of the overall harvest of mallards occurring annually in the State and, therefore, have no impact on the population.

American Coot Biology and Population Impacts Analysis

American Coots are the most abundant and widely distributed species of rail in North America (Brisbin and Mowbray 2002). Coots are also likely one of the most recognizable rail species in the United States with their boisterous behaviors and vocalizations. Coots can be commonly found on a variety of freshwater wetlands near the shoreline often found foraging in cattails, bulrushes, and reeds (Brisbin and Mowbray 2002).

In Arizona, coots are a very common migrant and winter resident across the state with smaller numbers being observed in the state during the summer breeding season. Breeding populations of American Coots in Arizona indicated the number of coots observed in areas surveyed have shown an annual increasing trend estimated at 0.03% since 1966 (Pardieck 2020). As mentioned previously, the numbers of breeding coots in the state is relatively low and Arizona is probably on the extreme southern edge of the breeding range. Across all BBS routes surveyed in the United States, the number of coots observed has shown a stable trend since 1966, with a -0.79% annual decreasing trend occurring from 2010 through 2019 (Pardieck 2020). The average number of American Coots observed in areas surveyed during the CBC from 2010 through 2019 was 26,028 coots. The lowest number of coots observed during the CBC from 2010 through 2019 occurred in 2018, 18,697 coots were recorded. The highest number of coots recorded in the state during the CBC between 2010 through 2019 occurred in 2019 when 31,388 coots were observed (NAS 2020). Since 1966, the number of coots observed in areas surveyed has shown a cyclical pattern (NAS 2020).

American Coots are often identified as a possible conveyance for disease transmission between aquaculture ponds and facilities. Coots primarily feed on aquatic vascular plants and algae but their diet may consist of grains, aquatic invertebrates, and vertebrates, including fish (Brisbin and Mowbray 2002). Coots can also negatively affect fish farming operations when they directly consume fish feed. Coot competition for pelletized feed increases fish farming costs and decreases growth potential of commercial fish. The

USFWS has authorized the take of coots in the state to alleviate damage and threats. From FY 2016 through FY 2020, 28 American Coots were dispersed by WS-Arizona and 793 American Coots have been lethally taken by WS-Arizona to alleviate damage pursuant to depredation permits (Table 24).

Table 24 – Number of American Coots addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	26	577
2017	0	142
2018	0	57
2019	2	16
2020	0	1
TOTAL	**28**	**793**

Based on the number of requests received to alleviate the threat of damage associated with American Coots and the number of American Coots addressed previously to alleviate those threats, WS-Arizona could lethally remove up to 2,000 American Coots annually in the state to alleviate damage. Using the average number of American Coots observed in areas of the State surveyed from 2011 through 2020, WS-Arizona take of 2,000 coots would represent 15.0% of the average. Using the lowest number of American Coots in areas of the state surveyed from 2010 through 2019 during the CBC, WS' take of 2,000 coots would represent 11% of the 18,697 coots observed. Based on the limited take that could occur by WS-Arizona when compared to the number observed during the CBC and the permitting of the take by the USFWS, WS-Arizona's take would have no adverse effects on American Coot populations in the state.

As stated previously, CBC data is best interpreted as an indication of long-term trends in the number of birds observed wintering in the state and is not intended to represent population estimates of wintering bird populations. However, the information is presented in this analysis and compared to WS-Arizona's proposed take to indicate the low magnitude of take occurring by WS-Arizona when compared to the number of coots observed in the state during the CBC which would be considered a minimum population estimate given the survey parameters of the CBC and the survey only covering a small portion of the state.

Corvids

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 Arizona, ravens and crows. The Common Raven and American Crow are commonly found in Arizona and the species most likely to cause damage resulting in requests for assistance from WS-Arizona for damage to agriculture and protection of human health safety at airports. Common Ravens cause the most consistent problems (mostly livestock predation, but also other resources) and have been the focus of several BDM projects. American Crows have also been the focus of BDM projects because they often damage crops such as nut crops 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. The Chihuahuan Raven in southeastern Arizona also causes damage, but much less so. Jays have rarely caused problems in Arizona, but have the potential to do so. Jays include Steller's, Blue, Western Scrub, and Gray Jays and Clark's Nutcracker. WS-Arizona does not anticipate that lethal take for these species 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. WS-Arizona anticipates that it could take any of the corvids given in Appendix C: Table C1, but will likely be for the 2 species typically taken.

Common Raven Biology and Population Impacts Analysis

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 Arizona, Common Ravens, are found mostly from the Front Range and west, but in winter can be seen in eastern areas. In some parts of its range, most areas of the western United States, the Common Raven population has expanded rapidly to densities much higher than historical densities (Boarman 1993, Restani and Marzluff 2001). Coinciding with their population increase has been a dramatic increase in raven damage and programs to manage such. In other parts of its range, the population 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-Arizona have included eating livestock feed and feeding on grains, pecans, and other crops. Non-agricultural property damage complaints received by WS 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), and the Gunnison's Sage-Grouse. Thus, a reduction of ravens in some areas of the country is seen as desirable to protect the T&E species such as the Masked Bobwhite quail, a T&E species in Arizona.

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' Western Region 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). Recent BBS data (PIF 2020) estimated a population of 240,000 ravens in Arizona.

Table 25 – Number of Common Ravens addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take

2012	42	22
2013	130	5
2014	138	10
2015	135	14
2016	84	6
TOTAL	**529**	**57**

The numbers that might be taken by WS-Arizona under the proposed action or Alternative 1 are relatively low. WS-Arizona anticipates that it could potentially take up to an estimated 100 annually, especially because the population has increased, but the take between FY16 and FY20 would likely be more realistic, 57 (Table 25). Cumulatively, WS-Arizona anticipates that private individuals would take potentially up to 1,000, but USFWS recorded an average of 151 between 2006 and 2010. In total, potential cumulative take would represent about 10% of the expected annual mortality, but averaged 0.2% between FY16 and FY20. These numbers are well within normal mortality levels for this species. It should be noted that West Nile virus has been documented in Arizona 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. 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 has not been a significant limiting factor because the population has been increasing significantly ($P<0.05$) in Arizona from 1999 to 2009 at 2.2%/yr. and significantly ($P<0.05$) at 2.7% and 2.33%/year from 1966 to 2019 in Arizona and survey-wide (Pardieck 2020). WS-Arizona believes that the Common Raven population has not been impacted at the population level by WS-Arizona BDM and that take will continue to be very minor portion of their expected annual mortality.

Raptors (Hawks, Falcons, Owls and Vultures)

These birds of prey typically feed upon rodents, rabbits and fish, and some of these species play significant roles as scavengers. Some of these birds, such as eagles and large buteos, are large enough to feed upon smaller livestock, such as lambs and poultry. For this reason, they do cause depredation losses to some agricultural producers. Additionally, raptors defend their breeding territories during the breeding season, some species more aggressively than others. Occasionally, where these territories are near areas frequented by humans, some raptors may become aggressive towards humans. Some species of raptors also may be found hunting on airfields, which can create aviation safety risks that will threaten human health and safety. Further, some raptors chose to build nests or roost in human structures where their waste can cause property damage or be a health issue to humans. All raptors identified under this section, including turkey vultures, are federally protected under the MBTA and, therefore, are also State protected as migratory nongame birds.

WS-Arizona has received requests for assistance with 19 different species of raptors: Red-tailed Hawk, Swainson’s Hawk, American Kestrel, Osprey, Burrowing Owl, Common Barn Owl, Merlin, Short-eared Owl, Great Horned Owl, Black Vulture, Turkey Vulture, Northern Harrier, Ferruginous Hawk, Harris Hawk, Cooper’s Hawk, Peregrine Falcon, Prairie Falcon, Common Black Hawk and Zone-tailed Hawk. Technical assistance was provided for 1 of these (Black Vulture) (Table 2b) (e.g., recommendations to remove tree snags that may be used as a perching site for harassment). While operational assistance has been provided for 18 of these species (all but these species in which technical assistance was provide Tables 8 and 9), WS-Arizona has targeted 15 of these species (Red-tailed Hawk, Turkey Vulture, American Kestrel, Burrowing Owl, Northern Harrier, Ferruginous Hawk, Swainson’s Hawk, Harris Hawk, Merlin, Peregrine Falcon, Prairie Falcon, Common Barn Owl, Great Horned Owl, Osprey, and Cooper’s Hawk) for lethal removal between FY 2016 through FY 2020 (Table 8). In addition to the species that were lethally targeted, and additional 3 species were dispersed for BDM: Common Black Hawk, Short-eared Owl and the Zone-tailed Hawk (Table 9). Seven species were trapped and relocated away from the damage situations: Black Vulture, American Kestrel, Red-tailed Hawk, Prairie Falcon, Great Horned Owl, Burrowing Owl and the Common Barn Owl (Table 10).

Eight of these raptor species will be analyzed in this EA: Prairie Falcon, Swainson's Hawk, Red-tailed Hawk, American Kestrel, Northern Harrier, Turkey Vulture, Great Horned Owl and Ferruginous Hawk (Table 1). BBS data for these 8 raptors species analyzed in this EA indicate populations are stable or increasing except for the Prairie Falcon, American Kestrel, Great Horned Owl and Ferruginous Hawk. Both in Arizona and across the United States, the American Kestrel is in decline. The Great Horned Owl's population is increasing in the State, but decreasing throughout the nation, while the Prairie Falcon's population is decreasing in the State but increasing through the nation. BBS data is not recorded for the Northern Harrier for the State, but populations are decreasing throughout the United States. CBC observations are consistent with these trends for all but 4 species. Ferruginous Hawks show a slight decline in Arizona CBC counts and American Kestrel, Northern Harrier, and Great Horned Owl observations are stable in CBC counts in Arizona.

Based on anticipated increases in requests for WS-Arizona assistance with BDM, WS-Arizona could take up to 100 birds of the 8 species. However, considering WS-Arizona has taken minimal numbers of these species in the last five years, actual take in most years is likely to be far lower than this number. Damage caused by any of the 8 raptor species analyzed here will focus primarily on dispersing or relocating individuals causing damage. If the maximum number of birds were relocated and lethally removed, the combined damage management activities of WS-Arizona would affect less than 1% of the population for all species. During FY2016-FY2020 an average of 265 birds from the raptor guild were killed under USFWS depredation permits per year. All take (lethal removal, nest destruction or relocation) by WS-Arizona would occur pursuant to depredation permits issued by the USFWS, which would ensure the USFWS had the opportunity to evaluate the cumulative effects of take from all known sources. Because of this consultation and the minimal numbers of individual raptors that would be taken, WS-Arizona's activities under this alternative, combined with other legal lethal take under federal depredation permits, would not have adverse impacts on the species of raptors analyzed here.

Buteos (Hawks with Broad Wings). Some buteos kill poultry and are problems for some T&E and sensitive species such as the Lesser Prairie-Chicken. However, most work tasks associated with buteos are related to reducing wildlife hazards at airports. Arizona has 4 regularly occurring buteos or buteo-like hawks and 5 that are rare or accidental. Of these, 2 are species of concern (Appendix C-Tables C1 and C3), the Swainson's and Ferruginous Hawks. WS has lethally taken the 4 buteos in Arizona and conducted nonlethal hazing or trapping with relocation for them. The Swainson's Hawk and Red-tailed Hawk consistently caused most problems.

Red-tailed Hawk Biology and Population Impact Analysis

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.

Red-tailed Hawks are one of the most abundant raptors in the United States, expanding their range, often replacing Ferruginous and Swainson's Hawks in their respective ranges of 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. Red-tailed Hawks 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 WS-Arizona personnel for Red-tailed Hawks has been associated with airports. Of the raptors, they are struck frequently and cause significant damage to aircraft (Dolbeer and Wright 2008). 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), especially because they are abundant. BBS data indicates that the Red-tailed Hawk population from 1966 to 2019 increased significantly (P<0.05) at 1.42%/year survey-wide, and at 1.08%/year in Arizona (Pardieck 2020). WS-Arizona has conducted more work at airports for the Red-tailed Hawk than any other raptor. From FY16 to FY20, WS-Arizona annually averaged 895 (Table 2b) work tasks associated with them, took 381 lethally and dispersed an average of 1,103 (Table 26). For an estimated population of 100,000 in Arizona (PIF 2020), this would be an unnoticeable take, or a very minor impact. However, to illustrate the impact of WS-Arizona BDM on the Red-tailed Hawk and other buteos, life history information will be used as above for other species to determine an impact level where WS-Arizona 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 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.

Table 26 – Number of Red-tailed Hawks addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	147	24
2017	111	26
2018	227	94
2019	250	96
2020	368	141
TOTAL	**1,103**	**381**

To consider the impacts of WS, the Red-tailed Hawk population in Arizona has been estimated at 100,000 (PIF 2020). Females were not found to breed until they were mostly 3 years old, with some 2 year olds breeding. If 60% of the population were adult and 80% of the estimated adults bred (13,000 breeding females) with females averaging 2.5 eggs that fledge 1.3 fledglings/nest (Preston and Beane 2009), annual production could be conservatively estimated at 17,000. Of this, it would be unlikely for an impact to occur until cumulative take by WS-Arizona surpassed 50% of the expected annual mortality for a stable population or 8,500 Red-tailed Hawks (a level equal to 15% of the breeding population) which would possibly be a low impact on this species. Obviously, an average of 76 taken lethally by WS-Arizona from FY16 to FY20 (Table 26) is a minor percentage, less than 1% of the expected annual mortality. Thus, WS-Arizona's impact on the Red-tailed Hawk population has been minimal. WS-Arizona anticipates that cumulative take by WS-Arizona will not surpass 5% of the expected annual mortality.

Swainson's hawk Biology and Population Impact Analysis

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, especially 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 an earlier negative trend in BBS data, the Swainson's Hawk was listed by NAS (2007) on their Watchlist. Swainson's Hawks are common in Arizona only during the breeding season as they 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 WS-Arizona (ave. 493 annually from FY16 to FY20, Table 2b) 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 201 has a significant ($P<0.05$) increasing trend in Arizona at 0.06%/year, but a significant ($P<0.05$) survey-wide at 0.72%/year. This suggests that habitat conditions and possibly other factors enabled them to increase.

To consider the impacts of WS-Arizona, the Swainson's Hawk population in Arizona has been estimated at 14,000 (PIF 2020). Reproduction has been found to be highly variable, mostly influenced by prey availability. Females were not found to breed until they were usually 3 years old, but some bred at 2 year old. If 60% of the population were adults and 80% of the estimated adults bred (13,000 breeding females) with females averaging 2.4 eggs with 71% fledging (Bechard et al. 2010), annual production could be conservatively estimated at 22,000. However, in years of poor prey availability, production can drop considerably and fledgling success could be as low as 31% fledging, but more realistically about 1 per successful nest or about 42% of the eggs would have a successful fledgling (Bechard et al. 2010). Thus, production would equal the number of breeding females or 13,000. Of this, WS-Arizona took 18 Swainson's Hawks from FY16 to FY20, less than 1% of the expected annual mortality (Table 27). This level of take would have no noticeable impact on the population. WS-Arizona could take hundreds to a few thousand before a noticeable impact would likely begin to occur, but WS-Arizona only anticipates taking a maximum of 25 or less than 1% of the expected annual mortality. Thus, the cumulative impact was minimal at less than 1% of the expected annual mortality which was calculated for years with low prey availability. Cumulative impact is anticipated to be no more than 5% of the expected annual mortality. WS-Arizona lethally removed 52 and hazed 155 (Table 27) Swainson's Hawks at airports in Arizona with no known resulting impacts on their population.

Table 27 – Number of Swainson's Hawks addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	9	7
2017	1	0
2018	29	16
2019	57	15
2020	59	14

TOTAL	155	52

Ferruginous Hawk Biology and Population Impact Analysis

The Ferruginous Hawk is an open-country species that inhabits grasslands, some shrublands, and deserts, avoiding forests and habitats recently altered by cultivation. Their primary prey includes rabbits and rodents. In years when prey is down, production appears to also go down (Bechard and Schmutz 1995). All work tasks conducted by WS-Arizona (ave. 79 annually from FY16 to FY20) have been associated with Ferruginous Hawks on airports and reducing their hazards (Table 2b). BBS data indicates that the Ferruginous Hawk population from 1966 to 2019 has a significant (P<0.05) survey-wide at 0.6%/year (Pardieck 2020). This suggests that habitat conditions and possibly other factors enabled them to increase.

Females breed when they are two years old, have an average of 2.8 eggs and fledge an average of 2.2 nestlings (Bechard and Schmutz 1995). An average of 17% of pairs, ranging from 5% to 40%, does not breed in a given season which depends mostly on prey availability (Bechard and Schmutz 1995). WS-Arizona took 9 Ferruginous Hawks from FY16 to FY20 with a high of 4 in FY19 or 3.6% of the expected annual mortality (Table 28). The mortality from WS-Arizona could increase at least five-fold in years with poor prey-base before the impact would increase to a moderate magnitude.

Table 28 – Number of Ferruginous Hawks addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	9	0
2017	1	2
2018	29	1
2019	57	4
2020	59	2
TOTAL	155	9

Northern Harrier Biology and Population Impact Analysis

Arizona regularly hosts the Northern Harrier statewide. The Northern Harrier primarily 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 and hazardous to aircraft. In Arizona, the Northern Harrier caused problems from FY16 to FY20 with an annual average of 751 work tasks associated with them (Table 2b).

The Northern Harrier has shown a significant (P<0.05) negative trend BBS survey-wide at -1.21%/year and no information is reported for Arizona from 1966 to 2019 (Pardieck 2020). 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 (Smith et al. 2011). Recent data from PIF (2020) gives an estimated population of 1,400 harriers in Arizona. CBC data (NAS 2020) shows a stable population for the State of Arizona without using any detectability factors. Thus, Northern Harriers can be found in Arizona year-round in at least similar numbers (probably more in winter), though some probably migrate out of the State, while others migrate into the State from northern areas. WS-Arizona has taken 45 Northern Harriers from FY16 to FY20 with a high of 13 in FY20 (Table 29). The cumulative impact in Arizona has averaged 9 from FY16 to FY20 (0.1% of the breeding population) Thus, the impact from WS-Arizona would be >1% of the breeding population in Arizona, a minimal impact to the population.

Table 29 – Number of Northern Harriers addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	116	3
2017	150	9
2018	143	10
2019	124	10
2020	166	13
TOTAL	**699**	**45**

Turkey Vulture Biology and Population Impact Analysis

Turkey Vultures can be found throughout Mexico, across most of the United States, and along the southern tier of Canada (Wilbur 1983, Rabenhold and Decker 1989). Turkey vultures can be found throughout the year in Arizona (Kirk and Mossman 1998). Turkey Vultures can be found in virtually all habitats but are most abundant where forested areas are interrupted by open land (Brauning 1992). Turkey Vultures nest on the ground in thickets, stumps, hollow logs, or abandoned buildings (Walsh et al. 1999). Turkey Vultures often roost in large groups near homes or other buildings where they can cause property damage from droppings or by pulling and tearing shingles. Turkey Vultures prefer carrion but will eat virtually anything, including insects, fish, tadpoles, decayed fruit, pumpkins, and recently hatched heron and ibis chicks (Brauning 1992).

The statewide population of Turkey Vultures is currently unknown but the breeding population has been estimated at 360,000 vultures based on BBS data (PIF 2020). Trending data from the BBS indicates the number of Turkey Vultures observed along BBS routes in the state have shown an increasing trend estimated at 2.54% annually from 1966 through 2019 (Pardieck 2020). The numbers of Turkey Vultures observed in areas surveyed during the CBC in the state are also showing an increasing trend (NAS 2020).

The take of Turkey Vultures is also prohibited under the MBTA except through the issuance of depredation permits by the USFWS. The number of Turkey Vultures addressed by WS-Arizona to alleviate damage is shown in Table 30. Nearly 93% of the Turkey Vultures addressed by WS-Arizona from FY 2016 through FY 2020 have been addressed using non-lethal harassment methods. From FY 2016 through FY 2020, 918 Turkey Vultures have been dispersed using non-lethal methods while WS-Arizona has lethally taken 73 Turkey Vultures in the state to alleviate damage.

Table 30 – Turkey Vulture addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2012	160	13
2013	106	2
2014	156	14
2015	205	21
2016	291	23
TOTAL	**918**	**73**

Based on trending data from the BBS and the CBC, the number of Turkey Vultures present in the state continues to increase annually. Based on current population trends for Turkey Vultures in the state, the number of requests for assistance with managing damage associated with Turkey Vultures and the number of vultures that will be addressed to meet those requests is likely to increase. Therefore, based on previous requests for assistance and in anticipation of an increasing number of requests and the subsequent need to address more vultures, up to 30 Turkey Vultures could be lethally taken annually by WS-Arizona to alleviate damage and threats.

If up to 30 Turkey Vultures were taken annually by WS-Arizona, WS-Arizona's take would represent >0.01% of the estimated statewide breeding population of Turkey Vultures estimated at 360,000 vultures if the population remains at least stable. The cumulative take of vultures would represent >0.01% of the statewide breeding population if the population remains at least stable. Thus, the impact from WS-Arizona would be >1% of the breeding population in Arizona, a minimal impact to the population.

Falcons. 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 Arizona. Most are adapted to capture birds or insects while flying. Arizona commonly hosts 5 falcons (American Kestrel, Merlin (in winter), Crested Caracara and Prairie and Peregrine Falcons). Most, in general, cause few problems with the exception that occasionally the larger falcons will occasionally take poultry. These species also take birds at bird feeders, a common complaint (usually handled by telling people to quit feeding birds for a time). Falcons are adapted to hunting in open areas causing airstrike hazards. Falcons were responsible for 38% of all raptor strikes and 5% of all known bird species strikes recorded by FAA from 1990 to 2007 with the American Kestrel responsible for 88% of the falcon strikes (Dolbeer and Wright 2018). In Arizona, from FY11 to FY20, American Kestrels caused 37 strikes, Merlin 1, Peregrine Falcons 5, 2 and unknown falcons 2 (Appendix D).

American Kestrel Biology and Population Impact Analysis

American Kestrels are the smallest and most common North American falcon. Their range includes most of North America, except the far northern portions of Alaska and Canada (Smallwood and Bird 2002). Kestrels are commonly found inhabiting open areas with short ground vegetation where it searches for prey from elevated perches and by hovering above the ground. Prey consists of arthropods and small vertebrates (Smallwood and Bird 2002). Kestrels are often attracted to areas of human activities because of the open areas created and the numerous perching sites (Smallwood and Bird 2002). Kestrels are cavity nesters, using the excavated holes of woodpeckers and other natural cavities in trees (Smallwood and Bird 2002). The availability of suitable cavities is often a limiting factor in parts of the breeding range of the kestrel (Smallwood and Bird 2002).

American Kestrels observed in areas observed during the BBS are showing a slightly declining trend in Arizona estimated at -1.59% annually since 1966 (Pardieck 2020). Kestrels observed on BBS routes in the United States have also shown a declining trend estimated at -0.88% annually since 1966 with the number of kestrels (Pardieck 2020). The breeding population of kestrels in Arizona has been estimated at 110,000 birds with the population across the United States estimated at nearly 1.7 million individuals (PIF 2020). Trend data available from CBC also indicates a general increase in the number of kestrels wintering in Arizona (NAS 2020).

Most requests for assistance associated with kestrels occur at airports where kestrels pose a strike risks to aircraft. As shown in Table 31, WS-Arizona has addressed 1,782 kestrels between FY 2016 and FY 2020 using non-lethal dispersal methods. In addition, WS-Arizona has live-captured and translocated 51 kestrels to alleviate strike risks in the state. WS-Arizona has also addressed kestrels using lethal methods to alleviate damage. Between FY 2016 and FY 2020, WS-Arizona removed 492 kestrels using lethal methods, with the highest take occurring in FY 2018.

Table 31 – Number of American Kestrels addressed by WS-Arizona, FY 2016 - FY 2020

Fiscal Year	Dispersed	Translocated	Take
2016	158	8	48
2017	183	0	60
2018	351	7	157

2019	181	5	133
2020	909	31	94
TOTAL	**1,782**	**51**	**492**

Based on the number of kestrels addressed previously and based on additional efforts that could occur, WS could live-capture and translocated up to 100 kestrels annually under the proposed action alternative. In addition, WS could lethally remove up to 200 kestrels annually to alleviate requests for assistance.

As stated previously, the breeding population in the state has been estimated at 110,000 kestrels (PIF 2020), which would likely represent the breeding population. Based on the best available population estimates, if WS-Arizona took up to 200 American Kestrels this would represent less than 0.01% of the breeding population of kestrels in the state estimated at 110,000 birds. However, most lethal removal activities would likely occur during the winter when the statewide population would likely be greater than 110,000 kestrels because populations would be augmented by northern migrants arriving in the state. Therefore, the proposed take would likely be a lower proportion of the total population present in the state during the winter. Because the southeastern subspecies breeds in the northern portion of the state, the proportion of the southeastern subspecies that migrates further southward after the breeding season to areas further south in the state is unknown.

Prairie Falcon Biology and Population Impact Analysis

Prairie Falcons breed in open country throughout the West wherever they can find bluffs and cliffs to nest on, including in alpine habitat to about 11,000 feet. Breeding habitats include grasslands, shrubsteppe desert, areas of mixed shrubs and grasslands, or alpine tundra that supports abundant ground squirrels populations. Breeding birds sometimes forage in agriculture fields. The majority of Prairie Falcons spend the winter in the Great Plains and Great Basin, in habitat that supports Horned Larks and Western Meadowlarks that make up much of the wintertime diet. This includes grasslands, sage scrub, dry-farmed wheat fields. Irrigated cropland, and cattle feedlots, where the falcons also prey on European Starlings (Steenhof 2013).

During the 1950s, populations of Prairie Falcons in North America began to experience sharp declines, primarily attributed to secondary hazards associated with pesticide use. Monitoring efforts continue to show increasing populations in their historical ranges (White et al. 2002, Green et al. 2006). The number of Prairie Falcons observed in all areas surveyed during the BBS have shown an increasing trend since 1966 estimated at 1.05% annually, with a 2.15% annual increase occurring from 1966 through 2019 (Pardieck 2020). The number of Prairie Falcons observed in Arizona during the BBS have shown increasing trend since 1966 estimated at 0.76% annually (Pardieck 2020). The number of Prairie Falcons observed in Arizona in areas surveyed during the CBC has shown a generally stable to slightly decreasing trend since 1966 (NAS 2020).

