ENVIRONMENTAL ASSESSMENT

Managing Damage and Threats Caused by Birds in the State of Mississippi

Prepared by

United States Department of Agriculture
Animal and Plant Health Inspection Service
Wildlife Services

In Cooperation with:

The Tennessee Valley Authority

April 2012

TABLE OF CONTENTS

ACRONYMS 3

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 PURPOSE 4
1.2 NEED FOR ACTION 5
1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT 19
1.4 RELATIONSHIP OF THIS DOCUMENT TO OTHER ENVIRONMENTAL DOCUMENTS 22
1.5 AUTHORITY OF FEDERAL AND STATE AGENCIES 23
1.6 COMPLIANCE WITH LAWS AND STATUTES 25
1.7 DECISIONS TO BE MADE 29

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES

2.1 AFFECTED ENVIRONMENT 30
2.2 ISSUES ASSOCIATED WITH BIRD DAMAGE MANAGEMENT ACTIVITIES 31
2.3 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE 39

CHAPTER 3: ALTERNATIVES

3.1 DESCRIPTION OF THE ALTERNATIVES 44
3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL 51
3.3 STANDARD OPERATING PROCEDURES FOR BIRD DAMAGE MANAGEMENT 55
3.4 ADDITIONAL STANDARD OPERATING PROCEDURES SPECIFIC TO THE ISSUES 56

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL 58
4.2 CUMULATIVE IMPACTS OF THE PROPOSED ACTION BY ISSUE 118

CHAPTER 5: LIST OF PREPARERS AND PERSONS CONSULTED

5.1 LIST OF PREPARERS AND REVIEWERS 127
5.2 LIST OF PERSONS CONSULTED 127

LIST OF APPENDICES

APPENDIX A LITERATURE CITED 128

APPENDIX B BIRD DAMAGE MANAGEMENT METHODS AVAILABLE FOR USE 148

APPENDIX C THREATENED AND ENDANGERED SPECIES THAT ARE FEDERALLY LISTED IN THE STATE OF MISSISSIPPI 155

APPENDIX D STATE THREATENED AND ENDANGERED SPECIES IN MISSISSIPPI 159

ACRONYMS

AI	Avian Influenza
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
AQDO	Aquaculture Depredation Order
BBS	Breeding Bird Survey
BO	Biological Opinion
CBC	Christmas Bird Count
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
EA	Environmental Assessment
ECOFRAM	Ecological Committee on FIFRA Risk Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESC	Enteric Septicemia of Catfish
FDA	Food and Drug Administration
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
FR	Federal Register
FY	Fiscal Year
HP	Highly Pathogenic
INAD	Investigational New Animal Drug
IPN	Infectious Pancreatic Necrosis
LD	Median Lethal Dose
LC	Median Lethal Concentration
MA	Methyl Anthranilate
MBTA	Migratory Bird Treaty Act
MDAC	Mississippi Department of Agriculture and Commerce
MDWFP	Mississippi Department of Wildlife, Fisheries, and Parks
MOU	Memorandum of Understanding
NAS	National Audubon Society
NASS	National Agricultural Statistics Service
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRP	Natural Resources Plan
NWRC	National Wildlife Research Center
PL	Public Law
PRDO	Public Resources Depredation Order
ROD	Record of Decision
SVC	Spring Viraemia of Carp
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
TVA	Tennessee Valley Authority
USC	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFWS	U.S. Fish and Wildlife Service
VHS	Viral Haemorrhagic Septicaemia
WS	Wildlife Services

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 PURPOSE

The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS)[1] program in Mississippi continues to receive requests for assistance to resolve or prevent damage occurring to agricultural resources, natural resources, and property, including threats to human safety, associated with eared grebes (*Podiceps nigricollis*), American white pelicans (*Pelecanus erythrorhynchos*), great blue herons (*Ardea herodias*), great egrets (*Ardea alba*), snowy egrets (*Egretta thula*), little blue herons (*Egretta caerulea*), cattle egrets (*Bubulcus ibis*), green herons (*Butorides virescens*), black vultures (*Coragyps atratus*), turkey vultures (*Cathartes aura*), snow geese (*Chen caerulescens*), wood ducks (*Aix sponsa*), gadwalls (*Anas strepera*), mallards (domestic/wild) (*Anas platyrhynchos*), blue-winged teal (*Anas discors*), feral ducks, feral geese, ospreys (*Pandion haliaetus*), northern harriers (*Circus cyaneus*), sharp-shinned hawks (*Accipiter striatus*), Cooper's hawks (*Accipiter cooperii*), red-shouldered hawks (*Buteo lineatus*), red-tailed hawks (*Buteo jamaicensis*), American kestrels (*Falco sparverius*), wild turkeys (*Meleagris gallopavo*), American coots (*Fulica americana*), killdeer (*Charadrius vociferous*), lesser yellowlegs (*Tringa flavipes*), least sandpipers (*Calidris minutilla*), spotted sandpipers (*Actitis macularia*), upland sandpipers (*Bartramia longicauda*), common snipe (*Gallinago gallinago*), laughing gulls (*Leucophaeus atricilla*), ring-billed gulls (*Larus delawarensis*), herring gulls (*Larus argentatus*), rock pigeons (*Columba livia*), Eurasian collared-doves (*Streptopelia decaocto*), mourning doves (*Zenaida macroura*), barred owls (*Strix varia*), chimney swifts (*Chaetura pelagica*), Eastern kingbirds (*Tyrannus tyrannus*), American crows (*Corvus brachyrhynchos*), horned larks (*Eremophila alpestris*), purple martins (*Progne subis*), tree swallows (*Tachycineta bicolor*), Northern rough-winged swallows (*Stelgidopteryx serripennis*), bank swallows (*Riparia riparia*), cliff swallows (*Hirundo pyrrhonota*), barn swallows (*Hirundo rustica*), Eastern bluebirds (*Sialia sialis*), American robins (*Turdus migratorisus*), European starlings (*Sturnus vulgaris*), cedar waxwings (*Bombycilla cedrorum*), field sparrows (*Spizella pusilla*), savannah sparrows (*Passerculus sandwichensis*), red-winged blackbirds (*Agelaius phoeniceus*), Eastern meadowlarks (*Sturnella magna*), Brewer's blackbirds (*Euphagus cyanocephalus*), common grackles (*Quiscalus quiscula*), brown-headed cowbirds (*Molothrus ater*), house finches (*Carpodacus mexicanus*), and house sparrows (*Passer domesticus*).

Free-ranging or feral domestic waterfowl refers to captive-reared, domestic, of some domestic genetic stock, or domesticated breeds of ducks, geese, and swans. Examples of domestic waterfowl include, but are not limited to, mute swans, Muscovy ducks, Pekin ducks, Rouen ducks, Cayuga ducks, Swedish ducks, Chinese geese, Toulouse geese, Khaki Campbell ducks, Embden geese, and pilgrim geese. Feral ducks may include a combination of mallards, Muscovy duck, and mallard-Muscovy hybrids.

Normally, individual wildlife damage management actions conducted by the WS program could be categorically excluded from further analyses under the National Environmental Policy Act (NEPA), in accordance with APHIS implementing regulations for the NEPA (7 CFR 372.5(c), 60 FR 6000-6003). The Tennessee Valley Authority (TVA) also continues to experience damage and threats of damage associated with birds at facilities or properties they own or manage in Mississippi. The TVA could request the assistance of WS to manage damage or threats of damage at those facilities and properties.

The purpose of this Environmental Assessment (EA) is to evaluate activities conducted by WS to manage damage and threats associated with those bird species identified. This EA will assist in determining if the proposed management of bird damage could have a significant impact on the environment for both

[1]The WS program is authorized to protect agriculture and other resources from damage caused by wildlife through the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 426c).

humans and other organisms to comply with the NEPA. This EA analyzes the potential effects of bird damage management when requested, as coordinated between WS, the United States Fish and Wildlife Service (USFWS), and the Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP). When assistance is requested on properties owned or managed by the TVA, WS would coordinate activities with the TVA. In addition to those species listed previously, WS also is routinely requested to address damage and threats of damage associated with Canada geese (*Branta canadensis*) and double-crested cormorants (*Phalacrocorax auritus*). Activities conducted by WS to alleviate damage or threats of damage associated with Canada geese were evaluated in a separate EA (USDA 2008). WS' activities associated with alleviating damage or threats of damage associated with cormorants were also addressed in a separate EA (USDA 2004). Those assessments are further discussed in Section 1.5 of this EA.

WS and the TVA are preparing this EA to: 1) facilitate planning, 2) promote interagency coordination, 3) streamline program management, 4) clearly communicate to the public the analysis of individual and cumulative impacts of program activities; and 5) evaluate and determine if there are any potentially significant or cumulative adverse effects from the proposed program or the alternatives. The analyses contained in this EA are based on information derived from WS' Management Information System, published documents (see Appendix A), interagency consultations, public involvement, and the analyses in WS' programmatic Final Environmental Impact Statement (FEIS)[2] (USDA 1997) which will be incorporated into this document by reference.

This EA evaluates the need for action to manage damage associated with birds in the State, the potential issues associated with bird damage management, and the environmental consequences of conducting different alternatives to address the need for action and the identified issues. Issues relating to the reduction of wildlife damage were raised during the scoping process for WS' programmatic FEIS (USDA 1997) and were considered in the preparation of this EA. The issues and alternatives associated with bird damage management were initially developed by WS and the TVA in consultation with the USFWS and the MDWFP. The USFWS has regulatory authority to manage populations of migratory bird species in the State. To assist with the identification of additional issues and alternatives associated with managing damage caused by birds in Mississippi this EA will be made available to the public for review and comment prior to a Decision[3] through the publication of legal notices in print media and through direct notification of potential interested parties.

1.2 NEED FOR ACTION

Some species of wildlife have adapted to and thrive in human altered habitats. Those species, in particular, are often responsible for the majority of conflicts between humans and wildlife that lead to requests for assistance to reduce damage to resources and to reduce threats to human safety. WS' programmatic FEIS summarizes the relationship of wildlife values and wildlife damage in this way (USDA 1997):

"*Wildlife has either positive or negative values, depending on varying human perspectives and circumstances...Wildlife is generally regarded as providing economic, recreational and aesthetic benefits...and the mere knowledge that wildlife exists is a positive benefit to many people. However... the activities of some wildlife may result in economic losses to agriculture and damage to property...Sensitivity to varying perspectives and values are required to manage the balance between*

[2]WS' has prepared a programmatic FEIS that further addresses WS' activities to manage damage associated with wildlife, including detailed discussion of program activities, risk assessment of methods, and discussion of issues (USDA 1997).

[3]After the development of the EA and after public involvement in identifying new issues and alternatives, WS and the TVA would issue a Decision. Based on the analyses in the EA after public involvement, a decision would be made to either publish a Notice of Intent to prepare an Environmental Impact Statement or a Finding of No Significant Impact would be noticed to the public in accordance to the NEPA and the Council of Environmental Quality regulations.

human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural and economic considerations as well."

Both sociological and biological carrying capacities must be applied to resolve wildlife damage problems. The wildlife acceptance capacity, or cultural carrying 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. Biological carrying capacity is the land or habitat's ability to support healthy populations of wildlife without degradation to the species' health or their environment during an extended period of time (Decker and Purdy 1988). These phenomena are especially important because they define the sensitivity of a person or community to a wildlife species. For any given damage situation, there are varying thresholds of tolerance exhibited by those people directly and indirectly affected by the species and any associated damage. This damage threshold determines the wildlife acceptance capacity. While the habitat may have a biological carrying capacity to support higher populations of wildlife, in many cases the wildlife acceptance capacity is lower or has been met. Once the wildlife acceptance capacity is met or exceeded, people begin to implement population or damage management to alleviate damage or address threats to human health and safety.

The alleviation of damage or other problems caused by or related to the behavior of wildlife is termed wildlife damage management and is recognized as an integral component of wildlife management (The Wildlife Society 1992). The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated and the need for damage management is derived from the specific threats to resources. Those species have no intent to do harm. They utilize habitats (*e.g.*, reproduce, walk, forage) where they can find a niche. If their activities result in lost economic value of resources or threaten human safety, people characterize this as damage. When damage exceeds or threatens to exceed an economic threshold and/or poses a threat to human safety, people often seek assistance with resolving damage or reducing threats to human safety. The threshold triggering a request for assistance is often unique to the individual person requesting assistance and can be based on many factors (*e.g.*, economic, social, aesthetics). Therefore, how damage is defined is often unique to the individual person and damage occurring to one individual may not be considered damage by another individual. However, the use of the term "*damage*" is consistently used to describe situations where the individual person has determined the losses associated with wildlife is actual damage requiring assistance (*i.e.*, has reached an individual threshold). The term "*damage*" is most often defined as economic losses to resources or threats to human safety but could also include a loss in aesthetic value and other situations where the actions of wildlife are no longer tolerable to an individual person.

The need for action to manage damage and threats associated with birds in Mississippi arises from requests for assistance[4] received by WS to reduce and prevent damage associated with birds. Bird damage can occur to four major categories: agricultural resources, natural resources, property, and threats to human safety. In addition, the TVA often experiences damage and threats of damage to property and natural resources, as well as threats to human safety at their facilities. WS and the TVA have identified those bird species most likely to be responsible for causing damage to those four categories in the State based on previous requests for assistance. Table 1.1 lists the number of WS' technical assistance projects involving bird damage or threats of bird damage to those four major resource types in Mississippi from the federal fiscal year[5] (FY) 2005 through FY 2011. Technical assistance has been provided by WS to those persons requesting assistance with resolving damage or the threat of damage by providing

[4] WS only conducts bird damage management after receiving a request for assistance. Before initiating bird damage activities, a Memorandum of Understanding, cooperative service agreement, or other comparable document must be signed between WS and the cooperating entity which lists all the methods the property owner or manager would allow to be used on property they own and/or manage.

[5] The federal fiscal year begins on October 1 and ends on September 30 the following year.

information and recommendations on bird damage management activities that can be conducted by the requestor without WS' direct involvement in managing or preventing the damage. WS' technical assistance activities are discussed further in Chapter 3 of this EA.

Requests for assistance received by WS are representative of the damage and threats that are caused by birds in Mississippi. As shown in Table 1.1, WS has conducted 677 projects in Mississippi that addressed damage and threats associated with those bird species addressed in this assessment. WS conducted 200 technical assistance projects involving turkey vultures and black vultures between FY 2005 and FY 2011. Vultures often roost in mixed species flocks in large numbers. Fecal droppings often accumulate under areas where vultures roost and loaf. Concerns are often raised about disease transmission to people that encounter fecal droppings on their property. The odor and aesthetically displeasing presence of fecal droppings at roost sites can also be a concern. Damage can also occur to property from vultures pulling and tearing shingles, trim, and rubber material on buildings and vehicles.

Table 1.1 – Technical assistance projects conducted by WS from FY 2005 through FY 2011

Species	Projects	Species	Projects
American White Pelican	80	**Lesser Yellowlegs**	9
Great Blue Heron	90	**Laughing Gull**	3
Great Egret	89	**Ring-billed Gull**	5
Snowy Egret	5	**Herring Gull**	3
Cattle Egret	3	**Rock Pigeon**	52
Black Vulture	153	**Mourning Dove**	2
Turkey Vulture	47	**Barred Owl**	3
Snow Goose	4	**American Crow**	16
Wood Duck	1	**Bank Swallow**	1
Mallard	6	**Cliff Swallow**	12
Feral Duck	9	**Barn Swallow**	14
Feral Goose	11	**American Robin**	1
Osprey	3	**European Starling**	7
Cooper's Hawk	3	**Cedar Waxwing**	1
Red-shouldered Hawk	1	**Red-winged Blackbird**	5
Red-tailed Hawk	13	**Eastern Meadowlark**	1
American Kestrel	1	**Brown-headed Cowbird**	3
American Coot	2	**House Finch**	1
Wild Turkey	1	**House Sparrow**	12
Killdeer	4	**TOTAL**	**677**

Vultures can cause injuries and death to newborn lambs and calves during the birth of the animals. Vultures often attack the soft tissue areas of newborns as they are being expunged from the female. During the birthing process, newborns and mothers are vulnerable and often unable to prevent attacks by large groups of vultures. Vultures often attack the eyes and rectal area of newborns during delivery, which results in serious injury to the lamb or calf and can lead to the death of the animal.

Table 1.2 lists those bird species and the resource types that those bird species can cause damage to in Mississippi. Many of the bird species can cause damage to or pose threats to a variety of resources. In Mississippi, most requests for assistance received by WS are related to threats associated with those bird species causing damage or threats of damage to property.

Many of the species addressed in this assessment are gregarious (*i.e*., form large flocks) species especially during the fall and spring migration periods. Although damage and threats can occur throughout the year, damage is highest during those periods when birds are concentrated into large flocks such as migration periods and during winter months when food sources are limited. For some bird species, high concentrations of birds can be found during the breeding season where suitable nesting habitat exists, such as swallows, pigeons, and house sparrows. The flocking behavior of many bird species during migration periods can pose increased risks when those species occur near or on airport properties. Aircraft striking multiple birds not only increases the damage to the aircraft but can also increase the risk that a catastrophic failure of the aircraft might occur, especially if multiple birds are ingested into aircraft engines.

Table 1.2 – Bird species and the resource types that those bird species can cause damage to in Mississippi

Species	Resource[a]				Species	Resource[a]			
	A	N	P	H		A	N	P	H
Eared Grebe	X		X	X	Common Snipe			X	X
American White Pelican	X		X	X	Laughing Gull	X	X	X	X
Great Blue Heron	X		X	X	Ring-billed Gull	X	X	X	X
Great Egret	X		X	X	Herring Gull	X	X	X	X
Snowy Egret	X		X	X	Rock Pigeon	X	X	X	X
Little Blue Heron	X		X	X	Eurasian Collared-dove		X	X	X
Cattle Egret	X		X	X	Mourning Dove		X	X	X
Green Heron	X		X	X	Barred Owls	X		X	X
Black Vulture	X		X	X	Chimney Swift			X	X
Turkey Vulture	X		X	X	Eastern Kingbird			X	X
Snow Goose	X		X	X	American Crow	X	X	X	X
Wood Duck	X		X	X	Horned Lark			X	X
Gadwall	X		X	X	Purple Martin			X	X
Mallard	X		X	X	Tree Swallow			X	X
Blue-winged Teal	X		X	X	Northern Rough-winged Swallow			X	X
Feral Duck	X	X	X	X	Bank Swallow			X	X
Feral Goose	X	X	X	X	Cliff Swallow			X	X
Osprey	X	X	X	X	Barn Swallow			X	X
Northern Harrier	X	X	X	X	Eastern Bluebird			X	X
Sharp-shinned Hawk	X	X	X	X	American Robin			X	X
Cooper's Hawk	X	X	X	X	European Starling	X	X	X	X
Red-shouldered Hawk	X	X	X	X	Cedar Waxwing			X	X
Red-tailed Hawk	X	X	X	X	Field Sparrow			X	X
American Kestrel	X	X	X	X	Savannah Sparrow			X	X
Wild Turkey	X		X	X	Red-winged Blackbird	X		X	X
American Coot	X		X	X	Eastern Meadowlark			X	X
Killdeer			X	X	Brewer's Blackbird	X		X	X
Lesser Yellowlegs			X	X	Common Grackle	X		X	X
Least Sandpiper			X	X	Brown-headed Cowbird	X		X	X
Spotted Sandpiper			X	X	House Finch		X	X	X
Upland Sandpiper			X	X	House Sparrow	X	X	X	X

[a]A=Agriculture, N =Natural Resources, P=Property, H=Human Safety

As stated previously, the need for action arises from requests received from state, federal, and private entities to provide assistance with resolving damage or threats of damage to four main categories of resources in Mississippi that include agricultural resources, natural resources, property, and human safety. More specific information regarding bird damage to those main categories are discussed in the following subsections of the EA:

Need for Bird Damage Management on TVA Properties and Facilities

The TVA owns and manages over 293,000 acres in the Tennessee River system. All of these lands support TVA's goals of power generation and transmission, flood control, and economic development of the Tennessee River Valley. The TVA operates three combustion turbine sites in Mississippi and two solar facilities. The TVA also owns or maintains electrical power substations and switching stations and the associated transmission lines and rights-of-way easements in Mississippi. In addition, the TVA operates public recreation areas throughout the Tennessee Valley region, including campgrounds, day-use areas, and boat launching ramps.

Bird damage and threats of damage occurring at facilities and properties owned or managed by the TVA have occurred primarily to property and human safety. Birds roosting at TVA facilities can cause considerable economic damage due to the excessive amount of droppings on buildings, equipment, and facilities resulting in constant cleaning. The droppings can occur in work areas which can be aesthetically displeasing to employees. Additionally, birds can pose a threat to people from the potential transmission of zoonotic diseases when employees contact fecal matter or surfaces contaminated with fecal matter. The fecal droppings make work areas slippery which can create safety concerns from employees slipping and falling.

For example, fecal droppings can also accumulate under areas where vultures roost and loaf. Fecal droppings can be corrosive to the metal support towers of transmission lines. Accumulation of fecal droppings on and around the structures can present a safety concern for workers that conduct maintenance on the towers. Large accumulations of feces threatens human safety by creating slick surfaces where employees work at extreme heights and increases the risk of zoonotic disease transmission from contact with contaminated surfaces as workers conduct maintenance. The odor and presence of fecal material on equipment is also aesthetically displeasing to employees. Vultures can also pose a risk of large power outages occurring to customers if the birds/fecal material short out the power supply the towers support.

Birds can also roost on or enter electrical substations and power generation facilities and threaten the interruption of power. Osprey nests are often a threat to the safe operation of electrical equipment due to the risk of outages caused when debris from the nests or debris being carried by osprey comes into contact with transmission equipment. Nests are often constructed of large sticks and twigs that can cause disruptions in the electrical power supply when those nests are located on utility structures and can inhibit access to utility structures for maintenance by creating obstacles to workers. For example, the average osprey nest size in Corvallis, Oregon weighed 264 pounds and was 41-inches in diameter (United States Geological Survey 2005). In 2001, 74% of occupied osprey nests along the Willamette River in Oregon occurred on power pole sites (United States Geological Survey 2005).

All of these damage issues and others occur throughout TVA owned and managed properties. The TVA has requested assistance from WS to address these in the past and may request assistance with additional bird damage issues in the future.

Need to Resolve Bird Damage to Agricultural Resources

Over 11 million acres were devoted to agricultural production in Mississippi during 2009 (USDA 2009). The total market value of agricultural products sold in the State was nearly $5 billion in 2007 (USDA 2009). The value of grain crops, oilseeds, dry beans, and dry peas production in the State was nearly $1.1 billion in 2007 (USDA 2009). The value of poultry and eggs sold in the State during 2007 was over $2.4 billion (USDA 2009). The cattle and calf inventory for Mississippi was over 987,000 head during 2007 with a sales value of nearly $324 million (USDA 2009). The value of sales from aquaculture production in the State during 2007 was nearly $238 million which ranked first in the United States (USDA 2009).

As shown in Table 1.2, many of the bird species addressed in this assessment have been identified as causing or posing threats to agricultural resources in Mississippi.

Damage to Aquaculture Resources

Damage to aquaculture resources occurs primarily from the economic losses associated with birds consuming fish and other commercially raised aquatic wildlife. Damage can also result from the death of fish and other aquatic wildlife from injuries suffered when birds attempt to prey upon aquatic wildlife. Threats of disease transmission from one impoundment to another or from one aquaculture facility to other facilities as birds move between sites can also be a concern for aquaculture producers. The principal species propagated in Mississippi are catfish (USDA 2009). In 2007, there were 451 commercial catfish operations in Mississippi with nearly 287 million pounds of catfish sold (USDA 2009). Of those birds shown in Table 1.2 associated with damage to agriculture, of primary concern to aquaculture facilities in Mississippi are herons, egrets, and gulls.

Price and Nickum (1995) concluded that the aquaculture industry has small profit margins so that even a small percentage reduction in the farm gate value due to predation is an economic issue. The magnitude of economic impacts that birds have on the aquaculture industry can vary dependent upon many different variables including, the value of the fish stock, number of depredating birds present, and the time of year the predation is taking place. In 1984, a survey of fish producing facilities identified 43 species of birds as foraging on fish at those facilities, including grebes, pelicans, herons, egrets, waterfowl, osprey, hawks, harriers, owls, gulls, terns, crows, mergansers, common grackles, and brown-headed cowbirds (Parkhurst et al. 1987).

Great blue herons are known to forage at aquaculture facilities (Parkhurst et al. 1987). During a survey of aquaculture facilities in the northeastern United States, 76% of respondents identified the great blue heron as the bird of highest concern from predation (Glahn et al. 1999*a*). Glahn et al. (1999*a*) found that 80% of the aquaculture facilities surveyed in the northeastern United States perceived birds as posing an economic threat due to predation which coincided with 81% of the facilities surveyed having birds present on aquaculture ponds. Great blue herons were found at 90% of the sites surveyed by Glahn et al. (1999*b*). Loss of trout in ponds with herons present ranged from 9.1% to 39.4% in Pennsylvania with an estimated loss in production ranging from $8,000 to nearly $66,000 (Glahn et al. 1999*b*). The stomach contents of great blue herons collected at trout producing facilities in the northeastern United States contained almost exclusively trout (Glahn et al. 1999*b*).

In addition to herons, other bird species have also been identified as causing damage or posing threats to aquaculture facilities.

Mallards have been identified by aquaculture facilities as posing a threat of economic loss from foraging behavior (Parkhurst et al. 1987, Parkhurst et al. 1992). During a survey conducted in 1984 of fisheries primarily in the eastern United States, managers at 49 of 175 facilities reported mallards as feeding on

fish at those facilities, which represented an increase in the number of facilities reporting mallards as feeding on fish when compared to prior surveys (Parkhurst et al. 1987). Parkhurst et al. (1992) found mallards foraging on trout fingerling at facilities in Pennsylvania. Mallards selected trout ranging in size from 8.9 centimeters to 12.2 centimeters in length. Once trout fingerlings reached a mean length of approximately 14 centimeters in raceways, mallards present at facilities switched to other food sources (Parkhurst et al. 1992). Of those predatory birds observed by Parkhurst et al. (1992), mallards consumed the most fish at the facilities with a mean of 148,599 fish captured and had the highest mean economic loss per year per site based on mallards being present at those facilities for a longer period of time per year compared to other species.

During a survey of fisheries in 1984, osprey ranked third highest among 43 species of birds identified as foraging on fish at aquaculture facilities in the United States (Parkhurst et al. 1987). Fish comprise the primary food source of osprey (Poole et al. 2002). Parkhurst et al. (1992) found that when ospreys were present at aquaculture facilities over 60% of their mean time was devoted to foraging. The mean length of trout captured by osprey was 30.5 centimeters leading to a higher economic loss per captured fish compared to other observed species (Parkhurst et al. 1992).

Predation at aquaculture facilities can also occur from American crows (Parkhurst et al. 1987, Parkhurst et al. 1992). During a survey of ten fisheries in 1985 and 1986, American crows were observed at eight of the facilities in central Pennsylvania (Parkhurst et al. 1992). The mean size of trout captured by crows in one study was 22.5 centimeters with a range of 15.2 to 31.7 centimeters (Parkhurst et al. 1992). Crows consumed a mean of 11,651 trout per year per site from ten trout hatcheries in Pennsylvania in 1985 and 1986 (Parkhurst et al. 1992). Since crows selected for larger fish classes at fish facilities, Parkhurst et al. (1992) determined economic losses from foraging by crows led to a higher mean economic impacts at facilities compared to other avian foragers based on the value of larger fish classes.

Although primarily insectivorous during the breeding season and granivorous during migration periods (Peer and Bollinger 1997), common grackles have been identified as feeding on fish (Hamilton 1951, Beeton and Wells 1957, Darden 1974, Zottoli 1976, Whoriskey and Fitzgerald 1985, Parkhurst et al. 1992). During a study of aquaculture facilities in central Pennsylvania, Parkhurst et al. (1992) found grackles feeding on trout fry at nine of the ten facilities observed. The mean length of trout captured by grackles was 7.6 centimeters with a range of 6.0 to 7.9 centimeters. Once fish reached a mean size of 14 centimeters, grackles switch to alternative food sources at the facilities (Parkhurst et al. 1992). Among all predatory bird species observed during the study conducted by Parkhurst et al. (1992), grackles captured and removed the most fish per day per site which was estimated at 145,035 fish captured per year per site.

Also of concern to aquaculture facilities is the transmission of diseases by birds between impoundments and from facility to facility. Given the confinement of aquatic wildlife inside impoundments at aquaculture facilities and the high densities of those organisms in the impoundments, the introduction of a disease can result in substantial economic losses since the entire impoundment is likely to become infected and result in extensive mortality. Although the actual transmission of diseases through transport by birds is difficult to document, birds have been documented as having the capability of spreading diseases through fecal droppings and possibly through other mechanical means such as on feathers, feet, and regurgitation.

Birds have been identified as a possible source of transmission of three fish viruses in Europe: Spring Viraemia of Carp (SVC), Viral Haemorrhagic Septicaemia (VHS), and Infectious Pancreatic Necrosis (IPN) (European Inland Fisheries Advisory Commission 1989). VHS and IPN are known to occur in North America (Price and Nickum 1995). SVC has also been documented to occur in North America (USDA 2003). Peters and Neukirch (1986) found the IPN virus in the fecal droppings of herons when the herons were fed IPN infected trout. Olesen and Vestergard-Jorgensen (1982) found herons could transmit

the VHS (Egtved virus) from beak to fish when the beaks of herons were contaminated with the virus. However, Eskildsen and Vestergaard-Jorgensen (1973) found the Egtved virus did not pass through the digestive tracks into the fecal droppings of black-headed gulls (*Larus ridibundus*) when artificially inserted into the esophagus of the gulls.

Birds are also capable of passing bacterial pathogens through fecal droppings and on their feet (Price and Nickum 1995). The bacterial pathogen for the fish disease Enteric Septicemia of Catfish (ESC) has been found within the intestines and rectal areas of great blue herons and double-crested cormorants from aquaculture facilities in Mississippi (Taylor 1992). However, since ESC is considered endemic in the region, Taylor (1992) did not consider birds as a primary vector of the disease. Birds also pose as primary hosts to several cestodes, nematods, trematodes, and other parasites which can infect fish. Birds can also act as intermediate hosts of parasites that can infect fish after completing a portion of their life-cycle in crustaceans or mollusks (Price and Nickum 1995).

Although birds can pose as vectors of diseases known to infect fish, the rate of transmission is currently unknown and is likely very low. Since fish-eating birds are known to target fish that are diseased and less likely to escape predation at aquaculture facilities (Price and Nickum 1995, Glahn et al. 2002) and given the mobility of birds to move from one impoundment or facility to another, the threat of disease transmission is a concern given the potential economic loss resulting from extensive mortality of fish or other cultivated aquatic wildlife if a disease outbreak occurs.

Damage and Threats to Livestock Operations

Damage to livestock operations can occur from several bird species in Mississippi. Economic damage can occur from birds feeding on livestock feed, from birds feeding on livestock, and from the increased risks of disease transmission associated with large concentrations of birds. Although individual or small groups of birds can cause economic damage to livestock producers, such as a vulture or a group of vultures feeding on newborn cattle, most economic damage occurs from bird species that congregate in large flocks at livestock operations.

Although damage and disease threats to livestock operations can occur throughout the year, damage is highest during those periods when birds are concentrated into large flocks such as migration periods and during winter months when food sources are limited. For some bird species, high concentrations of birds can be found during the breeding season where suitable nesting habitat exists, such as pigeons and house sparrows. Of primary concern to livestock feedlots and dairies in Mississippi are starlings, red-winged blackbirds, grackles, cowbirds, house sparrows, pigeons, and to a lesser extent crows and gulls. The flocking behavior of those species either from roosting and/or nesting behavior can lead to economic losses to agricultural producers from the consumption of livestock feed and from the increased risks associated with the transmission of diseases from fecal matter being deposited in feeding areas and in water used by livestock.

Economic damages associated with starlings and blackbirds feeding on livestock rations has been documented in France and Great Britain (Feare 1984), and in the United States (Besser et al. 1968, Dolbeer et al. 1978, Glahn and Otis 1981, Glahn 1983, Glahn and Otis 1986). It has been estimated that starlings damage an estimated $800 million worth of agricultural resources per year (Pimentel et al. 2000). 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 single component over others. Livestock feed and rations are often formulated to ensure proper health of the animal. Higher fiber roughage in livestock feed is often supplemented with corn, barley, and other grains to ensure weight gain and in the case of dairies, for dairy cattle to produce milk. Livestock are unable to select for certain ingredients in livestock feed while birds often can selectively choose to feed on the corn, barley, and other grains formulated in livestock feed.

Livestock feed provided in open troughs is most vulnerable to feeding by birds. Birds often select for those components of feed that are most beneficial to the desired outcome of livestock. When large flocks of birds selectively forage for components in livestock feeds, the composition and the energy value of the feed can be altered which can negatively impact the health and production of livestock. The removal of this high energy source by European starlings is believed to reduce milk yields and weight gains, and is economically critical (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 and blackbirds 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 European starlings consumed 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 of which 6.3% experienced considerable 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.

In addition, large concentrations of birds feeding, roosting, and/or loafing at livestock operations increase risks of disease transmission from fecal matter being deposited in areas where livestock feed, water, and are housed. Birds feeding in open troughs on livestock feed leave fecal deposits which can be consumed by feeding livestock, fecal matter can also be deposited in sources of water for livestock which increases the likelihood of disease transmission, and can contaminate other surfaces where livestock can encounter fecal matter deposited by birds. Many bird species, especially those encountered at livestock operations, are known to carry infectious diseases which can be excreted in fecal matter. This not only poses a risk to individual livestock operations but can be a source of transmission to other livestock operations as birds move from one area to another.

A number of diseases that affect livestock have been associated with rock pigeons, European starlings, and house sparrows (Weber 1979). Although birds are known to be carriers of diseases (vectors) that are transmissible to livestock, the rate that transmission occurs is unknown. Since many sources of disease transmission exist, identifying a specific source can be difficult. Birds are known to be vectors of disease which increases the threat of transmission when large numbers of birds are defecating and contacting surfaces and areas used by livestock. The rate of transmission is likely very low; however, the threat of transmission exists since birds are known vectors of many diseases transmittable to livestock. Rock pigeons, starlings, and house sparrows have been identified as carriers of erysipeloid, salmonellosis, pasteurellosis, avian tuberculosis, streptococcosis, vibrosis, and listeriosis (Weber 1979). Weber (1979) also reported pigeons, starlings, and house sparrows as vectors of several viral, fungal, protozoal, and rickettsial diseases that are known to infect livestock and pets.

Williams et al. (1977) and Johnston et al. (1979) reported that gulls can transmit salmonella to livestock through droppings and contaminated drinking water. Gulls also cause damage by defecating on fences, shade canopies, and other structures, which can accelerate corrosion of metal components and is generally considered an unsightly nuisance and potential health hazard for the feedlot operators and their personnel.

Although birds are known to be carriers of diseases (vectors) that are transmissible to livestock, the rate that transmission occurs is unknown but is likely to be low. Since many sources of disease transmission exist, identifying a specific source can be difficult. Birds are known to be vectors of disease which increases the threat of transmission when large numbers of birds are defecating and contacting surfaces and areas used by livestock. The rate of transmission is likely very low; however, the threat of transmission exists since birds are known vectors of many diseases transmittable to livestock.

In Mississippi, damage to livestock occurs primarily from vultures. Economic damage occurs from vultures feeding on livestock. Vultures are known to prey upon newly born calves and harass adult cattle, especially during the birthing process. The NASS reported livestock owners in the United States lost 11,900 head of cattle and calves from vultures in 2010 valued at $4.6 million (NASS 2011). Although turkey vultures are known to feed on livestock in mixed species flocks of vultures, livestock damages from vultures is generally restricted to the range of the black vulture. Vulture predation on livestock is distinctive. Lovell (1947, 1952) and Lowney (1999) reported black vultures killed pigs by pulling eyes out followed by attacks to the rectal area or directly attacking the rectal area. During a difficult delivery, vultures will peck at the half-expunged calf which can lead to the death of the animal. Reports of calf depredation occur throughout Mississippi but are not necessarily common. Many livestock producers do not leave birthing cows unattended.

Economic losses can also result from raptors, particularly red-tailed hawks, feeding on domestic fowl, such as chickens and waterfowl. Free-ranging fowl or fowl allowed to range outside of confinement for a period of time are particularly vulnerable to predation by raptors.

Damage to Agricultural Crops

Besser (1985) estimated damage to agricultural crops associated with birds exceeded $100 million annually in the United States. Bird damage to agricultural crops associated with birds addressed in this assessment occurs primarily from consumption (loss of the crop and revenue).

Fruit and nut crops can be damaged by robins, European starlings, red-winged blackbirds, grackles, cowbirds, and American crows. Besser (1985) estimated bird damage to grapes, cherries, and blueberries exceeded $1 million dollars annually in the United States. In 1972, Mott and Stone (1973) estimated that birds caused $1.6 to $2.1 million in damage to the blueberry industry in the United States, with starlings, robins, and grackles causing the most damage. Red-winged blackbirds, cowbirds, and crows are also known to cause damage to blueberries (Besser 1985). Damage to blueberries typically occurs from birds plucking and consuming the berry (Besser 1985).

Damage to apples occurs from beak punctures which makes the apples unmarketable (Besser 1985). Crows have been documented as causing damage to apples (Mitterling 1965). Damage is infrequently reported in apples since harvest of the crop typically occurs before apples reach a stage when damage is likely with damage being greatest during periods of drought (Mitterling 1965).

Bird damage to sweet corn can also result in economic losses to producers. Damage to sweet corn is often amplified since damage to sweet corn caused by birds makes the ear of corn unmarketable because the damage is unsightly to the consumer (Besser 1985). Large flocks of red-winged blackbird are responsible for most of the damage reported to sweet corn with damage also occurring from grackles (Besser 1985). Damage occurs when birds rip or pull back the husk exposing the ear for consumption. Most bird damage occurs during the development stage known as the milk and dough stage when the kernels are soft and filled with a milky liquid. Birds will puncture the kernel to ingest the contents. Once punctured, the area of the ear damaged often discolors and is susceptible to disease introduction into the ear (Besser 1985). Damage usually begins at the tip of the ear as the husk is ripped and pulled back but can occur anywhere on the ear (Besser 1985).

Damage can also occur to sprouting corn as birds pull out the sprout or dig the sprout up to feed on the seed kernel (Besser 1985). Damage to sprouting corn occurs primarily from grackles and crows but red-winged blackbirds are also known to cause damage to sprouting corn (Stone and Mott 1973). Damage to sprouting corn is likely localized and highest in areas where grackle breeding colonies exist in close proximately to agricultural fields planted with corn (Stone and Mott 1973, Rogers and Linehan 1977).

Rogers and Linehan (1977) found grackles damaged two corn sprouts per minute on average when present at a field planted near a grackle breeding colony.