Requests for assistance associated with Prairie Falcons would likely occur at airports where falcons posed a direct strike risk to aircraft and a threat to human safety during the migration periods. As shown in Table 32, WS-Arizona has addressed 136 Prairie Falcons between FY 2016 and FY 2020, all of which were dispersed using non-lethal harassment methods. However, if populations of Prairie Falcons were to increase and aircraft strike hazards associated with falcons continue to occur, WS-Arizona could be requested to lethally remove falcons to prevent aircraft strikes when non-lethal methods were ineffective at dispersing falcons and reducing strike risks. In most cases, non-lethal harassment methods or live-capture and translocation are effective at dispersing falcons from areas where aircraft strikes could occur. Therefore, WS-Arizona anticipates the need to lethally remove falcons to reduce aircraft strike risks would occur infrequently. Based on the unlikelihood for the need to lethally remove falcons to alleviate strike risks, WS-Arizona anticipates that one falcon could be lethally removed over a five-year period to alleviate strike risks. Lethal removal of one falcon per five-year period would only occur if authorized by the USFWS through the issuance of a depredation permit.

Table 32 – Number of Prairie Falcons addressed by WS-Arizona, FY 2016 - FY 2020

Fiscal Year	Dispersed	Translocated	Take
2016	35	0	0
2017	1	0	0
2018	30	0	0
2019	45	0	3
2020	21	1	0
TOTAL	**132**	**1**	**3**

The potential lethal removal of one Prairie Falcon every five years would not reach a magnitude where adverse effects would occur to the species' population. If one falcon were removed, the removal would represent 1.5% of the average number of falcons observed in areas surveyed during the CBC from 1966 through 2019. As stated previously, the data available from the CBC is intended to provide long-term trending information. However, the information on the actual number of Prairie Falcons observed in areas surveyed during the CBC conducted in the state is provided here to evaluate the magnitude of WS-Arizona's proposed take on the number of Prairie Falcons that could be present in the state. The number of Prairie Falcons observed by surveyors during the CBC would be considered a minimum estimate because not all areas of the state are surveyed during the CBC.

WS-Arizona would continue to address Prairie Falcons using non-lethal methods and would only use lethal methods if non-lethal methods were ineffective at reducing strike risks. As stated in Chapter 1, if this alternative was selected, WS-Arizona would monitor activities to ensure those activities occurred within the parameters evaluated in the EA. If the need to lethally remove Prairie Falcons became more frequent or involved more than one individual every five years, WS-Arizona would re-evaluate activities associated with falcons through a review of the EA and would conduct the appropriate analysis pursuant to the NEPA. In addition, the permitting of the lethal removal by the USFWS would also ensure any lethal removal conducted by WS-Arizona occurred within allowable limits to meet population objectives for the species.

Owls. Arizona is home to 12 species of owls (Tables C-1 and C-2) with 5 species that have a high potential to be strike hazards at airports, the Great Horned, Common Barn, Short-eared, Long-eared, and Burrowing Owls (Table C-1). Additionally, 1 species of owls have been accidentally found or are rare in Arizona (Table C-3). The Great Horned Owl is the primary species that causes damage to poultry and property. The Common Barn Owl causes damage primarily to structures where they nest; they nest in cracks and crevices often in structures such as barns. The other 3 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, but often use woodlands or tall grasslands for nesting and roosting. However, the Burrowing Owl lives among burrowing rodents where it will occupy a burrow which can be within an air operating area. In Arizona from FY07 to FY16, FAA (2018) documented 29 aircraft strikes with owls: 2 Great Horned Owls, 22 Burrowing Owls, 1 Short-eared Owls, 2 Barn Owls, 1 Western Screech-Owl, and 1 unidentified species of owls. All of the damaging species of owls are found year-round in Arizona and the Burrowing Owl only breeds in Arizona and migrates to the southern U.S. and Mexico for winter. PIF (2019) gives breeding populations in the state of 18,000 Burrowing Owls, 14,000 Great Horned, 9,000 Barn, and no Short-eared or Long-eared Owls. Long-eared Owls are highly cryptic during daytime hours and were not detected on any BBS counts from 2006 - 2015 in Arizona. Wiggins et. al. (2006) states that Short-eared Owl populations are difficult to determine.

Great Horned Owl Biology and Population Impact Analysis

Great Horned Owls are found all across North America and usually gravitate towards secondary-growth woodlands, swamps, orchards, and agriculture areas, but they are also found in a wide variety of deciduous, coniferous or mixed forests. Their home range usually includes some open habitat – such as fields, wetlands, pastures, or croplands – as well as forest. In deserts, they use cliffs or juniper for nesting. Great Horned Owls are also fairly common in wooded parks, suburban areas, and even cities (Artuso et. al 2013).

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. 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. Great Horned Owl populations rise and fall in cycles along with prey populations. The number of Great Horned Owls observed in all areas surveyed during the BBS have shown a decreasing trend since 1966 estimated at -0.81% annually (Pardieck 2020). The number of Great Horned Owls observed in Arizona during the BBS have shown increasing trend since 1966 estimated at 1.18% annually (Pardieck 2020). The number of Great Horned Owls observed in Arizona in areas surveyed during the CBC has shown a generally stable trend since 1966 (NAS 2020).

Requests for assistance associated with Great Horned Owls would likely occur at airports where owls posed a direct strike risk to aircraft and a threat to human safety during the migration periods. As shown in Table 33, WS-Arizona has addressed 16 Great Horned Owls between FY 2016 and FY 2020, all of which were live trapped and translocated using non-lethal harassment methods. However, if populations of Great Horned Owls were to increase and aircraft strike hazards associated with owls continue to occur, WS-Arizona could be requested to lethally remove owls to prevent aircraft strikes when non-lethal methods were ineffective at dispersing falcons and reducing strike risks. In most cases, non-lethal harassment methods or live-capture and translocation are effective at dispersing owls from areas where aircraft strikes could occur. Therefore, WS-Arizona anticipates the need to lethally remove owls to reduce aircraft strike risks would occur infrequently. Based on the unlikelihood for the need to lethally remove owls to alleviate strike risks, WS-Arizona anticipates that one owls could be lethally removed annually to alleviate strike risks.

Table 33 – Number of Great Horned Owls addressed by WS-Arizona, FY 2016 - FY 2020

Fiscal Year	Dispersed	Translocated	Take
2016	0	1	0
2017	0	3	1
2018	0	0	0
2019	0	0	3
2020	3	4	1
TOTAL	**3**	**8**	**5**

Based on the number of owls addressed previously and based on additional efforts that could occur, WS-Arizona could live-capture and translocate up to 10 owls annually under the proposed action alternative. In addition, WS could lethally remove up to 10 owls annually to alleviate requests for assistance.

The breeding population of Great Horned Owls in the state has been estimated at 180,000 owls (PIF 2020), which would likely represent the breeding population. Based on the best available population estimates, WS-Arizona took 1 Great Horned Owl would represent >0.01% of the breeding population of owls in the state estimated at 140,000 birds. However, most lethal removal activities would likely occur during the winter when the statewide population would likely be greater than 180,000 owls because populations would be augmented by northern migrants arriving in the state. Therefore, the proposed take would likely be a lower proportion of the total population present in the state during the winter.

Shorebirds

Arizona hosts 25 species of shorebirds regularly, 21 infrequently (Appendix C: Table C1 and C3). Shorebirds are mostly only a concern at airports as they are commonly struck by aircraft. Five strikes were reported at Arizona airports with shorebirds from FY11 to FY20 (Appendix D). Most shorebirds are hazed from airfields, but some such as the Upland Plover and Killdeer are difficult to haze out of an area because they will nest in grassland habitat such as that found at airports. Therefore, some are taken lethally. WS-Arizona at times will monitor shorebirds for disease, primarily monitoring for human pathogens such as HP H5N1 AI. Samples are often collected from shorebirds because they often breed in areas where they can intermingle with birds from other regions, 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 a disease such as HP H5N1 AI had been discovered (Asia). It is known that many diseases can spread from infected wild birds to other animals and humans through contact. As a result of this intermingling with birds of other regions of the world, samples were collected from species most likely to come into contact with other birds from around the world. Of high interest were many species of shorebirds because they breed in the arctic where they have that opportunity. Most disease work, though, 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 FY16 to FY20, WS-Arizona lethally took four species of shorebirds (Table 8) and hazed 9 species at airports (Table 9).

Of the shorebirds, only the Killdeer has been taken (Table 8) and hazed (Table 9) to any extent at airports in Arizona, but Greater Yellowlegs, Long-billed Curlews, Long-billed Dowitcher, Whimbrels, Willet, Black-necked Stilt, Western Sandpiper, and the Least Sandpiper have also been hazed at airports (Table 9). With the exception of these 5 species, WS-Arizona anticipates that no more than 50 shorebirds of any of the other regularly occurring species will be targeted with lethal methods. An occasional species accidental in Arizona may also be taken. From FY16 to FY20, WS-Arizona did not surpass this. This is a minimal take and would not impact any of these species populations. To determine impacts, it must be noted that the BBS does not quantify shorebird populations because they are difficult to assess with point counts such as the BBS. Morrison et al. (2006) used a variety of sources to determine populations of shorebirds in North America and these will be used to determine the impacts, at the national level since there is no estimate for Arizona. WS nationally has not impacted any species at a level higher than 0.1% of their population with the exception of Killdeer (0.13%), a species commonly controlled at airports because they prefer the habitat found at airports and are a significant strike risk.

Killdeer Biology and Population Impact Analysis

Killdeer occur over much of North America from the Gulf of Alaska southward throughout the United States with their range extending from the Atlantic coast to the Pacific coast (Hayman et. al. 1986, Jackson and Jackson 2000). Although Killdeer are technically in the family of shorebirds, they are unusual shorebirds in that they often nest and live far from water. Killdeer are commonly found in a variety of open areas, even concrete or asphalt parking lots at shopping malls, as well as fields and beaches, ponds, lakes, roadside ditches, mudflats, airports, pastures, and gravel roads and levees but are seldom seen in large flocks.

Distinguishing characteristics include a dark, double banded breast, with the top band completely encircling the upper body/breast. Another band is located at the head, resembling a mask absent of the facial portion. The band is continuous, thinning while going across the face along the forehead region and above the bill, and thickening at the supercilium; extending around the eye and onward around the back of the head. Plumage is relatively absent of complexity with the exception of a vividly colored, reddish-orange rump that is visible during flight and behavioral displays. The rest the body consists of a grayish-brown coloration along the dorsal side, crown, and nape, while the ventral region is white. Sex characteristics are difficult to determine because Killdeer are essentially monomorphic. The clutch of up to four eggs is laid in a ground scrape in open habitats (Leck 1984). Based on broad-scale surveys, the United States Shorebird Conservation Plan estimated the population of Killdeer in the United States to be approximately 2 million birds in 2001 (Brown et al. 2001).

In Arizona, the number of Killdeer observed during the BBS has shown declining trends since 1966 estimated at -1.83% (Pardieck 2020). Currently, no breeding population data is available for Killdeer in Arizona. The average number of Killdeer observed in areas surveyed during the CBC from 2010 through 2019 was 1,776 Killdeer. The lowest number of Killdeer observed during the CBC from 2010 through 2019 occurred in 2018 when 993 Killdeer were recorded. The highest number of Killdeer recorded in the state during the CBC from 2010 through 2019 occurred in 2009 and 2014 when 2,531 Killdeer were observed (NAS 2020).

Requests for assistance associated with Killdeer occur primarily at airports in the state. As the number of airports requesting assistance from WS-Arizona to manage damage and threats associated with Killdeer increases, the number of Killdeer lethally taken annually is also likely to increase when lethal methods are deemed appropriate for use to resolve damage and threats. From FY 2016 through FY 2020, WS-Arizona has lethally taken 179 Killdeer in the state at airports to reduce damages and threats associated with aircraft striking Killdeer. The highest level of Killdeer take by WS-Arizona occurred in FY 2020 when 53 Killdeer were lethally taken (Table 34). In addition, WS-Arizona has employed non-lethal methods at airports in the state to harass 1,143 Killdeer from FY 2016 through FY 2020. Of those Killdeer addressed by WS-Arizona from FY 2016 through FY 2020, nearly 86% were addressed using non-lethal dispersal methods and all lethal take by WS-Arizona in the state occurred pursuant to depredation permits issued by the USFWS.

Table 34 – Number of Killdeer addressed by WS-Arizona, FY 2016 - FY 2020

Fiscal Year	Dispersed	Take
2016	308	43
2017	160	25
2018	175	28
2019	216	30
2020	284	53
TOTAL	**1,143**	**179**

To address an increasing number of requests for assistance, up to 100 Killdeer could be lethally taken by WS-Arizona annually under the proposed action. WS-Arizona's take of 100 Killdeer would represent 0.04% of the largest number of Killdeer observed in areas surveyed during the CBC in the state from 2010 through 2019. Using the lowest number of CBC observations of 993 Killdeer, WS-Arizona's take of 100 Killdeer would represent 0.1% of the lowest number observed. Based on broad-scale surveys, the United States Shorebird Conservation Plan estimated the population of Killdeer in the United States to be approximately 2 million birds in 2001 (Brown et al. 2001). WS-Arizona's take of up to 100 Killdeer would only represent >0.01% of the estimated United States population. The permitting of the take of Killdeer by the USFWS pursuant to the MBTA ensures take is considered as part of trending and population data available for Killdeer and will not adversely affect the population. WS will continue to assist airport personnel in identifying habitat and other attractants to Killdeer on airport property. Killdeer will continue to be addressed using primarily non-lethal harassment and dispersal methods.

Wading Birds

Nine species of wading birds, herons, egrets, and bitterns are regularly found in Arizona with an additional 7 that are rare or accidental including the Roseate Spoonbill and Reddish Egret in addition to the others (Appendix C: Tables C1 and C3). The most common requests for assistance involving these species in Arizona are from airports to reduce their strikes. Wading birds were responsible for 14 strikes at Arizona airports from FY11 to FY20 with 7.14% of those causing damage (Appendix D). Wading birds also cause damage at aquaculture facilities (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 may require the take of some individuals to reinforce hazing efforts, but often do not involve the take of any. Thus, the impact to these species populations is typically negligible under the proposed action. WS-Arizona conducts minimal BDM for wading bird problems. To illustrate the scope of the conflicts with wading birds in Arizona, WS-Arizona received an average of 1,247 work tasks annually, with most for Great Egrets, from FY16 to FY20 (Table 2a).

WS-Arizona anticipates that some wading bird species in Appendix C: Table C1 will be taken lethally. This would likely be conducted for a significant problem that developed at an airport or a significant urban roost that created a nuisance or health and safety concerns. Lethal shooting is generally used to reinforce harassment methods and is conducted at airports where very damaging strikes could occur or in residential areas where a roost has formed. Urban roosts are mostly relocated prior to nesting using hazing devices (lasers have proven successful in some situations). WS-Arizona believes that few wading birds will ever be taken and that WS-Arizona 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.

Great Blue Heron Biology and Population Impact Analysis

The head of the Great Blue Heron is largely white with dark under parts and the body is primarily bluish in color. Great Blue Herons are a common widespread wading bird that can be found throughout most of North America. Herons can be found throughout the year in most of the United States, including Arizona (Vennesland and Butler 2011). Great Blue Herons are most often located in freshwater and brackish marshes, lakes, rivers, and lagoons (MANEM Region Waterbird Working Group 2006). Herons are known to nest in trees, rock ledges, and coastal cliffs and may travel up to 30 km to forage with a mean forage distance of 2.6 to 6.5 km (MANEM Region Waterbird Working Group 2006). Great Blue Herons feed mainly on fish but they are also known to capture invertebrates, amphibians, reptiles, birds, and mammals (Vennesland and Butler 2011).

In Arizona, herons observed on BBS routes are showing an upward trend estimated at 0.23% annually from 1966 through 2019 (Pardieck 2020). The National Audubon Society did not consistently observe herons overwintering in Arizona from 2010 to 2019 (NAS 2020). One hundred and twenty-four Great Blue Herons were observed from 2015 to 2019. However, it is known that Great Blue Herons overwinter in the Southern part of the state. The data available from the CBC is intended to provide long-term trending information. However, the information on the actual number of herons observed in areas surveyed during the CBC conducted in the state is provided here to evaluate the magnitude of WS-Arizona's proposed take on the number of herons that could be present in the state. The number of herons observed by surveyors during the CBC would be considered minimum estimates because not all areas of the state are surveyed during the CBC. However, the Arizona Field Orthinoligists survey considerable numbers of herons overwintering in the urban areas of Maricopa County. Arizona Field Orthinologist provide survey data from the Greater Phoenix Area Waterbird Survey.

To alleviate damage, WS-Arizona has lethally removed 50 Great Blue Herons in Arizona and employed non-lethal methods to disperse 312 Great Blue Herons from FY 2016 through FY 2020 (Table 35). Based on previous requests for assistance, WS-Arizona could lethally remove up to 30 Great Blue Herons per year in Arizona to alleviate damage and threats of damage.

The number of Great Blue Herons present in Arizona at any given time likely fluctuates throughout the year. Take of up to 30 herons by WS to alleviated damage would have minimal impact to the current population.

Table 35 – Number of Great Blue Herons addressed by WS-Arizona, FY 2016 - FY 2020

Fiscal Year	Dispersed	Take
2016	34	8
2017	24	1
2018	53	6
2019	83	11
2020	118	24
TOTAL	**312**	**50**

Great Egret Biology and Population Impact Analysis

Great Egrets are large white birds of intermediate size between the larger herons and smaller egrets commonly found in the United States (McCrimmon et al. 2011). Great Egrets can be found in freshwater, estuarine, and marine wetlands (McCrimmon et al. 2011). During the breeding season they live in colonies in the trees or shrubs with other waterbirds, ranging across the southeastern states and in scattered spots throughout the rest of the U.S, and southern Canada. The coloniesare located on lakes, ponds, marshes, estuaries, impoundments, and islands. Great Egrets use similar habitats for migration stopover sites and wintering grounds. They hunt marshes, swamps, streams, rivers, ponds, lakes, impoundments, lagoons, tidal flats, canals, ditches, fish-rearing ponds, flooded farm fields, and sometimes upland habitats (McCrimmon 2011).

The overharvest of Great Egrets that occurred primarily from 1870 to 1910 for plumes and the millinery trade reduced the population in North America by >95% (McCrimmon et al. 2011). During surveys conducted in 1911-1912, the total known nesting population of Great Egrets was estimated at 1,000 to 1,500 breeding pairs in 13 colonies in seven states (McCrimmon et al. 2011). Following regulations that ended plume-hunting, Great Egret populations rapidly recovered with increases reported in the late 1920s and 1930s (McCrimmon et al. 2011).

In Arizona, the numbers of Great Egrets observed across BBS routes are showing an increasing trend estimated at 1.49% annually since 1966 (Pardieck 2020). The highest number of egrets recorded in the state during the CBC between 2006 through 2015 occurred in 2017 when 1,163 egrets were observed (NAS 2020). Overall, the number of Great Egrets observed in areas of the state surveyed during the CBC has shown a slightly decreasing trend (NAS 2020).

Similar to other waterbirds addressed in this EA, Great Egrets can cause damage to aquaculture resources by consuming aquatic wildlife raised for sale and from the threats associated with disease transmission between aquaculture ponds and facilities. Egrets can also pose strike risks with aircraft at airports in the state. To address damages and threats associated with Great Egrets, the USFWS has issued depredation permits to WS and other entities pursuant to the MBTA that allow the take of egrets to manage damage and threats.

To alleviate damage, WS-Arizona has lethally removed 58 Great Egrets and employed non-lethal methods to disperse 1,133 Great Egrets from FY 2016 through FY 2020 (Table 36). Based on previous and current levels of take by WS-Arizona to alleviate damage and threats of damage associated with Great Egrets, WS-Arizona anticipates that up to 20 Great Egrets could be lethally taken by WS-Arizona in the state to manage damage and threats.

Table 36 – Number of Great Egrets addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	99	9
2017	60	6
2018	487	21
2019	198	7
2020	289	15
TOTAL	**1,133**	**58**

The population of Great Egrets in Arizona likely fluctuates throughout the year and is likely highest during migration periods. Nesting and winter populations of Great Egrets are currently unknown in Arizona. The number of Great Egrets observed in the state during the CBC from 2010 through 2019 has ranged from a low of 570 egrets to a high of 1,193 egrets with an average of 827 egrets observed. Take of up to 30 egrets by WS-Arizona would represent 0.24% of the average number of Great Egrets observed in the state during the CBC from 2010 through 2019 with the overall take ranging from 6.9% to 14.1% of the number of Great Egrets observed.

Based on the limited take that could occur by WS-Arizona and the permitting of the take by the USFWS, WS-Arizona's take would have no adverse effects on Great Egret populations in the State. Similar to other migratory birds addressed in this EA, the take of Great Egrets by WS-Arizona would only occur at the discretion of the USFWS and only at levels permitted by the USFWS. Therefore, all take by WS to alleviate damage or threats associated with Great Egrets would be evaluated pursuant to the objectives of the MBTA.

Fish Eating Birds

These birds are grouped within this guild due to their natural tendency to feed upon fish. These birds can cause a significant amount of damage at fish hatcheries and aquaculture facilities that produce fish for marketing and population restocking purposes. Some of these birds also are associated with airports and airfields. Airport environments can provide habitats that at times may support fish population through the airport's utilization of water retention and detention basins that store rain and snow melt runoff.

Several fish eating birds are present in Arizona, most present in varying numbers year-round, though many migrate out of the State for winter. Breeding fish eating birds in Arizona include the Double-crested Cormorants, American White Pelicans, Belted Kingfishers, and Pied-billed, Eared, and Western Grebes and, to a lesser extent, Clark's Grebes.

The typical damage associated with these birds is aircraft strikes, especially the larger ones such as pelicans and cormorants. Fish eating birds were responsible for 7 strikes in Arizona from FY11 to FY20 with no damage caused (Appendix D). Where fish eating bird populations are especially abundant, damage can also occur to aquaculture facilities and sport fisheries. From FY16 to FY20, WS-Arizona had lethal take of 81 Double-crested Cormorants. It is possible that WS-Arizona could target other fish eating birds lethally should the need arise.

Double-crested Cormorant Biology and Population Impact Analysis

Double-crested Cormorants are large fish-eating colonial waterbirds widely distributed across North America (Dorr et al. 2014). The fall migration period for Double-crested Cormorants generally occurs from August through early November with the peak occurring from late August through mid-October (Dorr et al. 2014). The spring migration period generally occurs from late March through the end of May with the peak occurring from mid-April through early March (Dorr et al. 2014).

Since the late 1970s, the Double-crested Cormorant population has increased in many regions of North America. Wires et al. (2001) and Jackson and Jackson (1995) suggested that the current cormorant resurgence may be, at least in part, a population recovery following years of DDT-induced reproductive suppression and unregulated take prior to protection under the MBTA. Between the late 1970s and early 1990s, the Double-crested Cormorant population expanded to an estimated 372,000 nesting pairs (Tyson et al. 1999, Wires et al. 2001). Tyson et al. (1999) estimated the Double-crested Cormorant population (breeding and non-breeding birds) in the United States to be greater than 1 million cormorants. Tyson et al. (1999) found that the cormorant population increased about 2.6% annually during the early 1990s. The greatest increase was in the Interior region, which was the result of a 22% annual increase in the number of cormorants in Ontario and those states in the United States bordering the Great Lakes (Tyson et al. 1999). From the early 1970s to the early 1990s, the Atlantic population of cormorants increased from about 25,000 pairs to 96,000 pairs (Hatch 1995). While the number of cormorants in this region declined in the early to mid-1990s by 6.5% overall, some populations were still increasing during this period (Tyson et al. 1999). The number of breeding pairs of cormorants in the Atlantic and Interior population was estimated at over 85,510 and 256,212 nesting pairs, respectively (Tyson et al. 1999). Based on 2021 data, the Wetlands International (2021) estimated the continental population of Double-crested Cormorants to be between 947,000 and 1,020,000 cormorants.

Relatively few Double-crested Cormorants nest in Arizona. BBS data indicate that the population has an increasing trend of 6.36% in Arizona from 1966 to 2019 (Pardieck 2020). As a result of the increased Double-crested Cormorant population, USFWS issued a depredation order in the eastern U.S., but not including Arizona, 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.

From FY 2016 through FY 2020, WS-Arizona has addressed 1,716 cormorants in the state using non-lethal methods to alleviate damage or threats to human health and safety. WS-Arizona has also lethally taken 81 cormorants to alleviate damage or threats from FY 2016 through FY 2020 (Table 37). Over 95% of the cormorants addressed by WS-Arizona from FY 2016 through FY 2020 were addressed using non-lethal methods.

Table 37 – Double-crested Cormorants addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	254	6
2017	8	8
2018	44	5
2019	204	47
2020	1,206	15
TOTAL	**1,716**	**81**

WS-Arizona has previously addressed requests for assistance associated with Double-crested Cormorant damage to property and human health and safety (Table 2a). Currently, requests for assistance received by WS-Arizona associated with Double-crested Cormorants would primarily be associated with aircraft strike risks at airports and military bases. Aircraft strikes with cormorants can cause substantial damage to aircraft and can cause the catastrophic failure of aircraft systems, especially when multiple birds are ingested into engines.

WS-Arizona anticipates the need to lethally take up to 100 cormorants annually to alleviate damage in state. WS-Arizona provided assistance with cormorant depredation problems from FY16 to FY20 and averaged the take of 16 annually. This level of take by WS-Arizona would have a negligible impact on the population.

Woodpeckers

Woodpeckers have strong bills for drilling into trees in search of worms and grubs under bark. They also use their bills to drum on trees, to mark their territory and attract a mate during the mating. These birds are cavity nesters and will hollow out a section of a tree within which they will build their nest. These birds frequent residential areas where they may sometimes seek bugs or build nests within the walls of homes. When they do this to buildings, they can cause thousands of dollars of damage due to their persistence in searching and creating multiple holes in the walls, generally in homes constructed with stucco or wood shingle walls. These birds seldom inhabit airport property but may travel across airports where they may be struck by departing or arriving aircraft. These birds are of sufficient size that they may damage the aircraft presenting a threat to human health and safety.

WS-Arizona is requested to assist with woodpecker damage, most always for damage to structures, and averaged 198 work tasks annually from FY16 to FY20 for all woodpecker species (Table 2b), but these requests only involved the Acorn Woodpecker, Gila Woodpecker, and Northern Flicker. They can also damage crops and can be a strike risk at airports. Risks of woodpecker strikes at airports, though, are minimal and none have occurred in Arizona from FY11 to FY20 (Appendix D). Some woodpeckers are abundant in Arizona (PIF 2020). Those with populations of the following: Acorn Woodpecker (230,000), Gila Woodpecker (560,000), Northern Flicker (210,000), and Williamson's Sapsucker (24,000).

Most woodpecker species are solitary (Acorn and possibly Lewis's Woodpeckers may live in colonies) and requests usually involve individual birds or nesting pairs. To illustrate potential impacts of BDM, the Lewis's Woodpecker (a more conservative breeder) will be used. Most woodpeckers breed at 1 year of age and have more than 1 brood per season, but a few, such as the Lewis's Woodpecker have only 1 brood. Most have 4 or more eggs per nest and fledge 1 or more young (Lewis's averages 5.88 eggs/nest and 0.59-2.9 (1.2 will be used) fledglings/nest). PIF (2020) estimated their population from at approximately 3,300, but current BBS data (Pardieck 2020) reflects the significant (P<0.05) downward BBS trend for Arizona (-0.93%) from 1966 to 2019. The downward trend for local populations of Lewis's Woodpeckers has mostly been determined to be loss of nesting habitat and competition for nest sites with European Starlings (Tobalske 1997). The current annual mortality, assuming 80% females breed in a 50:50 male: female population, could be estimated at 6,200. Thus, if WS-Arizona were to take 10% of the expected annual mortality of Lewis's Woodpeckers, 620 would be taken. WS-Arizona does not anticipate taking any Lewis's Woodpeckers, but the take of few in any given year 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.