Need to Resolve Threats that Birds Pose to Human Safety

Several bird species listed in Table 1.2 can be closely associated with human habitation and often exhibit gregarious roosting behavior (*i.e.*, roost in large numbers), such as house sparrows, starlings, pigeons, vultures, crows, blackbirds, and gulls. The close association of those bird species with human activity can pose threats to human safety from disease transmission, the safety of air passengers can be threatened if birds are struck by aircraft, excessive droppings can be aesthetically displeasing, and aggressive behavior can pose risks to human safety.

Threat of Disease Transmission

Birds can play an important role in the transmission of zoonotic diseases where humans may come into contact with fecal droppings of those birds. Few studies are available on the occurrence of zoonotic diseases in wild birds and the risks to humans from transmission of those diseases. Study of this issue is complicated by the fact that some disease-causing agents associated with birds may also be contracted from other sources. The risk of disease transmission from birds to humans is likely very low. However, human exposure to fecal droppings through direct contact or through the disturbance of accumulations of fecal droppings where disease organisms are known to occur increases the likelihood of disease transmission. The gregarious behavior of bird species leads to accumulations of fecal droppings that can be considered a threat to human health and safety due to the close association of those species of birds with human activity. Accumulations of bird droppings in public areas are aesthetically displeasing and are often in areas where humans may come in direct contact with fecal droppings.

Birds can play an important role in the transmission of zoonotic diseases to humans such as encephalitis, West Nile virus, psittacosis, and histoplasmosis. Public health officials and residents near areas where fecal droppings accumulate express concerns for human health related to the potential for disease transmission. Fecal droppings that accumulate from large communal bird roosts can facilitate the growth of disease organisms which grow in soils enriched by bird excrement, such as the fungus *Histoplasma capsulatum* which causes the disease histoplasmosis in humans (Weeks and Stickley 1984). The disturbance of soil or fecal droppings under bird roosts where fecal droppings have accumulated can cause *H. capsulatum* to become airborne. Once airborne, the fungus could be inhaled by people in the area. Ornithosis (*Chlamydia psittaci*) is another respiratory disease that can be contracted by humans, livestock, and pets that can be associated with accumulations of bird droppings. Pigeons are most commonly associated with the spread of Ornithosis to humans. Ornithosis is a virus that is spread through infected bird droppings when viral particles become airborne after infected bird droppings are disturbed. In most cases in which human health concerns are a major reason for requesting assistance, no actual cases of bird transmission of disease to humans have been proven to occur. Thus, it is the risk of disease transmission that is the primary reason for requesting assistance.

Even though many people are concerned about disease transmission from feces, the probability of contracting a disease from feces is believed to be small. However, human exposure to fecal droppings through direct contact or through the disturbance of accumulations of fecal droppings where disease organisms are known to occur increases the likelihood of disease transmission. Many of the bird species addressed in this assessment are closely associated with human habitation and they often exhibit gregarious roosting and nesting behavior. This gregarious behavior leads to accumulations of fecal droppings that can be considered a threat to human health and safety due to the close association of those species of birds with human activity. Accumulations of bird droppings in public areas are aesthetically displeasing and are often in areas where humans may come in direct contact with fecal droppings.

As many as 65 different diseases transmittable to humans or domestic animals have been associated with pigeons, European starlings, and house sparrows (Weber 1979). In most cases, in which human health concerns are a major reason for requesting assistance, no actual cases of bird transmission of disease to humans have been proven to occur. Thus, it is the risk of disease transmission that is the primary reason for requesting assistance.

Research has shown that gulls carry various species of bacteria such as *Bacillus* spp., *Clostridium* spp., *Campylobacter* spp., *Escherichia coli, Listeria* spp., and *Salmonella* spp. (MacDonald and Brown 1974, Fenlon 1981, Butterfield et al. 1983, Monaghan et al. 1985, Norton 1986, Vauk-Hentzelt et al. 1987, Quessey and Messier 1992). Transmission of bacteria from gulls to humans is difficult to document; however, Reilley et al. (1981) and Monaghan et al. (1985) both suggested that gulls were the source of contamination for cases of human salmonellosis. Gulls threaten the safety of municipal drinking water sources by potentially causing dangerously high levels of coliform bacteria from their fecal matter. Gull feces has also been implicated in accelerated nutrient loading of aquatic systems (Portnoy 1990), which could have serious implications for municipal drinking water sources.

Public health concerns often arise when gulls feed and loaf near fast food restaurants, and picnic facilities; deposit waste from landfills in urban areas and drinking water reservoirs; and contaminate industrial facility ventilation systems with feathers, nesting debris, and droppings. Gulls feeding on vegetable crops and livestock feed can potentially aid in the transmission of salmonella.

While transmission of diseases or parasites from birds to humans has not been well documented, the potential exists (Luechtefeld et al. 1980, Wobeser and Brand 1982, Hill and Grimes 1984, Pacha et al. 1988, Blandespoor and Reimink 1991, Graczyk et al. 1997, Saltoun et al. 2000, Kassa et al. 2001). In worst case scenarios, infections may even be life threatening for immunocompromised and immunosuppressed people (Roffe 1987, Graczyk et al. 1998). Even though many people are concerned about disease transmission from feces, the probability of contracting a disease from feces is believed to be small. Financial costs related to human health threats involving birds may include testing of water for *coliform* bacteria, cleaning and sanitizing public-use areas, contacting and obtaining assistance from public health officials, and implementing wildlife damage management to reduce risks. WS recognizes and defers to the authority and expertise of local and state health officials in determining what does or does not constitute a threat to public health.

Threat of Aircraft Striking Wildlife at Airports and Military Bases

In addition to threats of zoonotic diseases, birds also pose a threat to human safety from being struck by aircraft. Birds struck by aircraft, especially when ingested into engines, can lead to structural damage to the aircraft and can cause catastrophic failure of the aircraft. The civil and military aviation communities have acknowledged that the threat to human health and safety from aircraft collisions with wildlife is increasing (Dolbeer 2000, MacKinnon et al. 2001). Collisions between aircraft and wildlife are a concern throughout the world because wildlife strikes threaten passenger safety (Thorpe 1996), result in lost revenue, and repairs to aircraft can be costly (Linnell et al. 1996, Robinson 1996). Aircraft collisions with wildlife can also erode public confidence in the air transport industry as a whole (Conover et al. 1995). In several instances, wildlife-aircraft collisions in the United States have resulted in human fatalities. The risk that birds pose to aircraft is well documented with the worst case reported in Boston in 1960 when 62 people were killed in the crash of an airliner which collided with a flock of European starlings (Terres 1980). From 1990 through 2010, a total of 366 birds have been reported as struck by aircraft in Mississippi (Dolbeer et al. 2012).

Target bird species when in large flocks or flight lines entering or exiting a roost at or near airports or when present in large flocks foraging on or near an airport, present a safety threat to aviation. Vultures can also present a risk to aircraft because of their large body mass and slow-flying or soaring behavior. Vultures are considered to be the most hazardous bird for an aircraft to strike based on the frequency of strikes, effect on flight, and amount of damage caused by vultures throughout the country (Dolbeer et al. 2000).

From 1990 to 2010, 109,707 wildlife strikes involving civilian aircrafts have been reported in the United States, Puerto Rico, the Virgin Islands, and the Pacific Islands in possession of the United States. Birds were involved with over 97% of those reported strikes to civil aircraft in the United States (Dolbeer et al. 2012). This number is likely to be much greater since an estimated 80% of civil bird strikes go unreported (Cleary et al. 2005, Wright and Dolbeer 2005). In Mississippi, 96.1% of the reported aircraft strikes with wildlife have involved birds (Dolbeer et al. 2012). Generally, bird collisions occur when aircraft are near the ground during take-off and approach to the runway. From 1990 through 2010, approximately 76% of reported bird strikes to general aviation aircraft in the United States occurred when the aircraft was at an altitude of 500 feet above ground level or less. Additionally, approximately 97% occurred less than 3,500 feet above ground level (Dolbeer et al. 2012).

Gulls, pigeons/doves, raptors, and waterfowl have been the bird groups most frequently struck by aircraft in the United States. Of the total known birds struck in the United States from 1990 through 2010, gulls comprised 17% of the strikes, pigeons and doves comprised 15% of the total reported strikes where identification occurred, while raptors accounted for 13%, and waterfowl were identified in 7% of reported strikes (Dolbeer et al. 2012).

Birds being struck by aircraft can cause substantial damage. Bird strikes can cause catastrophic failure of aircraft systems (*e.g.*, ingesting birds into engines) which can cause the plane to become uncontrollable which can lead to crashes. Since 1988, more than 229 people worldwide have died in aircraft that have crashed after striking wildlife (Dolbeer and Wright 2008). Between 1990 and 2010, 24 people have died after aircraft have stuck birds in the United States (Dolbeer et al. 2012). Of those 24 fatalities involving bird strikes, seven fatalities occurred after striking birds that were not identified while eight fatalities occurred after strikes involving red-tailed hawks (Dolbeer et al. 2012). A recent example occurred in Oklahoma where an aircraft struck American white pelicans (*Pelecanus erythrorhynchos*) causing the plane to crash killing all five people aboard (Dove et al. 2009). Injuries also occur from bird strikes to pilots and passengers. Between 1990 and 2010, 44 strikes involving waterfowl have resulted in injuries to 49 people while 29 strikes involving vultures resulted in injuries to 32 people (Dolbeer et al. 2012).

Additional Human Safety Concerns Associated with Birds

As people are increasingly living with wildlife, the lack of harassing and threatening behavior by people toward many species of wildlife, especially around urban areas, has led to a decline in the fear wildlife have toward humans. When wildlife species begin to habituate to the presence of people and human activity, a loss of apprehension occurs that can lead those species to exhibit threatening behavior toward people. This threatening behavior continues to increase as human populations expand and the populations of those species that adapt to human activity increase. Threatening behavior can be in the form of aggressive posturing, a general lack of apprehension toward people, or abnormal behavior. Although birds attacking people occurs rarely, aggressive behavior by birds does occur, especially during nest building and the rearing of eggs and chicks. Raptors can aggressively defend their nests, nesting areas, and young, and may swoop and strike at pets, children, and adults.

In addition to raptors, waterfowl can also aggressively defend their nests and nestlings during the nesting season. Waterfowl aggressively defend their nests, nesting areas, and young, and may attack or threaten

pets, children, and adults (Smith et al. 1999). Feral waterfowl often nest in high densities in areas used by humans for recreational purposes such as industrial areas, parks, beaches, and sports fields (VerCauteren and Marks 2004). If people unknowingly approach waterfowl or their nests at those locations, injuries could occur if waterfowl react aggressively to the presence of those people or pets. Additionally, slipping hazards can be created by the buildup of feces from birds on docks, walkways, and other foot traffic areas. If fecal droppings occur in areas with foot traffic, slipping could occur resulting in injuries to people. To avoid those conditions, regular clean-up is often required to alleviate threats of slipping on fecal matter which can be economically burdensome.

Need to Resolve Bird Damage Occurring to Property

As shown in Table 1.2, all the bird species addressed in this assessment are known to cause damage to property in Mississippi. Property damage can occur in a variety of ways and can result in costly repairs and clean-up. Bird damage to property occurs through direct damage to structures, through roosting behavior, and through their nesting behavior. One example of direct damage to property occurs when vultures tear roofing shingles or pull out latex caulking around windows. Accumulations of fecal droppings can cause damage to buildings and statues. Aircraft striking birds can also cause substantial damage requiring costly repairs and aircraft downtime. Direct damage can also result from birds that act aggressively toward their reflection in mirrors and windows which can scratch paint and siding.

Gulls, raptors, waterfowl, and doves are the bird groups most frequently struck by aircraft in the United States. When struck, 27% of the reported gull strikes resulted in damage to the aircraft or had a negative effect on the flight while 66% of the reported waterfowl strikes resulted in damage or negative effects on the flight compared to 26% of strikes involving raptors and 12% of strikes involving pigeons and doves (Dolbeer et al. 2012). Since 1990, over $150 million in damages to civil aircraft have been reported from strikes involving waterfowl (Dolbeer et al. 2012). In total, aircraft striking birds has resulted in over $394 million in reported damages to civil aircraft since 1990 in the United States (Dolbeer et al. 2012).

Starlings and blackbirds, when in large flocks or flight lines entering or exiting a winter roost at or near airports, present a safety threat to aviation. Starlings and blackbirds are particularly dangerous birds to aircraft during take-offs and landings because of their high body density and tendency to travel in large flocks of hundreds to thousands of birds (Seamans et al. 1995). Mourning doves also present similar risks when their late summer behaviors include creating large roosting and loafing flocks. Their feeding, watering and gritting behavior on airport turf and runways further increase the risks of bird-aircraft collisions. Vulture species can also present a risk to aircraft because of their large body mass and slow-flying or soaring behavior. Snow geese and vultures are considered to be the most hazardous birds for an aircraft to strike based on the percentage of strikes resulting in an adverse effect to the aircraft (*i.e.*, a strike resulting in damage to the aircraft and/or having a negative effect on the flight) (Dolbeer et al. 2012). Gulls also present a strike risk to aircraft and are responsible for most of the damaging strikes reported in coastal areas.

Damage to property associated with large concentrations of roosting birds occurs primarily from accumulations of droppings and feather debris. Many of the bird species addressed in this assessment are gregarious. Although damage and threats can occur throughout the year, damage is highest during those periods when birds are concentrated into large flocks such as migration periods and during winter months when food sources are limited. Birds that routinely roost and loaf in the same areas often leave large accumulations of droppings and feather debris which is aesthetically displeasing and can cause damage to property. The reoccurring presence of fecal dropping under bird roosts can lead to constant cleaning costs for property owners.

Gull attraction to landfills as a food source has been well documented (Mudge and Ferns 1982, Patton 1988, Belant et al. 1995, Belant et al. 1998, Gabrey 1997). Large numbers of gulls are attracted to and use landfills as feeding and loafing areas throughout North America. In the northeastern United States, landfills often serve as foraging and loafing areas for gulls throughout the year, while attracting larger populations of gulls during migration periods (Bruleigh et al. 1998). Landfills have even been suggested as contributing to the increase in gull populations (Verbeek 1977, Patton 1988, Belant and Dolbeer 1993). Gulls that visit landfills may loaf on nearby rooftops, causing health concerns and structural damage to buildings and equipment. Bird conflicts associated with landfills include accumulation of feces on equipment and buildings, distraction of heavy machinery operators, and the potential for birds to transmit disease to workers on the site. The tendency for gulls to carry waste off site results in accumulation of feces and deposition of garbage in surrounding industrial and residential areas which creates a nuisance, as well as generates the potential for birds to transmit disease to neighboring residents.

Accumulated bird droppings can reduce the functional life of some building roofs by 50% (Weber 1979). Corrosion damage to metal structures and painted finishes, including those on automobiles, can occur because of the uric acid found in bird droppings. Electrical utility companies frequently have problems with birds and bird droppings causing power outages by shorting out transformers and substations. This has resulted in outage time for power companies and consumers. Those outages can cause violations in reliability standards set by the North American Electric Reliability Cooperation that could result in fines to the electric utility. Damage can also occur from droppings entering into food items or contaminating surfaces used to prepare food items at manufacturing facilities and can introduce undesirable components into the materials used in manufacturing processes.

The nesting behavior of some bird species can also cause damage to property. Nesting material can be aesthetically displeasing and fecal droppings often accumulate near nests which can also be aesthetically displeasing.

Need to Resolve Bird Damage Occurring to Natural Resources

Birds can also negatively impact natural resources through habitat degradation, competition with other wildlife, and through direct depredation on natural resources. Habitat degradation occurs when large concentrations of birds in a localized area negatively impact characteristics of the surrounding habitat that can adversely affect other wildlife species and can be aesthetically displeasing. Competition can occur when two species compete (usually to the detriment of one species) for available resources, such as food or nesting sites. Direct depredation occurs when predatory bird species feed on other wildlife species which can negatively influence those species' populations, especially when depredation occurs on threatened and endangered (T&E) species.

Habitat degradation in Mississippi occurs primarily in areas where birds congregate to nest or where the gregarious roosting behavior of birds occurs. The degradation of habitat occurs from the continuous accumulation of fecal droppings that occurs under areas where birds consistently roost. Over time, the accumulation of fecal droppings under areas where birds nest or roost can lead to the loss of vegetation due to the ammonium nitrogen found in the fecal droppings of birds. For example, large accumulations of fecal droppings under a crow roost could have a detrimental impact on desirable vegetation. A study conducted in Oklahoma found fewer annual and perennial plants in locations where crows roosted over several years (Hicks 1979).

Some species listed as threatened or endangered under the Endangered Species Act of 1973 (ESA) are preyed upon or otherwise adversely affected by certain bird species. Concentrations of gulls often impact the productivity and survivorship of rare or endangered colonial species such as terns (United States Department of the Interior 1996) and prey upon the eggs and chicks of colonial waterbirds. Colonial

nesting gull species are also known to compete with other bird species for nest sites, such as terns and plovers.

Crows are considered omnivorous, consuming a variety of invertebrates, amphibians, reptiles, mammals, and small birds, including birds' eggs, nestlings, and fledglings, as well as grain crops, seeds, fruits, carrion, and discarded human food (Verbeek and Caffrey 2002). With crows, the primary concern to natural resources occurs from predation on T&E species. Crows have been documented feeding on piping plover (*Charadrius melodus*) eggs and nestlings. Piping plovers are currently considered a threatened species by the USFWS. Although WS has not been requested previously to conduct bird damage management activities to reduce predation on T&E species, WS could be requested to provide assistance in the future.

Brood parasitism by brown-headed cowbirds has also become a concern for many wildlife professionals where those birds are plentiful. Inter-specific nest competition has been well documented in brown-headed cowbirds, which are known to parasitize the nests of at least 220 avian species (Lowther 1993).

Interspecific nest competition has been well documented in European starlings. European starlings compete aggressively for nesting sites and have been found to take over nesting cavities of native birds. Miller (1975) and Barnes (1991) reported European starlings were responsible for a severe depletion of the eastern bluebird (*Sialia sialis*) population due to nest competition. Nest competition by European starlings has also been known to adversely impact American kestrels (Von Jarchow 1943, Nickell 1967, Wilmer 1987), red-bellied woodpeckers (*Centurus carolinus*), gila woodpeckers (*Centurus uropygialis*) (Kerpez and Smith 1990, Ingold 1994), northern flickers (*Colaptes auratus*), purple martins (Allen and Nice 1952), and wood ducks (Shake 1967, McGilvery and Uhler 1971, Grabill 1977, Heusmann et al. 1977). Weitzel (1988) reported nine native species of birds in Nevada had been displaced by starling nest competition, and Mason et al. (1972) reported European starlings evicting bats from nest holes.

House sparrows out-compete native species for nesting sites, destroying their eggs, killing nestlings, and establish year round territories which prevent late arriving species like Eastern bluebirds and tree swallows from nesting (Cornell News 2004).

Large concentrations of waterfowl have affected water quality around beaches and in wetlands by acting as nonpoint source pollution. There are four forms of nonpoint source pollution: sedimentation, nutrients, toxic substances, and pathogens. Large concentrations of waterfowl can remove shoreline vegetation resulting in erosion of the shoreline and soil sediments being carried by rainwater into lakes, ponds, and reservoirs (USFWS 2005).

Scherer et al. (1995) stated that waterfowl metabolize food very rapidly and most of the phosphorus contributed by bird feces into water bodies probably originates from sources within a lake being studied. In addition, assimilation and defecation converted the phosphorus into a more soluble form and, therefore was considered a form of internal loading. Waterfowl can contributed substantial amounts of phosphorus and nitrogen into lakes through feces creating excessive aquatic macrophyte growth and algae blooms (Scherer et al. 1995) and accelerated eutrophication through nutrient loading (Harris et al. 1981).

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Actions Analyzed

This EA evaluates the need for bird damage management to reduce threats to human safety and to resolve damage to property, natural resources, and agricultural resources on federal, state, tribal, municipal, and private land within the State of Mississippi wherever such management is requested by a cooperator.

This EA discusses the issues associated with conducting bird damage management in the State to meet the need for action and evaluates different alternatives to meeting that need while addressing those issues.

The methods available for use or recommendation under each of the alternatives evaluated are provided in Appendix B. The alternatives and Appendix B also discuss how methods would be employed to manage damage and threats associated with birds in the State. Therefore, the actions evaluated in this EA are the use of those methods available under the alternatives and the employment of those methods by WS to manage or prevent damage and threats associated with birds from occurring when permitted by the USFWS pursuant to the Migratory Bird Treaty Act (MBTA).

The MBTA makes it unlawful to pursue, hunt, take, capture, kill, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or their parts, nests, or eggs (16 USC 703-711). A list of bird species protected under the MBTA can be found in 50 CFR 10.13.

The MBTA does allow for the lethal take of those bird species listed in 50 CFR 10.13 when depredation occurs through the issuance of depredation permits or the establishment of depredation orders. Under authorities in the MBTA, the USFWS is the federal agency responsible for the issuance of depredation permits or the establishment of depredation orders for the take of those protected bird species when damage or threats of damage are occurring. Information regarding migratory bird permits can be found in 50 CFR 13 and 50 CFR 21. The USFWS has jurisdiction over the management of migratory birds and has specialized expertise in identifying and quantifying potential adverse effects to the human environment from bird damage management activities. Under the proposed action alternative, WS' take of birds would only occur when permitted by the USFWS through the issuance of a depredation permit or pursuant to depredation orders, when applicable. WS would not be directly involved with bird damage management activities under the technical assistance alternative nor the no involvement by WS alternative; therefore, no take would occur under those alternatives.

Native American Lands and Tribes

The WS program in Mississippi would only conduct damage management activities when requested by a Native American Tribe and only after a Memorandum of Understanding (MOU) or cooperative service agreement has been signed between WS and the Tribe requesting assistance. Therefore, the Tribe would determine when WS' assistance is required and what activities would be allowed. Because Tribal officials would be responsible for requesting assistance from WS and determining what methods would be available to alleviate damage, no conflict with traditional cultural properties or beliefs would be anticipated. Those methods available to alleviate damage associated with birds on federal, State, county, municipal, and private properties under the alternatives analyzed in this EA would also be available for use to alleviate damage on Tribal properties when the use of those methods have been approved for use by the Tribe requesting WS' assistance. Therefore, the activities and methods addressed under the alternatives would include those activities that could be employed on Native American lands, when requested and agreed upon.

Period for which this EA is Valid

If the analyses in this EA indicates an Environmental Impact Statement (EIS) is not warranted, this EA would remain valid until WS and the TVA determines that new needs for action, changed conditions, new issues, or new alternatives having different environmental impacts must be analyzed. At that time, this analysis and document would be reviewed and supplemented pursuant to the NEPA. Review of the EA would be conducted to ensure that the EA is sufficient. If the alternative analyzing no involvement in bird damage activities by WS is selected, no annual analyses would occur based on the lack of involvement by WS. The monitoring of activities ensures the EA is complete and still appropriate to the

scope of bird damage management activities conducted by WS in Mississippi and damage management activities that could be conducted on property owned or managed by the TVA.

Site Specificity

Actions could be taken to protect human health and safety, reduce damage to agricultural resources, alleviate property damage, and protect native wildlife, including T&E species, in the State, when requested. As mentioned previously, WS would only conduct damage management activities when requested by the appropriate property owner or manager. In addition, WS' activities that could involve the take of birds under the alternatives would only occur when permitted by the USFWS, when required, and only at levels permitted.

This EA analyzes the potential impacts of bird damage management based on previous activities conducted on private and public lands in Mississippi where WS and the appropriate entities have entered into a MOU, cooperative service agreement, or other comparable document. This EA also addresses the potential impacts of bird damage management on areas where additional agreements may be signed in the future. Because the need for action is to reduce damage and because the program's goals and directives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional bird damage management efforts could occur. Thus, this EA anticipates the potential expansion and analyzes the impacts of such efforts as part of the alternatives.

Many of the bird species addressed in this EA can be found statewide and throughout the year in the State; therefore, damage or threats of damage can occur wherever those birds occur. Planning for the management of bird damage must be viewed as being conceptually similar to other federal or agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they would 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, and insurance companies. Although some of the sites where bird damage could occur can be predicted, all specific locations or times where such damage would occur in any given year cannot be predicted. The threshold triggering an entity to request assistance from WS to manage damage associated with birds is often unique to the individual; therefore, predicting where and when such a request for assistance would be received by WS is difficult. This EA emphasizes major issues as those issues relate to specific areas whenever possible; however, many issues apply wherever bird damage and the resulting management actions occur and are treated as such.

Chapter 2 of this EA identifies and discusses issues relating to bird damage management in Mississippi. The standard WS Decision Model (Slate et al. 1992, USDA 1997) would be the site-specific procedure for individual actions conducted by WS in the State (see Chapter 3 for a description of the Decision Model and its application). Additional information on the Decision Model is available in WS' programmatic FEIS (USDA 1997). Decisions made using the model would be in accordance with WS' directives and Standard Operating Procedures (SOPs) described in this EA as well as relevant laws and regulations.

The analyses in this EA are intended to apply to any action that may occur in any locale and at any time within Mississippi. In this way, WS believes it meets the intent of the NEPA with regard to site-specific analysis and that this is the only practical way for WS to comply with the NEPA and still be able to accomplish its mission.

Federal, State, County, City, and Private Lands

Under two of the alternatives analyzed in detail, WS could continue to provide bird damage management activities on federal, State, county, municipal, and private land in Mississippi when a request is received for such services by the appropriate resource owner or manager. In those cases where a federal agency requests WS' assistance with managing damage caused by birds, the requesting agency would be responsible for analyzing those activities in accordance with the NEPA. However, this EA could cover such actions if the requesting federal agency determined the analyses and scope of this EA were appropriate for those actions and the requesting federal agency adopted this EA through their own Decision based on the analyses in this EA. Therefore, actions taken on federal lands have been analyzed in the scope of this EA.

Summary of Public Involvement

Issues and alternatives related to bird damage management as conducted by WS in Mississippi were initially developed by WS and the TVA in consultation with the USFWS and the MDWFP. Issues were defined and preliminary alternatives were identified through the scoping process. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS' NEPA implementing regulations, this document is being noticed to the public through legal notices published in local print media, through direct mailings to parties that have requested to be notified or have been identified to have an interest in the reduction of threats and damage associated with birds in the State, and by posting the EA on the APHIS website at http://www.aphis.usda.gov/wildlife_damage/nepa.shtml.

WS and the TVA will provide for a minimum of a 30-day comment period for the public and interested parties to provide new issues, concerns, and/or alternatives. Through the public involvement process, WS and the TVA will clearly communicate to the public and interested parties the analyses of potential environmental impacts on the quality of the human environment. New issues or alternatives raised after publication of public notices will be fully considered to determine whether the EA should be revisited and, if appropriate, revised prior to issuance of a final Decision or publication of a notice of intent to prepare an EIS.

1.4 RELATIONSHIP OF THIS DOCUMENT TO OTHER ENVIRONMENTAL DOCUMENTS

WS' Programmatic Final Environmental Impact Statement: WS has developed a programmatic FEIS that addresses the need for wildlife damage management in the United States (USDA 1997). The FEIS contains detailed discussions of potential impacts to the human environment from wildlife damage management methods used by WS. Pertinent information available in the FEIS has been incorporated by reference into this EA.

Double-crested Cormorant Management in the United States Final Environmental Impact Statement: The USFWS has prepared a FEIS on the management of double-crested cormorants (USFWS 2003*a*). WS was a formal cooperating agency in the preparation of the FEIS and has adopted the FEIS to support WS' program decisions for its involvement in the management of cormorant damage. WS completed a Record of Decision (ROD) on November 18, 2003 (68 FR 68020).

Extended Management of Double-crested Cormorants under 50 CFR 21.47 and 21.48 Final Environmental Assessment: The FEIS developed by the USFWS in cooperation with WS established a Public Resource Depredation Order (PRDO; 50 CFR 21.48) and made changes to the 1998 Aquaculture Depredation Order (AQDO; 50 CFR 21.47). To allow for an adaptive evaluation of activities conducted under the PRDO and the AQDO established by the FEIS, those Orders would have expired on April 30, 2009 (USFWS 2003*a*). The EA determined that a five-year extension of the expiration date of the PRDO

and the AQDO would not threaten cormorant populations and activities conducted under those Orders would not have a significant impact on the human environment (74 FR 15394-15398; USFWS 2009).

Resident Canada Goose Management Final Environmental Impact Statement: The USFWS has issued a FEIS addressing the need for and potential environmental impacts associated with resident goose damage management activities titled "*Resident Canada Goose Management*" (USFWS 2005). The FEIS also contains detailed analyses of the issues and methods used to manage Canada goose damage. A ROD and Final Rule were published by the USFWS on August 10, 2006 (71 FR 45964-45993). On June 27, 2007, WS, as a cooperating agency, issued a ROD and adopted the USFWS FEIS (72 FR 35217).

WS' Canada Goose Damage Management Environmental Assessment: WS prepared an EA to evaluate potential impacts to the human environment from the implementation of a management program to address damage to agricultural resources, natural resources, property, and to reduce threats to human safety caused by Canada geese in Mississippi. The EA evaluated the need for WS' activities and the relative effectiveness of four alternatives to meet that proposed need, while accounting for the potential environmental effects of those activities (USDA 2008). After consideration of the analysis contained in the EA and review of public comments, a Decision and FONSI for the EA was issued on April 3, 2008. The Decision and FONSI selected the proposed action which implemented an integrated damage management program using multiple methods to adequately address the need to manage Canada goose damage.

WS' Double-crested Cormorant Damage Management Environmental Assessment: The WS program in Mississippi has also developed an EA to evaluate alternatives and issues related to the reduction of double-crested cormorant damage to property, agricultural resources, natural resources, and threats to human safety in Mississippi (USDA 2004). The EA evaluated the need for WS' activities and the relative effectiveness of five alternatives to meet that proposed need, while accounting for the potential environmental effects of those activities. After consideration of the analysis contained in the EA and review of public comments, a Decision and FONSI for the EA was issued on March 5, 2004. The Decision and FONSI selected the proposed action which implemented an integrated damage management program using multiple methods to adequately address the need to manage cormorant damage. Program activities involving cormorant damage management in Mississippi conducted under the selected alternative were further evaluated and a new Decision and FONSI were signed on January 26, 2010.

USFWS Light Goose Management FEIS: The USFWS has issued a FEIS which analyzes the potential environmental impacts of management alternatives for addressing problems associated with overabundant light goose populations. The "*light*" geese referred to in the FEIS include the greater snow goose (*Chen caerulescens caerulescens*), Ross's goose (*Chen rossii*), and the lesser snow goose that nest in Arctic and sub-Arctic regions of Canada and migrate and winter throughout the United States. A ROD and Final Rule were published by the USFWS and the final rule went into effect on December 5, 2008. Information from the USFWS FEIS on light goose management (USFWS 2007) has been incorporated by reference into this EA.

***TVA's Natural Resource Plan (NRP)*:** TVA has developed an extensive plan to strategically evaluate both renewable and nonrenewable resources and fulfill the responsibilities associated with good stewardship of TVA lands and resources. The NRP is designed to integrate the objectives of six resource areas (biological, cultural, recreation, water, public engagement and reservoir lands planning); provide optimum public use benefit; and balance competing and sometimes conflicting resource uses (TVA 2011*a*).

***TVA's Environment Impact Statement Assessing the Natural Resource Plan*:** TVA has also prepared an EIS to assess the impacts of the NRP and its reasonable alternatives on the environment. It specifically

describes the stewardship programs that are ongoing and are being evaluated for future implementation as part of the NRP; and assesses the potential environmental impacts associated with implementing the various alternatives. Pertinent information available in the FEIS has been incorporated by reference into this EA (TVA 2011*b*).

1.5 AUTHORITY OF FEDERAL AND STATE AGENCIES

The authorities of WS and other agencies as those authorities relate to conducting wildlife damage management activities are discussed by agency below:

WS' Legislative Authority

The primary statutory authorities for WS' program are the Act of March 2, 1931 (46 Stat. 1468; 7 USC 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 USC 426c). The WS program is the lead federal authority in managing damage to agricultural resources, natural resources, property, and threats to human safety associated with wildlife. WS' directives define program objectives and guide WS' activities to alleviate wildlife damage and threats.

Tennessee Valley Authority

The TVA is a federal corporation created by an Act of Congress in May 18, 1933 [48 Stat. 58-59, 16 U.S.C. Sec. 831, as amended]. The TVA provides electricity to 9 million people, businesses, and industries and manages 293,000 acres of public land and 11,000 miles of reservoir shoreline in the 7-state Tennessee Valley region (Tennessee, Alabama, Mississippi, Kentucky, Georgia, North Carolina and Virginia – an area of 80,000 square miles). The TVA operates 29 hydroelectric dams, 11 coal-fired power plants, three nuclear plants, 11 natural gas-fired power facilities, a pump-storage plant, as well as solar, wind, and other renewable energy production sites that can produce about 34,000 megawatts of electricity, delivered over 16,000 miles of high-voltage power lines. The TVA also provides flood control, navigation, land management and recreation for the Tennessee River system and works with local utilities and state and local governments to promote economic development across the region. The TVA often requests assistance from WS to provide nuisance wildlife damage management on its land and at its facilities. The TVA also makes its public lands available for use for continuation and expansion of the WS Oral Rabies Vaccination program across the Tennessee River basin and Valley states.

United States Fish and Wildlife Service Authority

The USFWS is the primary federal agency responsible for conserving, protecting, and enhancing the nation's fish and wildlife resources and their habitats. Responsibilities are shared with other federal, State, tribal, and local entities; however, the USFWS has specific responsibilities for the protection of T&E species under the ESA, migratory birds, inter-jurisdictional fish, and certain marine mammals, as well as for lands and waters that the USFWS administers for the management and protection of those resources, such as the National Wildlife Refuge System.

The USFWS is responsible for managing and regulating take of bird species that are listed as migratory under the MBTA and those that are listed as threatened or endangered under the ESA. The take of migratory birds is prohibited by the MBTA. However, the USFWS can issue depredation permits for the take of migratory birds when certain criteria are met pursuant to the MBTA. Depredation permits are issued to take migratory birds to alleviate damage and threats of damage. Under the permitting application process, the USFWS requires applicants to describe prior non-lethal damage management techniques that have been used. In addition, the USFWS can establish depredation orders that allow for

the take of those migratory birds addressed in those orders when those bird species are causing or about to cause damage without the need for a depredation permit.

The USFWS authority for action is based on the MBTA of 1918 (as amended), which implements treaties with the United States, Great Britain (for Canada), the United Mexican States, Japan, and the Soviet Union. Section 3 of this Act authorized the Secretary of Agriculture:

"From time to time, having due regard to the zones of temperature and distribution, abundance, economic value, breeding habits, and times and lines of migratory flight of such birds, to determine when, to what extent, if at all, and by what means, it is compatible with the terms of the convention to allow hunting, taking, capture, killing, possession, sale, purchase, shipment, transportation, carriage, or export of any such bird, or any part, nest, or egg thereof, and to adopt suitable regulations permitting and governing the same, in accordance with such determinations, which regulations shall become effective when approved by the President."

The authority of the Secretary of Agriculture, with respect to the MBTA, was transferred to the Secretary of the Interior in 1939 pursuant to Reorganization Plan No. II. Section 4(f), 4 Fed. Reg. 2731, 53 Stat. 1433.

United States Environmental Protection Agency

The EPA is responsible for implementing and enforcing the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) which regulates the registration and use of pesticides, including repellents for dispersing birds and avicides available for use to lethally take birds.

United States Food and Drug Administration (FDA)

The FDA is responsible for protecting public health by assuring the safety, efficacy, and security of human and veterinary drugs, biological products, medical devices, our nation's food supply, cosmetics, and products that emit radiation. The FDA is also responsible for advancing the public health by helping to speed innovations that make medicines and foods more effective, safer, and more affordable; and helping the public get the accurate, science-based information they need to use medicines and foods to improve their health.

Mississippi Department of Wildlife, Fisheries, and Parks

The MDWFP authority in wildlife management is given within the Mississippi Code Annotated Section 49-4-1 et seq., the official regulations of the Commission of Wildlife, Fisheries and Parks and applicable federal laws. The mission of the MDWFP is to conserve, manage, develop and protect the natural resources and wildlife in the State.

Mississippi Department of Agriculture and Commerce (MDAC)

The Pesticide Program of the MDAC enforces state laws pertaining to the use and application of pesticides. Under the Mississippi Pesticide Application Act (Sections 69-23-101 through 69-23-133) this section monitors the use of pesticides in a variety of pest management situations. It also licenses private and commercial pesticide applicators and pesticide contractors. Under the Mississippi Pesticide Law (Section 69-23-1 through 69-23-27) the program licenses restricted use pesticide dealers and registers all pesticides for sale and distribution in the State of Mississippi.

1.6 COMPLIANCE WITH LAWS AND STATUTES

Several laws and regulations pertaining to wildlife damage management activities, including activities conducted in the State are discussed below. Additional laws and regulations pertaining to wildlife damage management activities are addressed in WS' programmatic FEIS (USDA 1997). WS would comply with all applicable federal, State, and local laws and regulations in accordance with WS Directive 2.210. Those laws and regulations relevant to bird damage management activities in the State are addressed below:

National Environmental Policy Act

All federal actions are subject to the NEPA (Public Law 9-190, 42 USC 4321 et seq.). WS and the TVA follow CEQ regulations implementing the NEPA (40 CFR 1500 et seq.). In addition, WS follows USDA (7 CFR 1b) and APHIS Implementing Guidelines (7 CFR 372) as part of the decision-making process. Those laws, regulations, and guidelines generally outline five broad types of activities to be accomplished as part of any project: public involvement, analysis, documentation, implementation, and monitoring. The NEPA also sets forth the requirement that all major federal actions be evaluated in terms of their potential to significantly affect the quality of the human environment for the purpose of avoiding or, where possible, mitigating and minimizing adverse impacts. Federal activities affecting the physical and biological environment are regulated in part by CEQ through regulations in 40 CFR, Parts 1500-1508. In accordance with CEQ and USDA regulations, APHIS guidelines concerning Implementation of NEPA Procedures, as published in the Federal Register (44 CFR 50381-50384) provide guidance to APHIS regarding the NEPA process.

Pursuant to the NEPA and CEQ regulations, this EA documents the analyses resulting from federal actions, informs decision-makers, and the public of reasonable alternatives capable of avoiding or minimizing adverse impacts, and serves as a decision-aiding mechanism to ensure that the policies and goals of the NEPA are infused into federal agency actions. This EA was prepared by integrating as many of the natural and social sciences as warranted, based on the potential effects of the proposed action. The direct, indirect, and cumulative impacts of the proposed action are analyzed.

Migratory Bird Treaty Act of 1918 (16 USC 703-711; 40 Stat. 755), as amended

The MBTA makes it unlawful to pursue, hunt, take, capture, kill, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or their parts, nests, or eggs (16 USC 703-711). A list of bird species protected under the MBTA can be found in 50 CFR 10.13. The MBTA also provides the USFWS regulatory authority to protect families of migratory birds. The law prohibits any "*take*" of migratory bird species by any entities, except as permitted by the USFWS. Under permitting guidelines in the Act, the USFWS may issue depredation permits to requesters experiencing damage caused by bird species protected under the Act. Information regarding migratory bird permits can be found in 50 CFR 13 and 50 CFR 21. All actions conducted in this EA would be in compliance with the regulations of the MBTA, as amended.