WS-Arizona did lethally remove annual average of 121 Gila Woodpeckers and 7 Northern Flickers from FY16 to FY20 (Table 8). This level is minimal and take would not be noticeable at the population level. WS-Arizona will continue to conduct limited BDM for woodpeckers, mostly technical assistance, and will not cause a significant impact to any of their populations. However, WS-Arizona does anticipate to continue receiving removal requests for assistance to protect property but expects take would remain below 200, or less than 1% of their breeding population.

Northern Flicker Biology and Population Impact Analysis
The Northern Flicker is a common species of woodpecker found in wooded areas in North America (Wiebe and Moore 2008). It prefers open woodlands, savannas, farmland with tree rows and forest edges (Wiebe and Moore 2008). The northern flicker is well adapted to human altered habitats, commonly breeding in urban and suburban environments. While it is primarily a ground foraging species eating ants, beetle larvae and berries, it is recognized as a keystone excavator that may influence abundance of cavity nesters in woodland communities (Martin et al. 2004).

BBS data indicates a slight increase 0.32% for Arizona since 1966 in Northern Flicker abundance throughout the United States (Pardieck 2020). CBC data indicates the population is stable in Arizona (NAS 2020). Using data from the BBS, the PIF (2019) estimated the statewide breeding population of Northern Flickers at 210,000 birds.

Between FY2016 and FY2020, WS-Arizona took between 2 and 19 northern flickers annually (Table 38). Based on anticipated increases in requests for WS-Arizona assistance with BDM, WS-Arizona could remove up to 50 Northern Flickers per year, which represents 0.02% of the estimated population in Arizona. However, considering WS-Arizona's history of damage management for Northern Flickers in the last five years, actual take in most years is likely to be far lower than this number. WS-Arizona's take, which would only occur at isolated sites in a very small portion of the State under the proposed action, would have a low level of impact on Northern Flicker populations in Arizona.

Table 38 – Northern Flicker addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	0	2
2017	0	2
2018	0	19
2019	0	5
2020	0	7
TOTAL	**0**	**35**

Gila Woodpecker Biology and Population Impact Analysis
The Gila Woodpecker is a noisy, aggressive species that is characteristic of arid habitats in a limited part of the southwestern United States and northwestern Mexico, being most abundant on the desert mesas of southern Arizona. It is characteristic of sparsely covered deserts containing large saguaro cacti (*Carnegiea gigantean*), but the bird's range extends farther north, east, and west than that of the saguaro. This species is largely sedentary, with some movement to the north or to higher elevations in winter. While often closely associated with saguaros, the Gila woodpecker also makes ready use of riparian woodlands and residential areas. It is an omnivore, eating flowers and fruits of saguaros and other cacti and plants, insects, other animals, and even bird eggs (Edwards et al. 2000).

BBS data indicate significant decline of -0.03% for Arizona since 1966 in Gila Woodpecker abundance (Pardieck 2020). This decline may be due to competition with the European Starlings for nest cavities (Wiebe and Moore 2008). CBC data indicates the population is stable in Arizona (NAS 2020). Using data from the PIF (2020) estimated the statewide breeding population of Gila Woodpeckers at 560,000 birds.

Between FY2016 and FY2020, WS-Arizona took between 78 and 167 Gila Woodpeckers annually (Table 39). Based on anticipated increases in requests for WS-Arizona assistance with BDM, WS-Arizona could remove up to 200 Gila Woodpeckers per year, which represents 0.04% of the estimated population in

Arizona. However, considering WS-Arizona's history of damage management for Gila Woodpeckers in the last five years, actual take in most years is likely to be far lower than this number. WS-Arizona's take, which would only occur at isolated sites in a very small portion of the State under the proposed action, would have a low level of impact on Gila Woodpeckers populations in Arizona.

Table 39 – Gila Woodpecker addressed by WS-Arizona, FY 2016 – FY 2020

Fiscal Year	Dispersed	Take
2016	0	123
2017	0	78
2018	0	167
2019	0	105
2020	0	131
TOTAL	**0**	**604**

Frugivorous Birds

Several flocking fruit and seed eating birds are found in Arizona that can cause damage. The most notable of these, other than those discussed above such as starlings, are the American Robin, Northern Mockingbird, Cedar Waxwing, Bohemian Waxwing, Northern Cardinal, and House and Cassin's Finches. These species can damage fruit crops, but are the biggest problem for grape and berry growers. These species, especially the American Robin, can be strike threats at airports. In fact, from FY11 to FY20, 4 of these were involved in 13 strikes at airports in Arizona (Appendix D). American Robins, House and Cassin's Finches, and Northern Cardinals are found in Arizona year-round. The mockingbird is the only species that mostly leaves for the winter. Breeding populations of the 4 species found here during nesting are 1.8 million American Robins, 1.2 million Northern Mockingbirds, 34,000 Cassin's Finches, and 4.0 million House Finches (PIF 2020).

House Finch Biology and Population Impact Analysis

The House Finch is a recent introduction from western into eastern North America (and Hawaii), but it has received warmer reception than other arrivals like the European Starling and House Sparrow. That's partly due to the cheerful red head and breast of males, and to the bird's long, twittering song, which can be heard in most of the neighborhoods of the continent (Badyaev et. al. 2012).

In Arizona, the number of House Finches observed during the BBS has shown a decreasing trend estimated at -0.88% annually since 1966. (Pardieck 2020). The breeding population of House Finches has been estimated at 4.0 million finches (PIF 2020). The number of House Finches observed in areas surveyed during the CBC in the state has shown a stable trend (NAS 2020). Between 2010 and 2019, 16,171 House Finches have been observed on average per year in areas surveyed during the CBC in the state (NAS 2020). The range of House Finches observed in the state during the CBC conducted from 2010 through 2019 has been a low of 15,338 robins to a high of 17,652.

The number of House Finches addressed in Arizona to alleviate damage or threats by WS-Arizona is shown in Table 40. As shown in Table 40, WS-Arizona has addressed over 779 House Finches in the state to alleviate damage or threats of damage between FY 2016 and FY 2020, primarily at airports where large flocks of finches pose a strike risk to aircraft. Of those robins addressed by WS-Arizona, all were addressed using non-lethal methods of harassment.

Table 40 – Number of House Finches addressed by WS-Arizona, FY 2016 - FY 2020

Fiscal Year	Dispersed	Take
2016	200	0

2017	190	0
2018	150	0
2019	95	4
2020	140	0
TOTAL	**775**	**4**

Based on requests for assistance previously received, WS-Arizona could lethally remove up to 10 finches annually to alleviate damage or reduce threats in the state. As stated previously, large flocks of House Finches are present in the state during the winter, as well as, during the migration periods and most requests for assistance are associated with large groups of finches at airports. Based on the average number of House Finches observed in areas surveyed during the CBC from 2010 through 2019, the annual take of 10 House Finches by WS-Arizona would present 0.06% of the average. If WS-Arizona had lethally removed 10 House Finches annually from 2010 through 2019, the annual take would have ranged from 0.06% to 0.07% of the number of finches observed annually from 2010 through 2019 during the CBC. Although finches could be addressed during the breeding season, most lethal removal would occur during the migration periods when finches occur in large flocks.

All take of finches by WS-Arizona would occur only after a depredation permit has been issued by USFWS and only at levels allowed under the permit. Therefore, the cumulative take of finches in the state would occur at the discretion of the USFWS to meet desired population objectives for finches. Any take by WS-Arizona and other entities pursuant to depredation permits would occur within take limits to ensure the take of finches occurs within the allowable limits.

Additional Target Species

The specific analyses provided in the previous sections have addressed the top 24 bird species where WS-Arizona resolved the complaint issue with technical assistance, operational assistance (relocation) and/or lethal removal and anticipates receiving additional similar requests for assistance in the foreseeable future. This section covers those species of birds for which WS-Arizona has received request for assistance but a large number of birds were not impacted. The birds addressed in this section did not have an effect on the population of any species with lethal or non-lethal harassment because the impact was minimal. Table 41 summarizes the removal and bird species when less than an average of 25 birds were impacted annually. Table 42 summaries the dispersal of bird species when less than an average 1,500 birds were impacted annually.

Table 41. Birds removed by WS-Arizona in BDM from FY16 to FY20 with an annual average removal of less than 25.

Species	FY16	FY17	FY18	FY19	FY20	Ave
Introduced Commensal Birds						
Feral Duck	4	0	0	0	0	1
Feral Helmeted Guina Fowl	0	1	0	0	0	1
Feral Chicken	2	0	0	0	0	1
Blackbirds						
Brewer's Blackbird	0	0	7	22	31	12
Red-winged Blackbird	16	16	6	18	5	12
Brown-headed Cowbird	0	0	0	0	11	2
Raptors						
Turkey Vulture	13	2	14	21	23	15
Merlin	0	0	0	0	1	1
Peregrine Falcon	0	0	1	3	0	1
Praire Falcom	0	0	0	3	0	1
Burrowing Owl	0	3	4	5	3	3
Common Barn Owl	0	0	1	1	10	2
Great Horned Owl	0	1	0	3	1	1
Northern Harrier	3	9	10	10	13	9
Ferruginous Hawk	0	2	1	4	2	2
Harris Hawk	0	0	0	1	0	1
Cooper's Hawk	0	0	0	4	6	2

Osprey	0	0	0	0	1	1
Shorebirds						
Long-billed Curlew	0	0	0	0	2	1
Black-necked Stilt	0	0	0	0	17	3
Greater Yellowlegs	0	0	0	0	2	1
Wading Birds						
Great Blue Heron	8	1	6	11	24	10
Green Heron	0	0	0	0	2	1
Black-crowned Night Heron	1	0	0	1	4	1
Great Egret	9	6	21	7	15	12
Cattle Egret	0	0	0	0	2	1
Snowy Egret	1	0	0	0	0	1
Waterfowl						
Canada Goose	35	15	68	2	11	24
Ring-necked Duck	0	0	8	0	0	2
American Wigeon	3	0	1	0	0	1
Cinnamon Teal	0	0	0	0	1	1
Common Merganser	2	4	0	0	0	1
Black-bellied Whistling Duck	0	4	0	0	0	1
Grassland Passerines						
Lark Bunting	0	0	0	0	2	1
Eastern Meadowlark	0	0	0	0	24	5
Western Kingbird	0	0	6	5	6	3
Northern Mockingbird	0	0	0	1	0	1
Say's Phoebe	0	0	0	0	1	1
American Pipit	0	13	0	24	6	9
Black-chinned Sparrow	0	0	0	0	1	1
Brewer's Sparrow	0	0	0	2	0	1
Lark Sparrow	0	0	0	1	0	1
Vesper Sparrow	0	0	0	0	1	1
Frugivorous Birds						
House Finch	0	0	0	4	0	1
Native Doves and Pigeons						
White-winged Dove	0	0	4	11	104	24
Gallinaceous Birds						
Gambel's Quail	0	0	0	10	0	2
Woodpeckers						
Northern Flicker	2	2	19	5	7	7
Fish Eating Birds						
Double-crested Cormorant	6	8	5	47	15	16
Neotropic Cormorant	0	0	0	25	0	5
Aerialist						
Lesser Nighthawk	0	0	0	0	3	1
Cliff Swallow	4	17	0	5	8	7
Barn Swallow	0	0	0	2	0	1
Violet-green Swallow	3	0	0	0	0	1
Birds Other						
Greater Roadrunner	0	0	0	0	20	4

Table 42. Birds dispersed (hazed with frightening devices or other nonlethal method) from damage situations from FY16 to FY20 with an annual dispersal of less than 1,500.

Species	FY16	FY17	FY18	FY19	FY20	Ave
Introduced Commensal Birds						
House Sparrow	0	0	85	200	0	57
European Starling	0	100	0	2,044	10	431
Rock Pigeon	12	258	45	9	50	75
Blackbirds						
Red-winged Blackbird	100	338	0	29	1,818	457
Great-tailed Grackle	375	926	461	754	1,044	712
Yellow-headed Blackbird	0	1,000	0	0	100	220
Corvids						
Common Raven	42	130	138	135	84	106
Raptors						
Turkey Vulture	160	106	156	205	291	184
Red-tailed Hawk	147	111	227	250	368	221
American Kestrel	158	183	351	181	303	235
Northern Harrier	116	150	143	124	166	140
Swainsons Hawk	9	1	29	57	59	31
Ferruginous Hawk	2	4	3	5	3	17
Osprey	1	6	3	6	12	6
Peregrine Falcon	0	2	11	10	36	12
Prairie Falcon	35	1	30	45	21	26
Harris Hawk	0	0	0	1	2	1

Zone Tailed Hawk	1	0	0	0	0	1
Cooper's Hawk	1	0	2	6	2	2
Common Black Hawk	0	0	0	0	1	1
Burrowing Owl	0	0	1	2	9	2
Short-eared Owl	0	0	0	1	0	1
Common Barn Owl	0	0	0	0	4	1
Great-horned Owl	0	0	0	0	3	1
Fish Eating Birds						
Double-crested Cormorant	254	8	44	204	1,206	343
Neotropic Cormorant	0	0	0	925	0	185
Shorebirds						
Killdeer	308	160	175	216	284	229
Black-necked Stilt	14	0	16	2	104	27
Least Sandpiper	0	0	8	60	25	19
Western Sandpiper	0	0	0	18	0	4
Long-billed Curlew	0	0	10	0	3	3
Long-billed Dowitcher	0	0	0	2	0	1
Whimbrels	0	0	0	2	3	1
Willet	0	0	0	4	0	1
Greater Yellowlegs	0	0	0	0	8	2
Wading Birds						
Great Egret	99	60	487	198	289	227
Cattle Egret	0	0	0	0	33	7
Great Blue Heron	34	24	53	83	118	62
Snowy Egret	0	0	1	10	0	2
Green Heron	1	0	0	0	25	5
Black-crowned Night Heron	2	1	21	0	17	8
Waterfowl						
Mallard	86	47	57	294	638	224
Canada Goose	35	32	55	149	65	67
Northern Shoveler	0	22	0	0	0	4
American Wigeon	38	12	0	176	0	45
Canvasback	0	0	30	110	4	29
Gadwall	0	0	0	0	140	28
Ruddy Duck	0	8	0	0	0	2
American Coot	26	0	0	2	0	6
Black-bellied Whistling Duck	0	4	0	0	8	2
Common Merganser	0	300	90	91	13	99
Redhead	0	0	30	0	0	6
Cinnamon Teal	0	0	0	0	3	1
Wood Duck	0	0	0	0	5	1
Ross's Goose	4	6	0	0	0	2
Grassland Passerines						
Western Kingbird	1	50	10	1	0	12
American Pipit	650	0	0	700	510	372
Northern Mockingbird	0	0	0	1	0	1
Brewer's Sparrow	0	0	0	12	0	2
Lark Bunting	0	0	0	0	93	19
Aerialist						
Barn Swallow	0	0	0	27	0	5
Cliff Swallow	190	405	0	130	610	267
Violet-green Swallow	70	0	0	0	0	14
Lesser Nighthawk	0	0	0	0	40	8
Gallinaceous Birds						
Gambel's Quail	0	0	0	5	22	5
Frugivorous Birds						
House Finch	200	190	150	95	140	155
Birds Other						
Greater Roadrunner	0	0	2	0	15	3

This section also covers those species of birds for which WS-Arizona has not received requests for assistance in the past, and WS-Arizona anticipates not using lethal control actions to resolve those conflicts, if and when they occur. All species included in this section are likely to be federally protected under the MBTA and, therefore, would also be State protected as migratory nongame birds. This section does not include birds listed as T&E species nor birds of conservation concern. WS-Arizona recognizes that conflicts with individual birds may arise that are unforeseeable which makes specific analysis difficult to anticipate. This was also recognized by the USFWS in their migratory bird depredation permit which has been issued to WS-Arizona (USFWS Depredation Permit: MB714307-0). In addition to their specific authorization for taking named species of birds (i.e., Canada Geese, American Coot, American Kestrel, gull (sp.), Northern Flicker, etc.), the USFWS included a condition authorizing in emergency situatations to take, trap, or relocate and migratory birds, nests and eggs, including species that are not listed in Condition D (except Bald or Golden Eagles or T&E species) when the migratory birds, nests, or eggs are posing a direct threat to human health or safety. Federal Birds of Conservation Concern (USFWS 2008) found in Arizona are listed in Appendix B. Threatened and Endangered Species are found in Table 6 (ECOS USFWS 2020).

If WS-Arizona receives a request for assistance with any species under this section, it will attempt to resolve the conflict with available and effective non-lethal strategies. In the unlikely circumstance where immediate action is required, such as when human health and safety is threatened, lethal action may be employed to remove the minimum number of birds required to resolve the issue while remaining within the restrictions of the USFWS depredation permit. All take, which includes capture and release, is reported annually to the USFWS to ensure that the USFWS has the opportunity to evaluate the cumulative effects of take from all known sources in their management efforts to support and maintain viable migratory bird populations. For this reason, WS-Arizona does not expect any impact on any migratory bird species occurring within Arizona.

4.1.1.2 Alternative 2 - Nonlethal BDM by WS-Arizona Only

Under this alternative, WS-Arizona would not take any target species because lethal methods would not be used. AZGFD would likely provide some level of professional BDM assistance for lethal activities, but this would be limited by resources (i.e., personnel, funding, etc.) without federal assistance. Nonlethal activities conducted by WS would likely intensify but result in similar levels of nonlethal activities as conducted under Alternative 1 with similar numbers of birds hazed or captured and released or relocated (Tables 9 and 10). Nonlethal harassment, could be ineffective on some bird species, in particular pigeons, and some birds would quickly become habituated to harassment techniques, and, thus, where lethal techniques would be implemented to reinforce hazing efforts, WS would continue to conduct nonlethal control but with less success. This could be ineffective, especially at airports and for crop protection, and resource owners could become frustrated by WS-Arizona's apparent lack of success. Therefore, private entities may conduct increased lethal BDM, potentially more than under Alternative 1 resulting in similar or potentially increased levels of take.

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 potentially Starlicide Complete which contains the chemical in DRC-1339, to control starlings, Rock Pigeons, House Sparrows, and blackbirds. Technical grade DRC-1339 is available for use only by WS 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 likely 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. For the same reasons shown in the population impacts analysis in section 4.1.1.1, it is unlikely that starlings, Rock Pigeons, House Sparrows, blackbirds, Canada Geese, or other target bird populations would be impacted significantly by implementation of this alternative. Impacts and hypothetical risks of illegal chemicals and other methods under this alternative as described in Sections 2.1 would probably be greater than the proposed action, similar to Alternative 3, but less than Alternative 4. The use of illegal methods could lead to unknown risks to target species populations.

4.1.1.3 Alternative 3 – WS-Arizona Provides Technical Assistance Only for BDM.

Under this alternative, WS-Arizona would have no impact on any bird species population in Arizona because the program would not conduct any operational BDM activities. WS-Arizona would offer advice on the BDM techniques that could be used to resolve BDM problems. AZGFD 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 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. DRC-1339 could not be used by private individuals or entities, and thus, take with DRC-1339 chemicals would be nil, but other BDM methods, primarily Avitrol, 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 starlings, Rock Pigeons, blackbirds, 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 WS would not provide assistance in many situations. The use of illegal chemicals and other methods under this alternative as described in Sections 2.1. 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 WS-Arizona BDM

Under this alternative, WS-Arizona would have no impact on any bird species populations in Arizona. AZGFD would likely provide some level of professional BDM assistance, but this would be limited by resources (i.e., personnel, funding, etc.) without WS assistance. Private efforts to reduce or prevent depredations would increase which may 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 unknown if any target bird populations would be impacted significantly by implementation of this alternative. Technical grade DRC-1339 is currently only available for use by WS employees and, therefore, take with DRC-1339 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 methods for BDM would be greatest of the alternatives because frustrations from the inability of resources owners to reduce losses would be highest. The use of illegal chemicals and other methods under this alternative as described in Sections 2.1 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 WS-Arizona, 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 preclude use of certain methods, so it is important to maintain the widest possible selection of BDM tools for resolving bird damage problems. The BDM methods used to resolve damage must be legal and biologically sound. Where impacts occur, they are mostly of low magnitude in terms of nontarget species populations. Following is a discussion of the various impacts to nontarget species under the selected alternatives.

4.1.2.1 Alternative 1 - Continue the Current Federal BDM Program.

From FY16 to FY20, WS-Arizona lethally took a total of 5 Gambel's Quail as nontarget species (Table 43) during BDM activities using snap traps that were set for rodents. Nontarget take has been very low, annually averaging 1 taken lethally. 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, which is not used by WS-Arizona. 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. WS-Arizona did not document any such occurrences from FY16 to FY20. Additionally, bait substrates highly attractive to nontarget species such as rice were not used.

Table 43. Non-target birds killed or freed during all WS-Arizona BDM activities from FY16-FY20.

Species	Killed or Freed	FY2016	FY2017	FY2018	FY2019	FY2020	Totals by Species (K/F)
Gambel's Quail	Killed	-	-	-	5	-	**5 (K)**
Common Morehen	Freed	-	-	-	2	-	**2 (F)**
Abert's Towhee	Freed	-	1	-	-	-	**1 (F)**
Totals by Year		**0**	**1**	**0**	**2 (F) 5(K)**	**0**	**3 (F) 5 (K)**

WS 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, WS does not anticipate that populations of either species has been effected by BDM. BDM for these species would have to be focused during the nesting period when and where WS could reduce these species breeding populations during a critical time period, for example during the nesting season of the Southwestern Willow Flycatcher. The take of gulls invading a nesting colony of Interior Least Terns or Snowy Plovers could also be beneficial for these species. However, it would have to be focused specifically on gulls impacting a nesting colony. WS is not currently conducting such activities, but WS nationally conducts many BDM projects for the benefit of other wildlife species with many successes.

T&E Species Impacts. WS-Arizona has not had an impact on any federally listed T&E or candidate bird species (Table 6) in Arizona from FY96 to FY20. 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. 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 WS 2018). 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. None of the other 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.

Other sensitive species in Arizona were discussed in Section 2.1.2. and those bird species are denoted in Appendix C. Other than the sensitive species targeted during BDM, discussed in Section 4.1.1.1, WS-Arizona has not had any impacts on them from FY96 to FY20. WS-Arizona does anticipate that BDM will have an impact on any sensitive. Species.

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. WS received a Programmatic Biological Opinion from the USFWS in 2018 on the potential for WDM, in general and including BDM methods currently used, to impact the species listed nationwide and completed a Section 7 consultation in Arizona (USFWS 2018a). USFWS was consulted under Section 7 of the ESA and issued BOs on the species that WS may potentially affect. USFWS provided conservation measures to WS-Arizona in order reduce the potential of adversely affecting the included species (USFWS 2018a).

4.1.2.2 Alternative 2 - Nonlethal BDM by WS-Arizona Only.

Under this alternative, WS-Arizona would does not anticipate not killing any nontarget animals because lethal methods would not be used. Some nonlethal BDM methods have the potential to take nontarget species such as entanglement in netting, but even so, nontarget take would be minimal and less than under the proposed action. AZGFD 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. AZGFD take of nontarget species would likely be similar to WS-Arizona's. 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 increased 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 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 – WS-Arizona Provides Technical Assistance Only for BDM.

Alternative 3 would not allow WS to conduct any direct operational BDM in Arizona and, therefore, WS-Arizona would not have an impact on nontarget or T&E species. AZGFD 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-Arizona which has been minimal. WS would provide technical assistance 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 BDM 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 WS-Arizona would not provide any operational support to resolve BDM problems. It is possible that, probably to a greater extent than under Alternative 2, frustration caused by the inability to reduce losses could lead to increased take of misidentified species and increased use 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 WS-Arizona BDM.

Alternative 4 would not allow WS-Arizona to conduct BDM in the State and, therefore, no impact would occur on nontarget or T&E species by WS-Arizona BDM activities. AZGFD would likely provide some level of professional BDM assistance, but this would be limited by resources (i.e., personnel, etc.) with less experience. Individuals and organizations with BDM problems would likely conduct BDM themselves and use lethal methods more often thereby increasing nontarget take over that which already occurs. Since private efforts to reduce or prevent depredations would increase and less experienced persons would likely implement control methods, nontarget take of wildlife would likely be greater than under the proposed action or the other 2 alternatives. This is partially due to the lack of using SOPs to minimize nontarget take such as WS-Arizona's self-imposed restrictions and policies to minimize or nullify nontarget take. It is hypothetically possible that frustration caused by the inability to reduce losses could lead to illegal use of chemical toxicants as described in Sections 2.1.3 and 2.2.3 which could impact local nontarget species populations, including some T&E and sensitive species. Hazards to raptors, including Bald Eagles, could therefore be greater under this alternative if chemicals, that are less selective or that cause secondary poisoning, are used by frustrated private individuals suffering damage that they cannot abate. It is, therefore, likely that more impacts to nontarget species would occur under this alternative than the current program and the other alternatives.

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 WS-Arizona, 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. BDM methods used to resolve bird damage must be legal and biologically sound. Following is a discussion of the various potential impacts to the public and pet safety and the environment under the selected 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. WS-Arizona poses minimal threat to people, pets and the environment with BDM methods such as shooting, hazing with pyrotechnics, trapping, and use of chemicals. All firearm and pyrotechnic safety precautions are followed by WS-Arizona when conducting BDM and WS-Arizona 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 WS-Arizona 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, WS-Arizona 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). WS-Arizona personnel, who use firearms as a condition of employment, are required to certify that they meet the criteria as stated in the Lautenberg Amendment. WS-Arizona also follows safety precautions and WS Policies when using pyrotechnics. WS-Arizona 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. WS-Arizona 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 WS 2018). Therefore, no significant impact on human safety from WS' use of BDM methods is expected.

WS-Arizona personnel that use avian toxicants are certified through ADA. Two toxicants are used in BDM, DRC-1339 and Avitrol. Immobilization and euthanasia drugs are used only by WS personnel trained and certified to use them per WS policy. WS-Arizona personnel abide by WS policies and SOPs, and federal and state laws and regulations when using BDM methods that have potential risks. The same apply to immunocontraceptives such as nicarbazin (OvoControlTM G) for use in Arizona. USDA WS (2018) 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.

DRC-1339 (3-chloro-p-toluidine hydrochloride). DRC-1339 is the primary lethal chemical BDM method that would be used under the current program alternative. WS-Arizona used an average of about 2.17 grams of DRC-1339 from FY16 to FY20 with a high of 4.8 grams used in FY19 (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 WS (2018) 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.
- Its use is prohibited within 50 feet of standing water and cannot be applied directly to food or feed crops (contrary to some misconceptions, DRC-1339 is not applied to feed materials that livestock can access).
- 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). Avitrol is another chemical method that is used by WS-Arizona in BDM. WS-Arizona did not use any Avitrol from FY16 to FY20. 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 WS (2018) 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 WS-Arizona. 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.

- 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 1997). 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.

Other BDM Chemicals. Other nonlethal BDM chemicals that might be used or recommended by WS 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, methiocarb (used in eggs), tactile polybutene repellents, nicarbazin (OvoControlTM G) reproductive inhibitor. (WS-Arizona did not use any of the other chemicals from FY16 to FY20 in Arizona, but these have the potential for use).

> 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.

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 WS 2018). WS-Arizona did not have any known incidents involving the public or pets conducting BDM from FY16 to FY20.

WS-Arizona's BDM poses minimal risks to public and pet health and safety when implementing BDM. In fact, WS can reduce public safety hazards. Many WS 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 WS-Arizona Only.

Alternative 2 would not allow for any lethal methods use by WS. WS would only implement nonlethal methods such as harassment with shooting firearms and pyrotechnics, live traps, repellents (e.g., methiocarb, MA, and polybutene tactile repellents), 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 concerned with the use of chemicals. The nonlethal chemicals that could be used by WS 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.

AZGFD 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 WS assistance. The impact on human and pet health and safety from AZGFD activities would likely be similar to WS-Arizona's and be minimal. Excessive cost or ineffectiveness of nonlethal techniques could result in some individuals or entities to reject WS'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-Arizona, 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 WS'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 WS'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 – WS-Arizona Provides Technical Assistance Only for BDM

Alternative 3 would not allow any direct operational BDM assistance by WS-Arizona in the State. WS-Arizona 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 WS implementing BDM under this alternative would be nullified. Additionally, DRC-1339 is only registered for use by WS-Arizona personnel and would not be available for use by private individuals; Starlicide Complete may be available to private pesticide applicators in some areas. AZGFD 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 AZGFD activities would likely be similar to WS-Arizona's and be minimal. Private efforts to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing BDM 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 WS-Arizona, 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. AZGFD 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 such use would likely occur to a greater extent in the absence of WS-Arizona's assistance. Use of Avitrol 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, as discussed in Sections 2.1.3 and 2.2.3, could lead to illegal use of certain toxicants that, unlike WS-Arizona'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 WS-Arizona BDM.

Alternative 4 would not allow WS-Arizona to conduct BDM in the State. Therefore, concerns about risks to people, pets, and the environment from WS would be nullified. In addition, DRC-1339 is registered for use only for WS-Arizona personnel, would not be available for use by private individuals. AZGFD possibly could provide some level of professional BDM, and their actions and associated risks would be similar to Alternative 1. 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 and other available pesticides and requests for such use would likely be greater than present in the absence of WS'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 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 Rock Pigeons or urban waterfowl would likely be disturbed by removal of such birds under the current program. WS-Arizona 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, WS could selectively capture the target species (coots, ducks, geese, etc.) utilizing trapping without disturbing the other waterfowl species that are present and deemed enjoyable to the public. This strategy could also be utilized 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. However, many persons who voice opposition have no direct connection or opportunity to view or enjoy the particular birds that would be killed by WS-Arizona'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 cranes, 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 WS-Arizona'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 WS 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.

4.1.4.2 Alternative 2 - Nonlethal BDM by WS-Arizona Only

Under this alternative, WS-Arizona 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. However, other private entities would likely conduct similar BDM activities as those in Alternative 1 which means the impacts would then be similar to the current program alternative.

Under this alternative, WS-Arizona 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.

4.1.4.3 Alternative 3 – WS-Arizona Provides Technical Assistance Only for BDM

Under this alternative, WS would not conduct any direct operational BDM but would still provide technical assistance to persons requesting assistance with bird damage. WS-Arizona would also not conduct any harassment 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. However, other private entities would likely conduct similar BDM activities as those that would no longer be conducted by WS-Arizona 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 WS-Arizona's technical assistance recommendations.

Relocation of birds damaging 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 WS-Arizona 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 WS 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.

4.1.3.4 Alternative 4 - No Federal WS-Arizona BDM

Under this alternative, WS-Arizona would not conduct any lethal removal of birds nor would the program conduct any harassment. Persons who have developed affectionate bonds with individual wild birds would not be affected by WS-Arizona under this alternative. However, other private entities would likely conduct similar BDM activities as those that would no longer be conducted by WS-Arizona which means the impacts would then be similar to the current program alternative.

Under this alternative, the lack of WS-Arizona support in BDM in reducing nuisance pigeon and other bird problems where droppings cause unsightly messes would mean aesthetic values of some affected properties would continue to be adversely affected if the property owners were not effective in reducing the problem. 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.

4.1.5 Humaneness of BDM

Humaneness and ethical concerns associated with methods available for use to manage bird damage have been identified as an issue. As described previously, most of those methods available for use to manage bird damage would be available under any of the alternatives, when permitted by the USFWS and/or the AZGFD, when required. The humaneness and ethical concerns for methods used for BDM by WS-Arizona are discussed below for each Alternative.

4.1.5.1 Alternative 1- Continue the Current Federal BDM Program

Under the proposed action, WS would integrate methods using the WS' Decision Model as part of technical assistance and direct operational assistance. Methods available under the proposed action could include non-lethal and lethal methods integrated into direct operational assistance conducted by WS. Under this alternative, WS would use non-lethal methods that are regarded as humane. Non-lethal methods would include resource management methods (*e.g.*, crop selection, limited habitat modification, modification of human behavior), exclusion devices, frightening devices, reproductive inhibitors, immobilizing drugs, inactive nest destruction, cage traps, nets, and repellents.

As discussed previously, 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.

Some people believe any use of lethal methods to alleviate damage associated with wildlife is inhumane because the resulting fate is the death of the animal. Other people believe that certain lethal methods can lead to a humane death. Others believe most non-lethal methods of capturing wildlife to be humane because the animal is generally unharmed and alive. Still others believe that any disruption in the behavior of wildlife is inhumane. With the multitude of attitudes on the meaning of humaneness and the varying perspectives on the most effective way to address damage and threats in a humane manner, agencies are challenged with conducting activities and employing methods that are perceived to be humane while assisting those persons requesting assistance to manage damage and threats associated with wildlife. The goal of WS would be to use methods as humanely as possible to address requests for assistance to reduce damage and threats to human safety. WS would continue to evaluate methods and activities to minimize the pain and suffering of animals addressed when attempting to alleviate requests for assistance.

Some methods have been stereotyped as "*humane*" or "*inhumane*". However, many "*humane*" methods can be inhumane if not used appropriately. For instance, many members of the public would consider a cage trap to be a "*humane*" method. Yet, without proper care, live-captured wildlife in a cage trap can be treated inhumanely if not attended to appropriately. Some concern arises from the use of live-capture methods causing stress on the animal, but if used appropriately, the stress is minimal and only temporary. Overall, many people consider the use of non-lethal management methods as humane when used appropriately.

Although some concerns of humaneness and animal welfare could occur from the use of cage traps, nets, immobilizing drugs, reproductive inhibitors, and repellents, those methods, when used appropriately and by trained personnel, would not result in the inhumane treatment of wildlife. Concerns from the use of those non-lethal methods could occur from injuries to animals while restrained, from the stress of the animal while being restrained, or during the application of the method. Pain and physical restraint can cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when action is not taken to alleviate conditions that cause pain or distress in animals.

If birds were to be live-captured by WS, WS' personnel would be present on-site during capture events or WS' employees would check methods at least once every 24 hours to ensure WS' employees addressed birds captured quickly to prevent injury. Although stress could occur to an animal restrained in a live-capture device, timely attention to live-captured wildlife would alleviate suffering. Stress would likely be temporary.

Under the proposed action, lethal methods could also be employed to alleviate or prevent bird damage and threats, when requested. Lethal methods would include shooting, egg destruction, DRC-1339, the recommendation that birds be harvested during the regulated hunting seasons, and euthanasia after birds were live-captured. WS' use of euthanasia methods under the proposed action would follow those methods required by WS' directives (see WS Directive 2.430, WS Directive 2.505).

The euthanasia methods being considered for use under the proposed action for live-captured birds would be cervical dislocation and carbon dioxide. The AVMA guidelines on euthanasia list cervical dislocation, carbon dioxide, and gunshot as conditionally acceptable methods of euthanasia for free-ranging birds that can lead to a humane death (AVMA 2020). The use of cervical dislocation, carbon dioxide, or gunshot for euthanasia would occur after the animal had been live-captured and away from public view. Although the AVMA guidelines list cervical dislocation and gunshot as conditionally acceptable methods of euthanasia for free-ranging wildlife, there is greater potential those methods may not consistently produce a humane death (AVMA 2020). WS' personnel that employ methods to euthanize live-captured birds would be trained in the proper use of those methods to ensure a timely and quick death.

Although the mode of action associated with DRC-1339 is not well understood, it appears to cause death primarily by nephrotoxicity (*i.e*., toxic effect on the kidneys) in susceptible species and by central nervous system depression in non-susceptible species (DeCino et al. 1966, Westberg 1969, Schafer 1984). DRC-1339 causes irreversible necrosis of the kidney and the affected bird is subsequently unable to excrete uric acid with death occurring from uremic poisoning and congestion of major organs (DeCino et al. 1966, Knittle et al. 1990). The external appearances and behavior of starlings that ingest DRC-1339 slightly above the LD_{50} for starlings appear normal for 20 to 30 hours, but water consumption doubles after 4 to 8 hours and decreases thereafter. Food consumption remains fairly constant until about 4 hours before death, at which time starlings refuse food and water and become listless and inactive. The birds perch with feathers fluffed as in cold weather and appear to doze, but are still responsive to external stimuli. As death nears, breathing rate increases slightly and becomes more difficult. Eventually, the birds no longer respond to external stimuli and become comatose. Death follows shortly thereafter without convulsions or spasms (DeCino et al. 1966). Birds ingesting a lethal dose of DRC-1339 become listless and lethargic, and a quiet death normally occurs in 24 to 72 hours following ingestion. This method appears to result in a less stressful death than probably occur by most natural causes, which are primarily disease, starvation, and predation. In non-sensitive birds and mammals, central nervous system depression and the attendant cardiac or pulmonary arrest is the cause of death (Felsenstein et al. 1974). DRC-1339 is the only lethal method that would not be available to other entities under the other alternatives. DRC-1339 to manage damage caused by certain species of birds would only be available for use by WS' personnel. A similar product containing the same active ingredient could commercially become available as a restricted use pesticide for use to manage damage associated with blackbirds and starlings; however, DRC-1339 nor a similar product with the same active ingredient is currently registered for use in Arizona.

The chemical repellent under the trade name Avitrol acts as a dispersing agent when birds ingest treated bait, which causes them to become hyperactive. Their distress calls generally alarm the other birds and cause them to leave the site. Only a small number of birds need to be affected to cause alarm in the rest of the flock. The affected birds generally die. In most cases where Avitrol is used, only a small percentage of the birds are affected and killed by the chemical with the rest being dispersed. In experiments to determine suffering, stress, or pain in affected animals, Rowsell et al. (1979) tested Avitrol on pigeons and observed subjects for clinical, pathological, or neural changes indicative of pain or distress but none were observed. Conclusions of the study were that the chemical met the criteria for a humane pesticide.

The use of nicarbazin would generally be considered as a humane method of managing local populations of domestic waterfowl and pigeons. Nicarbazin reduces the hatchability of eggs laid by waterfowl and appears to have no adverse effects on waterfowl. Consuming bait daily did not appear to adversely affect those chicks that hatched from parents fed nicarbazin (Avery et al. 2006*b*, Avery et al. 2008*b*). Nicarbazin has been characterized as a veterinary drug since 1955 by the FDA for use in broiler chickens to treat outbreaks of coccidiosis with no apparent ill effects to chickens. Based on current information and research, the use of nicarbazin would generally be considered humane.

Research and development by WS has improved the selectivity and humaneness of management techniques. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in situations where non-lethal damage management methods are not practical or effective. Personnel from WS are experienced and professional in their use of management methods. Consequently, management methods are implemented in the most humane manner possible under the constraints of current technology. Those methods discussed to alleviate bird damage and/or threats in the state, except for DRC-1339 and mesurol, could be used under any of the alternatives by those people experiencing damage regardless of WS' direct involvement. Therefore, the issue of humaneness associated with methods would be similar across any of the alternatives. Those persons who view a particular method as humane or inhumane would likely continue to view those methods as humane or inhumane under any of the alternatives. SOPs that would be incorporated into WS' activities to ensure methods are used by WS as humanely as possible are listed in Chapter 3.

Therefore, the goal would be to address requests for assistance using methods in the most humane way possible that minimizes the stress and pain to the animal. Overall, the use of resource management methods, harassment methods, and exclusion devices are regarded as humane when used appropriately. Although some concern arises from the use of live-capture methods, the stress of animals is likely temporary.

People have also expressed concerns over the potential separation of goose families from management actions. Generally, adult geese form pair bonds that they maintain until one of the pair dies; however, geese will form new pairs bonds even when their previous mate is still alive (MacInnes et al. 1974, Mowbray et al. 2002). Goose family units generally migrate together during the fall migration period and spend much of the fall and winter together (Raveling 1968, Raveling 1969, Mowbray et al. 2002). The separation of family units could occur during damage management activities targeting geese. This could occur through translocation, harassment (*e.g.*, pyrotechnics, dogs), and lethal control methods.

Although resident Canada Geese can have high adult and juvenile survival rates, especially in urban areas with a reduced number of predators, Canada Goose family units often experience change. For example, annual harvest of Canada Geese appears to strongly influence annual survival rates of geese (Mowbray et al. 2002). People harvested 35,812 Canada geese in the state during the 2014 hunting season and 19,257 geese during the 2015 hunting season. During the 2014 hunting season, people harvested 5,600 Canada Geese in the state during the special September hunting season that specifically targets resident Canada Geese in the state. Similarly, people harvested 5,300 resident Canada Geese during the 2015 September hunting season for resident Canada Geese (Raftovich et al. 2016). In addition, the period between when geese hatch and when they fledge tends to be a period of high mortality in Canada Geese (Mowbray et al. 2002). Adults that lose a mate can form new pair bonds and will breed with new mates (Mowbray et al. 2002). Although WS' activities could separate geese, adult geese do form new pair bonds and continue to breed with new mates. Although juvenile geese generally migrate with their parents during the fall migration period and spend much of the fall and winter together, juveniles would likely survive if they separate from a parent or both parents.

4.1.5.2 Alternative 2- Nonlethal BDM by WS-Arizona Only

Generally, non-lethal methods are considered more humane than lethal methods. However, as noted for Alternative 1, some individuals also consider non-lethal methods such as frightening devices and repellents to be inhumane because they may cause temporary illness or stress to the target animal. For individuals opposed to the use of lethal BDM methods, WS-Arizona actions under this alternative would be considered more humane than Alternative 1. However, most lethal methods would still be available to and used by non-WS personnel under depredation permits (see page 49 for details) and control orders. Use of BDM methods by inexperienced individuals may result in greater risk of injury, stress or distress to target animals from improper or imprecise use. Risks of this type of impact are likely lower with this alternative than Alternatives 3 and 4 because individuals would have access to WS-Arizona operational assistance with non-lethal methods.

4.1.5.3 Alternative 3-WS-Arizona Provides Technical Assistance only for BDM

The issue of humaneness of methods under this alternative is likely to be perceived as similar to humaneness issues discussed under the proposed action. This perceived similarity is derived from WS' recommendation of methods that some consider inhumane. WS would not directly be involved with BDM activities under this alternative. However, the recommendation of the use of methods would likely result in the requester employing those methods. Therefore, by recommending methods and thus a requester employing those methods, the issue of humaneness would be similar to the proposed action.

WS would instruct and demonstrate the proper use and placement of methodologies to increase effectiveness in capturing target bird species and to ensure methods are used in such a way as to minimize pain and suffering. However, the efficacy of methods employed by a cooperator would be based on the skill and knowledge of the person using the methods to resolve the threat to safety or damage situation despite WS' demonstration. Therefore, a lack of understanding of the behavior of birds or improperly identifying the damage caused by birds along with inadequate knowledge and skill in using methodologies to alleviate the damage or threat could lead to incidents with a greater probability of being perceived as inhumane. In those situations, the pain and suffering are likely to be regarded as greater than those discussed under Alternative 1.

Those people requesting assistance would be directly responsible for the use and placement of methods and if monitoring or checking of those methods does not occur in a timely manner, captured wildlife could experience suffering and if not addressed timely, could experience distress. The amount of time an animal is restrained under the proposed action would be shorter compared to a technical assistance alternative if those requesters implementing methods were not as diligent or timely in checking methods. Similar to Alternative 3, it can be difficult to evaluate the behavior of individual people and determining what may occur under given circumstances. Therefore, only the availability of WS' assistance can be evaluated under this alternative because determining human behavior can be difficult. If those persons seeking assistance from WS apply methods recommended by WS through technical assistance as intended and as described by WS, then those methods would be applied as humanely as possible to minimize pain and distress. If those persons provided technical assistance by WS apply methods not recommended by WS or do not employ methods as intended or without regard for humaneness, then the issue of method humaneness would be of greater concern because pain and distress of birds would likely be higher.

4.1.5.4 Alternative 4-No Federal WS-Arizona BDM

Under this alternative, WS would not be involved with any aspect of bird damage management in Arizona. Those people experiencing damage or threats associated with birds could use those methods legally available and permitted by the USFWS, the AZGFD, and other federal, state, and local regulations. Those methods would likely be considered inhumane by those persons who would consider methods proposed under any alternative as inhumane. The issue of humaneness would likely be directly linked to the methods legally available to the public because methods are often labeled as inhumane by segments of society no matter the entity employing those methods. A method considered inhumane, would still be perceived as inhumane regardless of the person or entity applying the method. However, even methods generally regarded as being humane could be employed in inhumane ways. Methods could be employed inhumanely by those people inexperienced in the use of those methods or if those people were not as diligent in attending to those methods.

The efficacy and, therefore, the humaneness of methods would be based on the skill and knowledge of the person employing those methods. A lack of understanding of the target species or methods used could lead to an increase in situations perceived as being inhumane to wildlife despite the method used. Despite the lack of involvement by WS under this alternative, those methods perceived as inhumane by certain individuals and groups would still be available to the public for use to alleviate damage and threats caused by birds. Therefore, those methods considered inhumane would continue to be available for use under this alternative. If those people experiencing bird damage apply those methods considered humane as intended and in consideration of the humane use of those methods, then the issue of method humaneness would be similar across the alternatives. If persons employ humane methods in ways that are inhumane, the issue of method humaneness could be greater under this alternative if those persons experiencing bird damage are not provided with information and demonstration on the proper use of those methods. However, the level at which people would apply humane methods inhumanely under this alternative based on a lack of assistance is difficult to determine and could just as likely be similar across the alternatives.

4.2 SUMMARY AND CONCLUSION

Impacts associated with activities under consideration in this EA are not expected to be "significant." 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 BDM program on the populations of both target and nontarget species will continue. All BDM 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 17. The current program alternative provides the lowest overall negative environmental consequences combined with the highest positive effects.

Table 44. 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	HUMANENESS
Target Spp,	Non-Sensitive	0	0	0	0	0
	Sensitive	0	0	0	-/0	-/0
Nontarget Spp.	Non-Sensitive	0	0	0	0	0
	Sensitive	0/++	-/+	-/0	-/0	0
Risks – Adverse	People & Pets	-/0	--/0	--/0	--/0	--/0
	Environment	-/0	--/0	--/0	--/0	--/0
Beneficial	People & Pets	++	+	+	0/+	--/0
Aesthetics	Enjoyment	-	-	-	-	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 or issue, removing the individual bird could also have a positive effect on a T&E species.

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5.4 RESPONSES TO PUBLIC COMMENTS

WS-Arizona received comment letters during the public comment period that contained a combined total of approximately 13,738 individual comments. Many of these comments were identical or substantially similar, so "like" comments were grouped together. Below, we have summarized the public comments into 16 individual comments and provided responses to them. All of the comments we received were either outside the scope of the EA, were adequately addressed in the Draft EA, or have been addressed more clearly in this Final EA. WS-Arizona has provided responses to the substantive comments in the section below.

Below, comments are provided in bold, and our response is provided below the comment in normal font (*i.e.*, not bold).

1. **We received numerous comments on the draft EA which are categorically outside the scope of the EA.**

   Comments on topics outside the scope of the EA include comments opposing or supporting certain actions or alternatives without providing any further context, decisions regarding state laws, and habitat and land management decisions that WS has no regulatory authority over.

2. **Numerous commenters oppose the use of lethal BDM methods and claim that WS-Arizona should examine whether lethal BDM is necessary given the wide array of available nonlethal methods.**

   WS-Arizona does use and recommend nonlethal methods as part of Integrated BDM. Alternative 2 (WS-Arizona Provides Nonlethal Only) adequately analyzes the nonlethal BDM only Alternative. WS-Arizona determined that Alternative 2 fails to meet the objective and goals of WS-Arizona's BDM program.

3. **Commenters claim that BDM methods used by WS-Arizona are indiscriminate and inhumane.**

   We disagree with this claim. WS-Arizona uses an integrated approach to BDM that includes the option to use a variety of methods and techniques to resolve BDM conflicts (EA Section 3.4.1.3). SOPs to prevent, reduce, or compensate for negative impacts of BDM methods are provided in section 3.5.1 and 3.5.2 of the EA. Humaneness and Ethics of WS-Arizona's BDM activities is fully discussed in section 4.1.5 of the EA. WS-Arizona personnel are skilled professionals who abide by applicable laws, WS-Directives, and regulations when conducting BDM activities.

4. **Commenters oppose the use of bird toxicants/pesticides including Avitrol and DRC-1339 and claim that these methods are inhumane and pose a threat to nontarget species and the environment.**

WS-Arizona abides by all EPA label restrictions, state laws and local laws, and WS-Directive 2.401 when applying bird toxicants which reduces the risk of negative impacts to nontarget species and the environment. WS-Arizona personnel that use restricted-use pesticides in their job duties must become a certified pesticide applicator by ADA or be supervised by a certified applicator. WS-Arizona used a very minimal amount of bird toxicants during the analysis period of this EA. From FY16 to FY20 WS-Arizona used an annual average of 2.17 grams of DRC-1339 for BDM. WS-Arizona did not use any Avitrol during the analysis period of this EA. Humaneness of these methods is fully discussed in section 4.1.5.1 of the EA. Numerous scientific studies are provided that concluded these chemicals meet the criteria for a humane pesticide. WS-Arizona pesticide use is fully discussed for each issue and Alternative in the EA and WS-Arizona determined that the proposed action would not have a significant impact on any bird populations or the environment. WS formal Risk Assessment for the use of DRC-1339 found the environmental risk associated with WS use of DRC-1339 is minimal (USDA 2019).

5. **Limits should be set on the percentage of lethal BDM methods used vs nonlethal BDM methods.**

WS-Arizona uses an integrated approach for BDM in Arizona (EA section 1.3.1) WS-Arizona does not set limits on the amount of lethal methods used compared to nonlethal methods. WS-Arizona personnel use the WS Decision Model to select the most appropriate method and approach for reducing bird damage management conflicts (EA section 3.4.1.2). Most of WS-Arizona's lethal take of birds occurs on Airports where birds present a direct threat to aircraft/aviation and human health and safety (EA section 1.3.2).

6. **Lethal BDM violates the government's "public trust doctrine".**

WS-Arizona disagrees with this assertion. The Act of March 2, 1931 authorizes the Secretary of Agriculture to conduct a program of wildlife services. As amended in 1987, congress explicitly authorized Wildlife Services "to control nuisance mammals…". WS-Arizona continues to act under that authority and in good faith with state and federal natural resource management partners. See EA Section 1.7.

The Public Trust Doctrine is the foundation of State and Federal wildlife management programs in North America. The basis for the doctrine in the United States was established by the Supreme Court in 1842 (*Martin v. Waddell)* and subsequently supported by other case law rulings during the 19th through the 20th centuries. The Doctrine establishes that wildlife is a natural resource that belongs to the public and that should be maintained through government programs in trust for the people, including future generations. APHIS-WS conducts wildlife damage management according to the Public Trust Doctrine and its underlying public stewardship principles, not to generate revenue and profit for the Government. The Doctrine guides the relationship between natural resources that are publicly owned, and the Government wildlife management programs that provide stewardship to maintain the resources for the benefit of the public and future generations.

7. **WS must stop killing birds for exhibiting natural behaviors like singing and defecating.**

   WS-Arizona does not consider a bird "singing" as damage and has never conducted BDM to stop birds from singing or making noise. WS-Arizona occasionally conducts BDM projects to manage roosting birds such as pigeons and vultures from residential areas or building structures where the birds and their droppings damage building structures and are a potential disease source. BDM projects are also conducted at animal feedlots to reduce bird dropping contamination which is a potential disease threat to livestock feed and water sources. This issue is most frequently addressed by recommending exclusion devices/barriers (such as netting, hardware cloth, screen, porcupine wire) or habitat modification and localized lethal BDM methods. This issue is discussed throughout the EA.

8. **Commenters claim that public attitudes regarding the need for WDM have shifted and that people are more willing to coexist with wildlife.**

   The views of independent organizations or individuals do not necessarily represent the views of the general public. This issue is adequately addressed in Section 1.3, 4.1.4 and throughout the EA. 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. Birds cause damage but they also have value, depending on personal perceptions. Clucas et al. (2012) summarized that human attitudes towards wildlife in general range from negative to utilitarian in Germany and North America. Some people dislike wildlife that damage their property, others value their utilitarian considerations such as sport hunting, while many appreciate their intrinsic values. Human perceptions, attitudes, and emotions differ depending on how humans desire to "use" different bird species and how they interact with individual or groups of animals.

   Within the constraints of WS-Arizona's decision-making, we believe that the proposed EA works in good faith to preserve bird populations and their role in ecosystems for current and future generations. WS-Arizona also consults extensively with state and federal agencies to ensure consistency with their land management plans, which is explained in Sections 1.7 of the EA. WS-Arizona's monitoring of program actions will help to ensure that new information on bird biology, the role of birds in ecosystems, efficacy of nonlethal and lethal BDM methods, and the human dimensions of BDM are considered and included in program decision-making, as appropriate.

9. **Taxpayer dollars should not be used to support WS-Arizona BDM activities.**

   Some persons feel that WDM should not be provided at the expense of taxpayers or that it should be fee based. As wildlife belongs to the American public and is managed for many uses and values by tax-supported state and federal agencies, it is national policy that some of the resolution of damage caused by those same species is also publicly supported.

Federal and state funds also support research and management of wildlife-related diseases, especially those that can be transmitted to livestock, pets, and humans.