The law was further clarified to include only those birds considered migratory and native to the United States by the Migratory Bird Treaty Reform Act of 2004. Under the Reform Act, the USFWS published a list of bird species not protected under the MBTA (70 FR 12710-12716). Free-ranging or feral domestic waterfowl, rock pigeons, Eurasian collared-doves, European starlings, and house sparrows are not protected from take under the MBTA. A permit from the USFWS to take those species is not required.

In addition to the issuance of depredation permits for the take of migratory birds, the Act allows for the establishment of depredation orders that allow migratory birds to be taken without a depredation permit when certain criteria are met.

Depredation Order for Blackbirds, Cowbirds, Grackles, Crows, and Magpies (50 CFR 21.43)

Pursuant to the MBTA under 50 CFR 21.43, a depredation permit is not required to lethal take blackbirds when those species are found committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance. Those bird species that can be lethally taken under the blackbird depredation order that are addressed in the assessment include American crows, red-winged blackbirds, Brewer's blackbirds, common grackles, and brown-headed cowbirds.

Control Order for Muscovy Ducks (50 CFR 21.54)

Muscovy ducks are native to South America, Central America, and Mexico with a small naturally occurring population in southern Texas. Muscovy ducks have also been domesticated and have been sold and kept for food and as pets in the United States. In many States, Muscovy ducks have been released or escaped captivity and have formed feral populations, especially in urban areas, that are non-migratory. The USFWS has issued a Final Rule on the status of the Muscovy duck in the United States (75 FR 9316-9322). Since naturally occurring populations of Muscovy ducks are known to inhabit parts of south Texas, the USFWS has included the Muscovy duck in the list of bird species afforded protection under the MBTA at 50 CFR 10.13 (75 FR 9316-9322). To address damage and threats of damage associated with Muscovy ducks, the USFWS has also established a control order for Muscovy ducks under 50 CFR 21.54 (75 FR 9316-9322). Under 50 CFR 21.54, Muscovy ducks, and their nests and eggs, may be removed or destroyed without a depredation permit from the USFWS at any time in the United States, except in Hidalgo, Starr, and Zapata Counties in Texas (75 FR 9316-9322).

Endangered Species Act

Under the ESA, all federal agencies will seek to conserve T&E species and will utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). WS conducts Section 7 consultations with the USFWS to use the expertise of the USFWS to ensure that "*any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species . . . Each agency will use the best scientific and commercial data available*" (Sec.7 (a)(2)).

WS obtained a Biological Opinion (BO) on programmatic activities from the USFWS in 1992 describing potential effects on T&E species, and prescribing reasonable and prudent measures for avoiding jeopardy (see Appendix F in USDA 1997). As part of the development of this EA, WS has also consulted with the USFWS regarding T&E species in Mississippi in regards to bird damage management activities proposed which will be discussed in Chapter 4 of this EA.

National Historic Preservation Act (NHPA) of 1966, as amended

The NHPA and its implementing regulations (36 CFR 800) require federal agencies to initiate the section 106 process if an agency determines that the agency's actions are undertakings as defined in Sec. 800.16(y) and, if so, whether it is a type of activity that has the potential to cause effects on historic properties. If the undertaking is a type of activity that does not have the potential to cause effects on historic properties, assuming such historic properties were present, the agency official has no further obligations under section 106. None of the bird damage management methods described in this EA that might be used under the alternatives causes major ground disturbance, any physical destruction or damage

to property, any alterations of property, wildlife habitat, or landscapes, nor involves the sale, lease, or transfer of ownership of any property. In general, such 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. Therefore, the methods that could be used under the alternatives are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, the site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

Noise-making methods, such as firearms, that are used at or in close proximity to historic or cultural sites for the purposes of hazing or removing nuisance wildlife have the potential for audible effects on the use and enjoyment of historic property. However, such methods would only be used at a historic site at the request of the owner or manager of the site to resolve a damage problem, which means such use, would be to the benefit of the historic property. A built-in minimization factor for this issue is that virtually all the methods involved would only have temporary effects on the audible nature of a site and can be ended at any time to restore the audible qualities of such sites to their original condition with no further adverse effects. Site-specific consultation as required by the Section 106 of the NHPA would be conducted as necessary in those types of situations.

Coastal Zone Management Act of 1972, as amended (16 USC 1451-1464, Chapter 33; PL 92-583, October 27, 1972; 86 Stat. 1280).

This law established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans. Funds were authorized for cost-sharing grants to states to develop their programs. Subsequent to federal approval of their plans, grants would be awarded for implementation purposes. In order to be eligible for federal approval, each state's plan was required to define boundaries of the coastal zone, identify uses of the area to be regulated by the state, determine the mechanism (criteria, standards or regulations) for controlling such uses, and develop broad guidelines for priorities of uses within the coastal zone. In addition, this law established a system of criteria and standards for requiring that federal actions be conducted in a manner consistent with the federally approved plan. The standard for determining consistency varied depending on whether the federal action involved a permit, license, financial assistance, or a federally authorized activity. As appropriate, a consistency determination would be conducted by WS to assure management actions would be consistent with the State's Coastal Zone Management Program.

Environmental Justice - Executive Order 12898

Executive Order 12898, entitled "*Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*" promotes 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 is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. Environmental justice is a priority within APHIS and WS. Executive Order 12898 requires federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies and activities on minorities and persons or populations of low income. APHIS implements Executive Order 12898 principally through its compliance with the NEPA. All WS' activities are evaluated for their impact on the human environment and compliance with Executive Order 12898. WS personnel use only legal, effective, and environmentally safe wildlife damage management methods, tools, and approaches. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minorities and persons or populations of low income.

Protection of Children - Executive Order 13045

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

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

Executive Order 13186 requires each Federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations, is directed to develop and implement, a MOU with the USFWS that shall promote the conservation of migratory bird populations. WS has developed a draft MOU with the USFWS as required by this Executive Order and is currently waiting for USFWS approval. WS would abide by the MOU once it is finalized and signed by both parties.

Invasive Species - Executive Order 13112

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.

The Native American Graves and Repatriation Act of 1990

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

Federal Insecticide, Fungicide, and Rodenticide Act

The FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The EPA is responsible for implementing and enforcing the FIFRA. All chemical methods integrated into the WS' program in Mississippi, including the use of or recommendation of repellents are registered with and regulated by the EPA and the MDAC, and used or recommended by WS in compliance with labeling procedures and requirements.

Occupational Safety and Health Act of 1970

The Occupational Safety and Health Act of 1970 and its implementing regulations (29 CFR 1910) on sanitation standards states that, "*Every enclosed workplace shall be so constructed, equipped, and maintained, so far as reasonably practical, as to prevent the entrance or harborage of rodents, insects, and other vermin. A continuing and effective extermination program shall be instituted where their*

presence is detected." This standard includes birds that may cause safety and health concerns at workplaces.

New Animal Drugs for Investigational Use (INAD)

The FDA can grant permission to use investigational new animal drugs (see 21 CFR 511). The sedative drug alpha-chloralose is registered with the FDA to capture waterfowl, coots, and pigeons. The use of alpha-chloralose by WS was authorized by the FDA which allows use of the drug as a non-lethal form of capture. Alpha-chloralose as a method for resolving waterfowl damage and threats to human safety are discussed in Appendix B of this EA.

1.7 DECISIONS TO BE MADE

Based on agency relationships, MOUs, and legislative authorities, WS is the lead agency for this EA, and therefore, responsible for the scope, content, and decisions made. The TVA owns and operates numerous electrical power generation sites and transmission structures within Mississippi, including electrical substations and transmission lines. In addition, the TVA manages lands within the State for recreational, natural, and cultural resources. Many of these sites experience damage associated with birds within the State. The TVA would be the primary decision-maker for bird damage management activities occurring on sites owned or managed by the TVA. Management of migratory birds is the responsibility of the USFWS. As the authority for the management of bird populations, the USFWS was involved in the development of the EA and provided input throughout the EA preparation process to ensure an interdisciplinary approach according to the NEPA and agency mandates, policies, and regulations. The MDWFP is responsible for managing wildlife in the State of Mississippi, including birds. The MDWFP establishes and enforces regulated hunting seasons in the State, including the establishment of seasons that allow the take of snow geese, wood ducks, gadwall, mallards, blue-winged teal, American coots, common snipe, mourning doves, and crows. For migratory birds, the MDWFP can establish hunting seasons for those species under frameworks determined by the USFWS. In addition, the MDWFP establishes hunting seasons and take limits for wild turkeys in the State. WS' activities to reduce and/or prevent bird damage in the State would be coordinated with the USFWS and the MDWFP which ensure WS' actions are incorporated into population objectives established by those agencies for bird populations in the State.

Based on the scope of this EA, the decisions to be made are: 1) should WS, in cooperation with the TVA, conduct bird damage management to alleviate damage to agriculture, property, natural resources, and threats to human safety, 2) should WS conduct disease surveillance and monitoring in the bird population when requested by the MDWFP, the USFWS, and other agencies, 3) should WS, in cooperation with the TVA, implement an integrated wildlife damage management strategy, including technical assistance and direct operation assistance, to meet the need for bird damage management in Mississippi, 4) if not, should WS and/or the TVA attempt to implement one of the alternatives to an integrated damage management strategy as described in the EA, and 5) would the proposed action result in potentially significant adverse impacts to the environment requiring the preparation of an EIS.

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES

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

2.1 AFFECTED ENVIRONMENT

Bird damage or threats of damage can occur statewide in Mississippi where ever birds occur. However, bird damage management would only be conducted by WS when requested by a landowner or manager and only on properties where a cooperative service agreement or other comparable document has been signed between WS and a cooperating entity. Most species of birds addressed in this EA can be found throughout the year across the State where suitable habitat exists for foraging, loafing, roosting, and breeding. Bird species are capable of utilizing a variety of habitats in the State. Since birds can be found throughout the State, requests for assistance to manage damage or threats of damage could occur in areas occupied by those bird species.

Upon receiving a request for assistance, the proposed action alternative or those actions described in the other alternatives could be conducted on private, federal, State, tribal, and municipal lands in Mississippi to reduce damages and threats associated with birds to agricultural resources, natural resources, property, and threats to human safety. The analyses in this EA are intended to apply to actions taken under the selected alternative that could occur in any locale and at any time within the analysis area. This EA analyzes the potential impacts of bird damage management and addresses activities in Mississippi that are currently being conducted under a MOU or cooperative service agreement with WS where activities have been and currently are being conducted. This EA also addresses the impacts of bird damage management in the State where additional agreements may be signed in the future.

Assistance requests to resolve bird damage could occur, but is not necessarily limited to, areas in and around commercial, industrial, public, and private buildings, facilities and properties and at other sites where birds may roost, loaf, feed, nest, or otherwise occur. Examples of areas where bird damage management activities could be conducted are: residential buildings, golf courses, athletic fields, recreational areas, swimming beaches, parks, corporate complexes, subdivisions, businesses, industrial parks, schools, agricultural areas, wetlands, restoration sites, cemeteries, public parks, bridges, industrial sites, urban/suburban woodlots, hydro-electric dam structures, reservoirs and reservoir shore lands, nuclear, hydro and fossil power plant sites, substations, transmission line rights-of-way, landfills, on ship fleets, military bases, or at any other sites where birds may roost, loaf, or nest. Damage management activities could be conducted at agricultural fields, vineyards, orchards, farmyards, dairies, ranches, livestock operations, grain mills, and grain handling areas (*e.g.*, railroad yards) where birds destroy crops, feed on spilled grains, or contaminate food products for human or livestock consumption. Additionally, activities could be conducted at airports and surrounding properties where birds represent a threat to aviation safety.

Environmental Status Quo

As defined by the NEPA implementing regulations, the "*human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment*" (40 CFR 1508.14). Therefore, when a federal action agency analyzes its potential impacts on the "*human environment*", it is reasonable for that agency to compare not only the effects of the federal action, but also the potential impacts that occur or would occur in the absence of the federal action. This concept is applicable to situations involving federal assistance in managing damage associated with resident wildlife species managed by the state natural resources agency, invasive species, or unprotected wildlife species.

Wildlife species, such as most native species are protected under state or federal law. For some bird species, take during the hunting season is regulated pursuant to the MBTA by the USFWS through the issuance of frameworks, that includes the allowable length of hunting seasons, methods of take, and

allowed take which are implemented by the MDWFP. Under the blackbird depredation order (50 CFR 21.43), blackbirds can be taken by any entity without a depredation permit when those species identified in the order are found committing or about to commit damage or posing a human safety threat. In addition, Muscovy ducks can also be removed pursuant to a control order without the need for a permit in Mississippi. Pursuant to the MBTA, the USFWS can issue depredation permits to those entities experiencing damage associated with birds, when deemed appropriate. Free-ranging or feral domestic waterfowl, rock pigeons, Eurasian collared-doves, European starlings, and house sparrows are not protected from take under the MBTA and can be addressed without the need for a depredation permit from the USFWS.

When a non-federal entity (*e.g.*, agricultural producers, health agencies, municipalities, counties, private companies, individuals, or any other non-federal entity) takes a bird damage management action, the action is not subject to compliance with the NEPA due to the lack of federal involvement[6] in the action. Under such circumstances, the environmental baseline or status quo must be viewed as an environment that includes those resources as they are managed or impacted by non-federal entities in the absence of the federal action being proposed.

Therefore, in those situations in which a non-federal entity has decided that a management action directed towards birds should occur and even the particular methods that would be used, WS' involvement in the action would not affect the environmental status quo. WS' involvement would not change the environmental status quo if the requestor would have conducted the action in the absence of WS' involvement in the action. Since the lethal take of birds can occur either without a permit if those species are non-native, during hunting seasons, under depredation orders, under control orders, or through the issuance of depredation permits by the USFWS and since most methods for resolving damage are available to WS and to other entities, WS' decision-making ability is restricted to one of three alternatives. WS can either provide technical assistance with managing damage with no direct involvement, take the action using the specific methods as decided upon by the non-federal entity, or take no action at which point the non-federal entity could take the action anyway either without a permit, during the hunting season, under depredation orders, under a control order, or through the issuance of a depredation permit by the USFWS. Under those circumstances, WS would have virtually no ability to affect the environmental status quo since the action would likely occur in the absence of WS' direct involvement.

Therefore, based on the discussion above, in those situations where a non-federal entity has already made the decision to remove or otherwise manage birds to stop damage with or without WS' assistance, WS' participation in carrying out that action would not affect the environmental status quo. In some situations, however, certain aspects of the human environment may actually benefit more from WS' involvement than from a decision not to assist. For example, if a cooperator believes WS has greater expertise to manage damage when compared to other entities, WS' management activities may have less of an impact on target and non-target species than if the non-federal entity conducted the action alone. The concern arises from those persons experiencing damage using methods that have no prior experience with managing damage or threats associated with birds. The lack of experience in bird behavior and damage management methods could lead to the continuation of damage which could threaten human safety or could lead to the use of inappropriate methods in an attempt to resolve damage. WS' personnel are trained in the use of methods which increases the likelihood that damage management methods are employed appropriately with regards to effectiveness, humaneness, minimizes non-target take, and reduces threats to human safety from those methods. WS' mission is to provide leadership in resolving and preventing damage to resources and to reduce threats to human safety caused by wildlife, including

[6]If a federal permit is required to conduct damage management activities, the issuing federal agency would be responsible for compliance with the NEPA for issuing the permit.

birds in Mississippi. Thus, in those situations, WS' involvement may actually provide some benefit to the human environment when compared to the environmental status quo in the absence of such involvement.

TVA Facilities

In addition, bird damage management could occur at facilities owned or managed by the TVA when those bird species addressed in this assessment cause damage or pose threats of damage to property and natural resources or pose a threat to human safety. Bird damage management activities could be conducted at any of the three TVA combustion turbine facilities located in Caledonia, Southaven, and Kemper. The TVA also operates two solar facilities in Mississippi at the University of Mississippi and Mississippi State University. The TVA also maintains 80 TVA electrical substations and switchyards along with 2,036 miles of transmission lines and right-of-way easements. Bird damage management activities could also be conducted on any of the lands owned or managed by the TVA including 1,700 acres of public lands in Mississippi and 90 miles of shoreline along Pickwick Reservoir in northeastern Mississippi.

Airports

Because many bird species are ubiquitous throughout the State, it is possible for those species to be present at nearly any airport or military airbase. WS may be requested to address threats of aircraft strikes from airport authorities at any of the airports or airbases in the State where those bird species addressed in this assessment pose a threat to aircraft and passenger safety.

Federal Property

Many federal properties are controlled access areas with security fencing. Those properties often are unconcerned with the presence of birds until the populations of those species are large enough to negatively impact natural resources on the facility or the aesthetic value of property or landscaping. Examples of those types of fenced federal facilities include, but are not limited to, military bases, research facilities, and federal parks. WS may be requested to assist facilities managers in the management of bird damage at such facilities. In those cases where a federal agency requests WS' assistance with managing damage caused by birds, the requesting agency would be responsible for analyzing those activities in accordance with the NEPA. However, this EA would cover such actions if the requesting federal agency determined the analyses and scope of this EA were appropriate for those actions and the requesting federal agency adopted this EA through their own Decision based on the analyses in this EA. Therefore, actions taken on federal lands have been analyzed in the scope of this EA.

State Property

Activities could be conducted on properties owned and/or managed by the State when requested, such as parks, forestland, historical sites, natural areas, scenic areas, conservations areas, and campgrounds. Bird damage management activities could be requested to occur on state highway right-of-ways and interstate right-of ways.

Municipal Property

Activities under the alternatives could be conducted on city, town, or other local governmental properties when requested by those entities. Those areas could include, but would not be limited to city parks, landfills, woodlots, cemeteries, greenways, treatment facilities, utilities areas, and recreational areas. Similar to other areas, birds can cause damage to natural resources, agricultural resources, property, and threaten human safety in those areas. Areas could also include properties in urban and suburban areas of the State.

Private Property

Requests for assistance to manage bird damage and threats could also occur from private property owners and/or managers of private property. Private property could include areas in private ownership in urban, suburban, and rural areas, which could include agricultural lands, timberlands, pastures, industrial parks, residential complexes, subdivisions, businesses, railroad right-of-ways, and utility right-of-ways.

Disease Surveillance and Monitoring Activities

Upon receiving a request for assistance, bird damage management activities could be conducted on private, federal, state, county, and municipal lands in the State for the purposes of studying, containing, and curtailing disease outbreaks in bird populations. Areas of the proposed action could include, but are not limited to, state, county, municipal and federal natural resource areas, park lands, and historic sites; state and interstate highways and roads; railroads and their rights-of-way; property in or adjacent to subdivisions, businesses, and industrial parks; timberlands, croplands, and pastures; public and private properties in rural/urban/suburban areas where birds are a threat to human safety through vehicle collisions and the spread of disease. The area of the proposed action would also include airports and military airbases where birds are a threat to human safety and to property; areas where birds negatively impact wildlife, including T&E species; and public property where birds are negatively impacting historic structures, cultural landscapes and natural resources.

2.2 ISSUES ASSOCIATED WITH BIRD DAMAGE MANAGEMENT ACTIVITIES

Issues are concerns of the public and/or professional community raised regarding potential adverse effects that might occur from a proposed action. Such issues must be considered in the NEPA decision-making process. Issues relating to the reduction of wildlife damage were raised during the scoping process for WS' programmatic FEIS (USDA 1997) and were considered in the preparation of this EA. Those issues are fully evaluated within WS' FEIS which analyzed specific data relevant to WS' programmatic activities at the time of preparation. Issues related to managing damage associated with birds in Mississippi were developed by WS in consultation with the USFWS and the MDWFP. This EA will also be made available to the public for review and comment to identify additional issues.

The issues as related to the possible implementation of the alternatives, including the proposed action, are discussed in detail in Chapter 4. The issues analyzed in detail in the EA are the following:

Issue 1 - Effects of Damage Management Activities on Target Bird Populations

A common issue when addressing damage caused by wildlife are the potential impacts of management actions on the populations of target species. Methods available to resolve damage or threats to human safety are categorized into non-lethal and lethal methods. Non-lethal methods can disperse or otherwise make an area unattractive to target species causing damage which reduces the presence of those species at the site and potentially the immediate area around the site where non-lethal methods are employed. Lethal methods could be employed to remove a bird or those birds responsible for causing damage or posing threats to human safety. The use of lethal methods would therefore result in local population reductions in the area where damage or threats were occurring. The number of target species removed from the population using lethal methods under the alternatives would be dependent on the number of requests for assistance received, the number of individuals involved with the associated damage or threat, and the efficacy of methods employed.

The analysis for magnitude of impact on populations from the use of lethal methods generally follows the process described in WS' programmatic FEIS (USDA 1997). Magnitude is described in WS' programmatic FEIS as "*...a measure of the number of animals killed in relation to their abundance*." Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest data when available. Generally, WS only conducts damage management on species whose population densities are high and usually only after they have caused damage. WS' take is monitored by comparing numbers of animals killed with overall populations or trends in populations to assure the magnitude of take is maintained below the level that would cause significant adverse impacts to the viability of native species populations (USDA 1997). All lethal take of birds by WS would occur at the requests of a cooperator seeking assistance.

In addition, many of the bird species addressed in this EA can be harvested in the State during annual hunting seasons. Therefore, any bird damage management activities conducted by WS under the alternatives addressed would be occurring along with other natural process and human-induced events such as natural mortality, human-induced mortality from private damage management activities, mortality from regulated harvest, and human-induced alterations of wildlife habitat.

Methods available under each of the alternatives to resolve damage and reduce threats to human safety would be employed targeting an individual of a bird species or a group of individuals after applying the WS' Decision Model (Slate et al. 1992, USDA 1997) to identify possible techniques. The effects on the populations of target mammal populations in the State from implementation of the alternatives addressed in detail, including the proposed action, are analyzed in Chapter 4. Information on bird populations and trends are often derived from several sources including the Breeding Bird Survey (BBS), the Christmas Bird Count (CBC), the Partners in Flight Landbird Population database, published literature, and harvest data. Further information on those sources of information is provided below.

Breeding Bird Survey

Bird populations can be monitored by using trend data 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. 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, Patuxent Wildlife Research Center (Sauer et al. 2011). 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, as a result of variable local habitat and climatic conditions. Trends can be determined using different population equations and statistically tested to determine if a trend 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 (Sauer et al. 2011).

Christmas Bird Count

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 and is based on 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 can be used as an indicator of trends in the population 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 2010).

Partners in Flight 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 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) surveyed 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).

Annual Harvest Estimate

The populations of several migratory bird species are sufficient to allow for annual harvest seasons that typically occur during the fall migration periods of those species. Migratory bird hunting seasons are established under frameworks developed by the USFWS and implemented in the State by the MDWFP. Snow geese, wood ducks, gadwall, mallards, blue-winged teal, American coots, common snipe, mourning doves, and crows are the species of birds addressed in this EA that have established hunting seasons the State.

For crows, take can also occur under the blackbird depredation order established by the USFWS pursuant to the MBTA. Therefore, the take of crows can occur during annual hunting seasons and under the blackbird depredation order that allows crows to be taken to alleviate damage and to alleviate threats of damage. For many migratory bird species considered harvestable during a hunting season, the number of birds harvested during the season is reported by the USFWS and/or the MDWFP in published reports.

Bird Conservation Regions

Bird Conservation Regions are areas in North America that are characterized by distinct ecological habitats that have similar bird communities and resource management issues. The State of Mississippi lies almost entirely within the Southeastern Coastal Plain, also known as Bird Conservation Region 27. The Southeastern Coastal Plain overlaps areas of Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, and small parts of Louisiana, Tennessee, and Kentucky. This region is characterized by extensive riverine swamps and marsh complexes along the Atlantic Coast. The region also includes the interior forests dominated by longleaf, slash, and loblolly pine forests. However, areas within the State along the Mississippi River and the Mississippi Delta Region lie within the Mississippi Alluvial Valley, also known as Bird Conservation Region 26. The Mississippi Alluvial Valley consists of areas along the Mississippi River floodplain south of the Ohio River confluence encompassing areas along the Mississippi River in Missouri, Kentucky, Tennessee, Arkansas, Mississippi, and Louisiana. Historically, the Mississippi Alluvial Valley was dominated by bottomland hardwood forests that were subject to annual flooding events of the Mississippi River. Today, less than 25% of the region remains forested and flooding has been reduced by 90%. However, the regions still acts as an important area for nesting and migrating waterfowl and other waterbirds (USFWS 2000).

Issue 2 - Effects on Non-target Wildlife Species Populations, Including T&E Species

The issue of non-target species effects, including effects on T&E species arises from the use of non-lethal and lethal methods identified in the alternatives. The use of non-lethal and lethal methods has the potential to inadvertently disperse, capture, or kill non-target wildlife. To reduce the risks of adverse effects to non-target wildlife, WS would select damage management methods that are as target-selective as possible or apply such methods in ways to reduce the likelihood of capturing non-target species. Before initiating management activities, WS would select locations which are extensively used by the target species. WS would also use SOPs designed to reduce the effects on non-target species' populations. SOPs are further discussed in Chapter 3. Methods available for use under the alternatives are described in Appendix B.

Concerns have also been raised about the potential for adverse effects to occur to non-target wildlife from the use of registered toxicants. Chemical methods considered for use to manage damage or threat associated with birds includes the avicide DRC-1339, the immobilizing drug alpha-chloralose, the reproductive inhibitor nicarbazin, mesurol, and repellents, including Avitrol. Chemical methods being considered for use to manage damage and threats associated with birds in Mississippi are further discussed in Appendix B.

The ESA states that all federal agencies *"...shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act"* [Sec. 7(a)(1)]. WS conducts Section 7 consultations with the USFWS to ensure compliance with the ESA and to ensure that *"any action authorized, funded or carried out by such an agency...is not likely to jeopardize the continued existence of any endangered or threatened species…Each agency shall use the best scientific and commercial data available"* [Sec. 7(a)(2)].

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or minimization measures. WS has consulted with the USFWS on programmatic activities under Section 7 of the ESA concerning potential impacts of methods available for use by WS on T&E species. The USFWS issued a BO on WS' programmatic activities in 1992 (USDA 1997). As part of the scoping process and to facilitate interagency cooperation, WS consulted with the USFWS under Section 7 during the development of this EA which is further discussed in Chapter 4.

Issue 3 - Effects of Damage Management Methods on Human Health and Safety

An additional issue often raised is the potential risks associated with employing methods to manage damage caused by target species. Both chemical and non-chemical methods have the potential to have adverse effects on human safety. WS' employees would use and recommend only those methods which are legally available, selective for target species, and effective to resolve the wildlife conflict. Still, some concerns exist regarding the safety of WS' methods despite their legality. As a result, WS will analyze the potential for proposed methods to pose a risk to members of the public or employees of WS.

In addition to the potential risks to the public associated with WS' methods, risks to employees are also an issue. WS' employees are potentially exposed to damage management methods as well as subject to workplace accidents. Selection of methods, as part of an integrated approach, would include consideration for public and employee safety.

Safety of Chemical Methods Employed

The issue of using chemicals methods as part of managing damage associated with wildlife relates to the potential for human exposure either through direct contact with the chemical or exposure to the chemical from wildlife that have been exposed. Under the alternatives identified, the use of chemical methods would include avicides, immobilizing drugs, reproductive inhibitors, and repellents. Avicides are those chemical methods used to lethally take birds. DRC-1339 is the only avicide currently being considered for use to manage damage in this assessment. The avicide DRC-1339 is registered for use to alleviate damage associated with pigeons, starlings, red-winged blackbirds, Brewer's blackbirds, brown-headed cowbirds, common grackles, and gulls. The only reproductive inhibitor currently available is nicarbazin which is registered to reduce the reproductive potential of rock pigeons. Several avian repellents are commercially available to disperse birds from an area or discourage birds from feeding on desired resources. The most common ingredients of avian repellents are polybutene, anthraquinone, and methyl anthranilate. In addition, Avitrol is registered as a flock dispersing agent registered for house sparrows, crows, cowbirds, grackles, red-winged blackbirds, gulls, and pigeons. An additional repellent being considered for use in this assessment is mesurol which is intended for use to discourage crows from predating on eggs of T&E species. Alpha-chloralose, a sedative, is also being considered as a method that could be employed under the alternatives to manage damage associated with waterfowl. Chemical methods are further discussed in Appendix B.

The use of chemical methods is regulated by the EPA through the FIFRA, the MDAC, and by WS Directives[7]. WS' use of chemical methods is also discussed in WS' programmatic FEIS (USDA 1997).

Safety of Non-Chemical Methods Employed

Most methods available to alleviate damage and threats associated with birds are considered non-chemical methods. Non-chemical methods may include cultural methods, limited habitat modification, animal behavior modification, and other mechanical methods. Changes in cultural methods could include improved animal husbandry practices, altering feeding schedules, changes in crop rotations, or conducting structural repairs. Limited habitat modification would be practices that alter specific characteristic of a localized area, such as pruning trees to discourage birds from roosting or planting vegetation that are less palatable to birds. Animal behavior modification methods would include those methods designed to disperse birds from an area through harassment or exclusion. Behavior modification methods could include pyrotechnics, propane cannons, bird-proof barriers, electronic distress calls, effigies, mylar tape, lasers, eye-spot balloons, or nest destruction. Other mechanical methods could include live-traps, mist nests, cannon nets, shooting, or the recommendation that a local population of birds be reduced through the use of hunting.

The primary safety risk of most non-chemical methods occurs directly to the applicator or those persons assisting the applicator. However, risks to others do exist when employing non-chemical methods, such as when using firearms, cannon nets, or pyrotechnics. Most of the non-chemical methods available to address bird damage in Mississippi would be available for use under any of the alternatives and could be employed by any entity, when permitted. Risks to human safety from the use of non-chemical methods will be further evaluated as this issue relates to the alternatives in Chapter 4.

[7]At the time of preparation, WS' Directives could be found at the following web address: http://www.aphis.usda.gov/wildlife_damage/ws_directives.shtml.

Effects of Not Employing Methods to Reduce Threats to Human Safety

An issue identified is the concern for human safety from not employing methods or not employing the most effective methods to reduce the threats that birds can pose. The risks to human safety from diseases associated with certain bird populations were addressed previously. The low risk of disease transmission from birds does not lessen the concerns of cooperators requesting assistance to reduce threats from zoonotic diseases. Increased public awareness of zoonotic events has only heightened the concern of direct or indirect exposure to zoonoses. Not adequately addressing the threats associated with potential zoonoses could lead to an increase in incidences of injury, illness, or loss of human life.

Additional concern is raised with inadequately addressing threats to human safety associated with aircraft striking birds at airports in the State. Birds have the potential to cause severe damage to aircraft and can threaten the safety of passengers. Limiting or preventing the use of certain methods to address the potential for aircraft striking birds could lead to higher risks to passenger safety. This issue will be fully evaluated in Chapter 4 in relationship to the alternatives.

Issue 4 - Effects on the Aesthetic Values of Birds

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. Wildlife generally is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and 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.

The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The American public shares a similar bond with animals and/or wildlife in general and in modern societies a large percentage of households have indoor or outdoor pets. However, some people may consider individual wild animals and birds as "*pets*" or exhibit affection toward these animals, especially people who enjoy viewing wildlife. Therefore, the public reaction is variable and mixed to wildlife damage management because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between humans and wildlife.

Wildlife populations provide a wide range of social and economic benefits (Decker and Goff 1987). These 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 and may take the form of direct consumptive use (using parts of or the entire animal) or non-consumptive use (viewing the animal in nature or in a zoo, photographing) (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).

Public attitudes toward wildlife vary considerably. Some people believe that all wildlife should be captured and translocated to another area to alleviate damage or threats to protected resources. Some

people directly affected by the problems caused by wildlife strongly support removal. Individuals not directly affected by the harm or damage may be supportive, neutral, or totally opposed to any removal of wildlife from specific locations or sites. Some people totally opposed to wildlife damage management want agencies to teach tolerance for damage and threats caused by wildlife, and that wildlife should never be killed. Some of the people who oppose removal of wildlife do so because of human-affectionate bonds with individual wildlife. These human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment.

The effects on the aesthetic value of birds from implementation of the identified alternatives, including the proposed action, are analyzed in Chapter 4.

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

The issue of humaneness and animal welfare, 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."*

According to the American Veterinary Medical Association (AVMA) (1987), suffering is described as a *"…highly unpleasant emotional response usually associated with pain and distress."* However, suffering *"…can occur without pain…,"* and *"…pain can occur without suffering…"* Because suffering carries with it the implication of a time frame, a case could be made for *"…little or no suffering where death comes immediately…"* (California Department of Fish and Game 1991). 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.

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 and identifying the causes that elicit pain responses in humans would "*…probably be causes for pain in other animals…*" (AVMA 1987). However, pain experienced by individual animals probably ranges from little or no pain to considerable pain (California Department of Fish and Game 1991).

The AVMA states "*...euthanasia is the act of inducing humane death in an animal*" and "*... the technique should minimize any stress and anxiety experienced by the animal prior to unconsciousness*" (Beaver et al. 2001). Some people would prefer AVMA accepted methods of euthanasia to be used when killing all animals, including wild animals. The AVMA states that "*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*" (Beaver et al. 2001).

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, since *"…neither medical nor veterinary curricula explicitly address suffering or its relief"* (California Department of Fish and Game 1991). Research suggests that some methods can cause "*stress*" (USDA 1997). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness.

The decision-making process involves 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.

The issue of humanness and animal welfare concerns will be further discussed as it relates to the methods available for use under the alternatives in Chapter 4. SOPs to alleviate pain and suffering are discussed in Chapter 3.

Issue 6 – Effects of Bird Damage Management Activities on the Regulated Harvest of Birds

Another issue commonly identified is a concern that bird damage management activities conducted by WS would affect the ability of persons to harvest birds during the regulated hunting seasons by reducing local populations. Potential impacts could arise from the use of non-lethal or lethal damage management methods. Those species that are addressed in this EA that also can be hunted during regulated seasons in the State include: snow geese, wood ducks, gadwall, mallards, blue-winged teal, American coots, common snipe, mourning doves, and crows. Non-lethal methods used to reduce or alleviate damage caused by those birds species are used to reduce bird densities through dispersal in damage management areas. Similarly, lethal methods used to reduce damage associated with those birds could lower densities in areas where damage is occurring resulting in a reduction in the availability of those species during the regulated harvest season. WS' bird damage management activities would primarily be conducted on populations in areas where hunting access is restricted (*e.g.*, airports, urban areas) or has been ineffective. The use of non-lethal or lethal methods often disperses birds from areas where damage is occurring to areas outside the damage area which could serve to move those bird species from those less accessible areas to places accessible to hunters.

Issue 7 - Effectiveness of Bird Damage Management Methods

The effectiveness of any damage management program could be defined in terms of losses or risks potentially reduced or prevented, how accurately practitioners diagnose the problem, the species responsible for the damage, and how actions are implemented to correct or mitigate risks or damages. To determine that effectiveness, WS must be able to complete management actions expeditiously to minimize harm to non-target animals and the environment, while at the same time, using methods as humanely as possible within the limitations of current technology. The most effective approach to resolving any wildlife damage problem is to use an adaptive integrated approach which may call for the use of several management methods simultaneously or sequentially (USDA 1997, Courchamp et al. 2003).

The purpose behind integrated management is to implement methods in the most effective manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment[8]. Efficacy is based on the types of methods employed, the application of the method, restrictions on the use of the method(s), the skill of the personnel using the method and, for WS' personnel, the guidance provided by WS Directives and policies.

The goal is to reduce damage, risks, and conflicts with wildlife as requested and not to necessarily reduce/eliminate populations. Localized population reduction could be short-term and new individuals may immigrate or be born to animals remaining at the site (Courchamp et al. 2003). The ability of an animal population to sustain a certain level of removal and to eventually return to pre-management levels, however, does not mean individual management actions are unsuccessful, but that periodic management

[8]The cost of management may sometimes be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns.

may be necessary. The return of wildlife to pre-management levels also demonstrates that limited, localized damage management methods have minimal impacts on species' populations.

Based on the evaluation of the damage situation under the proposed action, the most effective methods would be employed individually or in combination based on the prior evaluations of methods or combinations of methods in other damage management situations. Once employed, methods would be further evaluated for effectiveness based on a continuous evaluation of activities by WS. Therefore, the effectiveness of methods is considered as part of the decision process for each damage management request based on continual evaluation of methods and results.

2.3 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

Additional issues were also identified by WS, the TVA, the MDWFP, and the USFWS during the scoping process of this EA that were considered but will not receive detailed analyses for the reasons provided. The following issues were considered but will not be analyzed in detail:

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

A concern was raised that an EA for an area as large as the State of Mississippi would not meet the NEPA requirements for site specificity. Wildlife damage management falls within the category of federal or other regulatory agency actions in which the exact timing or location of individual activities cannot usually be predicted well enough ahead of time to accurately describe such locations or times in an EA or EIS. Although WS can predict some of the possible locations or types of situations and sites where some kinds of wildlife damage could occur, the program cannot predict the specific locations or times at which affected resource owners would determine a damage problem has become intolerable to the point that they request assistance from WS. In addition, the WS program would not be able to prevent such damage in all areas where it might occur without resorting to destruction of wild animal populations over broad areas at a much more intensive level than would be desired by most people, including WS and other agencies. Such broad scale population management would also be impractical or impossible to achieve within WS' policies and professional philosophies.

Lead agencies have the discretion to determine the geographic scope of their analyses under the NEPA (Kleppe v Sierra Club, 427 U.S. 390, 414 (1976), CEQ 1508.25). Ordinarily, according to APHIS procedures implementing the NEPA, WS' individual wildlife damage management actions may be categorically excluded (7 CFR 372.5(c)). The intent in developing this EA is to determine if the proposed action would potentially have significant individual and/or cumulative impacts on the quality of the human environment that would warrant the preparation of an EIS or a FONSI. This EA addresses impacts for managing damage and threats to human safety associated with birds in the State to analyze individual and cumulative impacts and to provide a thorough analysis.

In terms of considering cumulative effects, one EA analyzing impacts for the entire State would provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. If a determination is made through this EA that the proposed action or the other alternatives would have a significant impact on the quality of the human environment, then an EIS would be prepared. Based on previous requests for assistance, the WS program in Mississippi would continue to conducted bird damage management in a very small area of the State where damage is occurring or likely to occur.

WS' Impact on Biodiversity

The WS program does not attempt to eradicate any species of native wildlife in the State. WS operates in accordance with applicable international, federal, and state laws and regulations enacted to ensure species

viability. Methods available are employed to target individual birds or groups of birds identified as causing damage or posing a threat of damage. Any reduction of a local population or group is frequently temporary because immigration from adjacent areas or reproduction would replace the animals removed. WS operates on a small percentage of the land area in Mississippi and would only target those birds identified as causing damage or posing a threat. Therefore, impacts on biodiversity associated with bird damage management would not adversely affect biodiversity in the State.

A Loss Threshold Should Be Established Before Allowing Lethal Methods

One issue identified through WS' implementation of the NEPA processes is a concern that a threshold of loss should be established before employing lethal methods to resolve damage and that wildlife damage should be a cost of doing business. Some damage and economic loss can be tolerated by cooperators until the damage reaches a threshold where damage becomes an economic burden. The appropriate level of allowed tolerance or threshold before employing lethal methods would differ among cooperators and damage situations. Establishing a threshold would be difficult or inappropriate to apply to human health and safety situations.

In a ruling for Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie National Forest, et al., the United States District Court of Utah denied plaintiffs' motion for a preliminary injunction. In part, the court found that a forest supervisor needs only show that damage from wildlife is threatened, to establish a need for wildlife damage management (Civil No. 92-C-0052A January 20, 1993). Thus, there is judicial precedence indicating that it is not necessary to establish a criterion such as a percentage of loss of a particular resource to justify the need for wildlife damage management actions.

Bird Damage Management Should Not Occur at Taxpayer Expense

An issue identified through the development of WS' programmatic FEIS is the concern that wildlife damage management should not be provided at the expense of the taxpayer or that activities should be fee-based (USDA 1997). Funding for bird damage management activities is derived from federal appropriations and through cooperative funding. Activities conducted in the State for the management of damage and threats to human safety from birds would be funded through cooperative service agreements with individual property owners or managers. A minimal federal appropriation is allotted for the maintenance of a WS program in Mississippi. The remainder of the WS program would be entirely fee-based. Technical assistance is provided to requesters as part of the federally-funded activities, but all direct assistance in which WS' employees perform damage management activities would be funded through cooperative agreements between the requester and WS.

Cost Effectiveness of Management Methods

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 would likely receive the greatest application. As part of an integrated approach, evaluation of methods would continually occur to allow for those methods that are most effective at resolving damage or threats to be employed under similar circumstance where birds are causing damage or pose a threat. Additionally, management operations may be constrained by cooperator funding and/or objectives and needs.

Impacts of Avian Influenza (AI) on Bird Populations

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 to be the natural reservoirs for AI (Clark and Hall 2006). 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. However, even the strains which do not cause severe illness in birds are a concern for human and animal health officials because the viruses have the potential to become virulent and transmissible to other species through mutation and reassortment (Clark and Hall 2006).

Recently, the occurrence of highly pathogenic (HP) H5N1 AI virus has raised concern regarding the potential impact on wild birds, domestic poultry, and human health should it be introduced into the United States. 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 in those species. HP H5N1 AI likely underwent further change allowing infection in additional species of birds, mammals, and humans. More recently, this virus moved back into wild birds resulting in mortality of some species of waterfowl, and other birds. This is only the second time in history that the HP 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, infected travelers, and the migration of infected wild birds. WS has been one of several agencies and organizations conducting surveillance for AI virus in migrating birds. The nationwide surveillance effort has detected some instances of low pathogenic AI viruses, as was expected given that waterfowl and shorebirds are considered to be the natural reservoirs for AI. Tens of thousands of birds have been tested, but there has been no evidence of the HP H5N1 virus in North America.

Bird Damage Should Be Managed By Private Nuisance Wildlife Control Agents

Private nuisance wildlife control agents could be contacted to reduce bird damage for property owners when deemed appropriate by the resource owner. Some property owners would prefer to use a private nuisance wildlife control agent because the nuisance wildlife agent is located in closer proximity and thus could provide the service at less expense, or because they prefer to use a private business rather than a government agency. However, some property owners would prefer to request assistance from a government agency. In particular, large industrial businesses and cities and towns may prefer to use WS because of security and safety issues.

Effects from the Use of Lead Ammunition in Firearms

Questions have arisen about the deposition of lead into the environment from ammunition used in firearms to lethally take birds. As described in Appendix B, the lethal removal of birds with firearms by WS to alleviate damage or threats would occur using a rifle or shotgun. In an ecological risk assessment of lead shot exposure in non-waterfowl birds, ingestion of lead shot was identified as the concern rather than just contact with lead shot or lead leaching from shot in the environment (Kendall et al. 1996). To address lead exposure from the use of shotguns, the standard conditions of depredation permits issued by the USFWS pursuant to the MBTA for the lethal take of birds requires the use of non-toxic shot pursuant to 50 CFR 20.21(j). To alleviate concerns associated with lead exposure in wildlife, WS would only use non-toxic shot as defined in 50 CFR 20.21(j) when using shotguns.

The take of birds by WS in the State would occur primarily from the use of shotguns. However, the use of rifles could be employed to lethally take some species. To reduce risks to human safety and property damage from bullets passing through birds, the use of rifles would be applied in such a way (*e.g.*, caliber,

bullet weight, distance) to ensure the bullet does not pass through birds. Birds that would be removed using rifles would occur within areas where retrieval of all bird carcasses for proper disposal would be highly likely (*e.g.*, at roost sites). With risks of lead exposure occurring primarily from ingestion of shot and bullet fragments, the retrieval and proper disposal of bird carcasses would greatly reduce the risk of scavengers ingesting or being exposed to lead.

However, deposition of lead into soil could occur if, during the use of a rifle, the projectile passes through a bird, if misses occur, or if the bird carcass is not retrieved. Laidlaw et al. (2005) reported that, because of the low mobility of lead in soil, all of the lead that accumulates on the surface layer of the soil is generally retained within the top 20 cm (about 8 inches). In addition, concerns occur that lead from bullets deposited in soil from shooting activities could lead to contamination of water, either ground water or surface water, from runoff. Stansley et al. (1992) studied lead levels in water that was subjected directly to high concentrations of lead shot accumulation because of intensive target shooting at several shooting ranges. Lead did not appear to "*transport*" readily in surface water when soils were neutral or slightly alkaline in pH (*i.e.*, not acidic), but lead did transport more readily under slightly acidic conditions. Although Stansley et al. (1992) detected elevated lead levels in water in a stream and a marsh that were in the shot "*fall zones*" at a shooting range, the study did not find higher lead levels in a lake into which the stream drained, except for one sample collected near a parking lot where it was believed the lead contamination was due to runoff from the parking lot, and not from the shooting range areas. The study also indicated that even when lead shot is highly accumulated in areas with permanent water bodies present, the lead does not necessarily cause elevated lead contamination of water further downstream. Muscle samples from two species of fish collected in water bodies with high lead shot accumulations had lead levels that were well below the accepted threshold standard of safety for human consumption (Stansley et al. 1992).

Craig et al. (1999) reported that lead levels in water draining away from a shooting range with high accumulations of lead bullets in the soil around the impact areas were far below the "*action level*" of 15 parts per billion as defined by the EPA (*i.e.*, requiring action to treat the water to remove lead). The study found that the dissolution (*i.e.*, capability of dissolving in water) of lead declines when lead oxides form on the surface areas of the spent bullets and fragments (Craig et al. 1999). Therefore, the transport of lead from bullets or shot distributed across the landscape is reduced once the bullets and shot form crusty lead oxide deposits on their surfaces, which serves to naturally further reduce the potential for ground or surface water contamination (Craig et al. 1999). These studies suggest that, given the very low amount of lead being deposited and the concentrations that would occur from WS' activities to reduce bird damage using rifles, as well as most other forms of dry land small game hunting in general, lead contamination of water from such sources would be minimal to nonexistent.

Since the take of birds can occur during regulated hunting seasons, through the issuance of depredation permits, crows can be taken under the blackbird depredation order without the need to obtain a depredation permit, Muscovy ducks can be lethally removed under the control order, or are considered non-native with no depredation permit required for take, WS' assistance with removing birds would not be additive to the environmental status quo since those birds removed by WS using firearms could be lethally removed by the entities experiencing damage using the same method in the absence of WS' involvement. The amount of lead deposited into the environment may be lowered by WS' involvement in bird damage management activities due to efforts by WS to ensure projectiles do no pass through but are contained within the bird carcass which limits the amount of lead potentially deposited into soil from projectiles passing through the carcass. The proficiency training received by WS' employees in firearm use and accuracy increases the likelihood that birds are lethally removed humanely in situations that ensure accuracy and that misses occur infrequently which further reduces the potential for lead to be deposited in the soil from misses or from projectiles passing through carcasses. In addition, WS' involvement ensures bird carcasses lethally removed using firearms would be retrieved and disposed of

properly to limit the availability of lead in the environment and ensures bird carcass would be removed from the environment to prevent the ingestion of lead in carcasses by scavengers. Based on current information, the risks associated with lead bullets that would be deposited into the environment from WS' activities due to misses, the bullet passing through the carcass, or from bird carcasses that may be irretrievable would be below any level that would pose any risk from exposure or significant contamination of water.

Impacts of Dispersing a Bird Roost on People in Urban/Suburban Areas

Another issue often raised is that the dispersal of birds from a roost location to alleviate damage or conflicts at one site could result in new damage or conflicts at a new roost site. While the original complainant may see resolution to the bird problem when the roost is dispersed, the recipient of the bird roost may see the bird problem as imposed on them. Thus, on the whole, there is no resolution to the original bird problem (Mott and Timbrook 1988). Bird roosts usually are dispersed using a combination of harassment methods including pyrotechnics, propane cannons, effigies, and electronic distress calls (Booth 1994, Avery et al. 2008, Chipman et al. 2008). A similar continuing conflict can develop when habitat alteration is used to disperse a bird roost. This concern is heightened in large metropolitan areas where the likelihood of conflict between birds and people is high as birds dispersed would likely cause damage or pose human safety concerns if roosts were dispersed to other areas within the metropolitan area. WS has minimized the impact of dispersing bird roosts in urban/suburban areas by creating a management option to depopulate the bird roost creating the conflict problem.

In urban areas, WS often works with the community or municipal leaders to address bird damage involving large bird roosts that are likely affecting several people. Therefore, WS often consults not only with the property owner where roosts are located but with community leaders to allow for community-based decision-making on the best management approach. In addition, when seeking funding for bird damage management activities involving urban bird roosts, funding would often be provided by the municipality where the roost is located which allows for bird damage management activities to occur within city limits where bird roosts occur. This allows for roosts that have been relocated and begin to cause damage or pose threats to be addressed effectively and often times, before roosts become well-established. The community-based decision-making approach to bird damage management in urban areas is further discussed under the proposed action alternative in Chapter 3. Therefore, this issue was not analyzed further.

A Site Specific Analysis Should be Made for Every Location Where Bird Damage Management Could Occur

The underlying intent for preparing an EA is to determine if a proposed action might have a significant impact on the human environment. WS' EA development process is issue driven, meaning issues that were raised during the interdisciplinary process and through public involvement that were substantive, were used to drive the analysis and determine the significance of the environmental impacts of the proposed action and the alternatives. Therefore, the level of site specificity must be appropriate to the issues listed.

The analysis in this EA was driven by the issues raised during the scoping process during the development of the EA. In addition to the analysis contained in this EA, WS' personnel use the WS Decision Model (Slate et al. 1992, USDA 1997) described in Chapter 3 as a site specific tool to develop the most appropriate strategy at each location. The WS Decision Model is an analytical thought process used by WS' personnel for evaluating and responding to wildlife damage management requests.

As discussed previously, one EA analyzing impacts for the entire State would provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas and allows for a better cumulative impact analysis. If a determination is made through this EA that the proposed action could have a significant impact on the quality of the human environment, then an EIS would be prepared.

CHAPTER 3: ALTERNATIVES

Chapter 3 contains a discussion of the alternatives which were developed to address the identified issues discussed in Chapter 2. Alternatives were developed for consideration based on the issues using the WS Decision model (Slate et al. 1992, USDA 1997). The alternatives will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences). Chapter 3 also discusses alternatives considered but not analyzed in detail, with rationale. SOPs for bird damage management in Mississippi are also discussed in Chapter 3.

3.1 DESCRIPTION OF THE ALTERNATIVES

The following alternatives were developed to address the identified issues associated with managing damage caused by birds in the State:

Alternative 1 - Continuing the Current Integrated Approach to Managing Bird Damage (Proposed Action/No Action)

The proposed action/no action alternative would continue the current implementation of an adaptive integrated approach utilizing non-lethal and lethal techniques, as deemed appropriate using the WS Decision Model, to reduce damage and threats caused by birds in Mississippi. A major goal of the program would be to resolve and prevent bird damages and to reduce threats to human safety. To meet this goal, WS would continue to respond to requests for assistance with, at a minimum, technical assistance, or when funding is available, operational damage management. Funding could occur through federal appropriations or from cooperative funding. The adaptive approach to managing damage associated with birds would integrate the use of the most practical and effective methods to resolve a request for damage management as determined by site-specific evaluation to reduce damage or threats to human safety for each request. City/town managers, agricultural producers, property owners, and others requesting assistance would be provided information regarding the use of appropriate non-lethal and lethal techniques.

Under this alternative, WS could respond to requests for assistance by: 1) taking no action, if warranted, 2) providing only technical assistance to property owners or managers on actions they could take to reduce damages caused by birds, or 3) providing technical assistance and direct operational assistance to a property owner or manager experiencing damage. The take of birds could only legally occur through the issuance of a depredation permit by the USFWS and only at levels specified in the permit, unless those bird species are afforded no protection under the MBTA or a depredation/control order has been established by the USFWS, in which case no permit for take is required.

Property owners or managers requesting assistance would be provided with information regarding the use of effective and practical non-lethal and lethal techniques. Property owners or managers may choose to implement WS' recommendations on their own (*i.e.*, technical assistance), use contractual services of private businesses, use volunteer services of private organizations, use the services of WS (*i.e.*, direct operational assistance), or take no action.

The property owner or manager may choose to apply for their own depredation permit from the USFWS to lethally take birds, as required by the implementing regulations of the MBTA for depredation control

(see 50 CFR 21.41). The USFWS requires non-lethal methods be used and shown ineffective or impractical before the USFWS will issue a depredation permit. In this situation, WS could evaluate the damage and complete a Migratory Bird Damage Report which would include information on the extent of the damages, the number of birds present, and a recommendation for the number of birds that should be taken to best alleviate the damages.

Following USFWS review of a complete application for a depredation permit from a property owner or manager and the Migratory Bird Damage Report, a depredation permit could be issued to authorize the lethal take of a specified number of birds as part of an integrated approach. Upon receipt of a depredation permit, the property owner/manager or appropriate subpermittee may commence the authorized activities and must submit a written report of their activities upon expiration of their permit. Permits may be renewed annually as needed to resolve damage or reduce threats to human safety. Property owners or managers could conduct management using those methods legally available. Most methods discussed in Appendix B that are available for use to manage bird damage would be available to all entities. The only methods currently available that would not be available for use by those persons experiencing bird damage is the avicide DRC-1339, the immobilizing drug alpha-chloralose, and the repellent mesurol which can only be used by WS.

WS would work with those persons experiencing bird damage to address those birds responsible for causing damage as expeditiously as possible. To be most effective, damage management activities should begin as soon as birds begin to cause damage. Bird damage that has been ongoing can be difficult to resolve using available methods since birds are conditioned to feed, roost, loaf, and are familiar with a particular location. Subsequently, making that area unattractive through the use of available methods can be difficult to achieve once damage has been ongoing. WS would work closely with those entities requesting assistance to identify situations where damage could occur and begin to implement damage management activities under this alternative as early as possible to increase the likelihood of those methods achieving the level of damage reduction requested by the cooperating entity.

The most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially. The philosophy behind integrated wildlife damage management is to implement the best combination of effective management methods in a cost-effective[9] manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment. Integrated damage management may incorporate cultural practices (*e.g.*, animal husbandry), habitat modification (*e.g.*, exclusion, vegetation management), animal behavior modification (*e.g.*, scaring, repellents), removal of individual offending animals (*e.g.*, trapping, shooting, and avicides), local population reduction, or any combination of these, depending on the circumstances of the specific damage problem.

Non-lethal methods would include, but are not limited to: habitat/behavior modification, nest/egg destruction, lure crops, visual deterrents, live traps, exclusionary devices, frightening devices, mesurol, alpha-chloralose, nicarbazin, and chemical taste repellents (see Appendix B for a complete list and description of potential methods). Lethal methods considered by WS include: live-capture followed by euthanasia, DRC-1339, and shooting. Euthanasia would occur through the use of cervical dislocation or carbon dioxide once birds are live-captured using other methods. Carbon dioxide is an acceptable form of euthanasia for birds while cervical dislocation is a conditionally acceptable[10] method of euthanasia (AVMA 2007). On occasion, birds could be euthanized by gunshot once live-captured which is a method of euthanasia considered a conditionally acceptable method for free-ranging wildlife (AVMA 2007).

---

[10]The AVMA (2007) defines conditional acceptable as "...[methods] *that by the nature of the technique or because of greater potential for operator error or safety hazards might not consistently produce humane death or are methods not well documented in the scientific literature".*

Lethal and non-lethal methods are intended to be short-term attempts at reducing damage occurring at the time those methods are employed. Long-term solutions to managing bird damage would include limited habitat manipulations and changes in cultural practices which are addressed further below and in Appendix B.

Appendix B contains a thorough discussion of the methods available for use in an integrated bird damage management approach to address requests for assistance to manage damage or reduce threats to human safety. WS' programmatic FEIS contains additional discussion on adaptive management using an integrated approach to address damage to resources and threats to human safety (USDA 1997). As part of an integrated approach, WS may provide technical assistance and direct operational assistance to those persons experiencing damage associated with birds.

Technical Assistance Recommendations

Under the proposed action, WS would provide technical assistance to those persons requesting bird damage management as part of an integrated approach to managing damage. Technical assistance would occur as described in Alternative 2 of this EA. Technical assistance is also further discussed in WS' programmatic FEIS (USDA 1997).

The WS program in the State regularly provides technical assistance to individuals, organizations, and other federal, state, and local government agencies for managing bird damage. Technical assistance includes collecting information about the species involved, the nature and extent of the damage, and previous methods that the cooperator has attempted to resolve the problem. WS then provides information on appropriate methods that the cooperator may consider to resolve the damage themselves. Types of technical assistance projects may include a visit to the affected property, written communication, telephone conversations, or presentations to groups such as homeowner associations or civic leagues.

From FY 2005 through FY 2011, WS has conducted 677 technical assistance projects that involved bird damage to agricultural resources, property, natural resources, and threats to human safety.

Operational Damage Management Assistance

Operational damage management assistance includes damage management activities that are directly conducted by or supervised by personnel of WS. Operational damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone and there is a written MOU, cooperative service agreement, or other comparable document between WS and the entity requesting assistance. The initial investigation defines the nature, history, and extent of the problem; species responsible for the damage; and methods available to resolve the problem. The professional skills of WS' personnel are often required to effectively resolve problems, especially if restricted-use chemicals are necessary or if the problems are complex.

Educational Efforts

Education is an important element of activities because wildlife damage management is about finding balance and coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations sustaining damage, WS provides lectures, courses, and demonstrations to producers, homeowners, state and county agents, colleges and universities, and other interested groups. Cooperating agencies frequently cooperate with other entities in education and public information efforts. Additionally, technical papers are presented at professional

meetings and conferences so that other wildlife professionals and the public are periodically updated on recent developments in damage management technology, programs, laws and regulations, and agency policies.

Research and Development

The National Wildlife Research Center (NWRC) functions as the research arm of WS by providing scientific information and development of methods for wildlife damage management that are effective and environmentally responsible. Research biologists with the NWRC work closely with wildlife managers, researchers, and others to develop and evaluate wildlife damage management techniques. For example, research biologists from the NWRC were involved with developing and evaluating mesurol for reducing crow predation on eggs. NWRC biologists have authored hundreds of scientific publications and reports, and are respected world-wide for their expertise in wildlife damage management.

WS' Decision Making Procedures

WS' personnel use a thought process for evaluating and responding to damage complaints which is depicted by the WS Decision Model (WS Directive 2.201) and described by Slate et al. (1992). WS' programmatic FEIS also provides further discussion and examples of how the Decision Model is used to address damage and threats associated with wildlife (USDA 1997). WS' personnel are frequently contacted after requesters have tried or considered non-lethal methods and found them to be impractical, too costly, or inadequate for effectively reducing damage. WS' personnel assess the problem and then evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic, and social considerations. Following this evaluation, methods deemed to be practical for the situation are incorporated into a damage management strategy. After this strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management is ended. In terms of the WS Decision 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 written documented process, but a mental problem-solving process common to most, if not all, professions, including WS.

Community-based Decision Making

The WS program in Mississippi under this alternative would follow the "*co-managerial approach*" to solve wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, WS could provide technical assistance regarding the biology and ecology of birds and effective, practical, and reasonable methods available to the local decision-maker(s) to reduce damage or threats. This could include non-lethal and lethal methods. WS and other state and federal wildlife management agencies may facilitate discussions at local community meetings when resources are available. Resource owners and others directly affected by bird damage or conflicts in the State have direct input into the resolution of such problems. They may implement management recommendations provided by WS or others, or may request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

Under a community based decision-making process, WS would provide information, demonstration, and discussion on all available methods to the appropriate representatives of the community for which services were requested to ensure a community-based decision is made. By involving decision-makers in the process, damage management actions can be presented to allow for decisions on damage management to involve those individuals that the decision maker(s) represents. As addressed in this EA, WS would provide technical assistance to the appropriate decision-maker(s) to allow for information on damage

management activities to be presented to those persons represented by the decision-maker(s), including demonstrations and presentation by WS at public meetings to allow for involvement of the community. Requests for assistance to manage birds often originate from the decision-maker(s) based on community feedback or from concerns about damage or threats to human safety. As representatives, the decision-maker(s) are able to provide the information to local interests either through technical assistance provided by WS or through demonstrations and presentation by WS on bird damage management activities. This process allows decisions on bird damage management activities to be made based on local input.

Community Decision-Makers

The decision-maker for the local community would be elected officials or representatives of the communities. The elected officials or representatives are popularly elected residents of the local community or appointees who oversee the interests and business of the local community. This person or persons would represent the local community's interest and make decisions for the local community or bring information back to a higher authority or the community for discussion and decision-making. Identifying the decision-maker for local business communities is more complex because building owners may not indicate whether the business must manage wildlife damage themselves, or seek approval to manage wildlife from the property owner or manager, or from a governing Board. WS could provide technical assistance and make recommendations for damage reduction to the local community or local business community decision-maker(s). Direct assistance could be provided by WS only if requested by the local community decision-maker, funding is provided, and if the requested direct control was compatible with WS' recommendations.

Private Property Decision-Makers

In the case of private property owners, the decision-maker is the individual that owns or manages the affected property. The decision-maker has the discretion to involve others as to what occurs or does not occur on property they own or manage. Due to privacy issues, WS can not disclose cooperator information to others. Therefore, in the case of an individual property owner or manager, the involvement of others and to what degree others are involved in the decision-making process is a decision made by that individual. Direct control could be provided by WS if requested, funding is provided, and the requested management was according to WS' recommendations.

Public Property Decision-Makers

The decision-maker for local, state, or federal property would be the official responsible for or authorized to manage the public land to meet interests, goals, and legal mandates for the property. WS could provide technical assistance to this person and recommendations to reduce damage. Direct control could be provided by WS if requested, funding provided, and the requested actions were within the recommendations made by WS.

Alternative 2 - Bird Damage Management by WS through Technical Assistance Only

Under this alternative, WS would provide those cooperators requesting assistance with managing damage and threats associated with birds with technical assistance only. Technical assistance would provide those cooperators experiencing damage or threats associated with birds with information, demonstrations, and recommendations on available and appropriate methods available. The implementation of methods and techniques to resolve or prevent damage would be the responsibility of the requester with no direct involvement by WS. In some cases, WS may provide supplies or materials that are of limited availability for use by private entities (*e.g.*, loaning of propane cannons).

The WS program regularly provides technical assistance to individuals, organizations, and other federal, State, and local government agencies for managing bird damage. Technical assistance includes collecting information about the species involved, the nature and extent of the damage, and previous methods that the cooperator has attempted to resolve the problem. WS then provides information on appropriate methods that the cooperator may consider to resolve the damage themselves. Types of technical assistance projects may include a visit to the affected property, written communication, telephone conversations, or presentations to groups such as homeowner associations or civic leagues. Between FY 2005 and FY 2011, WS has conducted 677 technical assistance projects that involved bird damage to agricultural resources, property, natural resources, and threats to human safety. Generally, several management strategies are described to the requester 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. In some instances, wildlife-related information provided to the requestor results in tolerance/acceptance of the situation. In other instances, management options are discussed and recommended. Only those methods legally available for use by the appropriate individual would be recommend or loaned by WS. Similar to Alternative 1, those methods described in Appendix B would be available to those persons experiencing damage or threats associated with birds in the State except for alpha-chloralose, DRC-1339, and mesurol.

Those persons experiencing damage or are concerned with threats posed by birds could seek direct operational assistance from other governmental agencies, private entities, or conduct damage managements on their own. In situations where non-lethal methods are ineffective or impractical, WS would advise the property owner or manager of appropriate lethal methods to supplement non-lethal methods. In order for the property owner or manager to use lethal methods, they would be required to apply for their own depredation permit to take birds from the USFWS, when a permit is required. In those situations, WS could evaluate the damage and complete a Migratory Bird Damage Report which would include information on the extent of the damages, the number of birds present, and a recommendation for the number of birds that should be taken to best alleviate the damages. Following USFWS review of a complete application for a depredation permit from a property owner or manager and the Migratory Bird Damage Report, a depredation permit could be issued to authorize the lethal take of a specified number of birds.

This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, and/or private businesses. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent bird damage as permitted by federal, State, and local laws and regulations or those persons could take no action.

Alternative 3 – No Bird Damage Management Conducted by WS

This alternative precludes any and all activities by WS to reduce threats to human health and safety, and alleviate damage to agricultural resources, property, and natural resources. WS would not be involved with any aspect of bird damage management in the State. All requests for assistance received by WS to resolve damage caused by birds would be referred to the USFWS, the MDWFP and/or private entities. This alternative would not deny other federal, State, and/or local agencies, including private entities from conducting damage management activities directed at alleviating damage and threats associated with birds in the State. Many of the methods listed in Appendix B would be available for use by other agencies and private entities, unless otherwise noted in the Appendix, to manage damage and threats associated with birds.

Under this alternative, property owners/managers may have difficulty obtaining permits to use lethal bird damage management methods. The USFWS needs professional recommendations on individual damage

situations before issuing a depredation permit for lethal take, and the USFWS does not have the mandate or the resources to conduct bird damage management activities. State agencies with responsibilities for migratory birds would likely have to provide this information if depredation permits are to be issued. If the information were provided to the USFWS, following the agency's review of a complete application package for a depredation permit from a property owner or manager to lethally take birds, the permit issuance procedures would follow that described in Alternative 1.

Despite no involvement by WS in resolving damage and threats associated with birds in the State, those persons experiencing damage caused by birds could continue to resolve damage by employing those methods legally available since the take of birds can occur either through the issuance of depredation permits by the USFWS, take during the hunting seasons, take under the depredation order for blackbirds without the need for a depredation permit issued by the USFWS, or take under the control order for Muscovy ducks. The take of pigeons, starlings, Eurasian collard-doves, and house sparrows could also occur without the need for a depredation a permit. All methods described in Appendix B would be available for use by those persons experiencing damage or threats except for the use of alpha-chloralose for waterfowl, DRC-1339 for blackbirds and gulls, along with mesurol for crows which can only be used by WS. The formulations of DRC-1339 registered in the State at the time this EA was developed were the DRC-1339 formulation to manage damage associated with starlings and blackbirds at feedlots and poultry facilities (EPA Reg. No. 56228-10), the formulation to manage damage associated with blackbirds in staging areas (EPA Reg. No. 56228-30), the formulation for pigeons (EPA Reg. No. 56228-28), and a formulation for gulls (EPA Reg. No. 56228-17). Mesurol was not registered for use in the State at the time this EA was developed.

3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

In addition to those alternative analyzed in detail, several alternatives were identified by WS, the TVA, and the MDWFP but will not receive detailed analyses for the reasons provided. Those alternatives considered but not analyzed in detail include:

Use of Non-lethal Methods before Lethal Methods

This alternative would require that all non-lethal methods or techniques described in Appendix B be applied to all requests for assistance to reduce damage and threats to safety from birds in the State. If the use of all non-lethal methods fails to resolve the damage situation or reduce threats to human safety at each damage situation, lethal methods would be employed to resolve the request. Non-lethal methods would be applied to every request for assistance regardless of severity or intensity of the damage or threat until deemed inadequate to resolve the request. This alternative would not prevent the use of lethal methods by those persons experiencing bird damage.

Those persons experiencing damage often employ non-lethal methods to reduce damage or threats prior to contacting WS. Verification of the methods used would be the responsibility of WS. No standard exists to determine requester diligence in applying those methods, nor are there any standards to determine how many non-lethal applications are necessary before the initiation of lethal methods. Thus, only the presence or absence of non-lethal methods can be evaluated. The proposed action (Alternative 1) is similar to a non-lethal before lethal alternative because the use of non-lethal methods is considered before lethal methods by WS (WS Directive 2.101). Adding a non-lethal before lethal alternative and the associated analysis would not add additional information to the analyses in the EA.

Use of Non-lethal Methods Only by WS

Under this alternative, WS would be required to implement non-lethal methods only to resolve damage caused by birds in Mississippi. Only those methods discussed in Appendix B that are considered non-lethal would be employed by WS. No lethal take of birds would occur by WS. The use of lethal methods could continue to be used under this alternative by those persons experiencing damage by birds when permitted by the USFWS and when required. The non-lethal methods used or recommended by WS under this alternative would be identical to those identified in any of the alternatives. Non-lethal methods would be employed by WS in an integrated approach under this alternative.

Since the destruction of nests is considered a non-lethal method, the take of nests and eggs could occur under this alternative. Since the destruction of nests and eggs is prohibited by the MBTA, the USFWS would still be required to issue depredation permits for the take of bird nests under this alternative, when required. The USFWS could continue to issue depredation permits to those persons experiencing damage or threats associated with birds under this alternative. Therefore, the lethal take of birds could continue to occur under this alternative. The number of nests of each species of birds addressed in this EA that would be destroyed to address damage and threats under this alternative would likely be similar to the levels analyzed under the proposed action.

Exclusionary devices can be effective in preventing access to resources in certain circumstances. The primary exclusionary methods are netting and over-head lines. Exclusion is most effective when applied to small areas to protect high value resources. However, exclusionary methods are neither feasible nor effective for protecting human safety, agriculture resources, or native wildlife species from birds across large areas. The non-lethal methods used or recommended by WS under this alternative would be identical to those identified in any of the alternatives addressed in detail. Appendix B describes a number of non-lethal methods available for use by WS under this alternative. WS would not need to apply for a depredation permit from the USFWS under this alternative since no take of birds would occur unless nests or eggs were destroyed, when required.

In situations where non-lethal methods were impractical or ineffective to alleviate damages, WS could refer requests for information regarding lethal methods to the MDWFP, the USFWS, local animal control agencies, or private businesses or organizations. Under this alternative, however, property owners/managers might be limited to using non-lethal methods only as they may have difficulty obtaining permits for lethal methods. The USFWS needs professional recommendations on individual damage situations before issuing a depredation permit for lethal methods, and the USFWS does not have the mandate or resources to conduct wildlife damage management work. State agencies with responsibilities for migratory birds would likely have to provide this information if depredation permits are to be issued. If the information were provided to the USFWS, following the agency's review of a complete application package for a depredation permit from a property owner or manager to lethally take birds, the permit issuance procedures would follow that described in proposed action/no action alternative.

Property owners or managers could conduct management using any non-lethal or lethal method that is legal, once a permit has been issued for lethal take, when required. Property owners or managers might choose to implement WS' non-lethal recommendations, implement lethal methods, or request assistance from private or public entities other than WS. Property owners/managers frustrated by lack of WS' assistance with the full range of bird damage management techniques may try methods not recommended by WS or use illegal methods (*e.g.*, poisons). In some cases, property owners or managers may misuse some methods or use some methods in excess of what is necessary which could then become hazardous and pose threats to the safety of humans and non-target species. . The USFWS may authorize more lethal take than is necessary to alleviate bird damages and conflicts because agencies, businesses, and organizations have less technical knowledge and experience managing wildlife damage than WS.

The proposed action, using an integrated damage management approach, incorporates the use of non-lethal methods when addressing requests for assistance. In those instances where non-lethal methods would effectively resolve damage from birds those methods would be used or recommended under the proposed action. Since non-lethal methods would be available for use under the alternatives analyzed in detail, this alternative would not add to the analyses.

This alternative was not analyzed in detail since the take of birds and the destruction of nests could continue at the levels analyzed in the proposed action alternative since the USFWS could permit the take despite WS' lack of involvement in the action. In addition, limiting the availability of methods under this alternative to only non-lethal methods would be inappropriate when attempting to address threats to human safety, primarily at airports, when lethal methods could be appropriate and could be employed to resolve the threat expeditiously.

Use of Lethal Methods Only by WS

This alternative would require the use of lethal methods only to reduce threats and damage associated with birds. However, non-lethal methods can be effective in preventing damage in certain instances. Under WS Directive 2.101, WS must consider the use of non-lethal methods before lethal methods. Non-lethal methods have been effective in alleviating bird damage. For example, the use of non-lethal methods has been effective in dispersing urban crow and vulture roosts (Avery et al. 2002, Seamans 2004, Avery et al. 2008, Chipman et al. 2008). In those situations where damage could be alleviated using non-lethal methods deemed effective, those methods would be employed or recommended as determined by the WS Decision Model. Therefore, this alternative was not considered in detail.

Trap and Translocate Birds Only

Under this alternative, all requests for assistance would be addressed using live-capture methods or the recommendation of live-capture methods. Birds would be live-captured using alpha-chloralose, live-traps, cannon nets, rocket nets, bow nets, or mist nets. All birds live-captured through direct operational assistance by WS would be translocated. Translocation sites would be identified and have to be approved by the USFWS, the MDWFP, and/or the property owner where the translocated birds would be placed prior to live-capture and translocation. Live-capture and translocation could be conducted as part of the alternatives analyzed in detail. However, the translocation of birds could only occur under the authority of the USFWS and/or the MDWFP. Therefore, the translocation of birds by WS would only occur as directed by those agencies. When requested by the USFWS and/or the MDWFP, WS could translocate birds under any of the alternatives analyzed in detail, except under the no involvement by WS alternative (Alternative 3). Since WS does not have the authority to translocate birds in the State unless permitted by the USFWS and/or the MDWFP, this alternative was not considered in detail. In addition, translocation of birds could occur under any of the alternatives analyzed in detail, except Alternative 3.

The translocation of birds causing damage to other areas following live-capture generally would not be effective or cost-effective. Translocation is generally ineffective 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 translocation would most likely result in bird damage problems at the new location. Also, hundreds or thousands of birds would need to be captured and translocated to solve some damage problems (*e.g.*, urban crow roosts); therefore, translocation would be unrealistic. Translocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of the stress to the translocated animal, poor survival rates, and the difficulties that translocated wildlife have with adapting to new locations or habitats (Nielsen 1988).

Reducing Damage by Managing Bird Populations through the Use of Reproductive Inhibitors

Under this alternative, the only method available to resolve requests for assistance would be the recommendation and the use of reproductive inhibitors to reduce or prevent reproduction in birds responsible for causing damage. Reproductive inhibitors are often considered for use where wildlife populations are overabundant and where traditional hunting or lethal control programs are not publicly acceptable (Muller et al. 1997). Use and effectiveness of reproductive control as a wildlife population management tool is limited by population dynamic characteristics (*e.g.*, longevity, age at onset of reproduction, population size and biological/cultural carrying capacity), habitat and environmental factors (*e.g.*, isolation of target population, cover types, and access to target individuals), socioeconomic, and other factors.

Reproductive control for wildlife could be accomplished either through sterilization (permanent) or contraception (reversible). Sterilization could be accomplished through: 1) surgical sterilization (vasectomy, castration, and tubal ligation), 2) chemosterilization, and 3) through gene therapy. Contraception could be accomplished through: 1) hormone implantation (synthetic steroids such as progestins), 2) immunocontraception (contraceptive vaccines), and 3) oral contraception (progestin administered daily).

Population modeling indicates that reproductive control is more efficient than lethal control only for some rodent and small bird species with high reproductive rates and low survival rates (Dolbeer 1998). Additionally, the need to treat a sufficiently large number of target animals, multiple treatments, and population dynamics of free-ranging populations place considerable logistic and economic constraints on the adoption of reproduction control technologies as a wildlife management tool for some species.

Currently, no reproductive inhibitors are available for use to manage most bird populations. Given the costs associated with live-capturing and performing sterilization procedures on birds and the lack of availability of chemical reproductive inhibitors for the management of most bird populations, this alternative was not evaluated in detail. If a reproductive inhibitor becomes available to manage a large number of bird populations and has proven effective in reducing localized bird populations, the use of the inhibitor could be evaluated under the proposed action as a method available that could be used in an integrated approach to managing damage. This EA would be reviewed and supplemented to the degree necessary to evaluate the use of the reproductive inhibitor as part of an integrated approach described under the proposed action. Currently, the only reproductive inhibitors that are registered with the EPA are nicarbazin which is registered for use to manage local populations of Canada geese, domestic waterfowl, and pigeons. However, the only reproductive inhibitor available in Mississippi at the time this EA was developed was nicarbazin to manage local rock pigeon populations.

Compensation for Bird Damage

The compensation alternative would require WS to establish a system to reimburse persons impacted by bird damage. Under such an alternative, WS would continue to provide technical assistance to those persons seeking assistance with managing damage. In addition, WS would conduct site visits to verify damage. Analysis of this alternative in WS' programmatic FEIS indicated that a compensation only alternative had many drawbacks. Compensation would: 1) require large expenditures of money and labor to investigate and validate all damage claims, and to determine and administer appropriate compensation, 2) compensation most likely would be below full market value, 3) give little incentive to resource owners to limit damage through improved cultural or other practices and management strategies, and 4) not be practical for reducing threats to human health and safety.

3.3 STANDARD OPERATING PROCEDURES FOR BIRD DAMAGE MANAGEMENT

SOPs improve the safety, selectivity, and efficacy of wildlife damage management activities. The current WS program in the State uses many such SOPs which are discussed in detail in Chapter 5 of WS' programmatic FEIS (USDA 1997). Those SOPs would be incorporated into activities conducted by WS when addressing bird damage and threats in the State.

Some key SOPs pertinent to the proposed action and alternatives include the following:

- The WS Decision Model, which is designed to identify effective wildlife damage management strategies and their impacts, would be consistently used and applied when addressing bird damage.

- 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.

- Non-target animals captured in traps would be released unless it is determined that the animal would not survive and/or that the animal cannot be released safely.

- The presence of non-target species would be monitored before using DRC-1339 to reduce the risk of mortality of non-target species' populations.

- WS has consulted with the USFWS and the MDWFP to determine the potential risks to T&E species in accordance with the ESA and State laws.

- 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' Directives.

- The use of non-lethal methods would be considered prior to the use of lethal methods when providing technical assistance and/or direct operational assistance.

- Management actions would be directed toward specific birds posing a threat to human safety, causing agricultural damage, causing damage to natural resources, or causing damage to property.