WS was established by Congress as the agency responsible for providing WDM to the people of the United States. Funding for WS-Arizona BDM operations come from a variety of sources in addition to federal appropriations. Such nonfederal sources include State general appropriations, local government funds (county or city), Airports, livestock associations, Indian tribes, and private funds which are all applied toward program operations. This issue is further discussed in section 2.2.10 of the EA.

10. WS should not set policy that benefits the agency Monetarily.

WS-Arizona disagrees with the claim that policies and decisions are made in order to benefit the agency monetarily. WS-Arizona is a cooperatively funded program funded by federal, state, and private and commercial entities that request its services. WS-Arizona is publicly accountable for the work that is requested by public and private entities, and all activities are conducted in accordance with the APHIS-Wildlife Services authorizing act. The Act of 1931, as amended, authorizes the Secretary of Agriculture to make expenditure of resources for the protection of agricultural resources. Congress makes annual allocations to APHIS-WS for the continuing federal action of WDM, including BDM. Congress further establishes that APHIS-WS may receive and retain funds provided by other entities (*e.g.*, States, industry, public and private funds) and use them towards those programs from which funds were received.

11. **WS must stop prioritizing economic variables of stakeholder and private entities when determining what is considered damage.**

WS-Arizona disagrees with the claim that economic variables of stakeholders and private entities are prioritized when determining what is considered damage. Most of the BDM operations conducted by WS-Arizona is for the protection of aviation safety and human health and safety at airports (EA Section 4.1.1.1). The need for BDM is fully addressed in section 1.3 of the EA. WS-Arizona BDM activities are conducted to protect human health and safety, agricultural and aquaculture resources, property, and natural resources including T&E species. The WS Decision Model WS Directive 2.201 is the site-specific process for determining methods and strategies to use or recommend for individual actions conducted by WS. Use of the WS-Decision model is fully discussed in section 3.4.1.2 of the EA. Also, 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 likely begin to implement BDM (EA Section 4.1.4).

12. WS-Arizona should have consulted with federally recognized Native American Tribes in Arizona during the development of this EA.

WS-Arizona provided a draft of the EA for review to cooperating state agencies, federal agencies, and Native American Tribes in Arizona in August 2019. WS-Arizona did not receive responses from any of the Tribes in Arizona during the cooperating agency/Native American Tribe review period. As discussed in section 1.6.2 of the EA, WS-Arizona only conducts BDM on tribal land at a Tribe's request. Since tribal lands are sovereign, tribal officials would determine if BDM is desired and what BDM methods would be used. WS-Arizona recognizes the rights of sovereign tribal nations, the unique legal relationship between each Tribe and the Federal Government, and the importance of strong partnerships with Native American communities. WS-Arizona is committed to respecting tribal heritage and cultural values when planning and initiating wildlife damage management programs as requested by Tribal governments and/or residents or permittees. Timely and meaningful consultation and coordination with tribal governments, to the greatest extent practicable and permitted by law, are conducted consistent with Executive Order (EO) 13175 and APHIS-WS' plan implementing the executive order, including implementing the government-to-government relationship (EA section 1.7.4).

13. Commenters provided reference to the study titled: North America Has Lost Nearly 3 Billion Birds Since 1970 was published in the journal, Science (Sept. 2019). Commenters posted concerns about loss of biodiversity and extinction and that the proposed action would accelerate negative effects on bird populations.

WS-Arizona does not manage bird populations or have regulatory authority over bird populations in the state of Arizona or in the United States. WS-Arizona included an additional study: Rosenberg et al. 2019 information in Natural Factors that Limit Bird Populations in section 4.1.1 of the EA. For detailed information on bird population impacts refer to EA sections 4.1.1, 4.1.2 and 4.2 of the EA. WS-Arizona has determined that the proposed action (Alternative 1) will not have a significant impact to any of the bird species populations discussed in the EA.

14. **Commenters question whether BDM conducted by WS-Arizona my result in less impacts than if BDM were conducted by other entities such as other federal agencies, state agencies, or private pest control companies.**

This issue is fully addressed Alternative 4 (No Federal WS-Arizona BDM). Private individuals and other entities involved in BDM activities may not have the same level of experience, training, certifications, and reporting requirements as WS-Arizona personnel. Agencies and the public enter into cooperative agreements with WS due to our professional skill set and authorities to resolve these issues. WS-Arizona personnel are highly experienced professionals that are trained and certified in the use of BDM methods. WS has numerous policies and directives that provide direction to staff involved in wildlife control, reinforcing safety, effectiveness, and humaneness. WS-Arizona works with USFWS and AZGFD to obtain the necessary permits to control birds and assists in providing annual take data so that they can determine cumulative impacts on species and whether these are within the management objectives for the different avian species. Also, private individuals and companies are not obligated to conduct any NEPA analyses, engage in consultations under the ESA, or conduct formal monitoring of BDM activities including lethal take, so potential cumulative impacts would be unknown. This could result in increased negative impacts to bird populations and the human environment.

15. Commenters Claim that WS-Arizona uses outdated literature/research on the effectiveness lethal PDM.

We disagree with the assertions that WS-Arizona did not use the best available science in the EA, used outdated science, ignored dissenting scientific documents and opinions, or failed to consider important relevant documents related to the effectiveness of lethal vs nonlethal methods. This assertion is true only to the extent that the EA contains some older citations generally related to species biology that has not changed in decades, or historic population trends provided as background information for the analysis. WS-Arizona reviewed and cited the best available science in the preparation of this EA, with extensive literature citations provided in the Section 5.3 of the EA.

16. **Commenter claim that the EA's analysis of BDM impacts climate change is insufficient.**

WS-Arizona disagrees with this claim. This issue is addressed in section 2.2.7 of the EA.

APPENDIX A – POPULATION ESTIMATES

Population estimates for all bird species found in Arizona from 2015 – 2019.

Species List	2015	2016	2017	2018	2019	Ave.	Ave Routes	Detect	State Sq Mi	Rt Sq Mi	Est Pop
Route Count	46	48	52	52	53	50.2					
Canada Goose	0	0	11	0	0	2.2	50.2	1.8	114006	9.82	916
Wood Duck	2	0	0	0	0	0.4	50.2	3.2	114006	9.82	296
Cinnamon Teal	7	18	0	10	0	7	50.2	3.2	114006	9.82	5180
Gadwall	2	0	2	8	0	2.4	50.2	3.2	114006	9.82	1776
Mallard	29	21	32	39	24	29	50.2	3.2	114006	9.82	21462
Mexican Duck	4	3	0	2	0	1.8	50.2	3.2	114006	9.82	1332
Gambel's Quail	1161	885	1148	535	1161	978	50.2	13.01	114006	9.82	2942583
Mearns Quail	16	2	4	1	6	5.8	50.2	7.98	114006	9.82	10704
Chukar	1	0	0	0	0	0.2	50.2	5.97	114006	9.82	276
Ring-necked Pheasant	1	0	1	0	1	0.6	50.2	7.53	114006	9.82	1045
Wild Turkey	2	17	23	7	14	12.6	50.2	5.14	114006	9.82	14978
Pied-billed Grebe	6	6	7	10	5	6.8	50.2	8.4	114006	9.82	13210
Western Grebe	0	0	6	0	5	2.2	50.2	8.4	114006	9.82	4274
Clark's Grebe	0	0	0	2	3	1	50.2	8.4	114006	9.82	1943
Western Grebe / Clark's Grebe	7	19	0	0	0	5.2	50.2	8.4	114006	9.82	10102
Rock Pigeon	36	38	31	27	30	32.4	50.2	6.89	114006	9.82	51627
Band-tailed Pigeon	9	12	9	9	7	9.2	50.2	10.96	114006	9.82	23319
Eurasian Collared-Dove	552	433	527	364	377	450.6	50.2	10	114006	9.82	1042086
Inca Dove	8	9	17	8	2	8.8	50.2	16.58	114006	9.82	33743
Common Ground Dove	10	16	15	15	9	13	50.2	25.45	114006	9.82	76514
White-winged Dove	1380	1350	1332	1049	1085	1239.2	50.2	7.02	114006	9.82	2011829
Mourning Dove	1806	1332	1414	967	1507	1405.2	50.2	9.63	114006	9.82	3129514
Greater Roadrunner	59	82	94	85	59	75.8	50.2	12.13	114006	9.82	212639
Yellow-billed Cuckoo	1	1	0	0	0	0.4	50.2	11.07	114006	9.82	1024
Lesser Nighthawk	186	174	175	185	171	178.2	50.2	29.82	114006	9.82	1228932
Common Nighthawk	24	22	22	21	22	22.2	50.2	30.58	114006	9.82	157001
Common Poorwill	12	12	10	14	7	11	50.2	102.61	114006	9.82	261033
Mexican Whip-poor-will	1	0	4	1	0	1.2	50.2	131.78	114006	9.82	36572
White-throated Swift	43	122	37	75	44	64.2	50.2	21.29	114006	9.82	316099
Blue-throated Mountain-gem	1	1	2	1	2	1.4	50.2	130.32	114006	9.82	42194
Black-chinned Hummingbird	41	29	30	24	26	30	50.2	127.59	114006	9.82	885218
Anna's Hummingbird	21	10	19	19	32	20.2	50.2	158.07	114006	9.82	738437
Costa's Hummingbird	18	17	27	30	20	22.4	50.2	108.6	114006	9.82	562588
Broad-tailed Hummingbird	17	37	41	50	24	33.8	50.2	57.73	114006	9.82	451264
Broad-billed Hummingbird	6	11	7	9	5	7.6	50.2	130.32	114006	9.82	229054
Black Rail	1	2	0	2	2	1.4	50.2	9.8	114006	9.82	3173
Ridgway's Rail	0	9	6	5	17	7.4	50.2	9.8	114006	9.82	16771
Virginia Rail	3	4	4	3	6	4	50.2	9.8	114006	9.82	9066
Sora	0	0	2	1	0	0.6	50.2	9.8	114006	9.82	1360
Common Gallinule	2	11	6	7	18	8.8	50.2	8.4	114006	9.82	17095
American Coot	20	20	20	26	14	20	50.2	8.4	114006	9.82	38853
Black-necked Stilt	10	5	0	4	10	5.8	50.2	3.2	114006	9.82	4292
Killdeer	47	80	54	49	58	57.6	50.2	3.2	114006	9.82	42627
Spotted Sandpiper	0	0	0	1	0	0.2	50.2	3.2	114006	9.82	148
Neotropic Cormorant	0	0	13	0	0	2.6	50.2	2.5	114006	9.82	1503
Double-crested Cormorant	50	61	20	156	1	57.6	50.2	2.5	114006	9.82	33302
Least Bittern	2	1	4	1	0	1.6	50.2	9.8	114006	9.82	3626
Great Blue Heron	18	9	24	10	9	14	50.2	3.2	114006	9.82	10361
Great Egret	0	4	2	4	8	3.6	50.2	3.2	114006	9.82	2664

Snowy Egret	4	7	12	4	8	7	50.2	3.2	114006	9.82	5180
Cattle Egret	0	0	2	5	5	2.4	50.2	3.2	114006	9.82	1776
Green Heron	0	0	0	0	2	0.4	50.2	3.2	114006	9.82	296
Black-crowned Night-Heron	1	2	1	0	1	1	50.2	3.2	114006	9.82	740
Black Vulture	21	11	36	31	28	25.4	50.2	4.27	114006	9.82	25083
Turkey Vulture	255	329	319	315	451	333.8	50.2	5.23	114006	9.82	403739
Osprey	4	0	1	6	4	3	50.2	3.67	114006	9.82	2546
White-tailed Kite	0	1	0	2	1	0.8	50.2	3.96	114006	9.82	733
Golden Eagle	2	0	2	4	2	2	50.2	2.68	114006	9.82	1240
Sharp-shinned Hawk	0	0	0	1	1	0.4	50.2	24.88	114006	9.82	2302
Cooper's Hawk	6	6	5	4	8	5.8	50.2	26.7	114006	9.82	35814
Northern Goshawk	0	1	1	0	0	0.4	50.2	29.04	114006	9.82	2686
Bald Eagle	0	0	0	1	0	0.2	50.2	3.79	114006	9.82	175
Common Black Hawk	0	0	0	0	1	0.2	50.2	4.62	114006	9.82	214
Harris's Hawk	5	9	10	3	9	7.2	50.2	3.96	114006	9.82	6594
Gray Hawk	13	19	12	15	28	17.4	50.2	4	114006	9.82	16096
Swainson's Hawk	20	28	33	21	26	25.6	50.2	3.09	114006	9.82	18294
Zone-tailed Hawk	2	1	3	3	6	3	50.2	5.47	114006	9.82	3795
Red-tailed Hawk	92	120	136	112	112	114.4	50.2	3.44	114006	9.82	91012
Ferruginous Hawk	0	1	0	0	0	0.2	50.2	2.55	114006	9.82	118
Barn Owl	0	1	0	0	0	0.2	50.2	41.34	114006	9.82	1912
Western Screech-Owl	1	1	1	0	2	1	50.2	300.8	114006	9.82	69565
Great Horned Owl	26	24	19	22	27	23.6	50.2	41.26	114006	9.82	225192
Northern Pygmy-Owl	1	0	2	2	3	1.6	50.2	23.06	114006	9.82	8533
Elf Owl	0	0	0	1	2	0.6	50.2	341.01	114006	9.82	47318
Burrowing Owl	13	6	16	4	4	8.6	50.2	9	114006	9.82	17900
Spotted Owl	0	0	2	0	0	0.4	50.2	52.94	114006	9.82	4897
Elegant Trogon	2	1	2	2	2	1.8	50.2	10.28	114006	9.82	4279
Acorn Woodpecker	153	161	171	180	172	167.4	50.2	9.11	114006	9.82	352684
Gila Woodpecker	498	690	565	397	561	542.2	50.2	5.56	114006	9.82	697183
Williamson's Sapsucker	0	1	1	6	13	4.2	50.2	17.47	114006	9.82	16969
Red-naped Sapsucker	0	0	2	1	7	2	50.2	25.09	114006	9.82	11605
American Three-toed Woodpecker	0	0	3	0	5	1.6	50.2	19.35	114006	9.82	7160
Downy Woodpecker	3	0	1	1	0	1	50.2	27.56	114006	9.82	6374
Ladder-backed Woodpecker	125	96	87	114	87	101.8	50.2	28.61	114006	9.82	673563
Hairy Woodpecker	29	31	58	45	42	41	50.2	26.25	114006	9.82	248900
Arizona Woodpecker	11	4	2	7	5	5.8	50.2	23.68	114006	9.82	31763
Northern Flicker	117	107	155	132	103	122.8	50.2	6.52	114006	9.82	185165
Gilded Flicker	119	140	127	96	107	117.8	50.2	6.52	114006	9.82	177626
Crested Caracara	2	2	1	0	1	1.2	50.2	2.32	114006	9.82	644
American Kestrel	71	44	35	37	39	45.2	50.2	6.7	114006	9.82	70037
Peregrine Falcon	2	3	2	3	1	2.2	50.2	2.84	114006	9.82	1445
Prairie Falcon	1	3	2	8	3	3.4	50.2	5.04	114006	9.82	3963
Rose-throated Becard	0	0	0	0	1	0.2	50.2	8	114006	9.82	370
Northern Beardless-Tyrannulet	5	12	6	8	5	7.2	50.2	27.87	114006	9.82	46407
Dusky-capped Flycatcher	32	43	44	65	60	48.8	50.2	8	114006	9.82	90286
Ash-throated Flycatcher	828	859	964	999	1114	952.8	50.2	8.01	114006	9.82	1765008
Brown-crested Flycatcher	282	264	267	199	296	261.6	50.2	10.16	114006	9.82	614673
Sulphur-bellied Flycatcher	5	3	4	3	3	3.6	50.2	9.56	114006	9.82	7959
Cassin's Kingbird	170	158	207	205	171	182.2	50.2	12.32	114006	9.82	519125
Thick-billed Kingbird	2	2	2	2	2	2	50.2	10.69	114006	9.82	4944
Western Kingbird	203	175	147	207	187	183.8	50.2	14.51	114006	9.82	616773
Olive-sided Flycatcher	5	2	19	14	8	9.6	50.2	3.97	114006	9.82	8814
Greater Pewee	3	6	5	9	4	5.4	50.2	8.96	114006	9.82	11190
Western Wood-Pewee	158	189	171	208	178	180.8	50.2	8.99	114006	9.82	375899

Hammond's Flycatcher	0	0	0	1	0	0.2	50.2	47.27	114006	9.82	2186
Gray Flycatcher	35	17	27	16	44	27.8	50.2	26.37	114006	9.82	169538
Dusky Flycatcher	0	3	10	10	24	9.4	50.2	23.81	114006	9.82	51761
Cordilleran Flycatcher	59	77	45	90	72	68.6	50.2	27.24	114006	9.82	432159
Black Phoebe	17	16	14	15	16	15.6	50.2	25.06	114006	9.82	90410
Say's Phoebe	177	88	111	112	116	120.8	50.2	20.58	114006	9.82	574943
Vermilion Flycatcher	37	59	53	62	38	49.8	50.2	27.87	114006	9.82	320981
Loggerhead Shrike	120	105	113	81	103	104.4	50.2	16.54	114006	9.82	399345
Bell's Vireo	180	243	191	174	170	191.6	50.2	24.5	114006	9.82	1085611
Gray Vireo	50	29	77	47	65	53.6	50.2	26.34	114006	9.82	326507
Hutton's Vireo	15	9	16	28	18	17.2	50.2	30.89	114006	9.82	122874
Plumbeous Vireo	83	135	171	132	127	129.6	50.2	28.4	114006	9.82	851208
Warbling Vireo	16	91	132	142	150	106.2	50.2	25.76	114006	9.82	632678
Pinyon Jay	95	163	92	95	147	118.4	50.2	2.93	114006	9.82	80229
Steller's Jay	106	100	115	122	127	114	50.2	6.02	114006	9.82	158713
Woodhouse's Scrub-Jay	94	35	118	116	86	89.8	50.2	5.9	114006	9.82	122530
Mexican Jay	55	96	87	83	91	82.4	50.2	5.9	114006	9.82	112432
Clark's Nutcracker	0	2	9	11	2	4.8	50.2	3.09	114006	9.82	3430
American Crow	24	29	39	53	20	33	50.2	2.91	114006	9.82	22209
Chihuahuan Raven	31	24	19	20	33	25.4	50.2	2.24	114006	9.82	13158
Common Raven	491	776	653	641	734	659	50.2	1.38	114006	9.82	210318
Horned Lark	466	523	445	415	440	457.8	50.2	11.04	114006	9.82	1168846
Tree Swallow	6	5	1	4	4	4	50.2	8.04	114006	9.82	7438
Violet-green Swallow	111	155	273	287	194	204	50.2	7.31	114006	9.82	344874
Northern Rough-winged Swallow	84	227	135	197	65	141.6	50.2	24.25	114006	9.82	794122
Purple Martin	75	63	106	95	81	84	50.2	6.4	114006	9.82	124329
Barn Swallow	54	70	75	137	62	79.6	50.2	8.02	114006	9.82	147639
Cliff Swallow	373	427	388	383	296	373.4	50.2	7.32	114006	9.82	632118
Mountain Chickadee	93	94	117	113	74	98.2	50.2	16.95	114006	9.82	384941
Mexican Chickadee	1	7	2	4	4	3.6	50.2	17	114006	9.82	14154
Bridled Titmouse	40	36	43	35	25	35.8	50.2	8.3	114006	9.82	68718
Juniper Titmouse	45	14	67	26	39	38.2	50.2	5.89	114006	9.82	52034
Verdin	878	886	592	542	584	696.4	50.2	19.05	114006	9.82	3068077
Bushtit	78	34	83	61	44	60	50.2	18.37	114006	9.82	254902
Red-breasted Nuthatch	10	22	11	42	22	21.4	50.2	22.27	114006	9.82	110216
White-breasted Nuthatch	154	160	148	108	119	137.8	50.2	20.72	114006	9.82	660315
Pygmy Nuthatch	211	205	184	137	167	180.8	50.2	28.43	114006	9.82	1188742
Brown Creeper	18	33	15	19	13	19.6	50.2	69.89	114006	9.82	316799
Rock Wren	92	74	86	68	114	86.8	50.2	10.25	114006	9.82	205758
Canyon Wren	46	20	28	25	26	29	50.2	15.01	114006	9.82	100668
House Wren	112	187	189	247	212	189.4	50.2	23.95	114006	9.82	1049054
Marsh Wren	0	2	5	7	6	4	50.2	48.61	114006	9.82	44967
Bewick's Wren	243	210	221	230	262	233.2	50.2	9.14	114006	9.82	492932
Cactus Wren	826	683	470	544	519	608.4	50.2	8.88	114006	9.82	1249438
Blue-gray Gnatcatcher	75	53	48	50	47	54.6	50.2	190.33	114006	9.82	2403324
Black-tailed Gnatcatcher	394	493	335	309	269	360	50.2	73.19	114006	9.82	6093499
Golden-crowned Kinglet	0	0	0	5	2	1.4	50.2	159.88	114006	9.82	51765
Ruby-crowned Kinglet	0	39	83	101	86	61.8	50.2	23.44	114006	9.82	335011
Eastern Bluebird	6	4	8	8	7	6.6	50.2	18.04	114006	9.82	27536
Western Bluebird	126	104	189	136	116	134.2	50.2	41.04	114006	9.82	1273715
Mountain Bluebird	21	10	29	47	36	28.6	50.2	14.06	114006	9.82	92996
Townsend's Solitaire	2	2	0	4	5	2.6	50.2	9.02	114006	9.82	5424
Hermit Thrush	44	136	98	115	167	112	50.2	11.37	114006	9.82	294504
American Robin	165	182	289	256	219	222.2	50.2	18.15	114006	9.82	932681
Gray Catbird	0	0	0	0	1	0.2	50.2	31.29	114006	9.82	1447

Curve-billed Thrasher	328	365	195	190	238	263.2	50.2	10.7	114006	9.82	651302
Bendire's Thrasher	31	17	6	20	20	18.8	50.2	9.33	114006	9.82	40565
LeConte's Thrasher	3	1	0	1	1	1.2	50.2	8.16	114006	9.82	2265
Crissal Thrasher	38	37	23	19	14	26.2	50.2	9.33	114006	9.82	56532
Sage Thrasher	1	0	0	3	6	2	50.2	9.76	114006	9.82	4514
Northern Mockingbird	527	357	621	420	1050	595	50.2	6.64	114006	9.82	913687
European Starling	175	96	207	77	140	139	50.2	6.32	114006	9.82	203163
Phainopepla	264	253	315	347	231	282	50.2	21.1	114006	9.82	1376081
Olive Warbler	11	16	14	24	16	16.2	50.2	28.64	114006	9.82	107300
House Sparrow	666	583	500	410	483	528.4	50.2	12.97	114006	9.82	1584949
Evening Grosbeak	0	0	1	0	0	0.2	50.2	23.04	114006	9.82	1066
House Finch	1029	1014	927	874	879	944.6	50.2	19.91	114006	9.82	4349424
Cassin's Finch	0	7	6	4	6	4.6	50.2	27.35	114006	9.82	29096
Red Crossbill	19	17	7	67	12	24.4	50.2	21.51	114006	9.82	121379
Pine Siskin	11	26	28	83	70	43.6	50.2	33.27	114006	9.82	335469
Lesser Goldfinch	151	93	118	112	119	118.6	50.2	24.18	114006	9.82	663214
Rufous-winged Sparrow	72	34	24	52	38	44	50.2	9.79	114006	9.82	99620
Botteri's Sparrow	28	36	18	24	21	25.4	50.2	9.79	114006	9.82	57508
Cassin's Sparrow	16	39	39	58	43	39	50.2	9.71	114006	9.82	87578
Grasshopper Sparrow	9	7	9	6	4	7	50.2	30.26	114006	9.82	48987
Black-throated Sparrow	1205	1054	911	856	1106	1026.4	50.2	34.98	114006	9.82	8303266
Lark Sparrow	108	85	134	127	99	110.6	50.2	6.94	114006	9.82	177512
Chipping Sparrow	95	125	177	141	150	137.6	50.2	41.01	114006	9.82	1305031
Black-chinned Sparrow	28	18	27	18	27	23.6	50.2	11.42	114006	9.82	62329
Brewer's Sparrow	1	0	9	3	72	17	50.2	13.96	114006	9.82	54884
Dark-eyed Junco	180	151	203	164	169	173.4	50.2	35.17	114006	9.82	1410373
Yellow-eyed Junco	22	143	18	61	57	60.2	50.2	26.37	114006	9.82	367129
Sagebrush Sparrow	5	6	18	19	37	17	50.2	11.48	114006	9.82	45134
Vesper Sparrow	26	21	42	37	39	33	50.2	11.91	114006	9.82	90895
Savannah Sparrow	0	0	0	0	1	0.2	50.2	29.24	114006	9.82	1352
Song Sparrow	30	27	18	17	11	20.6	50.2	29.85	114006	9.82	142208
Canyon Towhee	98	86	77	84	98	88.6	50.2	50.37	114006	9.82	1032091
Abert's Towhee	77	41	48	33	50	49.8	50.2	51.65	114006	9.82	594856
Rufous-crowned Sparrow	64	44	79	66	78	66.2	50.2	11.49	114006	9.82	175910
Green-tailed Towhee	0	0	17	7	10	6.8	50.2	15.13	114006	9.82	23794
Spotted Towhee	295	205	272	230	286	257.6	50.2	45.91	114006	9.82	2735052
Yellow-breasted Chat	151	139	138	125	145	139.6	50.2	13.63	114006	9.82	440042
Yellow-headed Blackbird	98	91	30	221	31	94.2	50.2	5.71	114006	9.82	124394
Eastern Meadowlark	86	84	101	134	169	114.8	50.2	8.97	114006	9.82	238148
Western Meadowlark	171	105	136	126	179	143.4	50.2	7.9	114006	9.82	261992
Hooded Oriole	26	46	40	32	13	31.4	50.2	20.49	114006	9.82	148794
Bullock's Oriole	41	55	41	57	80	54.8	50.2	21.25	114006	9.82	269310
Scott's Oriole	77	129	66	97	56	85	50.2	22.71	114006	9.82	446425
Red-winged Blackbird	1637	1848	1473	1127	1493	1515.6	50.2	6.73	114006	9.82	2358914
Bronzed Cowbird	3	5	12	2	5	5.4	50.2	15.56	114006	9.82	19432
Brown-headed Cowbird	220	526	203	193	362	300.8	50.2	21.79	114006	9.82	1515820
Brewer's Blackbird	15	21	34	37	18	25	50.2	6.67	114006	9.82	38564
Great-tailed Grackle	478	512	578	327	499	478.8	50.2	5.72	114006	9.82	633378
Orange-crowned Warbler	0	0	0	2	0	0.4	50.2	25.94	114006	9.82	2400
Lucy's Warbler	524	599	469	537	539	533.6	50.2	25.33	114006	9.82	3125817
Virginia's Warbler	101	71	66	45	71	70.8	50.2	23.15	114006	9.82	379050
MacGillivray's Warbler	0	0	4	4	3	2.2	50.2	23.89	114006	9.82	12155
Common Yellowthroat	27	33	32	23	25	28	50.2	22.73	114006	9.82	147187
Yellow Warbler	58	60	37	69	36	52	50.2	22.63	114006	9.82	272145
Yellow-rumped Warbler	71	196	197	195	191	170	50.2	26.54	114006	9.82	1043428

Grace's Warbler	104	110	99	91	143	109.4	50.2	23.84	114006	9.82	603165
Black-throated Gray Warbler	82	69	76	54	109	78	50.2	25.88	114006	9.82	466844
Red-faced Warbler	41	38	35	64	56	46.8	50.2	23.73	114006	9.82	256836
Painted Redstart	44	26	24	16	27	27.4	50.2	24.52	114006	9.82	155376
Hepatic Tanager	23	25	23	35	24	26	50.2	26.26	114006	9.82	157899
Summer Tanager	26	34	32	32	54	35.6	50.2	27.04	114006	9.82	222623
Western Tanager	81	125	127	106	159	119.6	50.2	12.55	114006	9.82	347126
Northern Cardinal	92	111	89	110	78	96	50.2	19.08	114006	9.82	423606
Pyrrhuloxia	48	43	38	59	58	49.2	50.2	8.34	114006	9.82	94895
Black-headed Grosbeak	90	96	106	119	118	105.8	50.2	29.23	114006	9.82	715199
Blue Grosbeak	155	87	95	106	138	116.2	50.2	31.3	114006	9.82	841130
Lazuli Bunting	1	0	0	0	0	0.2	50.2	26.37	114006	9.82	1220
Indigo Bunting	0	0	0	0	1	0.2	50.2	28.57	114006	9.82	1321
Varied Bunting	5	11	10	12	16	10.8	50.2	25.22	114006	9.82	62991

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APPENDIX B - Birds of Conservation Concern in Bird Conservation Regions (BCR) in Arizona (USFWS 2021)

BCR 16 (Southern Rockies/Colorado Plateau) *BCC 2021*

Western Grebe
Clark's Grebe
Black Swift
Broad-tailed Hummingbird
Mountain Plover
Snowy Plover (Interior/Gulf Coast)
Pectoral Sandpiper (nb)
Lesser Yellowlegs (nb)
California Gull
Flammulated Owl
Long-eared Owl
Short-eared Owl
Lewis's Woodpecker
Olive-sided Flycatcher
Pinyon Jay
Clark's Nutcracker
Bendire's Thrasher
Evening Grosbeak
Black Rosy-Finch
Brown-capped Rosy-Finch
Cassin's Finch
Black-chinned Sparrow
Yellow-headed Blackbird
Virginia's Warbler
Grace's Warbler

BCR 33 (Sonoran and Mojave Deserts U.S. Portion only) *BCC 2021*

American Avocet
Mountain Plover (nb)
Snowy Plover (Interior/Gulf Coast)
Marbled Godwit (nb)
Willet (nb)
Yellow-footed Gull (nb)
Gull-billed Tern
Black Skimmer
Burrowing Owl (Western)
Long-eared Owl
Gila Woodpecker

Gilded Flicker
Pinyon Jay
Verdin (Southwest)
Curve-billed Thrasher (Palmer's))
Bendire's Thrasher
California Thrasher
LeConte's Thrasher
Lawrence's Goldfinch
Rufous-winged Sparrow
Black-chinned Sparrow
Tricolored Blackbird
Grace's Warbler
Pyrrhuloxia

BCR 34 (Sierra Madre Occidental U.S. portion only) *BCC 2021*
Western Grebe
Mexican Whip-poor-will
Broad-tailed Hummingbird
Flammulated Owl
Whiskered Screech-Owl
Long-eared Owl
Elegant Trogon
Lewis's Woodpecker
Arizona Woodpecker
Gilded Flicker
Olive-sided Flycatcher
Cordilleran Flycatcher
Plumbeous Vireo
Pinyon Jay
Mexican Chickadee
Bendire's Thrasher
Phainopepla (Southwest)
Sprague's Pipit (nb)
Evening Grosbeak
Chestnut-collared Longspur (nb)
Rufous-winged Sparrow
Black-chinned Sparrow
Baird's Sparrow (nb)
Scott's Oriole
Virginia's Warbler
Grace's Warbler

Black-throated Gray Warbler
Red-faced Warbler
Pyrrhuloxia
Varied Bunting

(nb) non-breeding in this BCR

APPENDIX C - BIRD SPECIES OF ARIZONA

The Arizona Field Ornithologists (AZFO 2019) lists 563 bird species documented in Arizona. Of these, 340 species reside for some part of the year in the State regularly (Table C-1 and C-2). Additionally, 219 species have been seen accidentally inside the state from outside their normal range or reside in isolated areas and are seen infrequently (Table C-3), and these species will probably never be the focus of a BDM project (these are listed to let readers know the diversity of birds in the state and that the potential exists that any of these species could be encountered in a BDM project). Finally, 10 more species are listed that could be encountered, all feral domestic species with no viable wild population (Table C-4). Arizona 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 Arizona and the USFWS Central and Pacific Flyways, with the exception of an invasive species specifically targeted for removal.

Table C1. Common and scientific names are given for the 202 wild bird species that typically reside for some part of the year in Arizona 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 Arizona. About half of the species would only be involved in BDM at airports where they are perceived as a strike risk or possibly for disease surveillance (97 spp.). If a species could be involved in a request for assistance other than BDM at airports or for disease surveillance, it is noted.

Species	*Scientific Name*
Order Anseriformes - Waterfowl	
Black-bellied Whistling-Duck S	*Dendrocygna autumnalis*
Snow Goose [2]	*Anser caerulescens*
Ross's Goose [2]	*Anser rossii*
Greater White-fronted Goose [2]	*Anser albifrons*
Canada Goose [2,4,5,6]	*Branta canadensis*
Tundra Swan [2]	*Cygnus columbianus*
Wood Duck [2 S]	*Aix sponsa*
Blue-winged Teal	*Spatula discors*
Cinnamon Teal	*Spatula cyanoptera*
Northern Shoveler	*Spatula clypeata*
Gadwall	*Mareca strepera*
American Wigeon [6]	*Mareca americana*
Mallard [2,4,5,6]	*Anas platyrhynchos*
Northern Pintail	*Anas acuta*
Green-winged Teal	*Anas crecca*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Ring-necked Duck [1]	*Aythya collaris*
Lesser Scaup	*Aythya affinis*
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	
Scaled Quail [S]	*Callipepla squamata*
California Quail (I) [2]	*Callipepla californica*
Gambel's Quail	*Callipepla gambelii*
Mearns Quail [S]	*Cyrtonyx montezumae*
Chukar (I)	*Alectoris chukar*
Ring-necked Pheasant (I) [2]	*Phasianus colchicus*
Wild Turkey [2]	*Meleagris gallopavo*
Order Podicipediformes - Grebes	
Pied-billed Grebe [1]	*Podilymbus podiceps*
Eared Grebe [1]	*Podiceps nigricollis*
Western Grebe [1, S]	*Aechmophorus occidentalis*
Clark's Grebe [1 S]	*Aechmophorus clarkii*
Order Columbiformes – Doves & Pigeons	
Rock Pigeon (I) [2,3,4,5,6]	*Columba livia*
Band-tailed Pigeon [W, S, 2]	*Patagioenas fasciata*
Eurasian Collared Dove (I) [2,3,4,5,6]	*Streptopelia decaocto*
Inca Dove	*Columbina inca*
Common Ground-Dove	*Columbina passerina*
White-winged Dove [2,3,4,6]	*Zenaida asiatica*
Mourning Dove [2,3,4,6]	*Zenaida macroura*
Order Cuculiformes – Cuckoos & Roadrunners	
Greater Roadrunner [5]	*Geococcyx californianus*
Order Caprimulgiformes - Goatsuckers	
Lesser Nighthawk	*Chordeiles acutipennis*
Common Nighthawk S	*Chordeiles minor*
Order Apodiformes - Swifts	
Vaux's Swift [4,6]	*Chaetura vauxi*
White-throated Swift S	*Aeronautes saxatilis*

Order Gruiformes – Rails & Cranes	
Common Gallinule	*Gallinula galeata*
American Coot [6]	*Fulica americana*
Sandhill Crane [2]	*Grus canadensis*
Order Charadriiformes – Shorebirds, Gulls, & Terns	
Black-necked Stilt	*Himantopus mexicanus*
American Avocet	*Recurvirostra americana*
Black-bellied Plover	*Pluvialis squatarola*
Snowy Plover [W S]	*Charadrius alexandrinus*
Semipalmated Plover	*Charadrius semipalmatus*
Killdeer	*Charadrius vociferus*
Mountain Plover [W S]	*Charadrius montanus*
Long-billed Curlew	*Numenius americanus*
Marbled Godwit [W]	*Limosa fedoa*
Stilt Sandpiper	*Calidris himantopus*
Sanderling	*Calidris alba*
Dunlin	*Calidris alpina*
Baird's Sandpiper	*Calidris bairdii*
Least Sandpiper	*Calidris minutilla*
Pectoral Sandpiper [W]	*Calidris melanotos*
Western Sandpiper	*Calidris mauri*
Long-billed Dowitcher	*Limnodromus scolopaceus*
Wilson's Snipe	*Gallinago delicata*
Spotted Sandpiper	*Actitus macularius*
Solitary Sandpiper	*Tringa solitaria*
Lesser Yellowlegs [W]	*Tringa flavipes*
Willet [W]	*Tringa semipalmata*
Greater Yellowlegs	*Tringa melanoleuca*
Wilson's Phalarope	*Phalaropus tricolor*
Red-necked Phalarope	*Phalaropus lobatus*
Bonaparte's Gull [1,4,6]	*Chloicocephalus philadelphia*
Franklin's Gull [1,4,6]	*Leucophaeus pipixcan*
Ring-billed Gull [1,4,6]	*Larus delawarensis*
California Gull [1,4,6]	*Larus californicus*
Caspian Tern [1]	*Hydroprogne caspia*
Black Tern [1]	*Childonias niger*
Common Tern [1]	*Sterna hirundo*
Forster's Tern [1]	*Sterna forsteri*
Order Gaviiformes - Loons	
Common Loon [1]	*Gavia immer*
Order Pelecaniformes – Pelicans, Cormorants, & Allies	
Neotropic Cormorant [1]	*Phalacrocorax brasilianus*
Double-crested Cormorant [1]	*Phalacrocorax auritus*
American White Pelican [1]	*Pelecanus erythrorhynchos*
Brown Pelican [A 1]	*Pelecanus occidentalis*
Order Ciconiiformes –Herons, Egrets, & Ibises	
American Bittern [S 1]	*Botaurus lentiginosus*
Least Bittern [S]	*Ixobrychus exilis*
Great Blue Heron [1]	*Ardea herodias*
Great Egret [1,4,6,S]	*Ardea alba*
Snowy Egret [1,4,6,S]	*Egretta thula*
Cattle Egret [1,4,6]	*Bubulcus ibis*
Green Heron [1]	*Butorides virescens*
Black-crowned Night-Heron [1,4,6]	*Nycticorax nycticorax*
White-faced Ibis	*Plegadis chihi*
Order Accipitriformes – Vultures, Eagles, Kites, and Hawks	
Black Vulture [3,4,6]	*Coragyps atratus*
Turkey Vulture [3,4,6]	*Cathartes aura*
Osprey [1]	*Pandion haliaetus*
White-tailed Kite	*Elanus leucurus*
Mississippi Kite [4, S]	*Ictinia mississippiensis*
Bald Eagle [S, 1,3]	*Haliaeetus leucocephalus*
Northern Harrier	*Circus hudsonius*
Sharp-shinned Hawk [3]	*Accipiter striatus*
Cooper's Hawk [3]	*Accipiter cooperii*
Northern Goshawk S	*Accipiter gentilis*
Common Black-Hawk [S]	*Buteogallus anthracinus*
Harris's Hawk S	*Parabuteo unicinctus*

Gray Hawk	*Buteo plagiatus*
Swainson's Hawk [S]	*Buteo swainsoni*
Zone-tailed Hawk	*Buteo albonotatus*
Red-tailed Hawk [3]	*Buteo jamaicensis*
Ferruginous Hawk [S]	*Buteo regalis*
Golden Eagle [3 S]	*Aquila chrysaetos*
Order Strigiformes - Owls	
Barn Owl [4,6]	*Tyto alba*
Western Screech-Owl Swhite-	*Megascops kennicottii*
Whiskered Screech-Owl [W S]	*Megascops trichopsis*
Great Horned Owl [3]	*Bubo virginianus*
Burrowing Owl S	*Athene cunicularia*
Long-eared Owl [W, S]	*Asio otus*
Short-eared Owl	*Asio flammeus*
Order Coraciiformes - Kingfishers	
Belted Kingfisher [1]	*Megaceryle alcyon*
Green Kingfisher [1]	*Chloroceryle americana*
Order Piciformes - Woodpeckers	
Lewis's Woodpecker [W,S]	*Melanerpes lewis*
Acorn Woodpecker [2,6,S]	*Melanerpes formicivorus*
Gila Woodpecker [6 S]	*Melanerpes uropygialis*
Williamson's Sapsucker [S]	*Sphyrapicus thyroideus*
Red-naped Sapsucker [2,6,S]	*Sphyrapicus nuchalis*
Ladder-backed Woodpecker [2]	*Picoides scalaris*
Downy Woodpecker [2]	*Picoides pubescens*
Hairy Woodpecker [2]	*Picoides villosus*
Arizona Woodpecker [W S]	*Picoides arizonae*
Amer. Three-toed Woodpecker [6S]	*Picoides dorsalis*
Northern Flicker [2,6]	*Colaptes auratus*
Gilded Flicker [W S]	*Colaptes chrysoides*
Order Falconiformes – Caracaras & Falcons	
Crested Caracara [3]	*Caracara cheriway*
American Kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine Falcon S	*Falco peregrinus*
Prairie Falcon S	*Falco mexicanus*
Order Psittaciformes - Parrots	
Rosy-faced Lovebird (I) [6]	*Agapornis roseicollis*
Order Passeriformes – Perching Birds	
Family Tyrannidae - Flycatchers	
Say's Phoebe	*Sayornis saya*
Dusky-capped Flycatcher S	*Myiarchus tuberculifer*
Ash-throated Flycatcher	*Myiarchus cinerascens*
Brown-crested Flycatcher S	*Myiarchus tyrannulus*
Tropical Kingbird	*Tyrannus melancholicus*
Cassin's Kingbird	*Tyrannus vociferans*
Thick-billed Kingbird [S]	*Tyrannus crassirostris*
Western Kingbird	*Tyrannus verticalis*
Family Laniidae - Shrikes	
Loggerhead Shrike	*Lanius ludovicianus*
Family Corvidae – Crows & Jays	
Gray Jay S	*Perisoreus canadensis*
Pinyon Jay [W S]	*Gymnorhinus cyanocephalus*
Steller's Jay	*Cyanocitta stelleri*
Woodhouse's Scrub-Jay [4]	*Aphelocoma woodhouseii*
Mexican Jay S	*Aphelocoma wollweberi*
Clark's Nutcracker	*Nucifraga columbiana*
Black-billed Magpie [2,3,4,5,6,S]	*Pica hudsonia*
American Crow [2,3,4,6]	*Corvus brachyrhynchos*
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 S [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]	*Petrchelidon pyrrhonota*
Barn Swallow [3,6]	*Hirundo rustica*
Family Muscicapidae – Robins & Thrushes	
American Robin [2]	*Turdus migratorius*
Family Mimidae – Mockingbirds & Thrashers	
Curve-billed Thrasher	*Toxostoma curvirostre*
Bendire's Thrasher [W, S]	*Toxostoma bendirei*
Northern Mockingbird [4]	*Mimus polyglottos*
Family Sturnidae - Starlings	
European Starling (I) [2,3,4,5,6]	*Sturnus vulgaris*
Family Bombycillidae - Waxwings	
Cedar Waxwing [2]	*Bombycilla cedrorum*
Family Passeridae – Old World Sparrows	
House Sparrow (I) [2,3,4,6]	*Passer domesticus*
Family Motacillidae - Pipits	
American Pipit S	*Anthus rubescens*
Sprague's Pipit [W s]	*Anthus spragueii*
Family Fringillidae - Finches	
Evening Grosbeak [W S]	*Coccothraustes vespertinus*
House Finch [2,4,6]	*Haemorhous mexicanus*
Cassin's Finch [W 6]	*Haemorhous cassinii*
Red Crossbill [2, S]	*Loxia curvirostra*

Lesser Goldfinch [2]	*Spinus psaltria*
Lawrence's Goldfinch [W 2]	*Spinus lawrencei*
American Goldfinch [2]	*Spinus tristis*
Family Passerellidae –Towhees & Sparrows	
Lark Bunting [2]	*Calamospiza melanocorys*
Savannah Sparrow S	*Passerculus sandwichensis*
White-crowned Sparrow [2,6,S]	*Zonotrichia leucophrys*
Family Icteridae – Blackbirds, Meadowlarks, & Orioles	
Yellow-headed Blackbird [2,3]	*Xanthocephalus xanthocephalus*
Eastern Meadowlark S	*Sturnella magna*
Western Meadowlark	*Sturnella neglecta*
Bullock's Oriole S	*Icterus bullockii*
Scott's Oriole S	*Icterus parisorum*
Red-winged Blackbird [2,3,6]	*Agelaius phoeniceus*
Bronzed Cowbird [2,3]	*Molothrus aeneus*
Brown-headed Cowbird [2,3,5,6]	*Molothrus ater*
Brewer's Blackbird [2,3,6]	*Euphagus cyanocephalus*
Great-tailed Grackle [2,3,4,6]	*Quiscalus mexicanus*
Family Cardinalidae – Cardinals, Grosbeaks, & Buntings	
Northern Cardinal [4]	*Cardinalis cardinalis*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Black-headed Grosbeak	*Pheucticus melanocephalus*

(I) - Introduced Species; **E** = Endangered & **T** = Threatened (USFWS 2017); **W =** Watchlist Species (ACAD 2019); **S** = Species of Greatest Conservation Need (SWAP 2012)
1 = Aquaculture; **2** = Crops; **3** = Livestock and Feed; **4**= Human Health and Safety; **5** = Natural resources; **6** = Property

Table C2. Common and scientific names are given for the 138 bird species commonly occurring in Arizona that have little or no potential to be the target of a WS BDM project including projects at airports because these species are mostly limited in their distribution in Arizona, 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, WS does not anticipate that it will conduct BDM for these species, but the possibility could always arise.

Species	*Scientific Name*
Dusky Grouse S	*Dendragapus obscurus*
Yellow-billed Cuckoo [T W S]	*Coccyzus americanus*
Common Poorwill S	*Phalaenoptilus nuttallii*
Mexican Whip-poor-will [W]	*Antrostomus arizonae*
Rivoli's Hummingbird	*Eugenes fulgens*
Blue-throated Hummingbird S	*Lampornis clemenciae*
Black-chinned Hummingbird	*Archilochus alexandri*
Anna's Hummingbird	*Calypte anna*
Costa's Hummingbird [S]	*Calypte costae*
Broad-tailed Hummingbird	*Selasphorus platycercus*
Rufous Hummingbird [W]	*Selasphorus rufus*
Calliope Hummingbird	*Stellula calliope*
Broad-billed Hummingbird S	*Cynanthus latirostris*
Violet-crowned Hummingbird	*Amazilia violaceps*
Black Rail [W S]	*Laterallus jamaicensis*
Ridgway's Rail [W]	*Rallus obsoletus*
Virginia Rail S	*Rallus limicola*
Sora S	*Porzana carolina*
Flammulated Owl [W S]	*Psiliscops flammeolus*
Northern Pygmy-Owl S	*Glaucidium gnoma*
Elf Owl S	*Micrathene whitneyi*
Mexican Spotted Owl [T, S]	*Strix occidentalis lucida*
Northern Saw-whet Owl S	*Aegolius acadicus*
Elegant Trogon [W S]	*Trogon elegans*
Northern Beardless-Tyrannulet	*Camptostoma imberbe*
Olive-sided Flycatcher [W, S]	*Contopus cooperi*
Greater Pewee S	*Contopus pertinax*
Western Wood-Pewee	*Contopus sordidulus*
Willow Flycatcher [E*]	*Empidonax traillii*

Hammond's Flycatcher	*Empidonax hammondii*
Gray Flycatcher S	*Empidonax wrightii*
Dusky Flycatcher S	*Empidonax oberholseri*
Pacific-slope Flycatcher	*Empidonax difficilis*
Cordilleran Flycatcher S	*Empidonax occidentalis*
Buff-breasted Flycatcher S	*Empidonax fulvifrons*
Black Phoebe	*Sayornis nigricans*
Vermillion Flycatcher [S]	*Pyrocephalus rubinus*
Sulphur-bellied Flycatcher	*Myiodynastes luteiventris*
Bell's Vireo S	*Vireo bellii*
Gray Vireo [S]	*Vireo vicinior*
Hutton's Vireo	*Vireo huttoni*
Cassin's Vireo	*Vireo cassinii*
Plumbeous Vireo	*Vireo plumbeus*
Warbling Vireo	*Vireo gilvus*
Mountain Chickadee	*Poecile gambeli*
Mexican Chickadee [W S]	*Poecile sclateri*
Bridled Titmouse S	*Baeolophus wollweberi*
Juniper Titmouse S	*Baeolophus ridgwayi*
Verdin	*Auriparus flaviceps*
Bushtit	*Psaltriparus minimus*
Red-breasted Nuthatch	*Sitta canadensis*
White-breasted Nuthatch	*Sitta carolinensis*
Pygmy Nuthatch	*Sitta pygmaea*
Brown Creeper	*Certhia americana*
Rock Wren	*Salpinctes obsoletus*
Canyon Wren	*Catherpes mexicanus*
House Wren	*Troglodytes aedon*
Marsh Wren S	*Cistothorus palustris*
Bewick's Wren	*Thryomanes bewickii*

Cactus Wren	*Campylorhynchus brunneicapillus*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Black-tailed Gnatcatcher S	*Polioptila melanura*
American Dipper S	*Cinclus mexicanus*
Golden-crowned Kinglet S	*Regulus satrapa*
Ruby-crowned Kinglet	*Regulus calendula*
Eastern Bluebird	*Sialia sialis*
Western Bluebird	*Sialia mexicana*
Mountain Bluebird S	*Sialia currucoides*
Townsend's Solitaire	*Myadestes townsendi*
Swainson's Thrush S	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
Le Conte's Thrasher W S	*Toxostoma lecontei*
Crissal Thrasher	*Toxostoma crissale*
Sage Thrasher S	*Oreoscoptes montanus*
Phainopepla S	*Phainopepla nitens*
Olive Warbler	*Peucedramus taeniatus*
Pine Grosbeak	*Pinicola enucleator*
Pine Siskin	*Spinus pinus*
Chestnut-collared Longspur W S	*Calcarius ornatus*
Green-tailed Towhee	*Pipilo chlorurus*
Spotted Towhee	*Pipilo maculatus*
Rufous-crowned Sparrow	*Aimophila ruficeps*
Canyon Towhee	*Melozone fusca*
Abert's Towhee S	*Melozone aberti*
Rufous-winged Sparrow W S	*Peucaea carpalis*
Botteri's Sparrow S	*Peucaea botterii*
Cassin's Sparrow S	*Peucaea cassinii*
Chipping Sparrow	*Spizella passerina*
Clay-colored Sparrow	*Spizella pallida*
Brewer's Sparrow S	*Spizella breweri*
Black-chinned Sparrow W, S	*Spizella atrogularis*
Vesper Sparrow	*Pooecetes gramineus*
Lark Sparrow	*Chondestes grammacus*
Five-striped Sparrow W S	*Amphispiza quiquestriata*
Black-throated Sparrow	*Amphispiza bilineata*
Sage Sparrow S	*Amphispiza nevadensis*
Bell's Sparrow	*Amphispiza belli*

Grasshopper Sparrow W S	*Ammodramus savannarum*
Baird's Sparrow W S	*Ammodramus bairdii*
Fox Sparrow	*Passerella iliaca*
Song Sparrow	*Melospiza melodia*
Lincoln's Sparrow S	*Melospiza lincolnii*
Swamp Sparrow	*Melospiza georgiana*
White-throated Sparrow	*Zonotrichia albicollis*
Dark-eyed Junco	*Junco hyemalis*
Yellow-eyed Junco S	*Junco phaeonotus*
Yellow-breasted Chat S	*Icteria virens*
Hooded Oriole	*Icterus cucullatus*
Northern Waterthrush	*Parkesia noveboracensis*
Black-and-white Warbler	*Mniotilta varia*
Orange-crowned Warbler S	*Oreothlypis celata*
Lucy's Warbler S	*Oreothlypis luciae*
Nashville Warbler	*Oreothlypis ruficapilla*
Virginia's Warbler W,S	*Oreothlypis virginiae*
MacGillivray's Warbler S	*Geothlypis tolmiei*
Common Yellowthroat	*Geothlypis trichas*
American Redstart	*Setophaga ruticilla*
Northern Parula	*Setophaga americana*
Yellow Warbler S	*Setophaga petechia*
Yellow-rumped Warbler	*Setophaga coronata*
Grace's Warbler S	*Setophaga graciae*
Black-throated Gray Warbler	*Setophaga nigrescens*
Townsend's Warbler	*Setophaga townsendi*
Hermit Warbler	*Setophaga occidentalis*
Wilson's Warbler	*Cardellina pusilla*
Red-faced Warbler S	*Cardellina rubrifrons*
Painted Redstart S	*Myioborus pictus*
Hepatic Tanager	*Piranga flava*
Summer Tanager S	*Piranga rubra*
Western Tanager	*Piranga ludoviciana*
Pyrrhuloxia	*Cardinalis sinuatus*
Blue Grosbeak	*Guiraca caerulea*
Lazuli Bunting S	*Passerina amoena*
Indigo Bunting	*Passerina cyanea*
Varied Bunting S	*Passerina versicolor*

E = Endangered & **T** = Threatened (USFWS 2017); **W =** Watchlist Species (ACAD 2019); **S** = Species of Greatest Conservation Need (SWAP 2012)

***** Subspp. *extimus*

Table C3. Common and scientific names are given for the 202 bird species that are infrequently or accidentally seen in Arizona including extirpated species (5) with populations that have been reintroduced, but not established. These species have been designated by AZFO (2009) as review species because they are not commonly found in Arizona. Some of these species have the potential of being the focus of a BDM project. Shaded species will not be or are not likely to ever be involved in a BDM project. These species are not discussed in the EA because they occur so infrequently or in such remote areas on the border, especially in southeast Arizona along the border, 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 WS is aware of the other species potentially present in Arizona.