- WS would employ methods and conduct activities for which the risk of hazards to public safety and hazard to the environment have been determined to be low according to a formal risk assessment (USDA 1997). Where such activities are conducted on private lands or other lands of restricted public access, the risk of hazards to the public would be further reduced.

- Only non-toxic shot would be used when employing shotguns to lethally take birds species in the State.

- The take of bird would only occur when authorized by the USFWS, when applicable, and only at levels authorized.

3.4 ADDITIONAL STANDARD OPERATING PROCEDURES SPECIFIC TO THE ISSUES

Issue 1 - Effects of Damage Management Activities on Target Bird Populations

- Lethal take of birds by WS would be reported and monitored by WS and by the USFWS to evaluate population trends and the magnitude of WS' take of birds in the State.

- WS would only target those individuals or groups of target species identified as causing damage or posing a threat to human safety.

- The WS' Decision Model, designed to identify the most appropriate damage management strategies and their impacts, would be used to determine bird damage management strategies.

- WS would monitor bird damage management activities to ensure activities do not adversely affect bird populations in the State.

- Preference would be given to non-lethal methods, when practical and effective. If practical and effective non-lethal control methods are not available and if lethal control methods are available and appropriate for WS to implement, WS may implement lethal methods.

Issue 2 - Effects on Non-target Wildlife Species Populations, Including T&E Species

- When conducting removal operations via shooting, identification of the target would occur prior to application.

- As appropriate, suppressed firearms would be used to minimize noise impacts.

- WS' personnel would use bait, trap placements, and capture devices that are strategically placed at locations likely to capture a target animal and minimize the potential of non-target animal captures.

- Any non-target animals captured in cage traps, nets, or any other restraining device would be released whenever it is possible and safe to do so.

- Carcasses of birds retrieved after damage management activities have been conducted would be disposed of in accordance with WS Directive 2.515.

- WS would retrieve all dead birds to the extent possible following treatment with DRC-1339.

- WS has consulted with the USFWS and the MDWFP to evaluate activities to resolve bird damage and threats to ensure the protection of T&E species.

- WS would monitor activities conducted under the selected alternative, if activities are determined to have no significant impact on the environment and an EIS is not required, to ensure those activities do not negatively impact non-target species.

Issue 3 - Effects of Damage Management Methods on Human Health and Safety

- Damage management activities would be conducted professionally and in the safest manner possible. Damage management activities would be conducted away from areas of high human activity. If this is not possible, then activities would be conducted during periods when human activity is low (*e.g.*, early morning).

- Damage management via shooting would be conducted during time periods when public activity and access to the control areas are restricted. Personnel involved in shooting operations would be fully trained in the proper and safe application of this method.

- All personnel employing chemical methods would be properly trained and certified in the use of those chemicals. All chemicals used by WS would be securely stored and properly monitored to ensure the safety of the public. WS' use of chemicals and training requirements to use those chemicals are outlined in WS Directive 2.401.

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

- Carcasses of birds retrieved after damage management activities would be disposed of in accordance with WS Directive 2.515.

Issue 4 - Effects on the Aesthetic Values of Birds

- Management actions to reduce or prevent damage caused by birds would be directed toward specific individuals identified as responsible for the damage, identified as posing a threat to human safety, or identified as posing a threat of damage.

- All methods or techniques applied to resolve damage or threats to human safety would be agreed upon by entering into a cooperative service agreement, MOU, or comparable document prior to the implementation of those methods.

- Preference would be given to non-lethal methods, when practical and effective under WS Directive 2.101.

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

- Personnel would be trained in the latest and most humane devices/methods for removing problem birds.

- WS' use of euthanasia methods would comply with WS Directive 2.505.

- The NWRC is continually conducting research to improve the selectivity and humaneness of wildlife damage management devices used by personnel in the field.

Issue 6 – Effects of Bird Damage Management Activities on the Regulated Harvest of Birds

- Damage management actions to reduce or prevent damage caused by birds in the State would be directed toward specific individuals identified as responsible for causing damage, identified as posing a threat to human safety, or identified as posing a threat of damage.

- Preference is given to non-lethal methods, when practical and effective under WS Directive 2.101.

- Damage management activities would only occur after a request for assistance is received by WS.

- WS' activities to manage damage and threats caused by birds would be coordinated with the USFWS and the MDWFP.

- WS' lethal take (killing) of birds would be reported to and monitored by the USFWS and/or the MDWFP to ensure WS' take is considered as part of management objectives for those bird species in the State.

- WS would monitor bird damage management activities to ensure activities do not adversely affect bird populations in the State.

Issue 7 - Effectiveness of Bird Damage Management Methods

- The appropriateness and effectiveness of methods and techniques would be applied based on the WS Decision Model using site specific inputs.

- WS would continually monitor the results of methods employed to ensure those methods deemed appropriate and most effective are used to resolve bird damage.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides information needed for making informed decisions in selecting the appropriate alternative to address the need for action described in Chapter 1 and the issues described in Chapter 2. This chapter analyzes the environmental consequences of each alternative as those alternatives relate to the issues identified. The following resource values in the State are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, critical habitats (areas listed in T&E species recovery plans), visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. Those resources will not be analyzed further.

The activities proposed in the alternatives would have a negligible effect on atmospheric conditions including the global climate. Meaningful direct or indirect emissions of greenhouse gases would not occur as a result of any of the proposed alternatives. Those alternatives would meet the requirements of applicable laws, regulations, and Executive Orders including the Clean Air Act and Executive Order 13514.

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

This section analyzes the environmental consequences of each alternative in comparison to determine the extent of actual or potential impacts on the issues. Therefore, the proposed action/no action alternative

serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The analysis also takes into consideration mandates, directives, and the procedures of WS, the TVA, the MDWFP, the USFWS, and the MDAC.

Issue 1 - Effects of Damage Management Activities on Target Bird Populations

A common issue is whether damage management actions would adversely affect the populations of target bird species, especially when lethal methods are employed. WS maintains ongoing contact with the USFWS and the MDWFP to ensure activities are within management objectives for those species. WS submits annual bird damage management activity reports to the USFWS. The USFWS monitors the total take of birds from all sources and factors in survival rates from predation, disease, and other mortality data. Ongoing contact with the USFWS and the MDWFP assures local, state, and regional knowledge of wildlife population trends are considered.

As was discussed previously, methods available to address bird damage or threats of damage in the State that would be available for use or recommendation under Alternative 1 (technical and operational assistance) and Alternative 2 (technical assistance only) are either lethal methods or non-lethal methods. Under Alternative 2, WS would recommend lethal and non-lethal methods as part of an integrated approach to resolving requests for assistance. Alternative 1 addresses requests for assistance received by WS through technical and operational assistance where an integrated approach to methods would be employed and/or recommended. Non-lethal methods include, but are not limited to: habitat/behavior modification, lure crops, visual deterrents, live traps, exclusionary devices, frightening devices, nets, nests/egg destruction, immobilizing drugs, and chemical repellents (see Appendix B for a complete list and description of potential methods). Lethal methods considered by WS to address bird damage include: live-capture followed by euthanasia, DRC-1339, shooting, and the recommendation of hunting, where appropriate. Euthanasia would occur through the use of cervical dislocation or carbon dioxide once birds are live-captured using other methods. Carbon dioxide is an acceptable form of euthanasia for birds while cervical dislocation is a conditionally acceptable[11] method of euthanasia (AVMA 2007). No assistance would be provided by WS under Alternative 3 but many of those methods available to address bird damage would continue to be available for use by other entities under Alternative 3.

Non-lethal methods can disperse or otherwise make an area unattractive to birds causing damage; thereby, reducing the presence of birds at the site and potentially the immediate area around the site where non-lethal methods are employed. Non-lethal methods would be given priority when addressing requests for assistance (WS Directive 2.101). However, non-lethal methods would not necessarily be employed to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model. For example, if a cooperator requesting assistance has already used non-lethal methods, WS would not likely recommend or continue to employ those particular methods since their use has already been proven ineffective in adequately resolving the damage or threat. Non-lethal methods are used to excluded, harass, and disperse target wildlife from areas where damage or threats are occurring. When effective, non-lethal methods would disperse birds from the area resulting in a reduction in the presence of those birds at the site where those methods were employed.

The use of non-lethal methods in an integrated approach has proved effective in dispersing birds. For example, Avery et al. (2002) and Seamans (2004) found that the use of vulture effigies were an effective non-lethal method to disperse roosting vultures. Non-lethal methods have been effective in dispersing crow roosts (Gorenzel et al. 2000, Chipman et al. 2008), including the use of crow effigies (Avery et al. 2008), lasers (Gorenzel et al. 2002), and electronic distress calls (Gorenzel and Salmon 1993). Chipman

[11] The AVMA (2007) defines conditional acceptable as "...[methods] *that by the nature of the technique or because of greater potential for operator error or safety hazards might not consistently produce humane death or are methods not well documented in the scientific literature".*

et al. (2008) found the use of only non-lethal methods to disperse urban crow roosts often requires a long-term commitment of affected parties, including financial commitments, to achieve and maintain the desired result of reducing damage.

However, those species would be moved to other areas with minimal impact on those species' populations. Non-lethal methods are not employed over large geographical areas or applied at such intensity that essential resources (*e.g.*, food sources, habitat) would be unavailable for extended durations or over such a wide geographical scope that long-term adverse effects would occur to a species' population. Non-lethal methods are generally regarded as having minimal impacts on overall populations of wildlife since individuals of those species are unharmed. The use of non-lethal methods would not have adverse impacts on populations of birds in the State under any of the alternatives.

The continued use of non-lethal methods often leads to the habituation of birds to those methods which can decrease the effectiveness of those methods (Avery et al. 2008, Chipman et al. 2008). For any management methods employed, the proper timing is essential in effectively dispersing those birds causing damage. Employing methods soon after damage begins or soon after threats are identified increases the likelihood that those damage management activities would achieve success in addressing damage. Therefore, coordination and timing of methods is necessary to be effective in achieving expedient resolution of bird damage.

Lethal methods would be employed or recommended to resolve damage associated with those birds identified by WS as responsible for causing damage or threats to human safety only after receiving a request for the use of those methods. The use of lethal methods could result in local population reductions in the area where damage or threats were occurring since birds would be removed from the population. Lethal methods are often employed to reinforce non-lethal methods and to remove birds that have been identified as causing damage or posing a threat to human safety. The use of lethal methods would result in local reductions of birds in the area where damage or threats were occurring. The number of birds removed from the population using lethal methods would be dependent on the number of requests for assistance received, the number of birds involved with the associated damage or threat, and the efficacy of methods employed.

Most lethal methods are intended to reduce the number of birds present at a location since a reduction in the number of birds at a location leads to a reduction in damage which is applicable whether using lethal or non-lethal methods. The use of lethal methods has been successful in reducing bird damage (Boyd and Hall 1987, Gorenzel et al. 2000). The intent of non-lethal methods is to harass, exclude, or otherwise make an area unattractive to birds which disperses those birds to other areas which leads to a reduction in damage at the location where those birds were dispersed. The intent of using lethal methods is similar to the objective trying to be achieved when using non-lethal methods which is to reduce the number of birds in the area where damage is occurring which can lead to a reduction in the damage occurring at that location.

Although the use of firearms can reduce the number of birds using a location (similar to dispersing birds), the use of a firearm is most often used to supplement and reinforce the noise associated with non-lethal methods. The capture of birds using live-traps and subsequently euthanizing those birds is employed to reduce the number of birds using a particular area where damage is occurring. Similarly, the recommendation that birds be harvested during the regulated hunting season for those species in the State is intended to manage those populations in an area where damage is occurring.

The avicide DRC-1339 is also being proposed for use under the proposed action which would be applied as part of an integrated approach which could include non-lethal harassment methods. Like other methods, including non-lethal methods, the intent in using DRC-1339 is to reduce the number of birds

present at a location where damages or threats of damage are occurring. Reducing the number of birds at a location where damage or threats are occurring either through the use of non-lethal methods or lethal methods can lead to a reduction in damage. The dispersal of birds using non-lethal methods reduced the number of birds using a location which was correlated with a reduction in damage occurring at that location (Avery et al. 2008, Chipman et al. 2008) which would also occur if lethal methods were employed. Similarly, the use of DRC-1339 is intended to reduce the number of birds using a location. Boyd and Hall (1987) found the use of DRC-1339 to reduce local crow roosts by up to 25% could lead to a reduction in damage associated with those crows.

Often of concern with the use of lethal methods is that birds that are lethally taken would only be replaced by other birds either during the application of those methods (from other birds that immigrate into the area) or by birds the following year (increase in reproduction that could result from less competition). As stated previously, the use of lethal methods are not intended to be used as population management tools (except for hunting) over broad areas. The use of lethal methods, including the use of DRC-1339, are intended to reduce the number of birds present at a location where damage is occurring by targeting those birds causing damage or posing threats. Since the intent of lethal methods is to manage those birds causing damage and not to manage entire bird populations, those methods are not ineffective because birds return the following year.

Chipman et al. (2008) found that crows returned to roosts previously dispersed using non-lethal methods within 2 to 8 weeks. In addition, Chipman et al. (2008) found that the use of non-lethal methods had to be re-applied every year during a six-year project evaluating the use of only non-lethal methods. At some roost locations, Chipman et al. (2008) found the number of crows that returned each year to roosts over a six-year period actually increased despite the use of non-lethal methods each year. Despite the need to re-apply non-lethal methods yearly, the return of birds to roost locations previously dispersed, and the number of crows using roost locations increasing annually at some roost locations, Chipman et al. (2008) determined the use of non-lethal methods could be effective at dispersing urban crow roosts in New York. Similar results were found by Avery et al. (2008) during the use of crow effigies and other non-lethal methods to disperse urban crow roosts in Pennsylvania. Crows returned to roost locations in Pennsylvania annually despite the use of non-lethal methods and effigies (Avery et al. 2008). Gorenzel et al. (2002) found that crows returned to roost locations after the use of lasers. Therefore, the use of both lethal and non-lethal methods may require repeated use of those methods. The return of birds to areas where damage management methods were previously employed does not indicate previous use of those methods were ineffective since the intent of those methods are to reduce the number of birds present at a site where damage is occurring at the time those methods are employed.

Most lethal and non-lethal methods currently available provide only short-term benefits when addressing bird damage. Those methods are intended to reduce damage occurring at the time those methods are employed but do not necessarily ensure birds would not return once those methods are discontinued or the following year when birds return to an area. Long-term solutions to resolving bird damage are often difficult to implement and can be costly. In some cases, long-term solutions involve exclusionary devices, such as wire grids, or other practices such as closing garbage cans. When addressing bird damage, long-term solutions generally involve modifying existing habitat or making conditions to be less attractive to birds. To ensure complete success, alternative sites in areas where damage is not likely to occur are often times required to achieve complete success in reducing damage and avoid moving the problem from one area to another. Modifying a site to be less attractive to birds would likely result in the dispersal of those birds to other areas where damage could occur or could result in multiple occurrences of damage situations.

WS may recommend birds be harvested during the regulated hunting season for those species in an attempt to reduce the number of birds causing damage. Managing bird populations over broad areas

could lead to a decrease in the number of birds causing damage. Establishing hunting seasons and the allowed take during those seasons is the responsibility of the MDWFP under frameworks developed by the USFWS. WS does not have the authority to establish hunting seasons or to set allowed harvest numbers during those seasons.

As discussed previously, the analysis for magnitude of impact from lethal take can be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest trend data. Information on bird populations and trends are often derived from several sources including the BBS, the CBC, the Partners in Flight Landbird Population database, published literature, and harvest data.

Population Impact Analyses of the Alternatives

The alternatives discussed in Chapter 3 were developed in response to the issues identified in Chapter 2. The issue of the potential impacts of conducting the alternatives on the populations of target bird species is analyzed for each alternative below.

Alternative 1 - Continuing the Current Integrated Approach to Managing Bird Damage (Proposed Action/No Action)

Under the proposed action, WS would continue to provide both technical assistance and direct operational assistance to those persons requesting assistance with managing damage and threats associated with birds in the State. WS would employ those methods described in Appendix B in an adaptive approach that would integrate methods to effectively reduce damage and threats associated with birds in the State.

The issue of the effects on target bird species arises from the use of non-lethal and lethal methods to address the need for reducing damage and threats. Methods employed in an integrated approach to reduce damage and threats are categorized into non-lethal and lethal methods. As part of an integrated approach to managing damage and threats, WS could apply both lethal and non-lethal methods when requested by those persons experiencing damage.

Generally, WS only conducts damage management on species whose population densities are high and usually only after they have caused damage. WS' take is monitored by comparing numbers of animals killed with overall populations or trends in populations to assure the magnitude of take is maintained below the level that would cause significant adverse impacts to the viability of native species' populations (USDA 1997). The potential impacts on the populations of target bird species from the implementation of the proposed action are analyzed for each species below.

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, Jr. et al. 2011). Great egrets can be found in freshwater, estuarine, and marine wetlands (Mccrimmon, Jr. et al. 2011). In Mississippi, great egrets can be found throughout the year in the State with breeding and wintering populations occurring along the Mississippi River and southern Mississippi (Mccrimmon, Jr. et al. 2011).

The overharvest of great egrets that occurred primarily from 1870 to 1910 for plumes and the millinery trade reduced the population in North American by >95% (Mccrimmon, Jr. 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, Jr. et al. 2011). Following regulations

that ended plume-hunting, great egret populations rapidly recovered with increases reported in the late 1920s and 1930s (Mccrimmon, Jr. et al. 2011). Similar fluctuations in great egret populations occurred throughout the southeastern United States with the number of egrets present increasing during the 1940s and 1950s; however, populations again began to decline rapidly in the 1970s likely due to the conversion of lowland habitats to agricultural uses and the widespread use of organochloride pesticides (Hunter 2006). However, populations of great egrets appear to be recovering. Since the initiation of the BBS in 1966, the number of egrets observed along routes surveyed in Mississippi has shown an increasing trend estimated at 12.0% annually, which is a statistically significant trend (Sauer et al. 2011). From 2000 to 2010, the number of great egrets observed in the State during the BBS has shown an increasing trend estimated at 14.1% annually (Sauer et al. 2011). Across all BBS routes surveyed in the United States, the number of great egrets observed during the survey has shown an increasing trend estimated at 2.3% annually since 1966, which is also a statistically significant increase (Sauer et al. 2011).

The number of great egrets observed in areas surveyed during the CBC in the State has also shown a general increasing trend since 1966 (NAS 2010). However, trending information indicates great egrets overwintering in Mississippi can be cyclical. Great egrets were not observed on CBC surveys until 1970 where 21 were noted (NAS 2010). In areas surveyed during the CBC conducted in 1980, a total of 69 great egrets were recorded with five counts reporting egrets. During the CBC conducted in 2010, a total of 1,200 egrets were recorded with 15 counts reporting seeing egrets (NAS 2010). In the Southeastern Coastal Plain region (Bird Conservation Region 27), which includes most of the State, the breeding population of great egrets has been estimated at over 28,000 pairs (Hunter et al. 2006). Along the Mississippi Alluvial Valley (Bird Conservation Region 26), the great egret population has been estimated at 25,000 egrets (Hunter et al. 2006). In the southeastern United States, the breeding population of great egrets has been estimated at 119,266 breeding pairs (Hunter et al. 2006).

Of the five tiers of action levels for waterbirds in the southeastern United States, great egrets were assigned to the "*planning and responsibility*" tier which includes birds that require some level of planning to maintain sustainable populations in the region (Hunter et al. 2006). The planning and responsibility tier is the second lowest tier in terms of action priority ahead of only the last tier which includes those waterbirds that are considered above management levels and could require population management (Hunter et al. 2006). The North American Waterbird Conservation Plan classifies the great egret in a category of conservation concern considered as "*not currently at risk*" (Kushlan et al. 2002).

Like other waterbirds addressed in this assessment, 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 pursuant to the MBTA that allow the take of egrets to manage damage and threats. The total take of great egrets per year under depredation permits issued by the USFWS from 2005 through 2010 are shown in Table 4.1.

The take of great egrets by WS to alleviate damage and threats are also shown in Table 4.1 along with the number of great egrets dispersed by WS to alleviate damage or threats of damage using non-lethal methods. On average, nearly 757 egrets have been lethally taken in the State annually to alleviate damage or threats of damage. The highest level of take occurred in 2008 when 1,242 egrets were lethally taken in the State by all entities. WS' highest level of take occurred in FY 2009 when 49 egrets were taken to alleviate damage and threats of damage. WS has dispersed 18,154 great egrets in the State between FY 2005 and FY 2011. Based on previous and current levels of take by WS to alleviate damage and threats of damage associated with great egrets, WS' anticipates that up to 50 great egrets per year could be lethally taken by WS in the State to manage damage and threats.

Table 4.1 – Number of great egrets addressed in Mississippi from 2005 to 2011

Year	WS' Dispersed[1]		Authorized Take[2,3]	Take by Entity		Total Take
				WS[1]	Other[3]	
2005	19		**2,317**	7	374	**381**
2006	2		**1,837**	0	1,208	**1,208**
2007	5		**2,082**	1	351	**352**
2008	25		**1,892**	2	1,240	**1,242**
2009	18,074		**1,650**	49	1,086	**1,135**
2010	26		**2,080**	15	208	**223**
2011	3		**N/A**†	3	N/A	**≥3**
TOTAL	**18,154**		**11,858**	**77**	**4,467**	**4,544**

[1]Data reported by federal fiscal year

[2]The number of birds permitted to be taken by the USFWS under all depredation permits issued for the species, including authorized take by WS

[3]Data provided by calendar year

†Information is currently unavailable

The population of great egrets in Mississippi likely fluctuates throughout the year and is likely highest during migration periods. Nesting and winter populations of great egrets are currently unknown in Mississippi. Glahn et al. (1999*c*) estimated the great egret population in the Delta region of Mississippi to be 18,000 egrets based on density surveys at aquaculture facilities in that region. Since the number of great egrets present in Mississippi at any given time is unknown and the best available information for populations of egrets was derived from a small geographical area of Mississippi, the population estimate for the Delta Region of Mississippi will be used in this analysis. The number of egrets present in Mississippi is likely greater than 18,000 egrets since the estimate provided by Glahn et al. (1999*c*) only included the Delta Region of Mississippi. Based on the estimated population in the aquaculture producing region of Mississippi, WS' take of up to 50 egrets would represent an estimated 0.3% of the egret population in the aquaculture producing region along the Mississippi River.

Like other migratory birds addressed in this assessment, the take of great egrets by WS 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.

Black Vulture Biology and Population Impact Analysis

Historically in North America, black vultures occurred in the southeastern United States, Texas, New Mexico, and parts of Arizona (Wilbur 1983). Black vultures have been expanding their range northward in the eastern United States (Wilbur 1983, Rabenhold and Decker 1989). Black vultures are considered locally resident (Parmalee and Parmalee 1967, Rabenhold and Decker 1989); however, some populations will migrate (Eisenmann 1963 cited from Wilbur 1983). Black vultures nest and roost primarily in mature forested areas. Black vultures typically feed by scavenging but occasionally take live prey, especially newborn livestock (Brauning 1992). Black vultures have been reported to live to 25 years of age (Henny 1990).

Black vultures are considered a permanent resident that occur statewide in Mississippi (Turcotte and Watts 1999). Nesting occurs in the State mainly during March and April with records of breeding occurring into May. Black vultures nest under fallen trees or treetops, near stumps, or in rotted hollow trees (Turcotte and Watts 1999). Large winter vulture roosts have been observed in the State and usually include black vultures and turkey vultures (Turcotte and Watts 1999).

According to BBS trend data provided by Sauer et al. (2011), the number of black vulture observed in the State during the breeding season have shown an increasing trend estimated at 2.4% annually from 1966 through 2010, which is a statistically significant trend. From 2000 through 2010, the number of black vultures observed along routes surveyed during the BBS has shown an increasing trend estimated at 2.4% annually (Sauer et al. 2011). The number of black vultures observed in the southeastern coastal plain (Bird Conservation Region 27) during the BBS conducted from 1966 through 2010 has shown an increasing trend estimated at an annual rate of 2.8%, which is a statistically significant increase (Sauer et al. 2011). Black vultures overwintering in the State have shown a cyclical trend but have shown a general increasing trend since in the late-1990s (NAS 2010). Rich et al. (2004) estimated the statewide black vulture population at 11,000 vultures based on BBS data available from the State.

The numbers of black vultures addressed by WS from FY 2005 through FY 2011 are shown in Table 4.2. From FY 2005 through FY 2011, WS has lethally taken 1,083 black vultures in the State to alleviate damage and threats. In addition, WS has employed non-lethal harassment methods to disperse 4,303 vultures in the State to address requests for assistance to manage damage. A total of 3,065 black vultures have been authorized to be lethally taken in the State under depredation permits issued by the USFWS from 2005 through 2010. An average of 511 vultures per year have been authorized to be taken under depredation permits in the State from 2005 through 2010 with the highest permitted take occurring in 2009 when 870 black vultures were authorized to be lethally removed to alleviate damage. Other entities have lethally removed a total of 242 black vultures in the State from 2005 through 2010 with the highest level of take occurring in 2008 when 142 vultures were lethally removed. On average, other entities in the State have lethally taken 41 vultures annually from 2005 through 2010.

Table 4.2 – Number of black vultures addressed in Mississippi from 2005 to 2011

Year	WS' Dispersed[1]		Authorized Take[2,3]	Take by Entity		Total Take
				WS[1]	Other[3]	
2005	30		**300**	8	0	**8**
2006	91		**305**	0	0	**0**
2007	55		**725**	522	0	**522**
2008	1,342		**745**	365	142	**507**
2009	560		**870**	56	50	**106**
2010	534		**120**	12	50	**62**
2011	1,691		**N/A†**	120	**N/A**	**≥120**
TOTAL	**4,303**		**3,065**	**1,083**	**242**	**1,325**

[1]Data reported by federal fiscal year

[2]The number of birds permitted to be taken by the USFWS under all depredation permits issued for the species, including authorized take by WS

[3]Data provided by calendar year

†Information is currently unavailable

The population estimate provided by Rich et al. (2004) for some species are often poor due to high variance on BBS counts, low sample size, or due to other species-specific limitations of BBS methods. Estimates of bird populations calculated by Rich et al. (2004) were derived from BBS data for individual species. BBS survey data is derived from surveyors identifying bird species based on visual and auditory cues at stationary points along roadways. Vultures produce very few auditory cues that would allow for identification (Buckley 1999) and thus, surveying for vultures is reliant upon visual identification. For visual identification to occur during surveys, vultures must be either flying or visible while roosting. Coleman and Fraser (1989) estimated that black and turkey vultures spend 12 to 33% of the day in summer and 9 to 27% of the day in winter flying. Avery et al. (2011) found that both turkey vultures and black vultures were most active in the winter (January to March) and least active during the summer (July

to September). Avery et al. (2011) found that across all months of the year, black vultures were in flight only 8.4% of the daylight hours while turkey vultures were in flight 18.9% of the daylight hours.

Most vultures during surveys are counted while flying since counting at roosts can be difficult due to obstructions limiting sight and due to the constraints of boundaries used during the surveys, especially the BBS since observers are limited to counting only those bird species within a quarter mile of a survey point along a roadway. Bunn et al. (1995) reported vulture activity increased from morning to afternoon as temperatures increased. Avery et al. (2011) found turkey vulture flight activity peaked during the middle of the day. Three hours after sunrise, Avery et al. (2011) found only 10% of turkey vultures in flight and black vultures lagged about an hour behind turkey vultures in their flight activities. Therefore, surveys for vultures should occur later in the day to increase the likelihood of vultures being observed by surveyors. Observations conducted for the BBS are initiated in the morning since mornings tend to be periods of high bird activity. Since vulture activity tends to increase from morning to afternoon when the air warms and vultures can find thermals for soaring, vultures are probably under-represented in BBS data. The limitations associated with surveying for vultures under current BBS guidelines is likely resulting in lower than expected population estimates of black vultures and turkey vultures. Given the limitations of current survey protocols, populations of vultures in Mississippi are likely higher than derived by Rich et al. (2004) using data from the BBS.

The number of requests for assistance received by WS involving damage and threats of damage associated with vultures has increased in the State. In FY 2006, WS conducted six technical assistance projects involving damage or threats associated with black vultures. During FY 2008, WS conducted 18 technical assistance projects in the State involving damage or threats associated with black vultures representing an increase of 125% over the number of technical assistance projects conducted in FY 2006. The number of requests to provide direct operational assistance, in which WS is directly involved with providing damage management activities, has also increased recently. The number of requests to assist with damage or threats of damage associated with black vultures received by WS is likely to continue to increase in the State as the vulture population increases. Based on the possibility of receiving more requests for assistance, WS anticipates that up to 1,000 black vultures could be lethally taken in the State to address those requests for assistance.

As shown in Table 4.2, a total of 3,065 black vultures have been authorized to be taken in the State from 2005 through 2010 to alleviate damage which is an average of 511 vultures authorized to be taken annually by all entities. If the population in the State remains relative stable, take of up to 1,000 black vultures annually by WS would represent 9.1% of the estimated statewide population of black vultures. If the number of black vultures taken by other entities in the State remains similar to the number of black vultures taken from 2005 through 2010 and if 1,000 vultures were taken by WS, the annual take of vultures would be 1,040 vultures which would represent 9.5% of the estimated statewide population if the population remains at least stable. If the highest level of take that has occurred by other entities is combined with the proposed take of up to 1,000 vultures by WS, the cumulative take would represent 10.4% of the estimated population. As discussed previously, the statewide breeding population of black vultures is likely greater than 11,000 vultures based on the limitations of the BBS data used to derive the estimate.

Similar to the other native bird species addressed in this assessment, the take of vultures can only occur when authorized through the issuance of depredation permits by the USFWS. Permitting of take ensures cumulative take of black vultures annually would occur within allowable take levels to achieve desired population objectives for the species. Therefore, take of vultures by WS would only occur at levels permitted by the USFWS through the issuance of depredation permits.

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 in virtually all habitats but are most abundant where forest is 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 on 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). Turkey vultures have been reported to live up to 16 years of age (Henny 1990).

Turkey vultures are considered a permanent resident across the State (Turcotte and Watts 1999). Turkey vultures do show migratory patterns in the State and are more common during winter months. The breeding season occurs primarily in April in the State (Turcotte and Watts 1999). The number of turkey vultures observed in the State increases from mid-October through mid-March, which coincides with the migration periods and those vultures overwintering in the State (Turcotte and Watts 1999).

The statewide population of turkey vultures is currently unknown but has been estimated at 11,000 based on BBS data (Rich et al. 2004). Data from the BBS indicates the number of turkey vultures observed along BBS routes in the State have shown an increasing trend estimated at 4.9% annually in the State from 1966 through 2010, which is a statistically significant increase (Sauer et al. 2011). The number of turkey vultures observed in the State from 2000 through 2010 has also shown an increasing trend estimated at 5.4% annually (Sauer et al. 2011). The number of turkey vultures observed in the southeastern coastal plain, which encompasses most of Mississippi, has also shown increasing trends estimated at 4.8% annually from 1966 through 2010, which is statistically significant (Sauer et al. 2011). The number of turkey vultures observed during the CBC conducted annually in the State is also showing an increasing trend (NAS 2010).

The take of turkey vultures is prohibited under the MBTA except when authorized pursuant to the Act through the issuance of depredation permits issued by the USFWS. The number of turkey vultures addressed in Mississippi by all entities to alleviate damage is shown in Table 4.3. From FY 2005 through FY 2011, the WS program in Mississippi has killed 42 turkey vultures in the State and employed non-lethal methods to disperse 1,312 turkey vultures to alleviate damage. From 2005 through 2010, 166 turkey vultures were lethally taken by all entities in the State pursuant to depredation permits issued by the USFWS, with an average of 28 turkey vultures taken per year. The USFWS has authorized take of up to 3,525 vultures from 2005 through 2010 in the State to alleviate damage.

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 to assist with managing damage associated with turkey vultures in the State and the number of vultures addressed to meet those requests is also 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 100 turkey vultures could be lethally taken annually by WS to alleviate damage and threats in the State.

Table 4.3 – Number of turkey vultures addressed in Mississippi from 2005 to 2011

Year	WS' Dispersed[1]		Authorized Take[2,3]	Take by Entity		Total Take
				WS[1]	Other[3]	
2005	4		**300**	9	6	**15**
2006	35		**305**	1	0	**1**
2007	207		**700**	4	0	**4**
2008	493		**720**	13	26	**39**
2009	164		**750**	7	46	**53**
2010	114		**750**	4	50	**54**
2011	295		**N/A**†	4	**N/A**	**≥4**
TOTAL	**1,312**		**3,525**	**42**	**128**	**170**

[1]Data reported by federal fiscal year

[2]The number of birds permitted to be taken by the USFWS under all depredation permits issued for the species, including authorized take by WS

[3]Data provided by calendar year

†Information is currently unavailable

If up to 100 turkeys vultures are taken annually by WS, WS' take would represent 0.9% of the estimated statewide population of turkey vultures, estimated at 11,000 vultures if the population remains at least stable. If take by other entities remains stable, cumulative take of vultures annually by all entities would be 122 vultures. The cumulative take of vultures would represent 1.1% of the statewide population if the population remains at least stable. Permitting of the take by the USFWS pursuant to the MBTA would ensure take by WS and by other entities occurs within allowable take levels to achieve the desired population objectives for turkey vultures in the State.

Domestic and Feral Waterfowl Biology and Population Impact Analysis

Domestic waterfowl refers to captive-reared, domestic, of some domestic genetic stock, or domesticated breeds of ducks, geese, and swans. Examples of domestic waterfowl include, but are not limited to, mute swans, Muscovy ducks, Pekin ducks, Rouen ducks, Cayuga ducks, Swedish ducks, Chinese geese, Toulouse geese, Khaki Campbell ducks, Embden geese, and pilgrim geese. Feral ducks may include a combination of mallards, Muscovy duck, and mallard-Muscovy hybrids. All domestic ducks, except for Muscovy ducks, were derived from the mallard (Drilling et al. 2002).

Many waterfowl of domestic or semi-wild genetic backgrounds have been released by humans into rural and urban environments; including numerous species of ducks, geese, and swans. Selective breeding has resulted in the development of numerous domestic varieties of the mallard duck that no longer exhibit the external characteristics or coloration of their wild mallard ancestors. An example of a feral duck is the "*urban*" mallard duck. The coloration of the feathers of urban ducks is highly variable and often does not resemble that of the wild mallard ducks. Urban mallard ducks in the State often display the following physical characteristics: males may be missing the white neck ring or the neck ring will be an inch wide instead of the narrow 1/4 inch wide ring found on wild mallards; males may have purple heads instead of green heads and heavily mottled breast feathers; females may be blonde instead of mottled brown; the bills of females may be small and black instead of orange mottled with black; either sex may have white coloration on the wings, tail, or body feathers; and urban ducks may weigh more than wild ducks (2.5 to 3.5 pounds).

Domestic waterfowl have been purchased and released by property owners for their aesthetic value, but may not always remain at the release sites; thereby, becoming feral. Feral waterfowl are defined as a domestic species of waterfowl that cannot be linked to a specific ownership. Examples of areas where domestic waterfowl have been released are business parks, universities, wildlife management areas, parks,

military bases, residential communities, and housing developments. Many times, those birds are released with no regard or understanding of the consequences or problems they can cause to the environment or the local community.

Federal law does not protect domestic varieties of waterfowl (see 50 CFR 21), nor are domestic waterfowl specifically protected by law in Mississippi. Domestic and feral waterfowl may be of mixed heritage and may show feather coloration of wild waterfowl. Some domestic and feral waterfowl are incapable of sustained flight, while some are incapable of flight at all due to hybridization. Domestic waterfowl may at times cross breed with migratory waterfowl species creating a hybrid cross breed (*e.g*., mallard X domestic duck, Canada goose X domestic goose). Those types of hybrid waterfowl species would be taken in accordance with definitions and regulations provided in 50 CFR 10 and 50 CFR 21.

Domestic ducks, geese, and swans are non-indigenous species considered by many wildlife biologists and ornithologists to be an undesirable component of North American wild and native ecosystems. Any reduction in the number of those domestic waterfowl species could be considered a beneficial impact to other native bird species since they compete with native wildlife for resources. Domestic and feral waterfowl are almost always found near water, such as ponds, lakes, retaining pools, and waterways. Domestic and feral waterfowl generally reside in the same area year around with little to no migration occurring. Those birds are often found in areas where resident Canada geese inhabit. Currently, there are no population estimates for domestic and feral waterfowl in the State. Domestic and feral waterfowl are not protected by federal and State laws and are not considered for population goal requirements, including the MBTA except for certain portions of the Muscovy duck population.

The Muscovy ducks located in the State are from non-migratory populations that originated from domestic stock. The USFWS has recently changed the regulations governing Muscovy ducks. Because Muscovy ducks now occur naturally in southern Texas, this species has been added to the list of migratory birds afforded protection under the MBTA. However, it has been introduced and is not native in other parts of the United States, including the State of Mississippi. The USFWS has revised 50 CFR 21.14 (permit exceptions for captive-bred migratory waterfowl other than mallard ducks) and 50 CFR 21.25 (waterfowl sale and disposal permits), and has added 50 CFR 21.54, an order to allow for the control of Muscovy ducks, their nests, and eggs.

From FY 2005 through FY 2011, the WS program in Mississippi has lethally taken 29 domestic or feral waterfowl to reduce damage and threats. Since FY 2005, WS has lethally taken two feral ducks and 27 feral geese to alleviate damage. No feral duck or goose nests have been removed or destroyed since FY 2005.

Based on previous requests for assistance and in anticipation of an increase in the number of requests received by WS annually, take of up to 30 feral ducks and 30 feral duck nests, and up to 30 feral geese and 30 feral goose nests could occur annually under the proposed action. Since feral waterfowl often compete with native wildlife species for resources, any take of feral waterfowl could be viewed as benefitting the natural environment. The number of feral waterfowl inhabiting the State is currently unknown. However, based on the limited take proposed and the likely benefit to the natural environment that could occur, take of up to 30 feral ducks and up to 30 feral geese would not adversely affect populations of those feral species. WS' activities would be conducted pursuant to Executive Order 13112 which directs federal agencies whose actions may affect the status of invasive species to reduce invasion of exotic species and associated damages to the extent practicable and permitted by law.

Killdeer Biology and Population Impacts

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 (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, road-side ditches, mudflats, airports, pastures, gravel roads, and levees but are seldom seen in large flocks. The clutch of up to four eggs is laid in a ground scrape in open habitats (Leck 1984).

Requests for assistance associated with killdeer occur primarily at airports in the State. As the number of airports requesting assistance from WS to manage damage and threats associated with killdeer increases, the number of killdeer that could be lethally taken annually would also likely increase when lethal methods are deemed appropriate for use to resolve damage and threats. To address an increasing number of requests for assistance, up to 200 killdeer could be lethally taken by WS annually under the proposed action.