Species	*Scientific Name*
Fulvous Whistling-Duck	*Dendrocygna bicolor*
Brant A	*Branta bernicla*
Cackling Goose	*Branta hutchinsii*
Trumpeter Swan	*Cygnus buccinator*
Baikal Teal	*Sibirionetta formosa*
Garganey	*Spatula querquedula*
Eurasian Wigeon	*Mareca penelope*
Tufted Duck	*Aythya fuligula*
Greater Scaup	*Aythya marila*
Harlequin Duck	*Histrionicus histrionicus*
Surf Scoter	*Melanitta perspicillata*
White-winged Scoter	*Melanitta fusca*
Black Scoter	*Melanitta nigra*
Long-tailed Duck	*Clangula hyemalis*
Barrow's Goldeneye	*Bucephala islandica*
Northern Bobwhite (Masked) XE S	*Colinus virginianus ridgwayi*
Least Grebe	*Tachybaptus dominicus*
Horned Grebe	*Podiceps auritus*
Red-necked Grebe	*Podiceps grisegena*
Ruddy Ground-Dove	*Columbina talpacoti*
Black-billed Cuckoo W	*Coccyzus erythropthalmus*

Groove-billed Ani	*Crotophaga sulcirostris*
Buff-collared Nightjar S	*Antrostomus ridgwayi*
Eastern Whip-poor-will W	*Antrostomus vociferus*
Black Swift W	*Cypseloides niger*
Chimney Swift W	*Chaetura pelagica*
Plain-capped Starthroat	*Heliomaster constantii*
Lucifer Hummingbird W	*Calothorax lucifer*
Ruby-throated Hummingbird	*Archilochus colubris*
Bumblebee Hummingbird	*Atthis heloisa*
Allen's Hummingbird W	*Selasphorus sasin*
Berylline Hummingbird	*Amazilia beryllina*
Cinnamon Hummingbird	*Amazilia rutila*
White-eared Hummingbird	*Hylocharis leucotis*
Purple Gallinule	*Porphyrula martinicus*
American Golden-Plover	*Pluvialis dominica*
Pacific Golden-Plover	*Pluvalis fulva*
Northern Jacana	*Jacana spinosa*
Upland Sandpiper	*Bartramia longicauda*
Whimbrel	*Numenius phaeopus*
Hudsonian Godwit W	*Limosa haemastica*
Ruddy Turnstone	*Arenaria interpres*
Black Turnstone W	*Arenaria melanocephala*
Red Knot T* W	*Calidris canutus*
Ruff	*Calidris pugnax*
Sharp-tailed Sandpiper	*Calidris acuminate*
White-rumped Sandpiper	*Calidris fuscicollis*
Buff-breasted Sandpiper W	*Calidris subruficollis*
Semipalmated Sandpiper	*Calidris pusilla*
Short-billed Dowitcher W	*Limnodromus griseus*
Wandering Tattler	*Tringa incana*
Red Phalarope	*Phalaropus fulicarius*
Pomarine Jaeger	*Stercorarius pomarinus*
Parasitic Jaeger	*Stercorarius parasiticus*
Long-tailed Jaeger	*Stercorarius longicaudus*
Black-legged Kittiwake	*Rissa tridactyla*
Ivory Gull W	*Pagophila eburnea*
Sabine's Gull	*Xema sabini*
Little Gull	*Hydrocoloeus minutus*
Laughing Gull	*Leucophaeus atricilla*
Heermann's Gull W	*Larus heermanni*
Mew Gull	*Larus canus*
Western Gull	*Larus occidentalis*
Yellow-footed Gull W	*Larus livens*
Herring Gull	*Larus argentatus*
Iceland Gull	*Larus glaucoides*
Lesser Black-backed Gull	*Larus fuscus*
Glaucous-winged Gull	*Larus glaucescens*
Glaucous Gull	*Larus hyperboreus*
California Least Tern E S	*Sternula antillarum browni*
Gull-billed Tern	*Gelochelidon nilotica*
Arctic Tern	*Sterna paradisaea*
Royal Tern	*Thalasseus maximus*
Elegant Tern W	*Thalasseus elegans*
Black Skimmer W	*Rhynchops niger*
White-tailed Tropicbird	*Phaethon lepturus*
Red-billed Tropicbird	*Phaethon aethereus*
Red-throated loon	*Gavia stellata*
Pacific Loon	*Gavia pacifica*
Yellow-billed Loon W	*Gavia adamsii*
Laysan Albatross W	*Phoebastria immutabillis*
Hawaiian Petrel T	*Pterodroma sandwichensis*
Sooty Shearwater	*Ardenna grisea*
Black-vented Shearwater W	*Puffinis opisthomelas*
Leach's Storm-Petrel	*Oceanodroma leucorhoa*
Black Storm-Petrel W	*Oceanodroma melania*
Least Storm-Petrel W	*Oceanodroma microsoma*
Wood Stork A	*Mycteria americana*
Magnificent Frigatebird W S	*Fregata magnificens*
Blue-footed Booby W	*Sula nebouxii*

Brown Booby	*Sula leucogaster*
Anhinga	*Anhinga anhinga*
Little Blue Heron	*Egretta caerulea*
Tricolored Heron	*Egretta tricolor*
Reddish Egret W	*Egretta rufescens*
Yellow-crowned Night-Heron	*Nyctanassa violacea*
White Ibis	*Eudocimus albus*
Glossy Ibis	*Plegadis falcinellus*
Roseate Spoonbill	*Ajaia ajaja*
California Condor XE W S	*Gymnogyps californianus*
Swallow-tailed Kite	*Elanoides forficatus*
White-tailed Hawk	*Geranospiza albicaudatus*
Red-shouldered Hawk	*Buteo lineatus*
Broad-winged Hawk	*Buteo platypterus*
Short-tailed Hawk	*Buteo brachyurus*
Rough-legged Hawk	*Buteo lagopus*
Ferruginous Pygmy-Owl S	*Glaucidium brasilianum*
Eared Quetzal	*Euptilotis neoxenus*
Red-headed Woodpecker W	*Melanerpes erythrocephalus*
Yellow-bellied Sapsucker	*Sphyrapicus varias*
Red-breasted Sapsucker	*Sphyrapicus ruber*
Aplomado Falcon XES	*Falco femoralis*
Thick-billed Parrot XES	*Rhynchopsitta pachyrhyncha*
Tufted Flycatcher	*Mitrenphanes phaeocercus*
Eastern Wood-Pewee	*Contopus virens*
Yellow-bellied Flycatcher	*Empidonax flaviventris*
Acadian Flycatcher	*Empidonax virescens*
Least Flycatcher	*Empidonax minimus*
Pine Flycatcher	*Empidonax affinis*
Eastern Phoebe	*Sayornis phoebe*
Nutting's Flycatcher	*Myiarchus nuttingi*
Great Crested Flycatcher	*Myiarchus crinitus*
Great Kiskadee	*Pitangus sulphuratus*
Couch's Kingbird	*Tyrannus couchii*
Eastern Kingbird	*Tyrannus tyrannus*
Scissor-tailed Flycatcher	*Tyrannus forficatus*
Gray-collared Becard	*Pachyramphus major*
Rose-throated Becard S	*Pachyramphus aglaiae*
Northern Shrike	*Lanius borealis*
Black-capped Vireo E W	*Vireo atricapilla*
White-eyed Vireo	*Vireo griseus*
Yellow-throated Vireo	*Vireo flavifrons*
Blue-headed Vireo	*Vireo solitarius*
Philadelphia Vireo	*Vireo philadelphicus*
Red-eyed Vireo	*Vireo olivaceus*
Yellow-green Vireo	*Vireo flavoviridis*
Blue Jay	*Cyanocitta cristata*
Brown-chested Martin	*Progne tapera*
Cave Swallow	*Petrochelidon fulva*
Black-capped Chickadee	*Parus atricapillus*
Pacific Wren S	*Troglodytes pacificus*
Winter Wren	*Troglodytes hiernalis*
Sedge Wren	*Cistothorus platensis*
Carolina Wren	*Thryothorus ludovicianus*
Sinaloa Wren	*Thryophilus sinaloa*
Black-capped Gnatcatcher W S	*Polioptila nigriceps*
Northern Wheatear	*Oenanthe oenanthe*
Brown-backed Solitaire	*Myadestes occidentalis*
Veery	*Catharus fuscescens*
Gray-cheeked Thrush	*Catharus mimimus*
Wood Thrush W	*Hylocichla mustelina*
Rufous-backed Robin	*Turdus rufopalliatus*
Varied Thrush W	*Ixoreus naevius*
Aztec Thrush	*Ridgwayia pinicola*
Blue Mockingbird	*Melanotis caerulescens*
Gray Catbird S	*Dumetella carolinensis*
Brown Thrasher	*Toxostoma rufum*
Bohemian Waxwing	*Bombycilla garrulus*
White Wagtail	*Motacilla alba*

Red-throated Pipit	*Anthus cervinus*
Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*
Black Rosy-Finch W	*Leucosticte atrata*
Purple Finch	*Haemorhous purpureus*
Common Redpoll	*Acanthis flammea*
White-winged Crossbill	*Loxia leucoptera*
Lapland Longspur	*Calcarius lapponicus*
Smith's Longspur	*Calcarius pictus*
McCown's Longspur W S	*Rhynchophanes mccownii*
Snow Bunting	*Plectrophenax nivalis*
Eastern Towhee	*Pipilo erythrophthalmus*
American Tree Sparrow	*Spizelloides arborea*
Field Sparrow	*Spizella pusilla*
Le Conte's Sparrow	*Ammodramus leconteii*
Nelson's Sparrow W	*Ammodramus nelsoni*
Harris's Sparrow W	*Zonotrichia querula*
Golden-crowned Sparrow	*Zonotrichia atricapilla*
Bobolink W	*Dolichonyx oryzivorus*
Black-vented Oriole	*Icterus wagleri*
Orchard Oriole	*Icterus spurius*
Streaked-backed Oriole	*Icterus pustulatus*
Baltimore Oriole	*Icterus galbula*
Rusty Blackbird	*Euphagus carolinus*
Common Grackle	*Quiscalus quiscula*
Ovenbird	*Seiurus aurocapillus*
Worm-eating Warbler	*Helmitheros vermivorus*
Louisiana Waterthrush	*Parkesia motacilla*
Golden-winged Warbler W	*Vermivora chrysoptera*
Blue-winged Warbler	*Vermivora cyanoptera*
Prothonotary Warbler W	*Protonotaria citrea*

Swainson's Warbler	*Limnothylpis swainsonii*
Crescent-chested Warbler	*Oreothly superciliosa*
Tennessee Warbler	*Oreothly peregrina*
Connecticut Warbler	*Oporornis agilis*
Mourning Warbler	*Geothlypis philadelphia*
Kentucky Warbler W	*Geothlypis formosa*
Hooded Warbler	*Setophaga citrina*
Cape May Warbler	*Setophaga tigrina*
Cerulean Warbler W	*Setophaga cerulea*
Tropical Parula	*Setophaga pitiayumi*
Magnolia Warbler	*Setophaga magnolia*
Bay-breasted Warbler	*Setophaga castanea*
Blackburnian Warbler	*Setophaga fusca*
Chestnut-sided Warbler	*Setophaga pensylvanica*
Blackpoll Warbler	*Setophaga striata*
Black-throated Blue Warbler	*Setophaga caerulescens*
Palm Warbler	*Setophaga palmarum*
Pine Warbler	*Setophaga pinus*
Yellow-throated Warbler	*Setophaga dominica*
Prairie Warbler W	*Setophaga discolor*
Black-throated Green Warbler	*Setophaga virens*
Fan-tailed Warbler	*Basileuterus lachrymosus*
Rufous-capped Warbler	*Basileuterus rufifrons*
Canada Warbler W	*Cardellina canadensis*
Slate-throated Redstart	*Myioborus miniatus*
Scarlet Tanager	*Piranga olivacea*
Flame-colored Tanager	*Piranga bidentata*
Yellow Grosbeak	*Pheucticus chrysopeplus*
Painted Bunting	*Passerina ciris*
Dickcissel	*Spiza americana*

E = Endangered & **T** = Threatened, **X** = Experimental Population (USFWS 2017); **W =** Watchlist Species (ACAD 2019); **S** = Species of Greatest Conservation Need (SWAP 2012)

***** Subspp. *roselaari*

Table C4. Several species of birds are released into the wild from captivity and periodically the focus of a BDM project, primarily feral poultry and occasionally parrots, with prevalent species seen given, but not any of those already listed in Tables C1, C2, and C3 as none have a viable populations in Arizona. The most common species involved in feral poultry damage management projects are the domestic varieties of Mallard, Muscovy Duck, Graylag and Chinese Goose, Indian Peafowl, 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 10 species of birds to the potential list of species in Arizona (*Mallard already listed in Table C1 not counted*).

Species	*Scientific Name*
Domestic Graylag Goose	*Anser anser*
Domestic Swan (*Chinese*) Goose	*Anser cygnoides*
Mute Swan	*Cygnus olor*
Domestic Mallard	*Anas platyrhynchos*
Domestic Muscovy Duck	*Cairina moschata*
Domestic Helmeted Guineafowl	*Numida meleagris*
Domestic chicken (Red Junglefowl)	*Gallus gallus*
Indian Peafowl	*Pavo cristatus*
Green Peafowl	*Pavo muticus*
African Collared (*Ringed*) Dove	*Streptopelia roseogrisea (risoria)*
Cockatiel	*Nymphicus hollandicus*

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APPENDIX D - BIRD STRIKES IN ARIZONA

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 numbers being reported today far exceed the number reported in the 1990s. Table D-1 has all of the strikes reported in Arizona from FY11 to FY20.

Table D-1. Bird strikes at airfields in Arizona as reported to the Federal Aviation Administration from FY11 to FY20. The species included are only those that are commonly found in Arizona. A total of 1,427 bird strikes were recorded in Arizona.

SPECIES	ARIZONA				
	Number of Strikes	% of Strikes w/ Known Sp.	Damaging Strikes	% Strikes That Cause Damage	# Strikes w/ No Damage Data
Mallard	1	0.07%	-	-	1
Northern Shoveler	1	0.07%	-	-	1
Lesser Scaup	1	0.07%	-	-	1
Ruddy Duck	4	0.28%	-	-	4
Unknown Duck	1	0.07%	-	-	1
Unknown Geese	1	0.07%	1	11.10%	0
Waterfowl Total	**9**	**0.63%**	**1**	**11.10%**	**8**
Pied-billed Grebe	2	0.14%	-	-	2
Eared Grebe	3	0.21%	-	-	3
Unknown Grebe	1	0.07%	-	-	1
Double-crested Cormorant	1	0.07%	-	-	1
Fish Eating Bird Total	**7**	**0.49%**	**-**	**-**	**7**
American Bittern	1	0.07%	-	-	1
Great Egret	2	0.14%	1	7.14%	1
Unknown Egret	1	0.07%	-	-	1
American Coot	8	0.56%	-	-	8

Belted Kingfisher	1	0.07%	-	-	1
Common Gallinule	1	0.07%	-	-	1
Total Wading Birds	**14**	**0.98%**	**1**	**7.14%**	**13**
Turkey Vulture	3	0.21%	3	2.54%	0
Unknown Eagle	1	0.07%	-	-	1
Osprey	1	0.07%	-	-	1
Sharp-shinned Hawk	1	0.07%	-	-	1
Cooper's Hawk	5	0.35%	1	0.85%	4
Northern Goshawk	1	0.07%	-	-	1
Swainson’s Hawk	2	0.14%	-	-	2
Red-tailed Hawk	16	1.12%	4	3.39%	12
Harris Hawk	3	0.21%	-	-	3
Unknown Hawk	10	0.70%	2	1.69%	8
American Kestrel	37	2.59%	-	-	37
Merlin	1	0.07%	-	-	1
Peregrine Falcon	5	0.35%	1	0.85%	4
Unknown Falcon/Caracara/Kestrel	2	0.14%	-	-	2
Kites, Eagles, Hawks	1	0.07%	-	-	1
Barn Owl	4	0.28%	-	-	4
Great Horned Owl	3	0.21%	-	-	3
Burrowing Owl	19	1.33%	-	-	19
Short-eared Owl	2	0.14%	1	0.85%	1
Unknown Owl	1	0.07%	-	-	1
Raptor Total	**118**	**8.26%**	**12**	**10.17%**	**106**
Killdeer	2	0.14%	-	-	2
Black-necked Stilt	1	0.07%	-	-	1
Sandpipers, curlews, phalaropes, allies	1	0.07%	-	-	1
Red-necked Phalarope	1	0.07%	-	-	1
Shorebird Total	**5**	**0.35%**	**-**	**-**	**5**
Unknown Gull	1	0.07%	-	-	1
Larid Total	**1**	**0.07%**	**-**	**-**	**1**
Rock Pigeon	32	2.24%	1	2.70%	31
Unknown Pigeon/Dove	1	0.07%	-	-	1

European Starling	4	0.28%	-	-	4
Invasive Spp. Total	**37**	**2.59%**	**1**	**2.70%**	**36**
White-winged Dove	13	0.91%	-	-	13
Mourning Dove	246	17.24%	1	0.26%	245
Inca Dove	1	0.07%	-	-	1
Eurasian Collared Dove	5	0.35%	1	0.26%	4
Unknown Dove	116	8.13%	4	1.05%	112
Native Dove Total	**381**	**26.70%**	**6**	**1.57%**	**375**
Common Nighthawk	4	0.28%	-	-	4
Lesser Nighthawk	5	0.35%	-	-	5
Common Poorwill	1	0.07%	-	-	1
White-throated Swift	1	0.07%	1	4.54%	0
Cliff Swallows	5	0.35%	-	-	5
Barn Swallow	3	0.21%	-	-	3
Northern Rough-winged Swallow	1	0.07%	-	-	1
Unknown Swallow	2	0.14%	-	-	2
Aerialist Total	**22**	**1.54%**	**1**	**4.54%**	**21**
Red-naped Sapsucker	1	0.07%	-	-	1
Greater Roadrunner	1	0.07%	-	-	1
Unknown Hummingbird	1	0.07%	-	-	1
Other Bird Total	**3**	**0.21%**	**-**	**-**	**3**
American Pipit	1	0.07%	-	-	1
Horned Lark	21	1.47%	-	-	21
Chipping Sparrow	1	0.07%	-	-	1
Vesper Sparrow	2	0.14%	-	-	2
Vesper Sparrow	2	0.14%	-	-	2
Lark Sparrow	3	0.21%	-	-	3
House Sparrow	1	0.07%	-	-	1
Song Sparrow	2	0.14%	-	-	2
White-crowned Sparrow	3	0.21%	1	1.25%	2

Black-throated Sparrow	1	0.07%	-	-	1
Brewer's Sparrow	2	0.14%	-	-	2
Unknown Sparrow	29	2.03%	1	1.25%	28
Green-tailed Towhee	1	0.07%	1	1.25%	0
Loggerhead Shrike	1	0.07%	-	-	1
Western Bluebird	7	0.49%	1	1.25%	6
Western Meadowlark	3	0.21%	-	-	3
Grassland Species Total	**80**	**5.60%**	**4**	**5.00%**	**76**
Warbling Vireo	1	0.07%	-	-	1
Wilson's Warbler	1	0.07%	-	-	1
Townsend's Warbler	2	0.14%	-	-	2
Nashville Warbler	1	0.07%	-	-	1
New World Wood-warblers	1	0.07%	-	-	1
Least Flycatcher	1	0.07%	-	-	1
Ash-throated Flycatcher	2	0.14%	-	-	2
Tyrant Flycatcher	1	0.07%	-	-	1
Gray Flycatcher	2	0.14%	-	-	2
Western Kingbird	4	0.28%	-	-	4
Western Wood-pewee	1	0.07%	-	-	1
Cactus Wren	3	0.21%	-	-	3
House Wren	2	0.14%	-	-	2
Unknown Wren	1	0.07%	-	-	1
Woodland Species Total	**23**	**1.61%**	**-**	**-**	**23**
Northern Mockingbird	1	0.07%	-	-	1
House Finch	1	0.07%	-	-	1
Lesser Goldfinch	1	0.07%	-	-	1
Finches, Euphonias	10	0.70%	1	7.69%	9
Frugivorous Species Total	**13**	**0.91%**	**1**	**7.69%**	**12**
Great-tailed Grackle	3	0.21%	-	-	3
Common Grackle	2	0.14%	-	-	2

Blackbird Total	**5**	**0.35%**	**-**	**-**	**5**
Antelope Jackrabbit	1	0.07%	-	-	1
Black-tailed Jackrabbit	3	0.21%	-	-	3
Lagomorphs (rabbits, hares)	3	0.21%	-		3
Collared Peccary	3	0.21%	1	1.72%	2
North American Porcupin	2	0.14%	-	-	2
Woodchuck	1	0.07%	-	-	1
Coyote	10	0.70%	-	-	10
Pocketed free-tailed Bat	1	0.07%	-	-	1
Microbats	5	0.35%	-	-	5
Free-tailed Bats	5	0.35%	-	-	5
Western Small Footed Myotis	1	0.07%	-	-	1
Western Yellow Bat	1	0.07%	-	-	1
Brazilian Free-tailed Bat	21	1.47%	-	-	21
Unknown Terrestial Mammal	1	0.07%	-	-	1
Mammals Total	**58**	**4.06%**	**1**	**1.72%**	**57**
SPECIES	**# Strikes**	**% of All Strikes**	**Damaging Strikes**	**% Strikes That Cause Damage**	**# Strikes w/ No Damage Data**
Known Bird Spp. Total	**776**	**54.35%**	**28**	**51.63%**	**748**
Unknown Bird	236	16.54%	9	1.38%	227
Unknown Bird – small	305	21.37%	6	0.92%	299
Unknown Bird – medium	82	5.75%	5	0.77%	77
Unknown Bird - large	18	1.26%	9	1.38%	9
Perching birds	6	0.42%	-	-	6
Unknown Bird/Bat	4	0.28%	-	-	4
Unknown Total	**651**	**45.62%**	**29**	**4.45%**	**622**
ALL BIRD STRIKE TOTAL	**1427**	**99.97%**	**57**	**56.08%**	**1370**

APPENDIX E - ROCKY MOUNTAIN STATES WS TAKE AND IMPACTS

Many waterbird species are involved in BDM projects, especially at airports and aquaculture facilities (Table 1). Waterbirds include waterfowl (ducks, geese, and swans), marsh birds (grebes, rails, coots, and cranes), shorebirds (stilts, avocets, plovers, curlews, sandpipers, dowitchers, snipes, woodcocks, and phalaropes), larids (gulls and terns), open waterbirds (loons, frigatebirds, cormorants, and anhingas) and wading birds (bitterns, egrets, and herons). Wetlands International (2020) has population estimates for waterbirds, but most references used to make the estimates were from 2005-2012 with a few as far back as 1985. Table 1 gives estimates for waterbird species for the United States and Canada, as available (Wetlands International 2020). If specific subspecies estimates were available for the subspecies in the United States and Canada, only those were given.

In the Rocky Mountain States (RMS), consisting of Arizona and New Mexico north through Montana and Idaho (AZ, CO, ID, MT, NM, UT, & WY), waterbird populations can be grossly estimated using Breeding Bird Survey (BBS[5](USGS 2020) data in the 7 states that make up this area in the United States. Unfortunately, BBS data is a poor method to estimate waterbird populations as these censuses were developed for songbirds. Even so, these can be used to make a conservative number of individuals in a population (sometimes it may overestimate) to compare lethal take killed in BDM. BBS data is better than Wetland International (2020) because numbers are more recent, which are more reflective of the current population and available for 2015-2019[6]. We use 5 years of data to minimize normal annual fluctuations, which reflects more consistent numbers than just using one year. PIF (2020) uses ten years (2006-2015) to estimate landbird populations. We believe for analyzing take, data more reflective of the most current population numbers are best to determine impacts, but agree that 10 years is even more reflective of the actual population. To estimate populations, the following formula is used:

$$\text{Estimated Population} = \text{Detectability} * \text{Birds/Route} * (\text{State mi}^2/\text{Route mi}^2 \text{ or } 9.2 \text{ mi}^2)$$

For Table 1, the annual average number of birds seen on routes for 2015-2019 was used[1]. A detectability factor was conservatively determined for waterbirds using Will et al. (2020) parameters of distance, pair, and time, the three factors used to determine detectability. Detectability is a factor representing the number of birds not seen during censuses, but were likely within the quarter mile radius circle and not counted. For ease, only a few groups were completed using very conservative detectability parameters. To ensure the estimates were conservative, a species from each group that would be the most detectable in surveys was used to determine an estimated detectability including distance, pairs, and time. For waterbirds, we just used a minimal estimate for time of 1.4 for all species (this actually would be much higher for many species). The detectability for large birds got 1.4 (detection parameters of distance 440 yards or all seen in circle and males and females seen or 1.0) and included swans, cranes, and pelicans; geese got 1.8

[5] The BBS was not run in 2020 due to the coronavirus 2019 virus pandemic.

(detection distance 440 yards and 1.25 for pairs (female seen three fourths of the times), gulls, loons, frigatebirds, and cormorants 2.5 (detectability 330 yards, 1.0 for pairs), ducks, coots, stilts, plovers, large sandpipers, terns, egrets, and herons 3.2 (detectability 330 yards, pairs 1.25); grebes, gallinules, small sandpipers, and bitterns 8.4 (detectability 220 yards and pairs 1.25), and secretive rails, woodcock, and snipes 9.8 (detectability 220 yards and pairs 1.5). This may be conservative for some species (e.g., small ducks and rails), but possibly not conservative enough for a couple species (e.g., killdeer and great blue heron). We believe, though, that these provide reasonable population estimates from BBS data to compare take. It must be noted that several species breed in Canada, the Arctic, or on the edge of the CPS, so were rarely, if ever, seen on BBS routes in the RMS, such as gadwall; the continental was used when only minimal numbers were seen on BBS routes from Wetlands International (2020), which are denoted by parentheses in Table 1. Another estimate and numbers for these birds can be found in Audubon Christmas Bird Count (CBC) data for those species that winter in the in the RMS, but do not migrate to points further south.

Table 1 gives all waterbird species involved in BDM activities in the RMS for FY16-FY20. Table 1 includes species, scientific names, estimated continental population (Wetlands International 2021) rounded to two digits, RMS population estimates using BBS (USGS 2021b) data and conservative detectability parameters rounded to two digits (2015-2019), BBS trend estimate (USGS 2021a), WS average annual (FY16-FY20) lethal target take, nontarget lethal take, lethal take % of Rocky Mountain States or Continental population, average eggs taken, average target species freed (relocated), and average number hazed. The highest lethal take with numbers over 100 included only Canada geese, mallards, and American coots but lethal take that was not estimated to be above 1% of the estimated CPS population or 0.1% of the continental population for any waterbird species representing minimal impact to any waterbird in the CPS area. No sensitive species including listed threatened and endangered species, were taken.