From FY 2005 through FY 2011, WS has lethally taken a total of 824 killdeer in the State at airports to reduce damages and threats associated with aircraft striking killdeer. The highest level of killdeer take by WS occurred in FY 2011 when 254 killdeer were lethally taken (see Table 4.4). In addition, WS has employed non-lethal methods to harass 1,361 killdeer at airports in the State from FY 2005 through FY 2011. Over 62% of the killdeer addressed by WS have been harassed using non-lethal methods since FY 2005.

Table 4.4 – Number of killdeer addressed by WS in Mississippi from FY 2005 through FY 2011

Year	Dispersed	Take
2005	64	17
2006	79	10
2007	100	46
2008	421	153
2009	177	186
2010	306	158
2011	214	254
TOTAL	**1,361**	**824**

Since 1966, the number of killdeer observed during the breeding season in the State has shown an increasing trend estimated at 2.4% annually, which is a statistically significant trend (Sauer et al. 2011). Since 2000, the number of killdeer observed during the BBS conducted in the State annually has shown an increasing trend estimated at 3.2% annually (Sauer et al. 2011). Killdeer observed on BBS routes in the southeastern coastal plain (Bird Conservation Region 27) are showing an increasing trend estimated at 2.1% annually between 1966 and 2010 with a 4.3% annual increase occurring from 2000 through 2010 (Sauer et al. 2011). Across all routes surveyed in the United States, the number of killdeer observed has shown a declining trend between 1966 and 2010 estimated at -0.3% annually, which is statistically significant; however, from 2000 through 2010, the number of killdeer observed has increased at an annual rate of 0.4% (Sauer et al. 2011). No current population estimates are available for the number of killdeer residing in the State. With a relative abundance estimated at 3.2 killdeer per route in Mississippi (Sauer et al. 2011) and the area of Mississippi estimated at 48,430 square miles, the killdeer population could be estimated at nearly 15,500 birds based on the land area of the State.

Using a killdeer population estimated at 15,500 birds in Mississippi, WS' lethal removal of 200 killdeer annually would constitute 1.3% of the estimated population in the State. Take by WS would likely be much lower given the number of killdeer in Mississippi is likely more than 15,500 birds as a result of the bias associated with BBS data for certain species that were described previously. Survey data from the CBC indicates the number of killdeer overwintering in the State has shown a general increasing trend since 1966 (NAS 2010). During 1966, observers in the State noted 0.8 killdeer per party hour during the CBC which compares to 14.4 killdeer per party hour observed during the 2010 survey (NAS 2010). From 2001 through 2010, the total number of killdeer observed in areas surveyed during the CBC has been nearly 5,500 killdeer per year which could be considered a minimal estimates since not all areas of the State are surveyed.

WS would continue to assist airport personnel in identifying habitat and other attractants to killdeer on airport property. Killdeer would continue to be addressed using primarily non-lethal harassment and dispersal methods. All take of killdeer would occur within the levels permitted by the USFWS pursuant to the MBTA.

Laughing Gull Biology and Population Impact Analysis

The laughing gull is a common gull species found throughout the year in the southeastern United States, with breeding colonies occurring along coastal areas of the Atlantic Ocean, Gulf of Mexico, and coastal areas of the Caribbean Islands (Burger 1996). Localized breeding colonies can also be found along the Gulf of California and the Pacific Coast of Mexico (Burger 1996). Characterized by a black hood, laughing gulls are often associated with human activities near coastal areas where food sources are readily available (Burger 1996). Burger (1996) cites several sources that indicate laughing gulls are opportunistic foragers that feed on a wide-range of aquatic and terrestrial invertebrates, small vertebrates, garbage, and plant material, such as berries.

In Mississippi, the laughing gull is considered an abundant permanent resident along coastal areas of the State, and also occasionally occurs inland on large bodies of water (Turcotte and Watts 1999). The laughing gull is the only gull species that is known to nest in the State, with nesting occurring along the coast and on offshore islands of the State during June and July (Turcotte and Watts 1999).

The current population of laughing gulls in Mississippi is unknown. Belant and Dolbeer (1993) estimated the population of breeding laughing gulls in the United States at 258,851 pairs based on state population records. Non-breeding and sub-adult gulls were not considered as part of the United States breeding population estimated by Belant and Dolbeer (1993). Wintering laughing gulls have shown a general increasing trend since 1966 in Mississippi based on CBC data (NAS 2010). There is currently no BBS data for laughing gulls in Mississippi (Sauer et al. 2011). Belant and Dolbeer (1993) estimated a minimum of 230,000 adult laughing gulls may winter in states along the Gulf Coast. In the southeastern coastal plain, the number of laughing gulls observed along routes surveyed during the BBS has increased annually by an estimated 7.6% since 1966, which is a statistically significant increase (Sauer et al. 2011). The number of breeding pairs in the southeastern United States has been estimated at 170,000 pairs with an estimated 46,116 breeding pairs occurring in the southeastern coastal plain region which includes most of Mississippi (Hunter et al. 2006).

Of the five tiers of action levels for waterbirds in the southeastern United States, laughing gulls were assigned to the "*planning and responsibility*" tier which includes birds that require some level of planning to maintain sustainable populations in the region (Hunter et al. 2006). The planning and responsibility tier is the second lowest tier in terms of action priority ahead of only the last tier which includes those waterbirds that are considered above management levels and could require population management (Hunter et al. 2006). The breeding population of laughing gulls in the southeastern United States has

been placed in the "*planning and responsibility*" category of the waterbird conservation plan for the southeastern United States due to the large portion of the breeding population that occurs in the region (Hunter et al. 2006). Hunter et al. (2006) acknowledges that laughing gull populations in the southeastern United States have increased "*dramatically*" which could be having adverse effects on other nesting high priority bird species at a local level. The waterbird plan for the southeastern United States recommended the population of laughing gulls be reduced from the estimated 170,000 breeding pairs to 100,000 breeding pairs to reduce predation on higher priority beach nesting species such as plovers, oystercatchers, and terns (Hunter et al. 2006). The waterbird plan also recommended reducing the number of laughing gulls in the southeastern coastal plain from the current estimate of 46,116 breeding pairs to 25,000 breeding pairs (Hunter et al. 2006).

From FY 2005 through FY 2011, the WS program in Mississippi responded to requests for assistance to manage damage or threats associated with laughing gulls. WS responded to requests for assistance through technical assistance which provides those persons seeking assistance with information and recommendations on approaches to managing damage associated with laughing gulls. In addition, WS also provided direct operational assistance with managing damage associated with laughing gulls in the State. A total of 1,329 laughing gulls were lethally taken in the State by all entities under depredation permits issued by the USFWS from 2005 through 2010 (see Table 4.5). From FY 2005 through FY 2011, WS has lethally taken 349 laughing gulls in the State to alleviate damage or threats of damage. In addition, WS employed non-lethal methods to disperse 4,708 laughing gulls from FY 2005 through FY 2011 to alleviate damage or threats of damage in the State.

Table 4.5 – Number of laughing gulls addressed in Mississippi from 2005 to 2011

Year	WS' Dispersed[1]		Authorized Take[2,3]	Take by Entity		Total Take
				WS[1]	Other[3]	
2005	4,253		**1,000**	214	317	**531**
2006	0		**1,000**	0	90	**90**
2007	365		**1,000**	15	214	**229**
2008	0		**1,000**	0	158	**158**
2009	0		**1,000**	120	201	**321**
2010	90		**1,000**	0	0	**0**
2011	0		**N/A†**	0	N/A	**≥0**
TOTAL	**4,708**		**6,000**	**349**	**980**	**1,329**

[1]Data reported by federal fiscal year

[2]The number of birds permitted to be taken by the USFWS under all depredation permits issued for the species, including authorized take by WS

[3]Data provided by calendar year

†Information is currently unavailable

As populations of laughing gulls increase and in anticipation of addressing gulls at an increasing number of airports in the State, up to 1,000 laughing gulls could be taken annually in the State by WS to alleviate damage and threats. The take of laughing gulls by WS would only occur after the issuance of a depredation permit by the USFWS. Take of up to 1,000 laughing gulls by WS annually in the State would represent 0.4% of the 230,000 adult laughing gulls estimated by Belant and Dolbeer (1993) to overwinter along the Gulf Coast states. Hunter et al. (2006) estimated the breeding population at 170,000 breeding pairs of laughing gulls or 340,000 adults in the southeastern United States. Take of up to 1,000 laughing gulls by WS annually would represent 0.3% of the estimated breeding population, if the population remains at least stable. The number of laughing gulls breeding in the southeastern coastal plain which includes most of Mississippi has been estimated at 46,116 breeding pairs. Take of up to 1,000 laughing gulls by WS annually would represent 1.1% of the estimated breeding population, if the population remains at least stable. If the population objective of 25,000 breeding pairs in the southeastern

coastal plain is achieved, take of up to 1,000 laughing gulls would represent 2.0% of the breeding population if the population remained at least stable. Based on increasing population trends for laughing gulls along the southeastern coastal plain and permitting of the take by the USFWS pursuant to the MBTA, WS' take of up to 1,000 laughing gulls annually would occur within allowable take levels to reach desired population objectives for laughing gulls. Take of laughing gulls would only occur as determined and analyzed by the USFWS to ensure the desired population objectives for laughing gulls are achieved.

Ring-billed Gull Biology and Population Impact Analysis

Ring-billed gulls are migratory birds which prefer to nest on islands with sparse vegetation. The breeding population of ring-billed gulls is divided into the western population and the eastern population. The eastern breeding population of the United States includes New York, Vermont, Ohio, Illinois, Michigan, Wisconsin, and Minnesota (Blokpoel and Tessier 1986). Ring-billed gulls nest in high densities with nesting colonies located on islands, parklands, slag yards, rooftops, breakwalls, and landfills (Blokpoel and Tessier 1986).

Ring-billed gulls are considered common migrants and winter residents across the State, with most observations occurring near the coast or on or near large bodies of water (Turcotte and Watts 1999). Although ring-billed gulls can be found in the State throughout the year, ring-billed gulls are most common from October through May, with peak numbers occurring from November through mid-April (Turcotte and Watts 1999). Inland, Turcotte and Watts (1999) considered ring-billed gulls to be uncommon to fairly common on inland waters during winter and regularly common to abundant during fall and winter along the coast.

In 1984, the population of ring-billed gulls in the Great Lakes region was estimated at approximately 648,000 pairs (Blokpoel and Tessier 1986). Blokpoel and Tessier (1992) found that the nesting population of ring-billed gulls in the Canadian portion of the lower Great Lakes system increased from 56,000 pairs to 283,000 pairs from 1976 to 1990. Across all BBS routes, the number of ring-billed gulls observed during the survey has shown an increasing trend in the United States estimated at 3.4% since 1966, which is a statistically significant increase (Sauer et al. 2011). Between 2000 and 2010, the number of gulls observed across all routes surveyed in the United States has shown an increasing trend estimated at 11.5% annually (Sauer et al. 2011). In the northeastern United States where breeding populations occur, the number of ring-billed gulls observed during the BBS has increased 4.3% annually since 1966 (Sauer et al. 2011). In the southeastern coastal plain, the number of ring-billed gulls observed during the BBS has shown a declining trend estimated at -0.2% annually since 1966. More recently, the number of ring-billed gulls documented along routes of the BBS has increased annually in the southeastern coastal plain estimated at 1.1% from 2000 through 2010 (Sauer et al. 2011). The numbers of ring-billed gulls observed in areas surveyed during the CBC are also showing a general increasing trend in the State (NAS 2010). During the CBC conducted in the State during 2009, a total of 15,660 ring-billed gulls were counted in 16 survey areas which equated to over 26 ring-billed gulls observed per party hour. During the 2010 survey, observers counted 12,465 ring-billed gulls in areas surveyed with more than 28 gulls observed per party hour (NAS 2010). The number of ring-billed gulls observed in areas surveyed during 2009 was the highest number of gulls observed in the State between 1966 and 2010 (NAS 2010). For comparison, a total of 14 ring-billed gulls were observed in the State on two counts during the survey conducted in 1966. This equated to 0.3 ring-billed gulls observed per party hour (NAS 2010).

Ring-billed gulls feed primarily on fish, insects, earthworms, rodents, and grains (Ryder 1993). Requests for direct operational assistance received by WS in the Mississippi associated with ring-billed gulls occurs primarily from gulls feeding on aquaculture stock and gulls causing damage at waste facilities. Large concentrations of gulls on aquaculture ponds can consume enough fish to pose economic concerns to

aquaculture producers in the State. Gulls at waste facilities carry trash and debris away from facilities and leave the refuse in residential neighborhoods. As shown in the Table 4.6, the USFWS issued depredation permits to entities in Mississippi to alleviate damage and threats which lead to the lethal take of 621 ring-billed gulls from 2005 through 2010. WS did not receive requests for assistance associated with ring-billed gulls from FY 2005 through FY 2009. In FY 2010, WS employed non-lethal harassment methods to disperse 30 ring-billed gulls associated with damage or threats of damage in the State.

Table 4.6 – Number of ring-billed gulls addressed in Mississippi from 2005 to 2011

Year	WS' Dispersed[1]		Authorized Take[2,3]	Take by Entity		Total Take
				WS[1]	Other[3]	
2005	0		**1,030**	0	46	46
2006	0		**1,030**	0	134	134
2007	0		**1,030**	0	115	115
2008	0		**1,030**	0	175	175
2009	0		**1,030**	0	137	137
2010	30		**1,030**	0	14	14
2011	0		**N/A**†	0	**N/A**	≥0
TOTAL	**30**		**6,180**	**0**	**621**	**621**

[1]Data reported by federal fiscal year

[2]The number of birds permitted to be taken by the USFWS under all depredation permits issued for the species, including authorized take by WS

[3]Data provided by calendar year

†Information is currently unavailable

Based on previous requests for assistance and in anticipation of receiving additional requests for assistance, up to 100 ring-billed gulls could be taken annually by WS in the State to address damage and threats of damage when a request for assistance is received. An estimate of the number of ring-billed gulls present in the State during the migration periods is currently unavailable. No breeding populations of ring-billed gulls are known to occur within the State. The only information currently available to evaluate the magnitude of WS' proposed take of up to 100 ring-billed gulls annually in the State is the number of ring-billed gulls observed in the State during the CBC. Over the last 10-years, an average of 7,916 ring-billed gulls has been observed annually in the State during the CBC (NAS 2010). If 100 ring-billed gulls were taken by WS, WS' take would represent 1.3% of the average number of ring-billed gulls observed in the State during the CBC from 2001 through 2010. Over the 10-year period, the number of gulls observed during the CBC in the State has ranged from a low of 2,257 gulls observed in 2002 to a high of 15,660 gulls observed in 2009 (NAS 2010). Therefore, if WS had taken 100 ring-billed gulls annually from 2001 through 2010 in the State, the annual take by WS would range from a low of 0.6% to a high of 4.4% of the number of gulls observed in the State during the CBC.

From 2005 through 2010, a total of 621 ring-billed gulls were lethally taken under depredation permits issued by the USFWS to alleviate damage and threats of damage in the State which is an average of 104 gulls taken annually. If WS had taken 100 gulls from FY 2005 through FY 2010, the average annual take by all entities would have increased to 204 gulls taken per year in the State. Therefore, the cumulative take of gulls in the State, if WS had taken 100 gulls per year, would represent 2.6% of the average number of gulls observed in the State during the CBC from 2001 through 2010.

Herring Gull Biology and Population Impact Analysis

Herring gulls are the most widely distributed gulls in the Northern Hemisphere. Herring gulls breed in colonies near oceans, lakes, or rivers (Bent 1921). Herring gulls nest along the Atlantic coast and will nest on natural or man-made sites, such as rooftops and breakwalls. Herring gulls are also increasingly

nesting on man-made structures, particularly on rooftops or in areas with complete perimeter fencing, such as electrical substations. The herring gull is considered a migrant in Mississippi and a common winter resident along the coast and inland on large bodies of water (Turcotte and Watts 1999). Non-breeding herring gulls can also be observed in the State during the summer months along the coast but are considered uncommon. The number of herring gulls present in the State begins to increase as individuals arrive in October during the fall migration and continues through May when the spring migration ends. The peak period for herring gull numbers in the State occurs from November through mid-April (Turcotte and Watts 1999).

The number of herring gulls observed in those areas surveyed in the State during the CBC from 1966 through 2010 indicates a generally decreasing trend (NAS 2010). Since no breeding colonies are known to occur in the State (Turcotte and Watts 1999), no data from the BBS is currently available for Mississippi (Sauer et al. 2011). The number of herring gulls observed on the BBS has shown a downward trend in the United States estimated at -3.6% annually since 1966, which is a statistically significant trend. BBS data currently indicates an increasing trend in the southeastern coastal plain estimated at 1.6% annually since 1966 and 2.6% between 2000 and 2010 (Sauer et al. 2011).

One herring gull has been lethally taken and one gull has been dispersed by WS in Mississippi from FY 2005 to FY 2011 to manage damage and threats to human safety (see Table 4.7). Based on the gregarious behavior of gulls, WS could lethally take up to 75 herring gulls annually to alleviate damage or threats of damage when requested by a cooperating entity. The increase in the estimated annual take level by WS in the State when compared to take by WS previously arises primarily from an anticipation of increased requests to address damage associated with herring gulls at waste facilities. Herring gulls have also been lethally taken by other entities in the State to alleviate damage as permitted by the USFWS through the issuance of depredation permits. The number of herring gulls authorized to be lethally taken in the State by the USFWS are shown in Table 4.7. The highest level of herring gull take occurred in 2007 when 26 gulls were taken in Mississippi. The USFWS has authorized the lethal take of 230 herring gulls annually in the State from 2005 through 2010.

Table 4.7 – Number of herring gulls addressed in Mississippi from 2005 to 2011

Year	WS' Dispersed[1]		Authorized Take[2,3]	Take by Entity		Total Take
				WS[1]	Other[3]	
2005	0		**230**	0	10	10
2006	0		**230**	1	4	5
2007	0		**230**	0	26	26
2008	0		**230**	0	3	3
2009	0		**230**	0	15	15
2010	1		**230**	0	0	0
2011	0		**N/A†**	0	N/A	≥0
TOTAL	**1**		**1,380**	**1**	**58**	**59**

[1]Data reported by federal fiscal year

[2]The number of birds permitted to be taken by the USFWS under all depredation permits issued for the species, including authorized take by WS

[3]Data provided by calendar year

†Information is currently unavailable

The number of herring gulls overwintering in the State each year is unknown. Although trend data from the CBC indicates an overall decreasing trend in the number of herring gulls observed in those areas surveyed in the State since 1966, the trending data has also been highly cyclical which is likely due to the limited geographical distribution of herring gulls in the State. Herring gulls are most commonly observed near the coastal areas of the State and near large bodies of water. The only known breeding colonies of

herring gulls in the southeastern United States occur in North Carolina which is considered the southern edge of the breeding range for herring gulls (Hunter et al. 2006). The waterbird management plan for the southeastern United States recommended reducing the number of herring gulls nesting in North Carolina from approximately 1,000 breeding pairs down to 750 breeding pairs due to concern associated with herring gulls predating the eggs and nestlings of more sensitive beach-nesting birds (Hunter et al. 2006)

The North American Waterbird Conservation Plan ranked the herring gull as a species of "*low concern*" in North America (Kushlan et al. 2002). The take of herring gulls by WS in Mississippi would only occur after a depredation permit has been issued by the USFWS and would occur only at levels permitted. Therefore, the USFWS would determine the appropriate cumulative take level for herring gulls and would adjust management practices, including adjusting take through depredation permits, to achieve population objectives.

Rock Pigeon Biology and Population Impact Analysis

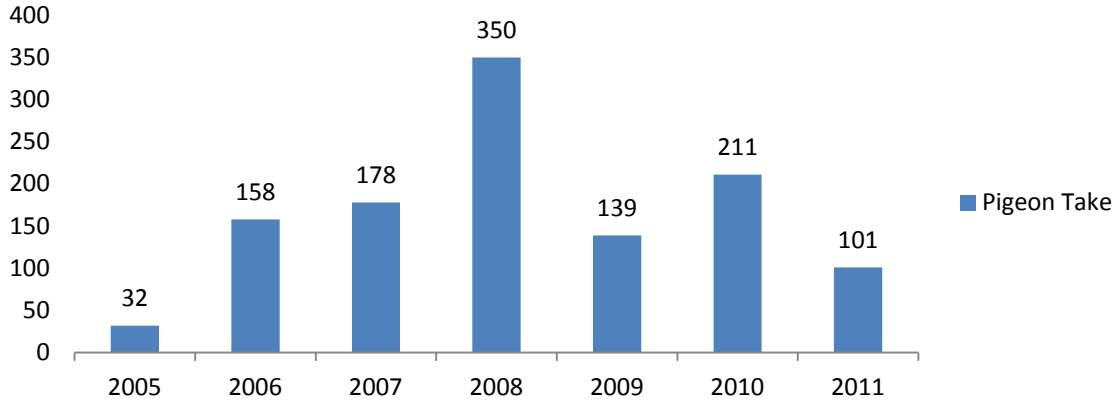
Rock pigeons are a non-native species that were first introduced into the United States by European settlers as a domestic bird to be used for sport, carrying messages, and as a source of food (USFWS 1981). Many of those birds escaped and eventually formed the feral pigeon populations that are now found throughout the United States, southern Canada, and Mexico (Williams and Corrigan 1994). However, because pigeons are an introduced rather than a native species, they are not protected by the MBTA or any State law.

Pigeons are closely associated with humans where human structures and activities provide them with food and sites for roosting, loafing, and nesting (Williams and Corrigan 1994). Thus, pigeons are commonly found around city buildings, bridges, parks, farm yards, 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). In Mississippi, pigeons can be found statewide throughout the year and are considered a common resident of the State (Turcotte and Watts 1999).

The number of pigeons observed along routes surveyed during the BBS in the State has shown a declining trend since 1966 estimated at -0.1% annually; however, from 2000 through 2010, the number of pigeons observed along routes surveyed indicated a declining trend estimated at -0.2% annually (Sauer et al. 2011). Since 1966, the number of pigeons observed along routes surveyed during the BBS across the southeastern coastal plain has shown a declining trend estimated at -1.6% annually with a -1.7% annual decline from 2000 through 2010, which are statistically significant trends (Sauer et al. 2011). Based on data from the BBS, Rich et al. (2004) estimated the statewide population at 130,000 pigeons. The number of pigeons observed in areas surveyed during the CBC had shown a general increasing trend from the early-1970s through the late-1990s but have shown declining trends since then (NAS 2010).

Since pigeons are a non-native species and thus are afforded no protection under the MBTA, the take of pigeons to alleviate damage or to reduce threats can occur without the need for a depredation permit from the USFWS. WS' take of pigeons from FY 2005 through FY 2011 to alleviate damage and threats of damage when requested is shown in Figure 4.1. WS has lethally taken a total of 1,169 pigeons between FY 2005 and FY 2011 in the State. The highest level of take by WS occurred in FY 2008 when 350 pigeons were lethally taken. Take of pigeons by WS from FY 2005 through FY 2011 occurred primarily through use of firearms and live traps. Pigeons live-captured are subsequently euthanized in accordance with WS Directive 2.505. In addition to the use of lethal methods, WS has employed non-lethal methods to harass 252 pigeons between FY 2005 and FY 2011.

Figure 4.1 - Pigeon Take by WS in Mississippi, FY 2005 -FY 2011



Take of pigeons by other entities in the State to alleviate damage or threats of damage is unknown since reporting of take to the USFWS or any other entity is not required. Since 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 Mississippi.

Based on the gregarious behavior of pigeons (*i.e.*, forming large flocks) and in anticipation of the number of requests received by WS to increase, WS could annually take up to 3,000 pigeons in the State to alleviate damage. Based on a population estimated at 130,000 pigeons, take of up to 3,000 pigeons by WS would represent 2.3% of the estimated statewide population. WS' proposed pigeon damage management activities would be conducted pursuant to Executive Order 13112. The Executive 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 associated damages, 2) monitor invasive species populations, 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 on invasive species.

Mourning Dove Biology and Population Impact Analysis

Mourning doves are migratory game birds with substantial populations throughout much of North America. Mourning doves are the most abundant dove species in North America and are expanding their range northward (Ehrlich et al. 1988). Doves can be found throughout the year in Mississippi (Turcotte and Watts 1999, Otis et al. 2008). According to trend data provided by Sauer et al. (2011) from 1966 through 2010, the number of mourning doves observed on routes surveyed has shown a decreasing trend in the State estimated at -0.4% annually. In 2010, the number of doves heard in Mississippi showed a declining trend when compared to the number of doves heard in 2009 (Sanders and Parker 2010). The number of doves heard during the annual dove survey has shown a decreasing trend in Mississippi from 1966 through 2010 estimated at -1.3% (Sanders and Parker 2010). The number of mourning doves observed during the CBC has shown a stable to slightly increasing trend in the State since 1966 (NAS 2010). Based on BBS data, Rich et al. (2004) estimated the statewide breeding population at 1.8 million mourning doves.

The number of doves addressed by WS and other entities is shown in Table 4.8. From FY 2005 through FY 2011, WS addressed 2,161 doves in the State to alleviate damage and threats. Of those doves addressed by WS in the State from FY 2005 through FY 2011, 588 were addressed using lethal methods while 1,573 doves were addressed using non-lethal methods. Most requests for assistance received by WS associated with doves occur from airports where the flocking behavior of doves poses a strike risk to

aircraft. No take by other entities occurred in the State from 2005 through 2010. Based on the number of requests to manage damage associated with doves received previously and based on the gregarious behavior of doves in the State during the migration periods, up to 3,000 mourning doves could be lethally taken by WS annually in the State to address damage or threats.

Due to the abundance of doves, many States have regulated annual hunting seasons for mourning doves. In Mississippi, doves can be harvested during established hunting seasons each year with generous bag limits. Season dates, season length, and bag limits are established under frameworks developed by the USFWS and implemented by the MDWFP in the State. In 2009, the preliminary mourning dove harvest in Mississippi was estimated at 361,500 doves compared with a preliminary estimate of 514,300 doves harvested in 2010 (Raftovich et al. 2011). Across the United States, the preliminary mourning dove harvest in 2010 was estimated at 17.2 million doves (Raftovich et al. 2011). The numbers of doves harvested in the State annually from 2005 through 2010 are listed in Table 4.9.

Table 4.8 – Number of mourning doves addressed in Mississippi from 2005 to 2011

Year	WS' Dispersed[1]		Authorized Take[2,3]	Take by Entity		Total Take
				WS[1]	Other[3]	
2005	45		**100**	7	0	7
2006	33		**100**	0	0	0
2007	800		**100**	108	0	108
2008	629		**100**	27	0	27
2009	0		**100**	301	0	301
2010	0		**100**	97	0	97
2011	66		**N/A**[†]	48	N/A	≥48
TOTAL	**1,573**		**600**	**588**	**0**	**588**

[1]Data reported by federal fiscal year

[2]The number of birds permitted to be taken by the USFWS under all depredation permits issued for the species, including authorized take by WS

[3]Data provided by calendar year

[†]Information is currently unavailable

As shown in Table 4.9, nearly 3 million mourning doves have been harvest in the State between 2005 and 2010. The highest harvest level in the State occurred in 2007 when 612,000 doves were harvested. If WS had taken 3,000 mourning doves in 2007, the take by WS would have represented 0.5% of the number of doves harvested in the State during the 2007 season. The lowest harvest of doves in the State occurred during the 2009 harvest season when 361,500 doves were harvested. If WS had lethally removed 3,000 mourning doves in 2009, the take would have represented 0.8% of the number of doves harvested in the State.

Table 4.9 – The number of mourning doves harvested in Mississippi from 2005 to 2010

Year	Harvest	Year	Harvest
2005	455,900	**2008**	452,400
2006	492,800	**2009**	361,500
2007	612,000	**2010**	514,300
		TOTAL	**2,888,900**

An annual take by WS of up to 3,000 mourning doves would represent 0.2% of the estimated statewide breeding population of 1.8 million doves based on a stable population trend. Local populations of mourning doves in the State are likely augmented by migrating birds during the migration periods and during the winter months. Like other native bird species, the take of mourning doves by WS to alleviate damage would only occur when permitted by the USFWS pursuant to the MBTA through the issuance of

depredation permits. Therefore, the take of mourning doves by WS would only occur when permitted and only at levels authorized by the USFWS which ensures WS' take and take by all entities, including hunter harvest, would be considered to achieve the desired population management levels of doves in Mississippi.

American Crow Biology and Population Impact Analysis

American crows have a wide range and are extremely abundant, being found across the United States (Verbeek and Caffrey 2002). Crows are found in both urban and rural environments and sometimes form large communal roosts in cities. In the United States, some crow roosts may reach a half-million birds (Verbeek and Caffrey 2002). American crows are found throughout the State and can be found throughout the year (Robbins and Blom 1996, Turcotte and Watts 1999).

Historically, crow populations have benefited from agricultural development because of grains available as a food supply. Crows typically roost in trees with the combination of food and tree availability being favored. In some areas where abundant food and roosting sites are available, large flocks of crows tend to concentrate. In the fall and winter, crows often form large roosting flocks in urban areas. Those large flocks disperse to different feeding areas during the day. Crows will fly from 6 to 12 miles from a roost to a feeding site each day (Johnson 1994). Large fall and winter crow roosts may cause serious problems in some areas particularly when located in towns or other sites near people. Such roosts are objectionable because of the odor of the bird droppings, health concerns, noise, and damage to trees in the roost.

As discussed previously, blackbirds, including crows, can be taken without a depredation permit issued by the USFWS when committing or about to commit damage or posing a threat to human safety under a blackbird depredation order (see 50 CFR 21.43). In addition, crows can be harvested in the State during a regulated season that allows an unlimited number of crows to be harvested. Since the take of crows can occur without a permit from the USFWS under the blackbird depredation order, there have been no reporting requirements for the take of crows to reduce damage or reduce threats. Therefore, the number of crows taken in the State under the depredation order to alleviate damage or reduce threats is currently unknown. Similarly, hunters harvesting crows during the regulated hunting season have not been required to report their take to the USFWS or the MDWFP.

The American crow breeding population in Mississippi has been estimated at 560,000 crows statewide based on BBS data (Rich et al. 2004). From 1966 through 2010, trend data from the BBS indicates the number of crows observed in the State during the survey has increased at an annual rate of 0.4% (Sauer et al. 2011). However, from 2000 through 2010, the number of crows observed along routes surveyed during the BBS has shown a declining trend estimated at -0.6% annually (Sauer et al. 2011). The number of crows observed in Mississippi in areas surveyed during the CBC has shown a general increasing trend since 1966 (NAS 2010).

From FY 2005 through FY 2011, WS has employed lethal methods to take 158 American crows in Mississippi and employed non-lethal methods to disperse 5,481 crows. Based on the requests for assistance received previously and the relative abundance of crows in the State, WS anticipates that up to 500 American crows could be lethally taken annually in the State to resolve requests for assistance. With a statewide breeding population estimated at 560,000 crows, an annual take by WS of 500 crows would represent 0.1% of the estimated population if the population remains stable.

As was stated previously, the take of crows by other entities either to alleviate damage or threats of damage or during the annual hunting seasons is unknown. Given the relative abundance of American crows in the State and the long-term stable to increasing population trends observed for the species, the take of crows by other entities to alleviate damage or threats of damage and the take of crows during the

annual hunting season is likely of low magnitude. The use of population trends as an index of magnitude is based on the assumption that annual harvests do not exceed allowable harvest levels. State wildlife management agencies act to avoid over-harvests by restricting take (either through hunting season regulation and/or permitted take) to ensure that annual harvests are within allowable harvest levels.

If crow populations remain stable in the State, WS' annual take of up to 500 American crows would represent 0.1% of the estimated statewide crow population. The take of crows under the depredation order by other entities is likely to be a small contributor to the cumulative take of crows annually. Although some take is likely to occur, take is not expected to reach a high magnitude. Similarly, the take of crows during the annual hunting season is likely of low magnitude when compared to the statewide population. Given that the number of American crows observed during statewide surveys are showing increasing trends (NAS 2010, Sauer et al. 2011), the population of crows have not declined since those population estimates were calculated and have likely remained at least stable despite the take of crows by WS and other entities under the depredation order and during the annual hunting season.

American Robin Biology and Population Impact Analysis

The conspicuous nature of the American robin and the close association of robins with human habitation, make the robin one of the most recognizable birds in the United States (Sallabanks and James 1999). Robins are often the harbinger of spring in many parts of the northern latitudes of North America as large flocks of robins begin arriving (Sallabanks and James 1999). Robins feed primarily on invertebrates and fruits throughout the year depending on food availability.

Robins can be found throughout the year in Mississippi with populations increasing as northern birds migrate to wintering grounds in the southern United States, including Mississippi. As the spring migration nears, robins often form large conspecific flocks that can be observed roosting and feeding together (Sallabanks and James 1999). Large flocks of robins during the spring migration period can pose a strike hazard to aircraft at airports.

The current population of robins in Mississippi is unknown but likely fluctuates throughout the year depending on the season and the status of migration. Rich et al. (2004) estimated the breeding population of robins in Mississippi at 700,000 robins based on BBS data. Robins overwintering in Mississippi have shown cyclical patterns but have remained relatively stable since 1966 (NAS 2010). BBS data shows a declining breeding population in Mississippi estimated at -1.2% annually since 1966, which is a statistically significant trend (Sauer et al. 2011). Since 2000, the breeding population of robins in Mississippi has shown a declining trend estimated at -1.5% annually (Sauer et al. 2011). Between 2001 and 2010, the average number of robins observed per year in areas surveyed during the CBC has been estimated at 10,568 robins (NAS 2010). The highest number of robins counted during the CBC between 2001 and 2010 occurred in 2004 when 37,620 robins were observed. The lowest number observed during the CBC conducted from 2001 through 2010 occurred during the 2009 survey when 5,102 robins were counted (NAS 2010).

The number of American robins addressed in Mississippi to alleviate damage or threats by WS is shown in Table 4.10. As shown in Table 4.10, WS has addressed over 25,000 robins in the State to alleviate damage or threats of damage between FY 2005 and FY 2011, primarily at airports where large flocks of robins pose a strike risk to aircraft. Of those robins addressed by WS, over 96% were addressed using non-lethal methods of harassment. Take of robins by other entities in the State to alleviate damage did not occur from 2005 through 2010.

Table 4.10 – Number of American robins addressed in Mississippi from FY 2005 to FY 2011

Year	Dispersed	Take
2005	30	5
2006	2,465	0
2007	18,345	778
2008	178	2
2009	0	0
2010	1,620	74
2011	2,209	83
TOTAL	**24,847**	**942**

Based on requests for assistance previously received by WS and to address increasing requests for assistance, the annual take of up to 200 robins could occur by WS to alleviate damage or reduce threats in the State. Using the breeding population estimate of 700,000 robins, WS' take of up to 200 robins would represent 0.03% of the estimated population in Mississippi. Although the take of robins by other entities has not occurred in the State since 2005, to address the potential impacts of cumulative take, the analyses would estimate that 200 robins are also taken by other entities in the State on an annual basis. If 200 robins were taken annually in the State by other entities in addition to the 200 robins taken by WS annually, the combined take would represent 0.06% of the estimated statewide population of robins if the population of robins remains stable.

All take of robins by WS 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 robins in the State would occur at the discretion of the USFWS to meet desired population objectives for robins. Any take by WS and other entities pursuant to depredation permits would occur within take limits to ensure the take of robins occurs within the allowable limits.

European Starling Biology and Population Impact Analysis

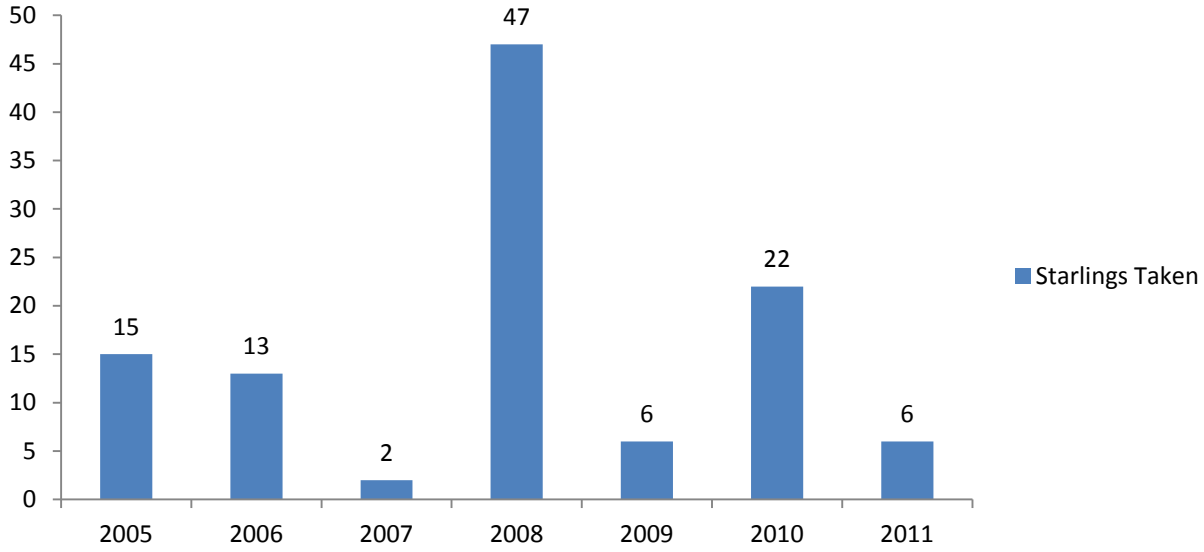
Colonization of North America by the European starling began on March 6, 1890 when a member of the Acclimatization Society, released 80 starlings into Central Park in New York. The released birds were able to exploit the habitat resources in the area and become established. By 1918, the distribution range of migrant juveniles extended from Ohio to Alabama; by 1926, the distribution of starlings in the United States had moved westward and encompassed an area from Illinois to Texas; by 1941, further westward expansion had occurred and starlings were known to occur and breed from Idaho to New Mexico; and by 1946, the range of starlings had expanded to California and the Canadian coasts (Miller 1975). In just 50 years, starlings colonized the United States and expanded into Canada and Mexico and 80 years after the initial introduction became one of the most common birds in North America (Feare 1984). The first record of European starlings in Mississippi occurred on January 26, 1926 at the Vicksburg National Military Park (Turcotte and Watts 1999). Today, starlings can be found throughout the State and are considered permanent residents (Turcotte and Watts 1999). However, some migration movements do occur within the State with large flocks often forming during winter (Turcotte and Watts 1999).

From 1966 through 2010, the number of starlings observed along routes surveyed during the BBS showed a declining trend in the State estimated at -3.3% annually, with a -4.0% annual decline occurring from 2000 through 2010, which are statistically significant trends (Sauer et al. 2011). Across all routes surveyed in the United States during the BBS, the number of starlings observed indicated a declining trend estimated at a rate of -0.9% annually from 1966 through 2010 (Sauer et al. 2011). The number of starlings observed in those areas surveyed during the CBC has shown a cyclical pattern from 1966

through 2010 with a general overall declining trend (NAS 2010). Using data from the BBS, Rich et al. (2004) estimated the statewide breeding population of starlings at 500,000 birds.