Table 1. Waterbird common and scientific names in taxonomic order, estimated continental populations (Wetlands International 2021), estimated Rocky Mountain States (AZ, CO, ID, MT, NM, UT, & WY) population using BBS raw data (USGS 2021b) for 2015 to 2019[1] using PIF (2020) factors for detectability, survey-wide BBS trend (bold font indicates *P*-value significant) (USGS 2021a), and WS average annual lethal target take, egg take, captured and released, and hazed. The percentage of the population numbers are given for species in the RMS for those where lethal take was estimated to be greater than 0.1% of the population, but where the population does not breed in any abundance in the RMS, the estimated continental population was used and percentages over 0.01% of the population (denoted by parentheses). Waterbird subspecies populations were used if those were the ones that would be found in the RMS area.

Average Annual Take by WS in RMS from FY16*-FY20 and Impact on the Population										
Species	Scientific Name	Est. Continental	RMS Estimate	Survey-wide BBS Trend 1966-2019	Ave. WS. RMS Target Lethal Take	Ave. Nontarget Take	Lethal Take % of RMS (NA) Pop.	Ave. WS Take of Eggs	Ave WS Freed (Relocate) (T/NT)	Ave WS Hazed (Dispersed)
Waterfowl - - Order Anseriformes (Ducks, Geese & Swans) (32 spp +										
Black-bellied Whistling Duck	*Dendrocygna autumnalis (autumnalis)*	550,000	nb	**6.2**	0.8	-	(<0.01%)	-	-	2
Canada Goose^	*Branta canadensis*	5,300,000	1,500,000	**7.3**	1,207	5	<0.1%)	433	824	138,715
Cackling Goose	*Branta hutchinsii*	990,000	nb	nb	-	-	-			-
Ross's Goose	*Anser rossii*	1,100,000	nb	nb	-	-	-	-	-	2
Snow Goose	*Anser caerulescens*	1,200,000	nb	nb	4	-	(<0.01%)	-	-	529
Tundra Swan	*Cygnus columbianus*	na	nb	nb	0.2-	-	(<0.01%)	-	-	96
Wood Duck	*Aix sponsa*	2,800,000	5,200	**1.2**	0.4	-	<0.1%	-	9	5
Blue-winged Teal	*Spatula discors*	8,900,000	61,000	0.3	20	-	<0.1%	-	28	1,316
Cinnamon Teal	*Spatula cyanoptera*	260,000	75,000	-0.9	4	-	<0.1%	-	7	133
Northern Shoveler	*Spatula clypeata*	4,600,000	64,000	0.7	18	-	<0.1%	-	7	4,414
Gadwall	*Mareca strepera*	3,300,000	230,000	**1.7**	6	0.2-	<0.1%	-	44	190
American Wigeon	*Anas crecca*	2,900,000	81,000	**-1.5**	4	-	<0.1%	-	18	583
Mallard	*Aythya valisineria*	9,200,000	670,000	0.1	244	0.8	<0.1%	51	222	12,015
Northern Pintail	*Aythya americana*	1,400,000	63,000	**-2.6**	2	-	<0.1%	-	4	452
Green-winged Teal	*Aythya collaris*	1,500,000	29,000	0.2	13	-	<0.1%	-	14	476
Canvasback	*Aythya affinis*	3,000,000	53,000	-0.2	0.2	-	<0.1%	-	3	142
Redhead	*Aythya americana*	1,400,000	32,000	0.9	0.8	-	<0.1%-	-	7	200
Ring-necked Duck	*Aythya collaris*	1,500,000	53,000	**1.9**	2	-	<0.1%-	-	0.6	81
Lesser Scaup	*Aythya affinis*	3,000,000	130,000	-0.4	2	-	<0.1%-	-	-	377
Bufflehead	*Bucephala albeola*	1,000,000	12,000	**3.2**	2	-	<0.1%	-	-	126

Common Goldeneye	*Bucephala clangula*	1,200,000	1,500	0.4	0.2	-	<0.1%	-	-	13
Barrow's Goldeneye	*Bucephala islandica*	230,000	16,000	-1.0	-	-	-	-	-	0.4
Hooded Merganser	*Lophodytes cucullatus*	1,100.000	4,400	**4.8**	-	-	-	-	-	2
Common Merganser	*Mergus merganser americanus*	1,200,000	43,000	-0.4	1	-	<0.1%	-	-	110
Ruddy Duck	*Oxyura jamaicensis*	490,000	45,000	0.4	24	-	<0.1%	-	2	3,181
Feral Domestic/ Escaped Pops. (Swan/Chinese/Egyptian/Graylag Geese, Muscovy Duck, & Domestic Mallard)					56	-	N/A	5	2	0.8
Marsh Birds - Order Podicipediformes (Grebes) and Gruiformes (Rails, Coots & Cranes[1]**)**										
Pied-billed Grebe	*Podilymbus podiceps podiceps*	130,000	72,000	0.2	0.4	-	<0.1%	-	-	32
Eared Grebe	*Podiceps nigricollis*	3,700,000	290,000	2	2	-	<0.1%	-	-	77
Western Grebe	*Aechmophorus occidentalis*	120,000	150,000	0.1	-	-	-	-	-	0.8
Common Gallinule*	*Gallinula galeata*	1,000,000	17,000	-0.2	-	-	-	-	0.4	-
American Coot	*Fulica americana americana*	6,000,000	650,000	-1.0	192	-	<0.1%	-	-	1,398
Sandhill Crane	*Antigone canadensis*	750,000	94,000	**4.1**	2	-	<0.1%	-	-	72,597
Shorebirds and Larids - Order Charadriiformes (Plovers, Sandpipers, Gulls & Terns)										
Black-necked Stilt	*Himantopus mexicanus*	550,000	38,000	1.1	6	-	<0.1%	2	-	204
American Avocet	*Recurvirostra americana*	550,000	110,000	0.3	0.2	-	<0.1%	7	0.2	110
Killdeer	*Charadrius vociferus*	1,000,000	630,000	**-0.6**	64	-	<0.1%	-	-	361
Whimbrel	*Numenius phaeopus hudsonicus*	40,000	nb	na	-	-	-	-	-	1
Long-billed Curlew	*Numenius americanus*	160,000	170,000	0.1	0.8	-	<0.1%	-	-	30
Least Sandpiper	*Calidris minutilla*	700,000	nb	na	-	-	-	-	-	19
Western Sandpiper	*Calidris maur*	3,500,000	nb	na	-	-	-	-	-	4
Long-billed Dowitcher	*Limnodromus scolopaceus*	500,000	nb	na	-	-	-	-	-	0.4
Wilson's Phalarope	*Phalaropus tricolor*	1,500,000	120,000	-0.6	-	-	-	-	-	345
Red-necked Phalarope	*Phalaropus lobatus*	2,500,000	nb	na	-	-	-	-	-	2
Lesser Yellowlegs	*Tringa flavipes*	400,000	nb	**-2.8**	-	-	-	-	-	17
Willet	*Tringa semipalmata*	160,000	81,000	**-0.6**	0.6	-	<0.1%	-	-	0.8
Greater Yellowlegs	*Tringa melanoleuca*	100,000	nb	0.5	0.6	-	(<0.01%)	-	-	4
Bonaparte's Gull	*Chroicocephalus philadelphia*	390,000	nb	na	-	-	-	-	-	1
Franklin's Gull	*Leucophaeus pipixcan*	1,200,000	680,000	-1.2	34	-	<0.1%	-	-	412
Ring-billed Gull	*Larus delawarensis*	2,600,000	520,000	0.8	24	-	<0.1%	-	-	464
California Gull	*Larus californicus*	620,000	1,200,000	-0.9	85	-	**(0.01%)**	-	-	2,502
Herring Gull	*Larus argentatus*	410,000	nb	**-2.7**	-	-	-	-	-	1
Common Tern	*Sterna hirundo*	750,000	460	-0.9	-	-	-	-	-	0.8
Open Water and Wading Birds – Order Gaviiformes (Loons), Order Suliformes (Frigatebirds & Cormorants) & Order Pelecaniformes (Pelicans Bitterns, Herons & Egrets)										
Common Loon	*Gavia immer*	620,000	3,600	0.3	-	-	-	-	-	0.4
Neotropic Cormorant	*Phalacrocorax brasilianus mexicanus*	650,000	1,500	na	5	-	(<0.01%)	-	-	185
Double-crested Cormorant	*Phalacrocorax auritus albociliatus*	980,000	120,000	**2.5**	19	-	<0.1%	-	-	742
American White Pelican	*Pelecanus erythrorhynchos*	157,000	120,000	3.1	3	0.2	<0.1%	-	-	648
Great Blue Heron	*Ardea herodias*	130,000	86,000	**0.6**	20	-	**(0.02%)**	-	-	107
Great Egret	*Ardea alba*	270,000	4,400	**1.5**	12	-	(<0.01%)	3	-	228
Snowy Egret	*Egretta thula brewsteri*	550,000	8,800	0.9	0.4	-	<0.1%	4	-	6
Cattle Egret	*Bubulcus ibis*	1,000,000	2,700	**-1.0**	0.4	-	<0.1%	-	-	10
Green Heron	*Butorides virescens*	na	700	**-1.93**	0.6	-	<0.1%	-	-	6
Black-crowned Night-Heron	*Nycticorax nycticorax hoactli*	110,000	10,000	-0.6	2	-	<0.1%	-	-	75
White-faced Ibis	*Plegadis chihi*	150,000	530,000	1.6	4	-	<0.1%	-	-	818

FY – Federal fiscal year (Oct. 1 – Sept 30) **T&E** – threatened and endangered species **N/A** – Not applicable **na** – not available **nb** - nonbreeding
[1] The BBS was not run in 2020 due to the COVID pandemic

Landbirds include upland gamebirds (gallinaceous birds, including species such as quail, grouse and turkeys, and pigeons and doves), aerialists (nightjars, swifts, and hummingbirds), raptors (vultures, eagles, hawks, owls, and falcons), woodland birds (nightjars, swifts, kingfishers, and woodpeckers), and passerines (perching birds or songbirds). The most recent population estimates for these species come from 2006-2015 (PIF 2020). These estimates are for North America, mostly for the United States and Canada, and individual states. Many of the species breed in the RMS, but several breed further north, on the fringes or outside the RMS. Table 2 gives the estimates for the U.S. and Canada population (PIF 2020) and the RMS area using BBS raw data for 2015-2019 (USGS 2021b) along with detectability factors determined by Will et al. (2020).

PIF (2020) data is ideal for landbird populations in the U.S. and covers populations from 2006-2015. BBS data (USGS 2020b) are ideal for estimating landbird populations using detectability parameters that have been refined for the last 15 years (Rich et al. 2005, Will et al. 2020). We use the most recent data for 5 years to reflect the current population and a set of data for 5 years minimizes normal annual fluctuations. Will et al. (2020) uses ten years (2006-2015) to estimate landbird populations. We believe when analyzing lethal take, data more reflective of current population numbers are best to determine impacts, but agree that 10 years is even more reflective of the overall population. To estimate populations, the formula given for waterbirds above was used. The time period used were for the five years 2015-2019, 2020 was not conducted due to the COVID pandemic , the state area in mi^2 divided by the area of the state censused, which is a BBS (USGS 2020b) route (9.2 mi^2) multiplied by the average routes censused, multiplied by a detectability factor (factor representing the number of birds not seen during censuses, but were likely within the quarter mile circle and not counted). Assuming that routes are random and equally cover habitats in a state, a conservative detectability parameter can be estimated using Will et al. (2020) parameters of distance, pair, and time, the three factors used to determine detectability. Several species of landbirds breed further north in Canada and Alaska or in the East and were not seen or minimally in BBS routes in the RMS area, so estimated continental populations (Will et al. 2020) were used to determine impact (denoted in parentheses in Table 2). Another estimate and numbers for these birds can be found in Audubon Christmas Bird Count (CBC) data for those species that winter in the RMS, but do not migrate to points further south.

Table 2. Landbird common and scientific names in taxonomic order with the exception of falcons, estimated population (PIF 2020), Surveywide BBS trend (bold font indicates *P*-value significant) (USGS 2020), WS estimated and actual average annual lethal take, and average annual airstrikes with those species.

Estimated Bird Populations (2015-2019), Trend (1966-2017), and Average Annual RMS WS Take (FY16-FY20)										
Species	Scientific Name	Continental[1] Breeding Pop.	RMS Breeding Pop. Estimate	Surveywide BBS Trend	Lethal Target Take	Lethal Nontarget Take	Lethal Take % of CPS or (NA) Pop.	Egg Take	Relocated or Freed	Hazed
Gamebirds - Orders Galliformes (Grouse and Quail) & Columbiformes (Pigeons and Doves)										
Scaled Quail	*Callipepla squamata*	2,400,000	1,700,000	-0.7	-	-	-	-	1	1
California Quail	*Callipepla californica*	3,400,000	160,000	0.8	-	-	-	-	-	3
Gambel's Quail	*Callipepla gambelii*	5,200,000	3,900,000	0.6	1	1	<0.1%	-	-	5
Wild Turkey	*Meleagris gallopavo*	6,700,000	600,000	**5.1**	-	0.6	<0.1%	-	0.4	2
Greater Sage-Grouse	*Centrocercus urophasianus*	430,000	120,000	**-1.7**	-	0.4	<0.1%	-	7	-
Sharp-tailed Grouse	*Tympanuchus phasianellus*	760,000	130,000	0.7	0.8	-	<0.1%	-	-	47
Gray Partridge (I)	*Perdix perdix*	820,000	160,000	-0.5	-	-	-	-	-	58
Ring-necked Pheasant (I)	*Phasianus colchicus*	17,000,000	1,300,000	**-0.6**	-	-	-	-	0.2	8
Feral Domestic/Escaped/Exotic Poultry (Feral Domestic Chicken, Guineafowl & Peafowl) (I)					0.6	4	N/A	-	-	-
Rock Pigeon (I)	*Columba livia*	16,000,000	1,700,000	**-0.7**	7,355	-	0.6%	10	0.6	12,436
Band-tailed Pigeon	*Patagioenas fasciata*	1,500,000	72,000	**-1.3**	0.2	-	<0.1%	-	-	-
Eurasian Collared-Dove (I)	*Streptopelia decaocto*	8,700,000	3,100,000	**13.0**	1,649	1	0.1%	-	0.2	424
White-winged Dove	*Zenaida asiatica*	5,200,000	2,200,000	0.5	33	-	<0.1%	-	4	3,318
Mourning Dove	*Zenaida macroura*	130,000,00	14,000,000	**-0.4**	4,710	-	<0.1%	0.8	5	50,585
Raptors - Orders Cathartiformes (Vultures), Accipitriformes (Hawks), Strigiformes (Owls) & Falconiformes (Falcons)										
Black Vulture	*Coragyps atratus*	9,600,000	25,000	**3.4**	-	-	-	-	0.2	-
Turkey Vulture	*Cathartes aura*	8,400,000	890,000	**1.8**	53	0.2	<0.1%	-	-	387
Osprey	*Pandion haliaetus*	400,000	46,000	**1.9**	0.2	-	<0.1%	-	-	12
Golden Eagle	*Aquila chrysaetos*	63,000	55,000	0.2	-	0.4	<0.1%		-	16
Northern Harrier	*Circus cyaneus*	820,000	180,000	**-0.8**	23	0.2	<0.1%	-	4	392
Sharp-shinned Hawk	*Accipiter striatus*	410,000	45,000	**0.3**	-	-	-	-	1	5
Cooper's Hawk	*Accipiter cooperii*	840,000	120,000	**1.4**	2	-	<0.1%	-	9	12
Northern Goshawk	*Accipiter gentilis*	210,000	46,000	0.0	-		-		-	0.2
Bald Eagle	*Haliaeetus leucocephalus*	200,000	50,000	**4.0**	-	-	-	-	2	60
Harris's Hawk	*Parabuteo unicinctus*	52,000	6,800	**-2.1**	0.2	-	<0.1%		-	0.6
Common Black Hawk	*Buteogallus anthracinus*	2,000	800	na	-	-	-	-	-	0.2
Swainson's Hawk	*Buteo swainsoni*	820,000	360,000	**1.1**	42	-	<0.1%	-	3	358
Zone-tailed Hawk	*Buteo albonotatus*	6,200	4,300	na	-	-	-	-	-	0.2
Red-tailed Hawk	*Buteo jamaicensis*	2,800,000	520,000	**1.3**	225	-	<0.1%	-	122	1,525
Rough-legged Hawk	*Buteo lagopus*	300,000	nb	nb	6	-	(<0.01%)	-	2	67
Ferruginous Hawk	*Buteo regalis*	110,000	49,000	**0.9**	15		(0.01%)	-	7	93
Barn Owl	*Tyto alba*	130,000	23,000	**1.9**	3	-	<0.01%	2	5	2
Great Horned Owl	*Bubo virginianus*	3,800,000	670,000	-0.1	13	-	<0.1%	8	87	10
Snowy Owl	*Bubo scandiacus*	15,000	nb	nb	-	-	(<0.01%)	-	0.2	1
Burrowing Owl	*Athene cunicularia*	990,000	350,000	-0.7	3	0.2	<0.1%		1	11
Short-eared Owl	*Asio flammeus*	600,000	81,000	-1.7	-	-	-	-	-	1
American Kestrel [1]	*Falco sparverius*	2,800,000	560,000	**-1.4**	146	-	<0.1%	-	54	1,725
Merlin	*Falco columbarius*	1,600,000	10,000	**1.9**	0.2	-	<0.1%	-	0.4	-
Peregrine Falcon	*Falco peregrinus*	37,000	5,300	**2.1**	0.8	-	<0.1%	-	0.2	13
Prairie Falcon	*Falco mexicanus*	110,000	42,000	**1.1**	0.8	-	<0.1%	-	6	64
Forest Birds - Orders Cuculiformes (Cuckoos), Caprimulgiformes (Nightjars), Coraciiformes (Kingfishers), & Piciformes (Woodpeckers)										
Greater Roadrunner	*Geococcyx californianus*	840,000	350,000	**0.9**	4	-	<0.1%	-	-	4
Lesser Nighthawk	*Chordeiles acutipennis*	3,800,000	1,800,000	0.2	0.6	-	<0.1%	-	-	8
Common Poorwill	*Phalaenoptilus nuttallii*	1,300,000	720,000	0.1	-	-	-	-	0.2	-
Costa's Hummingbird	*Calypte costae*	1,600,000	570,000	0.7	-	-	-	-	0.2	-
Belted Kingfisher	*Megaceryle alcyon*	1,800,000	62,000	**-0.9**	-	-	-	-	-	0.2
Acorn Woodpecker	*Melanerpes formicivorous*	2,200,000	380,000	na	2	-	<0.1%	-	-	-
Gila Woodpecker	*Melanerpes uropygialis*	590,000	710,000	0.0	121	-	(0.02%)	-	-	-

Northern Flicker	*Colaptes auratus*	11,000,000	530,000	**-1.2**	14	-	<0.1%	0.2	0.4	26
Songbirds - Order Passeriformes (Flycatchers, Corvids, Swallows, Thrushes, Sparrows, Blackbirds, and Others)										
Western Kingbird	*Tyrannus verticalis*	29,000,000	6,000,000	-0.1	306	-	<0.1%	7	-	1,916
Eastern Kingbird	*Tyrannus tyrannus*	26,000,000	1,800,000	**-1.0**	4	-	<0.1%	-	-	26
Say's Phoebe	*Sayornis saya*	5,000,000	2,700,000	**0.8**	-	-	<0.1%	-	0.6	-
Northern Shrike	*Laniu borealiss*	53,000	nb	na	-	-	-	-	2	0.2
Loggerhead Shrike	*Lanius ludovicianus*	4,600,000	1,500,000	**-2.6**	-	-	-	-	-	7
Pinyon Jay*	*Gymnorhinus cyanocephalus*	760,000	370,000	**-2.0**	-	-	-	-	0.2	-
Black-billed Magpie	*Pica hudsonia*	6,000,000	2,100,000	**-0.9**	389	-	<0.1%	31	0.2	1,320
American Crow	*Corvus brachyrhynchos*	28,000,000	650,000	**-0.2**	1,391	0.2	0.2%	-	-	1,247
Common Raven	*Corvus corax*	8,300,000	940,000	**2.2**	3,675	1	0.4%	13	-	1.269
Horned Lark	*Eremophila alpestris*	100,000,00	23,000,000	**-1.9**	1,001	-	<0.1%	-	-	22,324
Bank Swallow	*Riparia riparia*	7,900,000	830,000	**-3.7**	-	-	-	-	-	27
Tree Swallow	*Tachycineta bicolor*	19,000,000	1,800,000	**-0.7**	-	-	-	-	-	6
Violet-green Swallow	*Tachycineta thalassina*	6,700,000	1,900,000	**-0.6**	0.6	-	<0.1%	-	-	14
Barn Swallow	*Hirundo rustica*	47,000,000	2,600,000	**-0.6**	28	-	<0.1%	3	1	506
Cliff Swallow	*Hirundo pyrrhonota*	78,000,000	9,100,000	0.8	1,056	-	<0.1%	372	0.2-	10,544
Cactus Wren	*Campylorhynchus brunneicapillus*	3,000,000	1,600,000	**-1.3**	-	-	-	-	0.2	-
Western Bluebird	*Sialia mexicana*	5,700,000	2,700,000	0.3	-	-	-	-	-	52
Mountain Bluebird	*Sia;ia currucoides*	5,600,000	2,700,000	-0.5	-	-	-	-	-	413
American Robin	*Turdus migratorius*	370,000,00	24,000,000	**0.1**	49	-	<0.1%	1	7	551
Northern Mockingbird	*Mimus polyglottos*	34,000,000	4,000,000	**-0.7**	0.4	-	<0.1%	-	-	0.2
European Starling (I)	*Sturnus vulgaris*	93,000,000	6,800,000	**-1.3**	559,457	0.4	8.2%	-	4	39,536
House Sparrow (I)	*Passer domesticus*	93,000,000	10,000,000	**-3.0**	176	0.2	<0.1%	3	25	541
American Pipit	*Anthus rubescens*	18,000,000	17,000	na	9	-	<0.1%	-	-	389
House Finch	*Haemorhous mexicanus*	33,000,000	7,900,000	-0.2	6	-	<0.1%	-	1	825
American Goldfinch	*Spinus tristis*	44,000,000	1,200,000	**-0.6**	-	-	-	-	0.2	-
Lark Sparrow	*Chondestes grammacus*	11,000,000	2,300,000	**-1.2**	3	-	<0.1%	-	-	85
Lark Bunting	*Calamospiza melanocorys*	12,000,000	5,000,000	**-3.7**	95	-	<0.1%	-	-	1,353
Chipping Sparrow	*Spizella passerina*	230,000,000	15,000,000	**-0.6**	-	-	-	-	-	34
Black-chined Sparrow	*Spizella atrogularis*	290,000	110,000	**-2.1**	0.2	-	<0.1%	-	-	-
Brewer's Sparrow	*Spizella breweri*	17,000,000	6,700,000	**-0.9**	0.4	-	<0.1%	-	-	2
White-crowned Sparrow	*Zonotrichia leucophrys*	79,000,000	36,000,000	-0.2	-	-	-	-	2	-
Vesper Sparrow	*Pooecetes gramineus*	35,000,000	10,000,000	**-0.8**	0.2	-	<0.1%	-	-	7
Song Sparrow	*Melospiza melodia*	130,000,000	5,900,000	**-0.6**	-	-	-	-	-	0.6
Canyon Towhee	*Melozone fusca*	2,800,000	1,900,000	**-0.9**	-	-	-	-	-	0.2
Abert's Towhee8	*Melozone aberti*	890,000	610,000	0.0	-	-	-	-	0.2	-
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	11,000,000	840,000	0.7	435	-	<0.1%	-	-	676
Eastern Meadowlark	*Sturnella magna*	24,000,000	1,800,000	**-2.6**	5	-	<0.1%	-	-	-
Western Meadowlark	*Sturnella neglecta*	95,000,000	27,000,000	**-0.9**	752	-	<0.1%	-	0.4	5,799
Red-winged Blackbird	*Agelaius phoeniceus*	170,000,000	11,000,000	**-0.6**	1,603	-	<0.1%	-	-	17,714
Brown-headed Cowbird	*Molothrus ater*	130,000,000	11,000,000	**-0.5**	489	-	<0.1%	-	-	234
Brewer's Blackbird	*Euphagus cyanocephalus*	23,000,000	4,700,000	**-1.6**	45	-	<0.1%	5	-	3,047
Common Grackle	*Quiscalus quiscula*	67,000,000	1,600,000	**-1.5**	119	-	<0.1%	5	-	139
Great-tailed Grackle	*Quiscalus mexicanus*	8,200,000	1,000,000	0.9	342	-	(0.01%)	5	-	1,786
Mixed Blackbirds										12
Wilson's Warbler	*Cardellina pusilla*	81,000,000	910,000	**-1.7**	-	-	-	-	0.2	-

(I) – Introduced species **FY** – Federal fiscal year (Oct. 1 – Sept 30) **N/A** – Not applicable **na** – not available **nb** - nonbreeding

[1] Falcons follow woodpeckers taxonomically *Nontargets freed only

Table 2 gives all landbird species involved in BDM activities in the RMS for FY16-FY20. It includes species, scientific names, estimated continental population, RMS estimated 2015-2019 population estimates using BBS (USGS 2021) data rounded to two digits, BBS trend estimate (Sauer et al. 2020), WS lethal target take, nontarget lethal take, lethal take % of RMS or continental population, average eggs taken, average target and nontarget species freed (relocated), and average number hazed. The highest lethal take occurred with European Starlings (invasive), Rock Pigeon (feral pigeons - invasive), Mourning Doves, Common Ravens, Eurasian collared-doves (invasive), Red-winged Blackbirds, American Crows, Cliff Swallows, and Horned Larks, most all involved with the protection of aircraft or livestock. The only species with a take higher than 1% in the CPS or 0.1% for the continental population was the European starling (8% of the RMS population). Few species had a take higher than 0.1% in the CPS or 0.01% in the United States and Canada, reflecting a minimal lethal take of birds that would not have a noticeable effect on their populations. The only sensitive species taken from FY16-FY20 was an annual average of 0.4 golden eagles.

WS took few nontarget bird species in all WDM activities from FY16-FY20; those accidentally taken lethally (12 annual average) were given in Tables 1 and 2. Fifteen species were accidentally killed with only Canada goose (5), Eurasian collared doves (1), Gambel's Quail (1), and Common Ravens (1) averaging one or more taken annually. An average of 0.4 golden eagles were taken annually, species of concern. Most lethal take of birds was associated with livestock feed damage management or protection of human safety at airports. Nineteen species were taken in WDM that were freed (22 annual average) with white-winged doves (4), European starlings (4), and Redheads (4) the most common. Most of these were taken in cage traps set for other species, primarily in BDM. Overall, the take of birds as nontargets in WDM was very minimal and would not impact any of these species' populations.

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