Starlings are not native to Mississippi and thus, afforded no protection under the MBTA or any State law. Therefore, a depredation permit from the USFWS or State is not required to lethally take starlings to alleviate damage or threats of damage. Since take of starlings to alleviate damage or threats of damage is not reported to the USFWS or the MDWFP, lethal take of starlings in the State to alleviate damage or threats of damage by entities other than WS is unknown. At the request of those entities seeking assistance with managing damage and threats of damage associated with starlings, WS has lethally taken 111 starlings in the State from FY 2005 through FY 2011 (see Figure 4.2).

Figure 4.2 - WS' Take of European Starlings in Mississippi, FY 2005 - FY 2011



Based on the flocking behavior of starlings and potential for damage or threats of damage to arise from that behavior, WS anticipates that up to 10,000 starlings could be lethally taken annually in the State to alleviate damage or threats of damage. In anticipation of receiving requests for assistance to manage damage and threats associated with a large starling roost, take of up to 10,000 starlings could occur despite the limited take that has occurred previously. Take of 10,000 starlings would represent 2.0% of the estimated 500,000 starlings breeding in the State. However, most requests to address large roosts occur during migration periods and during the winter when the population in the State likely increases above the 500,000 starlings estimated to nest in the State. The increase in the statewide population is a result of migrants arriving in the State and the presence of juveniles in the population.

Executive Order 13112 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, 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 on invasive species. WS' take of European starlings to reduce damage and threats would be in compliance with Executive Order 13112.

Red-winged Blackbird Biology and Population Impact Analysis

The red-winged blackbird is one of the most abundant bird species in North America and is a commonly recognized bird that can be found 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). Primarily associated with emergent vegetation in freshwater wetlands and upland habitats during the breeding season, red-winged blackbirds also nest in marsh vegetation in roadside ditches, saltwater marshes, rice paddies, hay fields, pasture land, fallow fields, suburban habitats, and urban parks (Yasukawa and Searcy 1995). Northern breeding populations of red-winged blackbirds migrate southward during the migration periods but red-winged blackbirds are common year-round residents in States along the Gulf Coast and parts of the western United States (Yasukawa and Searcy 1995). During the migration periods, red-winged blackbirds often form mixed species flocks with other blackbird species.

In Mississippi, red-winged blackbirds are considered year-round residents of the State (Yasukawa and Searcy 1995) with a breeding population estimated at 2.6 million birds (Rich et al. 2004). Trend data from the BBS indicates the number of red-winged blackbirds observed in the State during the breeding season has shown a declining trend since 1966 estimated at -2.1% annually, which is a statistically significant downward trend (Sauer et al. 2011). More recent trend data from 2000 through 2010 also indicates a downward trend estimated at -2.1% annually (Sauer et al. 2011). Across all survey routes in the southeastern coastal plain, the number of red-winged blackbirds observed has shown downward trends since 1966 estimated at -3.1% annually, which is also a statistically significant trend (Sauer et al. 2011).

The number of red-winged blackbirds observed during the CBC in the State has shown a highly cyclical pattern since 1966 (NAS 2010). Between 2001 and 2010, the average number of red-winged blackbirds observed in areas surveyed during the CBC has totaled 314,037 red-winged blackbirds. The highest number of red-winged blackbirds recorded during the CBC conducted in Mississippi between 2001 and 2010 occurred in 2004 when nearly 2.1 million red-winged blackbirds were observed (NAS 2010). The lowest number of red-winged blackbirds observed in the State during the CBC conducted between 2001 and 2010 occurred in 2002 when 23,105 red-winged blackbirds were recorded (NAS 2010) which provides an indication of the cyclical pattern of the number of blackbirds present in the State during the winter period.

As mentioned 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. Data from the CBC 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.

Between FY 2005 and FY 2011, the WS program in Mississippi dispersed 70,631 red-winged blackbirds from areas where damage or threats of damage were occurring. In addition, WS also dispersed 90,750 blackbirds in mixed species flocks to alleviate damage or threats of damage in the State. As was mentioned previously, red-winged blackbirds often form mixed species flocks with other blackbird species and determining the number of birds of each species present in mixed species flocks can be difficult. Therefore, of the 90,750 blackbirds dispersed in mixed species flocks of blackbirds by WS, the number of red-winged blackbirds present in those flocks is unknown. The highest number of blackbirds addressed occurred in FY 2006 when 60,000 blackbirds in mixed species flocks were addressed by WS. WS also dispersed 54,500 red-winged blackbirds in the State during FY 2006.

WS has also addressed damage or threats of damage associated with red-winged blackbirds using lethal methods between FY 2005 and FY 2011. A total of 269 red-winged blackbirds have been lethally taken by WS from FY 2005 through FY 2011 to alleviate damage or threats of damage. The highest take level by WS occurred in FY 2011 when WS employed firearms to remove 112 red-winged blackbirds as requested to alleviate damage or threats of damage. Since the take of blackbird species, including red-winged blackbirds, can occur without the need for a depredation permit when committing or about to

commit damage, the number of red-winged blackbirds lethally taken by other entities in the State is currently unknown since reporting of take to the USFWS was not required previously.

Based on the number of blackbirds addressed by WS previously using non-lethal methods and the number of red-winged blackbirds present in the State during the breeding and migration season, WS could be requested to lethally take up to 5,000 red-winged blackbirds annually in the State to alleviate damage or threats of damage. With a breeding population estimated at nearly 2.6 million red-winged blackbirds, take of up to 5,000 red-winged blackbirds by WS annually would represent 0.2% of the estimated breeding population in the State. Using data from the CBC gathered in the State from 2001 through 2010, take of up to 5,000 red-winged blackbirds by WS would have represented 1.6% of the average number of red-winged blackbirds observed in the State of 314,037 red-winged blackbirds. Take of up to 5,000 red-winged blackbirds by WS would represent a low of 0.2% to a high of 21.6% of the number of red-winged blackbirds observed in the State during the CBC. The take of red-winged blackbirds by other entities is expected to be of low magnitude when compared to the statewide estimated population for Mississippi.

Eastern Meadowlark Biology and Population Impact Analysis

The eastern meadowlark epitomizes the open habitats of the eastern United States, where the conspicuous nature and call of the meadowlark is easily recognizable (Lanyon 1995). Eastern meadowlarks can be found throughout the eastern United States in suitable habitat where it can be found year-round in many parts of their range which can be highly dependent on weather. In Mississippi, eastern meadowlarks can be found year-round in the open, grassy areas of the State where they feed primarily on invertebrates and some plant material, such as weed seeds, grains, and some fruits (Lanyon 1995).

The open areas found at airports makes those areas ideal for meadowlarks to forage and nest while providing able perching areas. Most requests for assistance to reduce threats associated with meadowlarks occur at airports in Mississippi. Meadowlarks found on and adjacent to airport property can pose a hazard to aircraft from being struck which can cause damage to the aircraft and potentially threatening passenger safety.

Data from the CBC indicates the numbers of meadowlarks observed in Mississippi during the survey have been showing a declining trend since 1966 (NAS 2010). BBS data also shows a declining trend for meadowlarks observed during the survey in Mississippi. Since 1966, meadowlarks are showing a declining trend estimated at -4.0% annually in Mississippi according to BBS route data, which is statistically significant (Sauer et al. 2011). Across all routes surveyed during the BBS conducted in the United States, the number of meadowlarks has shown a declining trend estimated at -3.2% annually since 1966 with a -2.5% downward trend observed from 2000 through 2010 (Sauer et al. 2011). Based on BBS data, the statewide breeding population of meadowlarks was estimated at 300,000 meadowlarks (Rich et al. 2004).

The numbers of eastern meadowlarks addressed by WS annually from FY 2005 through FY 2011 to alleviate damage or threats are shown in Table 4.11. The take of meadowlarks by other entities in the State did not occur from 2005 through 2010. Data for 2011 is currently unavailable. From FY 2005 through FY 2011, WS employed lethal methods to take 549 meadowlarks in the State to alleviate damage or threats of damage. In addition, WS employed non-lethal methods to disperse 808 meadowlarks from FY 2005 through FY 2011.

On average, 78 meadowlarks were lethally addressed by WS from FY 2005 through FY 2011 while on average, 135 meadowlarks were addressed annually by WS using non-lethal methods during the same time frame. WS' highest take of meadowlarks occurred in FY 2010 when 160 meadowlarks were lethally

taken. In addition, the highest number of meadowlarks addressed by WS using non-lethal methods also occurred in FY 2010 when 358 meadowlarks were addressed.

Table 4.11 – Number of eastern meadowlarks addressed in Mississippi from FY 2005 to FY 2011

Year	Dispersed	Take
2005	50	61
2006	70	11
2007	32	24
2008	179	13
2009	119	150
2010	358	160
2011	0	130
TOTAL	**808**	**549**

Based on the number of meadowlarks addressed by WS previously and based on anticipation for the need to address an increasing number of requests for assistance, up to 200 meadowlarks could be taken annually by WS in the State. Using the best available population estimate for meadowlarks in the State, WS' take of up to 200 meadowlarks would represent 0.1% of the 300,000 meadowlarks present in the State during the breeding season. As discussed previously, no take of meadowlarks occurred by other entities in the State from 2005 through 2010. Although take could occur by other entities when authorized by the USFWS through the issuance of a depredation permit, the take of meadowlarks would not likely reach a magnitude where adverse effects to meadowlarks populations would occur from take to alleviate damage or threats. The permitting of the take by the USFWS through the issuance of depredation permits pursuant to the MBTA ensures cumulative take of meadowlarks would be considered as part of population management objectives for meadowlarks.

Common Grackle Biology and Population Impact Analysis

Another blackbird species commonly found in mixed species flocks in Mississippi is the common grackle. Common grackles are a semi-colonial nesting species often associated with human activities. Characterized by yellow eyes and iridescent bronze or purple plumage, common grackles are a common conspicuous bird species found in urban and residential environments (Peer and Bollinger 1997). The breeding range of the common grackle includes Canada and the United States east of the Rocky Mountains with grackles found throughout the year in the United States except for the far northern and western portion of the species range in the United States (Peer and Bollinger 1997). Common grackles have likely benefited from human activities, such as the clearing of forests in the eastern United States which provides suitable nesting habitat and the planting of trees in residential areas which has led to an expansion of the species range into the western United States (Peer and Bollinger 1997). The grackle has an extremely varied diet, which includes insects, crayfish, frogs, other small aquatic life, mice, nestling birds, eggs, sprouting and ripened grains, seeds, and fruits (Bull and Farrand 1977, Peterson 1980).

Common grackles can be found throughout the year in Mississippi (Peer and Bollinger 1997) with an estimated breeding population calculated at 1.3 million grackles (Rich et al. 2004). The number of common grackles observed in the State along routes surveyed during the BBS has shown a declining trend since 1966 which has been estimated at -4.8% annually, which is a statistically significant trend (Sauer et al. 2011). A downward trend has also been observed for grackles observed along BBS routes across the southeastern coastal plain which has been estimated at -2.8% annually since 1966, which is also a statistically significant trend (Sauer et al. 2011). Across the United States, the number of common grackles observed during the annual BBS has also shown a statistically significant downward trend estimated at -1.6% since 1966 (Sauer et al. 2011).

The number of grackles observed in the State during the annual CBC surveys has shown an overall declining trend since 1966 (NAS 2010). During surveys conducted from 2001 through 2010, the average number of grackles observed during the CBC conducted in the State has been 41,214 grackles. The lowest number of grackles observed during the CBC from 2001 through 2010 occurred in 2006 when 18,540 grackles were recorded. The highest number of grackles recorded in the State during the CBC between 2001 through 2010 occurred in 2004 when 81,811 grackles were observed (NAS 2010).

WS has been requested to provide assistance with managing damage or threats of damage associated with common grackles previously; however, requests to provide assistance specifically associated with common grackles occur infrequently. Most requests involving common grackles are associated with mixed species flocks of blackbirds where grackles are present. Since common grackles could be present in mixed species flocks of blackbirds, WS could be requested to employ lethal methods to take up to 200 common grackles annually. As was addressed previously, WS has dispersed 90,750 blackbirds in mixed species flocks to address damage or threats of damage in the State between FY 2005 and FY 2011. The number of common grackles present in those flocks is unknown. Like other blackbird species, the take of common grackles can occur under the blackbird depredation order which allows blackbirds, including common grackles, to be taken when committing damage or about to commit damage without the need for a depredation permit from the USFWS. Therefore, the number of common grackles taken annually by other entities in the State is unknown.

If up to 200 common grackles are taken annually by WS, the take would represent 0.02% of the estimated 1.3 million common grackles breeding within the State. Using the data from the CBC, take of up to 200 common grackles by WS would represent 0.5% of the average number of grackles observed in areas surveyed from 2001 through 2010. Using the range of grackles observed during the CBC from 2001 through 2010, take of up to 200 grackles by WS would range from 0.2% to 1.1% of the number of grackles observed in the State. The take of common grackles by other entities is expected to be of low magnitude when compared to the statewide estimated breeding population for Mississippi.

Brown-headed Cowbird Biology and Population Impact Analysis

Brown-headed cowbirds are another species of the blackbird family commonly found in mixed species flocks during migration periods. Cowbirds are a common summer resident across the United States and southern Canada (Lowther 1993). Breeding populations in the northern range of the cowbird are migratory with cowbirds present year-round in much of the eastern United States and along the west Coast (Lowther 1993). Likely restricted to the range of the bison (*Bison bison*) before the presence of European settlers, cowbirds were likely a common occurrence on the short-grass plains where they fed on insects disturbed by foraging bison (Lowther 1993). Cowbirds expanded their breeding range as people began clearing forests for agricultural practices (Lowther 1993). Cowbirds are still commonly found in open grassland habitats but also inhabit urban and residential areas. Somewhat unique in their breeding habits, cowbirds are known as brood parasites meaning they lay their eggs in the nests of other bird species (Lowther 1993). Female cowbirds can lay up to 40 eggs per season with eggs reportedly being laid in the nests of over 220 species of birds, of which, 144 species have actually raised cowbird young (Lowther 1993). No parental care is provided by cowbirds with the raising of cowbird young occurring by the host species. The preferred foods of brown-headed cowbird include insects, small fruits, wild seeds, grain, and small aquatic life (Peterson 1980).

In Mississippi, the number of cowbirds observed in areas surveyed during the BBS has shown a stable to slightly increasing trend estimated at 0.3% annually between 1966 and 2010 (Sauer et al. 2011). From 2000 through 2010, the number of cowbirds observed in the State has shown an increasing trend estimated at 1.8% annually (Sauer et al. 2011). In the southeastern coastal plain, cowbirds have shown an

increasing trend since 1966 estimated at 0.8%, annually which is a statistically significant trend (Sauer et al. 2011). Across all BBS routes surveyed in the United States since 1966, the number of cowbirds observed has shown a declining trend estimated at -0.4%, which is a statistically significant downward trend (Sauer et al. 2011). Similar to other blackbird species, the number of cowbirds observed during the CBC conducted annually in the State has shown a cyclical pattern (NAS 2010). Observers on the CBC have recorded on average a total of 6,825 cowbirds each year from 2001 through 2010 (NAS 2010). During 2002, a total of 2,605 cowbirds were observed during the CBC conducted in the State which was the lowest number observed from 2001 through 2010 (NAS 2010). The highest number of cowbirds observed during the CBC conducted from 2001 through 2010 has been 19,551 cowbirds which were recorded during the CBC in 2008 (NAS 2010). Rich et al. (2004) estimated the statewide breeding population of cowbirds at 510,000 cowbirds based on data from the BBS.

WS has previously received requests for assistance directly associated with brown-headed cowbirds in the State. Between FY 2005 and FY 2011, WS has employed non-lethal methods to disperse 772 cowbirds in the State to alleviate damage or threats of damage. In addition, WS has employed lethal methods to lethally remove 38 cowbirds in the State from FY 2005 through FY 2011. As was discussed previously, WS has dispersed blackbirds using non-lethal methods in mixed species flocks. The number of cowbirds present in those mixed flocks of blackbirds addressed by WS is currently unknown. However, since cowbirds could be present in mixed species flocks of blackbirds, WS could lethally take up to 200 cowbirds annually in the State to alleviate damage or threats of damage. Like other blackbird species, the take of cowbirds can occur pursuant to the blackbird depredation order without the need for a depredation permit from the USFWS; therefore, the number of cowbirds taken annually by other entities to alleviate damage or threats of damage in the State is currently unknown. However, the take of cowbirds by other entities to alleviate damage or threats is likely non-existent to minimal in the State. The take of brown-headed cowbirds by other entities is expected to be of low magnitude when compared to the statewide estimated population and the trend information available for Mississippi.

Based on a statewide breeding population estimated at 510,000 cowbirds, take of up to 200 cowbirds by WS to alleviate damage or threats of damage would represent 0.04% of the estimated population. Take of up to 200 cowbirds by WS would represent 2.9% of the average number of cowbirds observed annually during the CBC conducted from 2001 through 2010. The take of cowbirds by other entities to alleviate damage or threats of damage under the blackbird depredation order is not likely to reach a level where cumulative adverse effects to the species' population would occur. Although cowbirds can cause damage or pose threats of damage, most take of cowbirds by WS would be the result of addressing flocks of mixed species flocks of blackbirds. That take is not likely to reach a level where adverse effects on the species' population would occur and would be of low magnitude when compared to the statewide population of cowbirds and trend data.

House Sparrow Biology and Population Impact Analysis

House sparrows were introduced to North America from England in 1850 and have spread throughout the continent (Fitzwater 1994). 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 and in cities and suburbs (Robbins et al. 1983). House sparrows are not considered migratory in North America and are considered year-round residents wherever they occur, including those sparrows found in Mississippi (Lowther and Cink 2006). Nesting locations often occur in areas of human activities and are considered "*...fairly gregarious at all times of year*" with nesting occurring in small colonies or clumped distribution (Lowther and Cink 2006). Large flocks of sparrows can also be found in the winter as birds forage and roost together.

According to BBS trend data provided by Sauer et al. (2011), between 1966 and 2010 the number of house sparrows observed along routes surveyed across the United States have shown a statistically significant downward trend estimated at -3.7% annually. In Mississippi, the number of house sparrows observed in areas surveyed during the BBS has also shown a downward trend between 1966 and 2010 estimated at -4.8% annually, which is also statistically significant (Sauer et al. 2011). More recently, the number of house sparrows observed between 2000 and 2010 has also shown a declining trend estimated at -5.6% annually (Sauer et al. 2011). Rich et al. (2004) estimated the breeding population of house sparrows in the State to be 500,000 birds. Since 1966, the number of house sparrows observed in areas surveyed during the CBC annually has shown an overall declining trend but has shown a more stable trend since the early 1980s (NAS 2010).

Robbins (1973) suggested that declines in the sparrow population must be largely attributed to changes in farming practices which resulted in cleaner operations. One aspect of changing farming practices which might have been a factor would be the considerable decline in small farms and associated disappearance of a multitude of small feed lots, stables and barns, a primary source of food for these birds in the early part of the 20th century. Ehrlich et al. (1988) suggested that house sparrow population declines might be linked to the dramatic decrease during the 20th century in the presence of horses as transport animals. Grain rich horse droppings were apparently a major food source for this species.

House sparrows are non-indigenous and often have negative impacts on native birds, primarily through competition for nesting sites. Therefore, sparrows are considered by many wildlife biologists and ornithologists to be an undesirable component of North American wild and native ecosystems. Any reduction in house sparrow populations in North America, even to the extent of complete eradication, could be considered as providing some benefit to native bird species. House sparrows are afforded no protection from take under the MBTA or State laws.

Between FY 2005 and FY 2011, WS has employed non-lethal methods to disperse 79 sparrows and lethal methods to take 101 house sparrows in the State to alleviate damage or threats of damage. Since house sparrows are afforded no protection from take under the MBTA, no depredation permits are issued for the take of house sparrows and this 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 could take up to 1,000 house sparrows in the State annually to alleviate damage or threats of damage.

If up to 1,000 sparrows were lethally removed by WS annually in the State, the take would represent 0.2% of the statewide breeding population if the population remains at least stable. As stated previously, the annual take of house sparrows by other entities is currently not known. Although the breeding population of house sparrows appears to be showing a declining trend, the winter population appears to be showing a relatively stable trend since the early 1980s. Since house sparrows 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 Mississippi. WS' take of house sparrows to reduce damage and threats would be in compliance with Executive Order 13112.

Additional Target Bird Species

Target species, in addition to the bird species analyzed previously, have been lethally taken in small numbers by WS and have included no more than 20 individuals and/or 10 nests of the following species: eared grebes, American white pelicans, great blue herons, snowy egrets, little blue herons, cattle egrets, green herons, snow geese, wood ducks, gadwalls, mallards, blue-winged teal, ospreys, northern harriers, sharp-shinned hawks, Cooper's hawks, red-shouldered hawks, red-tailed hawks, American kestrels, wild turkeys, American coots, lesser yellowlegs, least sandpipers, spotted sandpipers, upland sandpipers,

common snipe, Eurasian collared-doves, barred owls, chimney swifts, Eastern kingbirds, horned larks, purple martins, tree swallows, Northern rough-winged swallows, bank swallows, cliff swallows, barn swallows, Eastern bluebirds, cedar waxwings, field sparrows, savannah sparrows, Brewer's blackbirds, and house finches.

Based on previous requests for assistance and the take levels necessary to alleviate those requests for assistance, no more than 20 individuals of any of those species could be taken annually by WS in the State. In addition, up to 10 nests of those species could be destroyed annually by WS in the State to alleviate damage or discourage nesting in areas where damages are occurring. None of those bird species are expected to be taken by WS at any level that would adversely affect populations of those species. Most of those birds listed are afforded protection from take under the MBTA and the take is only allowed through the issuance of a depredation permit and only at those levels stipulated in the permit, except for the Eurasian collared-dove and wild turkeys. Therefore, those birds listed under the MBTA would be taken in accordance with applicable state and federal laws and regulations authorizing take of migratory birds and their nests and eggs, including the USFWS permitting processes. The USFWS, as the agency with management responsibility for migratory birds, could impose restrictions on depredation take as needed to assure cumulative take does not adversely affect the continued viability of populations. This would assure that cumulative impacts on those bird populations would have no significant adverse impact on the quality of the human environment. In addition, any take of the above species in accordance with an issued federal and state permit would be reported to the USFWS annually. Eurasian collared-doves are considered a non-native species in the United States and the take of Eurasian collared-doves can occur without the need for a depredation permit from the USFWS. Wild turkeys are a species managed by the MDWFP and any take would occur pursuant to permits issued, when necessary.

Snow geese, wood ducks, gadwall, mallards, blue-winged teal, American coots, and wild turkeys maintain sufficient population densities to allow for annual harvest seasons. Eurasian collared-doves could also be harvested during the annual mourning dove hunting season in the State. The proposed take of up to 20 individuals of those species, including up to 10 nests, under the proposed action would be a minor component of the annual take of those species during the regulated hunting seasons.

Wildlife Disease Surveillance and Monitoring

The ability to efficiently conduct surveillance for and detect diseases is dependent upon rapid detection of the pathogen if it is introduced. Effective implementation of a surveillance system would facilitate planning and execution at regional and state levels, and coordination of surveillance data for risk assessment. It would also facilitate partnerships between public and private interests, including efforts by federal, state, and local governments as well as non-governmental organizations, universities, and other interest groups.[12] Current information on disease distribution and knowledge of the mixing of birds in migratory flyways has been used to develop a prioritized sampling approach based on the major North American flyways. Surveillance data from all of those areas would be incorporated into national risk assessments, preparedness and response planning to reduce the adverse impacts of a disease outbreak in wild birds, poultry, or humans.

To provide the most useful information and a uniform structure for surveillance, five strategies for collecting samples in birds have been proposed. Those strategies include:

Investigation of Illness/Death in Birds: A systematic investigation of illness and death in wild birds may be conducted to determine the cause of the illness or the cause of death in birds. This strategy offers the best and earliest probability of detection if a disease is introduced by migratory birds into the United

[12]Data collected by organizations/agencies conducting research and monitoring will provide a broad species and geographic surveillance effort.

States. Illness and death involving wildlife are often detected by, or reported to natural resource agencies and entities. This strategy capitalizes on existing situations of birds without additional birds being handled or killed.

Surveillance in Live Wild Birds: This strategy involves sampling live-captured, apparently healthy birds to detect the presence of a disease. Bird species that represent the highest risk of being exposed to, or infected with, the disease because of their migratory movement patterns, or birds that may be in contact with species from areas with reported outbreaks would be targeted. Where possible, this sampling effort would be coordinated with local projects that already plan on capturing and handling the desired bird species. Coordinating sampling with ongoing projects currently being conducted by state and federal agencies, universities, and others maximizes use of resources and minimizes the need for additional bird capture and handling.

Surveillance in Hunter-harvested Birds: Check stations for waterfowl hunting or other harvestable bird species provide an opportunity to sample dead birds to determine the presence of a disease, and supplement data collected during surveillance of live wild birds. Sampling of hunter-killed birds would focus on hunted species that are most likely to be exposed to a disease; have relatively direct migratory pathways from those areas to the United States; commingle in Alaska staging areas with species that could bring the virus from other parts of the world;

Sentinel Species: Waterfowl, gamefowl, and poultry flocks reared in backyard facilities may prove to be valuable for early detection and used as for surveillance of diseases. Sentinel duck flocks may also be placed in wetland environments where they are potentially exposed to and infected with disease agents as they commingle with wild birds.

Environmental Sampling: Many avian diseases are released by waterfowl through the intestinal tract and can be detected in both feces and the water in which the birds swim, defecate, and feed. This is the principal means of virus spread to new birds and potentially to poultry, livestock, and humans. Analysis of water and fecal material from certain habitats can provide evidence of diseases circulating in wild bird populations, the specific types of diseases, and pathogenicity. Monitoring of water and/or fecal samples gathered from habitat is a reasonably cost effective, technologically achievable means to assess risks to humans, livestock, and other wildlife.

Under the disease sampling strategies listed above that could be implemented to detect or monitor avian diseases in the United States, WS' implementation of those sampling strategies would not adversely affect avian populations in the State. Sampling strategies that could be employed involve sampling live-captured birds that could be released on site after sampling occurs. The sampling (*e.g.*, drawing blooding, feather sample, fecal sample) and the subsequent release of live-captured birds would not result in adverse effects since those birds are released unharmed on site. In addition, sampling of sick, dying, or hunter harvested birds would not result in the additive lethal take of birds that would not have already occurred in the absence of a disease sampling program. Therefore, the sampling of birds for diseases would not adversely affect the populations of any of the birds addressed in this EA nor would result in any take of birds that would not have already occurred in the absence of disease sampling (*e.g.*, hunter harvest).

Alternative 2 - Bird Damage Management by WS through Technical Assistance Only

Bird populations in the State would not be directly impacted by WS from a program implementing technical assistance only. However, persons experiencing damage or threats from birds may implement methods based on WS' recommendations. Under a technical assistance only alternative, WS would recommend and demonstrate for use both non-lethal and lethal methods legally available for use to resolve bird damage. Methods and techniques recommended would be based on WS' Decision Model

using information provided from the requestor or from a site visit. Requestors may implement WS' recommendations, implement other actions, or take no action. However, those persons requesting assistance are likely those people that would implement damage abatement methods in the absence of WS' recommendations.

Under a technical assistance only alternative, those persons experiencing threats or damage associated with birds in the State could lethally take birds despite WS' lack of direct involvement in the management action. Therefore, under this alternative the number of birds lethally taken would likely be similar to the other alternatives since take could occur through the issuance of a depredation permit by the USFWS, the take of blackbirds could occur under the blackbird depredation order without the need for a permit, take of Muscovy ducks could occur under the control order, take of non-native bird species can occur without the need for a depredation permit from the USFWS, and take would continue to occur during the harvest season for those species. WS' participation in a management action would not be additive to an action that could occur in the absence of WS' participation.

With the oversight of the USFWS and the MDWFP, it is unlikely that bird populations would be adversely impacted by implementation of this alternative. Under this alternative, WS would not be directly involved with damage management actions and therefore, direct operational assistance could be provided by other entities, such as the MDWFP, the USFWS, private entities, and/or municipal authorities. If direct operational assistance is not available from WS or other entities, it is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal take, which could lead to real but unknown effects on other wildlife populations. People have resorted to the illegal use of chemicals and methods to resolve wildlife damage issues (White et al. 1989, USDA 1997, USFWS 2001, FDA 2003).

Alternative 3 – No Bird Damage Management Conducted by WS

Under this alternative, WS would not conduct bird damage management activities in the State. WS would have no direct involvement with any aspect of addressing damage caused by birds and would provide no technical assistance. No take of birds by WS would occur in the State. Birds could continue to be lethally taken to resolve damage and/or threats occurring either through depredation permits issued by the USFWS, under the blackbird depredation order, under the control order for Muscovy ducks, during the regulated hunting seasons, or in the case of non-native species, take can occur anytime using legally available methods. Management actions taken by non-federal entities would be considered the *environmental status quo*.

Local bird populations could decline, stay the same, or increase depending on actions taken by those persons experiencing bird damage. Some resource/property owners may take illegal, unsafe, or environmentally harmful action against local populations of birds out of frustration or ignorance. While WS would provide no assistance under this alternative, other individuals or entities could conduct lethal damage management resulting in impacts similar to the proposed action.

Since birds would still be taken under this alternative, the potential effects on the populations of those bird species in the State would be similar among all the alternatives for this issue. WS' involvement would not be additive to take that could occur since the cooperator requesting WS' assistance could conduct bird damage management activities without WS' direct involvement. Therefore, any actions to resolve damage or reduce threats associated with birds could occur by other entities despite WS' lack of involvement under this alternative.

Issue 2 - Effects on Non-target Wildlife Species Populations, Including T&E Species

As discussed previously, a concern is often raised about the potential impacts to non-target species, including T&E species, from the use of methods to resolve damage caused by birds. The potential effects on the populations of non-target wildlife species, including T&E species, are analyzed below.

Alternative 1 - Continuing the Current Integrated Approach to Managing Bird Damage (Proposed Action/No Action)

The potential adverse effects to non-targets occur from the employment of methods to address bird damage. Under the proposed action, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance. The use of non-lethal methods as part of an integrated direct operational assistance program would be similar to those risks to non-targets discussed in the other alternatives.

Personnel from WS are experienced and trained in wildlife identification and to select the most appropriate methods for taking targeted animals and excluding non-target species. To reduce the likelihood of capturing non-target wildlife, WS would employ the most selective methods for the target species, would employ the use of attractants that are as specific to target species as possible, and determine placement of methods to avoid exposure to non-targets. SOPs to prevent and reduce any potential adverse impacts on non-targets are discussed in Chapter 3 of this EA. Despite the best efforts to minimize non-target take during program activities, the potential for adverse impacts to non-targets exist when applying both non-lethal and lethal methods to manage damage or reduce threats to safety. However, from FY 2005 through FY 2011, no non-targets have been lethally taken by WS during bird damage management activities.

Non-lethal methods have the potential to cause adverse effects to non-targets primarily through exclusion, harassment, and dispersal. Any exclusionary device erected to prevent access of target species also potentially excludes species that are not the primary reason the exclusion was erected; therefore, non-target species excluded from areas may potentially be adversely impacted if the area excluded is large enough. Auditory and visual dispersal methods used to reduce damage or threats caused by birds are also likely to disperse non-targets in the immediate area the methods are employed. Therefore, non-targets may be permanently dispersed from an area while employing non-lethal dispersal techniques. However, like target species, the potential impacts on non-target species are expected to be temporary with target and non-target species often returning after the cessation of dispersal methods. Non-lethal methods are not employed over large geographical areas or applied at such intensity that essential resources (*e.g.*, food sources, habitat) would be unavailable for extended durations or over a wide geographical scope that long-term adverse effects would occur to a species' population. Non-lethal methods are generally regarded as having minimal impacts on overall populations of wildlife since individuals of those species are unharmed. The use of non-lethal methods would not have adverse impacts on non-target populations in the State under any of the alternatives.

Other non-lethal methods available for use under this alternative include live traps, nets, nest destruction, and repellents. Live traps (*e.g.*, cage traps, walk-in traps, decoy traps) and nets restrain wildlife once captured and are considered live-capture methods. Live traps have the potential to capture non-target species. Trap and net placement in areas where target species are active and the use of target-specific attractants would likely minimize the capture of non-targets. If traps and nets are attended to appropriately, any non-targets captured can be released on site unharmed. Nest destruction would not adversely affect non-target species since identification of the nests of target species would occur prior to efforts to destroy the nest. Nets could include the use of cannon nets, drop nets, and mist nets. Nets are virtually selective for target individuals since activation occurs by attending personnel, with handling of

wildlife occurring after deployment of the net. Therefore, any non-targets captured using nets can be immediately released on site. Any potential non-targets captured using non-lethal methods would be handled in such a manner as to ensure the survivability of the animal if released. Even though live-capture does occur from those methods, the potential for death of a target or non-target animal while being restrained or released does exist, primarily from being struck by the cannon or rocket assemblies during deployment. The likelihood of non-targets being struck is extremely low and is based on being present when the net is activated and in a position to be struck. Nets are positioned to envelop wildlife upon deployment and to minimize striking hazards. Baiting of the areas to attract target species often occurs when using nets. Therefore, sites can be abandoned if non-target use of the area is high.

Non-lethal methods that use auditory and visual stimuli to reduce or prevent damage are intended to elicit fright responses in wildlife. When employing those methods to disperse or harass target species, any non-targets in the vicinity of those methods when employed are also likely dispersed from the area. Similarly, any exclusionary device constructed to prevent access by target species also excludes access to non-target species.

Only those repellents registered with the EPA pursuant to the FIFRA and registered for use in the State would be recommended and used by WS under this alternative. Therefore, the use and recommendation of repellents would not have negative impacts on non-target species when used according to label requirements. Most repellents for birds are derived from natural ingredients that pose a very low risk to non-targets when exposed to or when ingested. Two chemicals commonly registered with the EPA as bird repellents are methyl anthranilate and anthraquinone. Methyl anthranilate naturally occurs in grapes and is used to flavor food, candy, and soft drinks. Anthraquinone naturally occurs in plants like aloe and is also used to make dye. Both products claim to be unpalatable to many bird species. Several products are registered for use to reduce bird damage containing either methyl anthranilate or anthraquinone. Formulations containing those chemicals are liquids that are applied directly to susceptible resources. Methyl anthranilate applied to alleviate goose damage was effective for about four days depending on environmental conditions which was a similar duration experienced when applying anthraquinone as geese continued to feed on treated areas (Cummings et al. 1995, Dolbeer et al. 1998). Dolbeer et al. (1998) found that geese tended to loaf on anthraquinone treated turf, albeit at lower abundance, but the quantity of feces on treated and untreated turf was the same, thus the risk of damage was unabated. Mesurol is applied directly inside eggs that are of a similar appearance to those being predated on by crows. Therefore, risks to non-target would be restricted to those wildlife species that would select for the egg baits. However, adherence to the label requirements of mesurol would ensure threats to non-targets would be minimal. Similarly, when used in accordance with the label requirements, the use of Avitrol would also not adversely affect non-targets based on restrictions on baiting locations.

The persistent use of non-lethal methods would likely result in the dispersal or abandonment of those areas where non-lethal methods are employed of both target and non-target species. Therefore, any use of non-lethal methods has similar results on both non-target and target species. Though non-lethal methods do not result in the lethal take of non-targets, the use of non-lethal methods can restrict or prevent access of non-targets to beneficial resources. Overall, potential impacts to non-targets from the use of non-lethal methods only would not adversely impact populations since those methods are often temporary and are not applied over large geographical areas.

Impacts to non-targets from the use of non-lethal methods would be similar to the use of non-lethal methods under any of the alternatives. Non-targets would generally be unharmed from the use of non-lethal methods under any of the alternatives since no lethal take would occur. Non-lethal methods would be available under all the alternatives analyzed. WS' involvement in the use of or recommendation of non-lethal methods would ensure non-target impacts are considered under WS' Decision Model. Impacts

to non-targets under this alternative from the use of and/or the recommendation of non-lethal methods are likely to be low.

WS would also employ and/or recommend lethal methods under the proposed action alternative to alleviate damage. Lethal methods available for use to manage damage caused by birds under this alternative would include the recommendation of take by private entities during the hunting season, shooting, DRC-1339, and euthanasia after live capture. The use of firearms is essentially selective for target species since animals are identified prior to application; therefore, no adverse impacts are anticipated from use of this method. The euthanasia of birds by WS' personnel would be conducted in accordance with WS Directive 2.505. Chemical methods used for euthanasia would be limited to carbon dioxide administered in an enclosed chamber after birds have been live-captured. Since live-capture of birds using other methods occurs prior to the administering of euthanasia chemicals, no adverse effects to non-targets would occur under this alternative. WS' recommendation that birds be harvested during the regulated season by private entities to alleviate damage would not increase risks to non-targets. Shooting is essentially selective for target species and non-target take is not likely and would not increase based on WS' recommendation of the method.

A common concern regarding the use of DRC-1339 is the potential non-target risks. All label requirements of DRC-1339 would be followed to minimize non-target hazards. As required by the label, all potential bait sites are pre-baited and monitored for non-target use as outlined in the pre-treatment observations section of the label. If non-targets are observed feeding on the pre-bait, the plots are abandoned and no baiting would occur at those locations. Treated bait is mixed with untreated bait per label requirements when applied to bait sites to minimize the likelihood of non-targets finding and consuming bait that has been treated. The bait type selected can also limit the likelihood that non-target species would consume treated bait since some bait types are not preferred by non-target species.

Once sites are baited, sites are monitored daily to further observe for non-target feeding activity. If non-targets are observed feeding on bait, those sites are abandoned. By acclimating target bird species to a feeding schedule, baiting can occur at specific times to ensure bait placed is quickly consumed by target bird species, especially when large flocks of target species are present. The acclimation period allows for treated bait to be present only when birds are conditioned to be present at the site and provides a higher likelihood that treated bait is consumed by the target species which makes it unavailable to non-targets. In addition, with many blackbird species, including crows, when present in large numbers, tend to exclude non-targets from a feeding area due to their aggressive behavior and by the large number of conspecifics present at the location. Therefore, risks to non-target species from consuming treated bait only occurs when treated bait is present at a bait location. WS would retrieve all dead birds to the extent possible following treatment with DRC-1339 to minimize secondary hazards associated with scavengers feeding on bird carcasses.

DRC-1339 Primary Hazard Profile - DRC-1339 was selected for reducing bird damage because of its high toxicity to blackbirds (DeCino et al. 1966, West et al. 1967, Schafer, Jr. 1972) and low toxicity to most mammals, sparrows, and finches (Schafer, Jr. and Cunningham 1966, Apostolou 1969, Schafer, Jr. 1972, Schafer, Jr. et al. 1977, Matteson 1978, Cunningham et al. 1979, Cummings et al. 1992, Sterner et al. 1992). The likelihood of a non-target bird obtaining a lethal dose is dependent on: (1) frequency of encountering the bait, (2) length of feeding bout, (3) the bait dilution rate, (4) the bird's propensity to select against the treated bait, and (5) the susceptibility of the non-target species to the toxicant. Birds that ingest DRC-1339 probably die because of irreversible necrosis of the kidney and subsequent inability to excrete uric acid (*i.e.*, uremic poisoning) (DeCino et al. 1966, Felsenstein et al. 1974, Knittle et al. 1990). Birds ingesting a lethal dose of DRC-1339 usually die in one to three days.

The median acute lethal dose (LD_{50})[13] values for starlings, blackbirds, and magpies (Corvidae) range from one to five mg/kg (Eisemann et al. 2003). For American crows, the median acute lethal dose has been estimated at 1.33 mg/kg (DeCino et al. 1966). The acute oral toxicity (LD_{50}) of DRC-1339 has been estimated for over 55 species of birds (Eisemann et al. 2003). DRC-1339 is toxic to mourning doves, pigeons, quail (*Coturnix coturnix*), chickens and ducks (*Anas* spp.) at ≥5.6 mg/kg (DeCino et al. 1966). In cage trials, Cummings et al. (1992) found that 2% DRC-1339-treated rice did not kill savannah sparrows (*Passerculus sandwichensis*). Gallinaceous birds and waterfowl may be more resistant to DRC-1339 than blackbirds, and their large size may reduce the chances of ingesting a lethal dose (DeCino et al. 1966). Avian reproduction does not appear to be affected from ingestion of DRC-1339 treated baits until levels are ingested where toxicity is expressed (USDA 2001).

There have been concerns expressed about the study designs used to derived acute lethal doses of DRC-1339 for some bird species (Gamble et al. 2003). The appropriateness of study designs used to determine acute toxicity to pesticides has many views (Lipnick et al. 1995). The use of small sample sizes was the preferred method of screening for toxicity beginning as early as 1948 to minimize the number of animals involved (Dixon and Mood 1948). In 1982, the EPA established standardized methods for testing for acute toxicity that favored larger sample sizes (EPA 1982). More recently, regulatory agencies have again begun to debate the appropriate level of sample sizes in determining acute toxicity based on a growing public concern for the number of animals used for scientific purposes.

Based on those concerns, the Ecological Committee on FIFRA Risk Assessment (ECOFRAM) was established by the EPA to provide guidance on ecological risk assessment methods (EPA 1999). The committee report recommended to the EPA that only one definitive LD_{50} be used in toxicity screening either on the mallard or northern bobwhite and recommended further testing be conducted using the up-and-down method (EPA 1999). Many of the screening methods used for DRC-1339 prior to the establishment of EPA guidelines in 1982 used the up-and-down method of screening (Eisemann et al. 2003).

A review of the literature shows that LD_{50} research using smaller sample sizes conducted prior to EPA established guidelines are good indicators of LD_{50} derived from more rigorous designs (Bruce 1985, Bruce 1987, Lipnick et al. 1995). Therefore, acute and chronic toxicity data gathered prior to EPA guidance remain valid and to ignore the data would be inappropriate and wasteful of animal life (Eisemann et al. 2003).

DRC-1339 Secondary Hazards - 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 blackbirds killed by DRC-1339 and its tendency to be almost completely metabolized in the target birds which leaves little residue to be ingested by scavengers.

DRC-1339 is rapidly metabolized and excreted and does not bioaccumulate which probably accounts for its low secondary hazard profile (Schafer, Jr. 1991, USDA 1997). For example, cats, owls and magpies would be at risk only after exclusively eating DRC-1339-poisoned starlings for 30 continuous days (Cunningham et al. 1979). Studies using the American kestrel as a surrogate species show that secondary hazards to raptors are small, and those birds are not put at risk by DRC-1339 baiting (USDA 1997). The risk to mammalian predators from feeding on birds killed with DRC-1339 appears to be low (Johnston et al. 1999).

[13] An LD_{50} is the dosage in milligrams of material per kilogram of body weight required to cause death in 50% of a test population of a species.

The risks associated with non-target animal exposure to DRC-1339 baits have been evaluated in rice fields in Louisiana (Glahn et al. 1990, Cummings et al. 1992, Glahn and Wilson 1992), poultry and cattle feedlots in several western states (Besser 1964, Ford 1967, Royall et al. 1967), ripening sunflower fields in North Dakota (Linz et al. 2000), and around blackbird staging areas in east-central South Dakota (Knutsen 1998, Linz et al. 1999, Smith 1999). Smith (1999) used field personnel and dogs to search for dead non-target animals and found no non-target carcasses that exhibited histological signs consistent with DRC-1339 poisoning. The other studies also failed to detect any non-target birds that had succumbed to DRC-1339. However, DRC-1339 is a slow-acting avicide and thus, some birds could move to areas not searched by the study participants before dying.

DRC-1339 Environmental Degradation - DRC-1339 is unstable in the environment and degrades rapidly when exposed to sunlight, heat, or ultra violet radiation and has a half-life of less than two days (USDA 1997). DRC-1339 is highly soluble in water but does not hydrolyze and degradation occurs rapidly in water. The chemical tightly binds to soil and has low mobility. The half life is about 25 hours, which means it is nearly 100% broken down within a week, and identified metabolites (*i.e.*, degradation chemicals) have low toxicity. Aquatic and invertebrate toxicity is low (USDA 1997). WS' programmatic FEIS contains a thorough risk assessment of DRC-1339 and the reader is referred to that source for a more complete discussion (USDA 1997). That risk assessment concluded that no adverse effects are expected from use of DRC-1339.

Additional concerns have been raised regarding the risks to non-target wildlife associated with crows caching bait treated with DRC-1339. Crows are known to cache surplus food usually by making a small hole in the soil using the bill, by pushing the food item under the substrate, or covering items with debris (Verbeek and Caffrey 2002). Distances traveled from where the food items were gathered to where the item is cached varies but some studies suggests crows can travel up to 100 meters (Kilham 1989) and up to 2 kilometers (Cristol 2001, Cristol 2005). Caching activities appear to occur throughout the year but may increase when food supplies are low. Therefore, the potential for treated baits to be carried from a bait site to surrounding areas exists as part of the food cache behavior exhibited by crows.

Several mitigating factors must be overcome for non-target risks to occur from bait cached by a crow. Those factors being: (1) the non-target wildlife species would have to locate the cached bait, (2) the bait-type used to target crows would have to be palatable or selected for by the non-target wildlife, (3) the non-target wildlife species consuming the treated bait would have to consume a lethal dose from a single bait, and (4) if a lethal dose is not achieved by eating a single treated cached bait, the non-target wildlife would have to ingest several treated baits (either from cached bait or from the bait site) to obtain a lethal dose which could vary by the species.

DRC-1339 is typically very unstable in the environment and degrades quickly when exposed to sunlight, heat, and ultraviolet radiation. The half-life of DRC-1339 in biologically active soil was estimated at 25 hours with the identified metabolites having a low toxicity (EPA 1995). DRC-1339 is also highly soluble in water, does not hydrolyze, and photodegrades quickly in water with a half-life estimated at 6.3 hours in summer, 9.2 hours in spring sunlight, and 41 hours during winter (EPA 1995). DRC-1339 binds tightly with soil and is considered to have low mobility (EPA 1995). Given the best environmental fate information available and the unlikelihood of a non-target locating enough treated bait(s) sufficient to produce lethal effects, the risks to non-targets from crows caching treated bait would be low. When baiting, treated baits are mixed with untreated bait to minimize non-target hazards directly at the bait site and to minimize the likelihood of target species developing bait aversion. Since treated bait is diluted, often times up to 1 treated bait for every 25 untreated baits, the likelihood of a crow selecting treated bait and then caching the bait is further reduced.

While every precaution is taken to safeguard against taking non-targets during operational use of methods and techniques for resolving damage and reducing threats caused by birds, the use of such methods can result in the incidental take of unintended species. Those occurrences are rare and should not affect the overall populations of any species under the proposed action. WS' take of non-target species during activities to reduce damage or threats to human safety associated with birds in Mississippi is expected to be extremely low to non-existent. No non-targets have been taken by WS during prior bird damage management activities in the State. WS would monitor the take of non-target species to ensure program activities or methodologies used in bird damage management do not adversely impact non-targets. Methods available to resolve and prevent bird damage or threats when employed by trained, knowledgeable personnel are selective for target species. WS would annually report to the USFWS and/or the MDWFP any non-target take to ensure take by WS is considered as part of management objectives established. The potential impacts to non-targets are similar to the other alternatives and are considered to be minimal to non-existent.

The proposed bird damage management could benefit many other wildlife species that are impacted by predation or competition for resources. For example, crows are generally very aggressive nesting area colonizers and will force other species from prime nesting areas. American crows often feed on the eggs, nestlings, and fledglings of other bird species. This alternative has the greatest possibility of successfully reducing bird damage and conflicts to wildlife species since all available methods could possibly be implemented or recommended by WS.

Birds could still be lethally taken during the regulated harvest season, through depredation/control orders, and through the issuance of depredation permits under this alternative. Impacts to non-targets from the use of non-lethal methods would be similar to the use of non-lethal methods under any of the alternatives. Non-targets would generally be unharmed from the use of non-lethal methods under any of the alternatives since no lethal take would occur. Non-lethal methods would be available under all the alternatives analyzed. WS' involvement in the use of or recommendation of non-lethal methods would ensure non-target impacts are considered under WS' Decision Model. Impacts to non-targets under this alternative from the use of and/or the recommendation of non-lethal methods are likely to be low.

T&E Species Effects

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and establishment of special restrictions or mitigation measures. SOPs to avoid T&E effects are described in Chapter 3 of this EA.

Federally Listed Species - The current list of species designated as threatened and endangered in Mississippi as determined by the USFWS and the National Marine Fisheries Services was obtained and reviewed during the development of this EA. Appendix C contains the list of species currently listed in the State along with common and scientific names. Consultation with the USFWS under Section 7 of the ESA concerning potential impacts of WS' programmatic activities on T&E species was conducted as part of the development of WS' programmatic FEIS (USDA 1997). WS obtained a BO from the USFWS addressing WS' programmatic activities. For the full context of the BO, see Appendix F of WS' programmatic FEIS (USDA 1997).

Based on a review of those T&E species listed in the State during the development of the EA, WS determined that activities conducted pursuant to the proposed action would not likely adversely affect those species listed in the State by the USFWS and the National Marine Fisheries Services or their critical habitats. As part of the development of the EA, WS consulted with the USFWS under Section 7 of the ESA. The USFWS concurred with WS' determination that activities conducted pursuant to the proposed

action would not likely adversely affect those species currently listed in the State or their critical habitats (T. Jacobson, USFWS, pers. comm. 2012).

WS' activities in Mississippi would not adversely affect the Mississippi beach mouse (*Peromyscus polionotus ammobates*), Perdido Key beach mouse (*Peromyscus polionotus trissyllepsis*), gray bat (*Myotis grisescens*), Indiana bat (*Myotis sodalis*)**,** wood stork (*Mycteria americana*), piping plover (*Charadrius melodus*), Mississippi red-bellied turtle (*Pseudemys alabamensis*), Kemp's Ridley sea turtle (*Lepidochelys kempii*), Loggerhead sea turtle (*Caretta caretta*), Flattened musk turtle (*Sternotherus depressus*), Green sea turtle (*Chelonia mydas*), gopher tortoise (*Gopherus polyphemus*), Eastern indigo snake (*Drymarchon corais couperi*), Mississippi cavefish (*Speoplatyrhinus poulsoni*), Spotfin chub (*Erimonax monachus*), snail darter (*Percina tanasi*), slackwater darter (*Etheostoma boschungi*), shiny pigtoe (*Fusconaia cor*), pink mucket (pearlymussel) (*Lampsilis abrupta*), white warty-back (pearlymussel) (*Plethobasus cicatricosus*), rough pigtoe (*Pleurobema plenum*), Mississippi lampmussel (*Lampsilis virescens*), pale lilliput (pearlymussel) (*Toxolasma cylindrellus*), Cumberland monkeyface (pearlymussel) (*Quadrula intermedia*), orangefoot pimpleback (*Plethobasus cooperianus*), Mississippi canebrake pitcher-plant (*Sarracenia rubra alabamensis*), and green pitcher plant (*Sarracenia oreophila*). This determination is based on conclusions made by the USFWS during their 1992 programmatic consultation of WS' activities and subsequent BO (USDA 1997).

The 1992 BO listed the gopher tortoise (*Gopherus polyphemus*) and the Eastern indigo snake (*Drymarchon corais couperi*) as species which might be adversely affected by some aspect of the WS' program. The USFWS stated the concern of the potential effects of toxic baits and fumigants used for rodent and predator damage management. WS would not be using any rodent or predator toxicants or fumigants under the proposed action alternative. Therefore, bird damage management activities in Mississippi are not likely to have an adverse effect of those species.

The red-cockaded woodpecker (*Picoides borealis*) was granted endangered status in 1970 (USFWS 2003*b*). The 1992 BO from the USFWS made no determination concerning any effect by WS' programs on the red-cockaded woodpecker and no effects from any component of a WS' program were identified in the programmatic FEIS (USDA 1997). DRC-1339 nor Avitrol pose any primary hazard to red-cockaded woodpeckers because they do not eat grain or other bait materials on which this chemical might be applied during damage management activities under the proposed action alternative. In addition, no secondary effects on red-cockaded woodpeckers are expected to be related to any actions in Mississippi.

State Listed Species – The current list of State listed species as endangered or threatened by the State as determined by the MDWFP was obtained and reviewed during the development of the EA (see Appendix D). Based on the review of species listed in the State, WS has determined that the proposed activities would not adversely affect those species currently listed by the State. The Mississippi Museum of Natural Sciences within the MDWFP has reviewed the EA and concurred with WS determination (S. Peyton, Mississippi Museum of Natural Sciences pers. comm. 2012).

Alternative 2 - Bird Damage Management by WS through Technical Assistance Only

Under a technical assistance alternative, WS would have no direct impact on non-target species, including T&E species. Methods recommended or provided through loaning of equipment could be employed by those persons requesting assistance. Recommendations would be based on WS' Decision Model using information provided by the person requesting assistance or through site visits. Recommendations would include methods or techniques to minimize non-target impacts associated with the methods being recommended or loaned. Methods recommended could include non-lethal and lethal methods as deemed appropriate by WS' Decision Model and as permitted by laws and regulations. The only methods that

would not be available under a technical assistance only alternative would include some formulations of DRC-1339, alpha-chloralose, and mesurol which are only available to for use by WS' employees.

The potential impacts to non-targets under this alternative would be variable and based on several factors. If methods are employed, as recommended by WS, the potential impacts to non-targets are likely similar to the proposed action. If recommended methods and techniques are not followed or if other methods are employed that were not recommended, the potential impacts on non-target species, including T&E species is likely higher compared to the proposed action.

The potential impacts of harassment and exclusion methods to non-target species would be similar to those described under the proposed action. Harassment and exclusion methods are easily obtainable and simple to employ. Since identification of targets occurs when employing shooting as a method, the potential impacts to non-target species are likely low under this alternative if the person is familiar with the identifying characteristics of the target bird species.

Those persons experiencing damage from birds may implement methods and techniques based on the recommendations of WS. The potential for impacts would be based on the knowledge and skill of those persons implementing recommended methods. Potential impacts from providing only technical assistance could be greater than those described in the proposed action if those persons experiencing damage do not implement methods or techniques correctly. Incorrectly implemented methods or techniques recommended by WS could lead to an increase in non-target take.

If requestors are provided technical assistance but do not implement any of the recommended actions and take other actions, the potential impacts to non-targets could be higher compared to the proposed action. If those persons requesting assistance implement recommended methods appropriately and as instructed or demonstrated, the potential impacts to non-targets would be similar to the proposed action. Methods or techniques not implemented as recommended or used inappropriately would likely increase potential impacts to non-targets. Therefore, the potential impacts to non-targets, including T&E species would be variable under a technical assistance only alternative. It is possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal killing of birds, which could lead to unknown effects on local non-target species populations, including some T&E species.

Those persons requesting assistance are those likely to use lethal methods since a damage threshold has been met for that individual requestor that has triggered seeking assistance to reduce damage. The potential impacts on non-targets by those persons experiencing damage would be highly variable. People whose bird damage problems were not effectively resolved by non-lethal control methods would likely resort to other means of legal or illegal lethal control. This could result in less experienced persons implementing control methods and could lead to greater take of non-target wildlife than the proposed action. When those persons experiencing damage caused by wildlife reach a level where assistance does not adequately reduce damage or where no assistance is available, people have resorted to using chemical toxicants that are illegal for use on the intended target species that often results in loss of both target and non-target wildlife (*e.g.*, White et al. 1989, USFWS 2001, FDA 2003). The use of illegal toxicants by those persons frustrated with the lack of assistance or assistance that inadequately reduces damage to an acceptable level can often result in the indiscriminate take of wildlife species.

The ability to reduce negative impacts caused by birds to wildlife species and their habitats, including T&E species, would be variable based upon the skills and abilities of the person implementing damage management actions under this alternative. It would be expected that this alternative would have a greater chance of reducing damage than Alternative 3 since WS would be available to provide information and advice.

Alternative 3 – No Bird Damage Management Conducted by WS

Under this alternative, WS would not be directly involved with bird damage management activities in the State. Therefore, no direct impacts to non-targets or T&E species would occur by WS under this alternative. Birds would continue to be taken during the regulated harvest season, under depredation permits issued by USFWS, under the depredation order for blackbirds and cormorants, and the control order for Muscovy ducks. No depredation permit is required to take non-native species. Risks to non-targets and T&E species would continue to occur from those persons who implement bird damage management activities on their own or through recommendations by the other federal, state, and private entities. Although some risks occur from those people that implement bird damage management in the absence of any involvement by WS, those risks are likely low and are similar to those under the other alternatives.

The ability to reduce damage and threats of damage caused by birds would be variable based upon the skills and abilities of the person implementing damage management actions under this alternative. The risks to non-targets and T&E species would be similar across the alternatives since most of those methods described in Appendix B are available across the alternatives. If those methods available are applied as intended, risks to non-targets would be minimal to non-existent. If methods available are applied incorrectly or applied without knowledge of bird behavior, risks to non-target wildlife would be higher under this alternative. If frustration from the lack of available assistance causes those persons experiencing bird damage to use methods that are not legally available for use, risks to non-targets would be higher under this alternative. People have resorted to the use of illegal methods to resolve wildlife damage that have resulted in the lethal take of non-target wildlife (*e.g.*, White et al. 1989, USDA 1997, USFWS 2001, FDA 2003).

Issue 3 - Effects of Damage Management Methods on Human Health and Safety

A common concern is the potential adverse effects methods available could have on human health and safety. The threats to human safety of methods available under the alternatives are evaluated below by each of the alternatives.

Alternative 1 - Continuing the Current Integrated Approach to Managing Bird Damage (Proposed Action/No Action)

The cooperator requesting assistance is made aware through a MOU, cooperative service agreement, or a similar document that those methods agreed upon could potentially be used on property owned or managed by the cooperator; thereby, making the cooperator aware of the use of those methods on property they own or manage to identify any risks to human safety associated with the use of those methods.

Under the proposed action, those methods discussed in Appendix B, would be integrated to resolve and prevent damage associated with birds in the State. WS would use the Decision Model to determine the appropriate method or methods that would effectively resolve the request for assistance. Those methods would be continually evaluated for effectiveness and if necessary, additional methods could be employed. Non-lethal and lethal methods could be used under the proposed action. WS would continue to provide technical assistance and/or direct operational assistance to those persons seeking assistance with managing damage or threats from birds. Risks to human safety from technical assistance conducted by WS would be similar to those risks addressed under the other alternatives. The use of non-lethal methods as part of an integrated approach to managing damage that would be employed as part of direct operational assistance by WS would also be similar to those risks addressed by the other alternatives.

Although hazards to human safety from non-lethal methods exist, those methods are generally regarded as safe when used by trained individuals who are experienced in their use. Risks to human safety from the use of non-lethal methods were considered low when evaluated in a formal risk assessment in WS' programmatic FEIS (USDA 1997). Risks to human safety associated with non-chemical methods such as resource management methods (*e.g*., crop selection, limited habitat modification, modification of human behavior), exclusion devices, frightening devices, and cage traps were considered low based on their use profile for alleviating damage associated with wildlife (USDA 1997). Although some risk of fire and bodily harm exists from the use of pyrotechnics, lasers, and propane cannons, when used appropriately and in consideration of those risks, they can be used with a high degree of safety.

Lethal methods available under the proposed action would include the use of firearms, DRC-1339, live-capture followed by euthanasia, and the recommendation that birds be harvested during the regulated hunting season established for those species by the USFWS and the MDWFP. Those lethal methods available under the proposed action alternative or similar products would also be available under the other alternatives. Although some formulations of the avicide DRC-1339 are restricted to use by WS only, a similar product containing the same active ingredient as DRC-1339 could be made available for use as a restricted use pesticide by other entities. However, at the time this EA was developed, the commercially available product containing the same active ingredient as DRC-1339 for use to manage damage associated with blackbirds and starlings at livestock and poultry operations was not registered for use in the State.

WS' employees who conducted bird damage management activities are knowledgeable in the use of methods, wildlife species responsible for causing damage or threats, and WS' directives. That knowledge is incorporated into the decision-making process inherent with the WS' Decision Model that is applied when addressing threats and damage caused by birds. When employing lethal methods, WS' employees consider risks to human safety when employing those methods based on location and method. Risks to human safety from the use of methods is likely greater in urban areas when compared to rural areas that are less densely populated. Consideration is also given to the location where damage management activities would be conducted based on property ownership. If locations where methods would be employed occur on private property in rural areas where access to the property is controlled and monitored, the risks to human safety from the use of methods is likely less. If damage management activities occur at parks or near other public use areas, then risks of the public encountering damage management methods and the corresponding risk to human safety increases. Activities would generally be conducted when human activity is minimal (*e.g*., early mornings, at night) or in areas where human activities are minimal (*e.g*., in areas closed to the public).

The use of live-capture traps have also been identified as a potential issue. Live-capture traps are typically set in situations where human activity is minimal to ensure public safety. Traps rarely cause serious injury and are triggered through direct activation of the device. Live-capture traps available for birds are typically walk-in style traps where birds enter but are unable to exit. Therefore, human safety concerns associated with live traps used to capture birds require direct contact to cause bodily harm. If left undisturbed, risks to human safety would be minimal. A formal risk assessment of live-capture methods determined risks to human safety associated with the use patterns of those methods was low (USDA 1997).

Other live-capture devices, such as cannon nets, pose minor safety hazards to the public since activation of the device occurs by trained personnel after target species are observed in the capture area of the net. Lasers also pose minimal risks to the public since application occurs directly to target species by trained personnel which limits the exposure of the public to misuse of the method.

Certain safety issues due arise related to misusing firearms and the potential human hazards associated with firearm use when employed to reduce damage and threats. To help ensure safe use and awareness, WS' employees who use firearms to conduct official duties are required to attend an approved firearm safety training course and to remain certified for firearm use, WS' employees must attend a re-certification safety training course in accordance with WS Directive 2.615. WS' employees who carry and use firearms as a condition of employment, are required to sign a form certifying that they have not been convicted of a misdemeanor crime of domestic violence. A thorough safety assessment would be conducted before firearms are deemed appropriate to alleviate or reduce damage and threats to human safety when conducting activities. WS would work closely with cooperators requesting assistance to ensure all safety issues are considered before the use of firearms are deemed appropriate. All methods, including firearms, must be agreed upon with the cooperator to ensure the safe use of methods. A risk assessment conducted during the development of WS' programmatic FEIS, determined the risks to human safety from the use of firearms was low based on the use profile of the method (USDA 1997).

All WS' personnel who handle and administered chemical methods would be properly trained in the use of those methods. Training and adherence to agency directives would ensure the safety of employees applying chemical methods. Birds euthanized by WS or taken using chemical methods would be disposed of in accordance with WS Directive 2.515. All euthanasia would occur in the absence of the public to further minimize risks. SOPs are further described in Chapter 3 of this EA.

The recommendation of repellents or the use of those repellents registered for use to disperse birds in the State could occur under the proposed action as part of an integrated approach to managing bird damage. Those chemical repellents that would be available to recommend for use or directly used by WS under this alternative would also be available under any of the alternatives. Therefore, risks to human safety from the recommendation of repellents or the direct use of repellents would be similar across all the alternatives. Risks to human safety associated with the use or recommendation of repellents were addressed under the technical assistance only alternative (Alternative 2) and would be similar across all the alternatives. WS' involvement, either through recommending the use of repellents or the direct use of repellents, would ensure that label requirements of those repellents are discussed with those persons requesting assistance when recommended through technical assistance or would be specifically adhered to by WS' personnel when directly using those chemical methods. Therefore, the risks to human safety associated with the recommendation of or direct use of repellents could be lessened through WS' participation.

Mesurol contains the active ingredient methiocarb and is registered by the EPA for use to condition crows not to feed on the eggs of T&E species. Mesurol is currently not registered for use in Mississippi but will be evaluated in this assessment as a repellent that could be employed under the proposed action if the product becomes available. Mesurol is mixed with water and once mixed, placed inside raw eggs that are similar in size and appearance to the eggs of the species being protected. Treated eggs are placed in the area where the protected species are known to nest at least three weeks prior to the onset of egg-laying to condition crows to avoid feeding on eggs. Methiocarb is a carbamate pesticide that acts as a cholinesterase inhibitor. Crows ingesting treated eggs become sick (*e.g.*, regurgitate, become lethargic) but recover. Human safety risks associated with the use of mesurol occur primarily to the mixer and handler during preparation. WS' personnel would follow all label requirements, including the personal protective equipment required to handle and mix bait. When used according to label requirements, the risks to human safety from the use of mesurol would be minimal.

Risks to human safety from the use of avicides could occur either through direct exposure of the chemical or exposure to the chemical from birds that have been lethally taken. The only avicide currently registered for use in Mississippi is DRC-1339 (3-chloro-p-toluidine hydrochloride) that could be used for bird damage management. DRC-1339 is currently registered with the EPA to manage damage associated

with several bird species and can be formulated on a variety of bait types depending on the label. Technical DRC-1339 (powder) must be mixed with water and in some cases, a binding agent (required by the label for specific bait types). Once the technical DRC-1339, water, and binding agent, if required, are mixed, the liquid is poured over the bait and mixed until the liquid is absorbed and evenly distributed. The treated bait is then allowed to air dry. The mixing, drying, and storage of DRC-1339 treated bait occurs in controlled areas that are not accessible by the public. Therefore, risks to public safety from the preparation of DRC-1339 are minimal. Some risks do occur to the handlers during the mixing process from inhalation and direct exposure on the skin and eyes. Adherence to label requirements during the mixing and handling of DRC-1339 treated bait for use of personal protective equipment ensures the safety of WS' personnel handling and mixing treated bait. Therefore, risks to handlers and mixers that adhere to the personal protective equipment requirements of the label are low. Before application at bait locations, treated bait is mixed with untreated bait at ratios required by the product label to minimize non-target hazards and to avoid bait aversion by target species.

Locations where treated bait may be placed are determined based on product label requirements (*e.g.*, distance from water, specific location restrictions), the target bird species use of the site (determined through prebaiting and an acclimation period), on non-target use of the area (areas with non-target activity are not used or abandoned), and based on human safety (*e.g.*, in areas restricted or inaccessible by the public or where warning signs have been placed). Once appropriate locations are determined, treated baits are placed in feedings stations or are broadcast using mechanical methods (ground-based equipment or hand spreaders) and by manual broadcast (distributed by hand) per label requirements. Once baited using the diluted mixture (treated bait and untreated bait) when required by the label, locations are monitored for non-target activity and to ensure the safety of the public. After each baiting session, all uneaten bait is retrieved. Through prebaiting, target birds can be acclimated to feed at certain locations at certain periods of time. By acclimating birds to a feeding schedule, baiting can occur at specific times to ensure bait placed is quickly consumed by target bird species, especially when large flocks of target species are present. The acclimation period allows for treated bait to be placed at a location only when target birds are conditioned to be present at the site and provides a higher likelihood that treated bait is consumed by the target species which makes it unavailable for potential exposure to humans. To be exposed to the bait, someone would have to approach a bait site and handle treated bait. If the bait has been consumed by target species or is removed by WS, then treated bait is no longer available and human exposure to the bait could not occur. Therefore, direct exposure to treated bait during the baiting process would only occur if someone approached a bait site that contained bait and if treated bait was present, would have to handle treated bait.

Factors that minimize any risk of public health problems from the use of DRC-1339 are: 1) 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 feed upon), 2) DRC-1339 is highly unstable and degrades rapidly when exposed to sunlight, heat, or ultraviolet radiation. The half-life is about 25 hours; in general, DRC-1339 on treated bait material is almost completely broken down within a week if not consumed or retrieved, 3) the chemical is more than 90% metabolized in target birds within the first few hours after they consume the bait. Therefore, little material is left in bird carcasses that may be found or retrieved by people, 4) application rates are extremely low (EPA 1995), 5) a human would need to ingest the internal organs of birds found dead from DRC-1339 to be exposed, and 6) the EPA has concluded that, based on mutagenicity (the tendency to cause gene mutations in cells) studies, this chemical is not a mutagen or a carcinogen (*i.e.*, cancer-causing agent) (EPA 1995).

Of additional concern is the potential exposure of people to crows harvested during the regulated hunting season that have ingested DRC-1339 treated bait. The hunting season for crows in the State during the development of this assessment occurred from November until the end of February the following calendar

year with no daily take limit and no possession limit (MDWFP 2011). Under the proposed action, baiting using DRC-1339 to reduce crow damage could occur in the State during the period of time when crows can be harvested. Although baiting could occur in rural areas of State during those periods of time, most requests for assistance to manage crow damage during the period of time when crows can be harvested in the State occur in urban areas associated with urban crow roosts. Crows using urban communal roost locations often travel long distances to forage before returning to the roost location during the evening.

When managing damage associated with urban crow roosts, the use of DRC-1339 would likely occur at known forage areas (where crows from a roost location are known to travel to) or could occur near the roost location where crows have be conditioned to feed through the use of pre-baiting. Crows, like other blackbirds, often stage (congregate) in an area prior to entering a roost location. The staging behavior exhibited by blackbirds occurs consistently and can be induced to occur consistently at a particular location through the use of pre-baiting since blackbirds often feed prior to entering a roost location. Pre-baiting can also induce feeding at a specific location as crows exit a roost location in the morning by providing a consistent food source. Baiting with DRC-1339 treated baits most often occurs during the winter when the availability of food is limited and crows can be conditioned to feed consistently at a location by providing a consistent source of food. Given the range in which the death of sensitive bird species occurs, crows that consume treated bait could fly long distances. Although not specifically known for crows, sensitive bird species that ingest a lethal dose of DRC-1339 treated bait generally die within 24 to 72 hours after ingestion (USDA 2001). Therefore, crows that ingest a lethal dose of DRC-1339 at the bait site could die in other areas besides the roost location or the bait site.

For a crow that ingested DRC-1339 treated bait to pose a potential risk to human safety to someone harvesting crows during the hunting season in the State, a hunter would have to harvest a crow that ingested DRC-1339 treated bait and subsequently consume certain portions of the crow. The mode of action of DRC-1339 requires ingestion by crows so handling a crow harvested or found dead would not pose any primary risks to human safety. Although not specifically known for crows, in other sensitive species, DRC-1339 is metabolized and/or excreted quickly once ingested. In starlings, nearly 90% of the DRC-1339 administered dosages well above the LD_{50} for starlings was metabolized or excreted within 30 minutes of dosage (Cunningham et al. 1979). In one study more than 98% of a DRC-1339 dose delivered to starlings could be detected in the feces with 2.5 hours (Peoples and Apostolou 1967) with similar results found for other bird species (Eisemann et al. 2003). Once death occurs, DRC-1339 concentrations appear to be highest in the gastrointestinal tract of birds but some residue could be found in other tissue of carcasses examined (Giri et al. 1976, Cunningham et al. 1979, Johnston et al. 1999) with residues diminishing more slowly in the kidneys (Eisemann et al. 2003). However, most residue tests to detect DRC-1339 in tissues of birds have been completed using DRC-1339 dosages that far exceeded the known acute lethal oral dose for those species tested and far exceeds the level of DRC-1339 that would be ingested from treated bait. Johnston et al. (1999) found DRC-1339 residues in breast tissue of boat-tailed grackles using acute doses ranging from 40 to 863 mg/kg. The acute lethal oral dose of DRC-1339 for boat-tailed grackles has been estimated to be ≤ 1 mg/kg which is similar to the LD_{50} for crows (Eisemann et al. 2003). In those boat-tailed grackles consuming a trace of DRC-1339 up to 22 mg/kg, no DRC-1339 residues were found in the gastrointestinal track nor found in breast tissue (Johnston et al. 1999).

In summary, nearly all of the DRC-1339 ingested by sensitive species is metabolized or excreted quickly, normally within a few hours. Residues of DRC-1339 have been found in the tissues of birds consuming DRC-1339 at very high dosage rates that exceed current acute lethal dosages achieved under the label requirements of DRC-1339. Residues of DRC-1339 ingested by birds appear to be primarily located in the gastrointestinal tract of birds.

As stated previously, to pose of risks to human safety, a hunter would have to harvest a crow that has ingested DRC-1339 and then, ingest tissue of the crow containing residue. Very little information is

available on the acute or chronic toxicity of DRC-1339 on people. However, based on the information available, risks to human safety would be extremely low based on several factors. First, a hunter would have to harvest a crow that had ingested DRC-1339. As stated previously, the use of DRC-1339 primarily occurs to address damage associated with urban roosts. Hunting and discharging a firearm is prohibited in most municipal areas. Therefore, a crow would have to ingest treated bait and then travel to an area (typically outside of the city limit) where hunting was allowed. WS would not recommend hunting as a damage management tool in those general areas where DRC-1339 was actively being applied. Secondly, to pose a risk to human safety the crow would have to be consumed and the tissue consumed would have to contain chemical residues. Although no information is currently available on the number of people that might consume crows in Mississippi, very few, if any, people are likely consuming crows harvested in the State or elsewhere. Crows are primarily harvested for recreational purposes and to alleviate damage in the State and are not harvested for subsistence. Thirdly, the tissue consumed would have to contain chemical residues of DRC-1339. Current information indicates that the majority of the chemical is excreted within a few hours of ingestion. The highest concentration of the chemical occurs in the gastrointestinal tract of the bird which is discarded and not consumed. Although residues have been detected in the tissues that might be consumed (*e.g.*, breast meat) in some bird species that have consumed DRC-1339, residues appear to only be detectable when the bird has consumed a high dose of the chemical that far exceeds the LD_{50} for that species which would not be achievable under normal baiting procedures. Under the proposed action, the controlled and limited circumstances in which DRC-1339 would be used would prevent any exposure of the public to this chemical. Based on current information, the human health risks from the use of DRC-1339 would be virtually nonexistent under this alternative.

Reproductive inhibitors are formulated on bait and are administered to target wildlife through consumption of treated bait. Therefore, the current concern, outside of transport and storage, is the risks directly to the handler and support staff during the handling and distributing the bait on the ground for consumption.

Threats to human safety from the use of nicarbazin would likely be minimal if labeled directions are followed. The use pattern of nicarbazin would also ensure threats to public safety are minimal. The label requires an acclimation period which assists with identifying risks, requires the presence of the applicator at the location until all bait is consumed, and requires any unconsumed bait be retrieved. The EPA has characterized nicarbazin as a moderate eye irritant. The FDA has established a tolerance of nicarbazin residues of 4 parts per million allowed in uncooked chicken muscle, skin, liver, and kidney (21 CFR 556.445). The EPA characterized the risks of human exposure as low when used to reduce egg hatch in Canada geese. The EPA also concluded that if human consumption occurred, a prohibitively large amount of nicarbazin would have to be consumed to produce toxic effects (EPA 2005). Based on the use pattern of the nicarbazin and if label instructions are followed, risks to human safety would be low with the primary exposure occurring to those handling and applying the product. Safety procedures required by the label, when followed, would minimize risks to handlers and applicators.

Alpha chloralose is an immobilizing agent available only for use by WS. The FDA has approved the use of alpha chloralose as an INAD (INAD #6602) to be used for the immobilization and capture of certain species of birds by trained WS' personnel. Alpha chloralose is administered to target individuals, either as a tablet or liquid solution contained within a bread ball or as a powder formulated on whole kernel corn. Application of either form occurs by hand with applicators present on site for monitoring. Application of the tablet or liquid solution form in bread baits occurs by hand and targets individual or small groups of waterfowl. Alpha chloralose formulated on whole corn is placed on the ground in designated areas where target waterfowl are pre-conditioned to feed using a pre-bait. All unconsumed baits are retrieved. Since applicators are present at all times during application of alpha chloralose, the risks to human safety are low. All WS' employees using alpha chloralose are required to successfully

complete a training course on the proper use and handling of alpha chloralose. All WS' employees who use alpha chloralose would wear the appropriate personal protective equipment required to ensure the safety of employees.

Of additional concern with the use of immobilizing drugs and reproductive inhibitors is the potential for human consumption of meat from waterfowl that have been immobilized using alpha chloralose or have consumed nicarbazin. Since waterfowl are harvested during a regulated harvest season and consumed, the use of immobilizing drugs and potentially reproductive inhibitors is of concern. The intended use of immobilizing drugs is to live-capture waterfowl. Waterfowl are conditioned to feed during a period in the day when consumption of treated bait ensures waterfowl do not disperse from the immediate area where the bait is applied. The use of immobilizing drugs and reproductive inhibitors targets waterfowl in urban environments where hunting and the harvest of waterfowl does not occur or is unlikely to occur (*e.g.*, due to city ordinances preventing the discharge of a firearm within city limits). However, it could be possible for target waterfowl to leave the immediate area where baiting is occurring after consuming bait and enter areas where hunting could occur. To mitigate this risk, withdrawal times are often established. A withdrawal time is the period of time established between when the animal consumed treated bait to when it is safe to consume the meat of the animal by humans. Withdrawal periods are not well defined for free-ranging wildlife species for all drugs. In compliance with FDA use restrictions, the use of alpha chloralose is prohibited for 30 days prior to and during the hunting season on waterfowl and other game birds that could be hunted. In the event that WS is requested to immobilize waterfowl or use nicarbazin either during a period of time when harvest of waterfowl is occurring or during a period of time where a withdrawal period could overlap with the start of a harvest season, WS would not use immobilizing drugs or nicarbazin. In those cases other methods would be employed.

The recommendation by WS that birds be harvested during the regulated hunting season which is established by the MDWFP under frameworks determined by the USFWS would not increase risks to human safety above those risks already inherent with hunting those species. Recommendations of allowing hunting on property owned or managed by a cooperator to reduce bird populations which could then reduce damage or threats would not increase risks to human safety. Safety requirements established by the MDWFP for the regulated hunting season would further minimize risks associated with hunting. Although hunting accidents do occur, the recommendation of allowing hunting to reduce localized populations of birds would not increase those risks.

No adverse effects to human safety have occurred from WS' use of methods to alleviate bird damage in the State from FY 2005 through FY 2011. The risks to human safety from the use of non-lethal and lethal methods, when used appropriately and by trained personnel, is considered low.

Alternative 2 - Bird Damage Management by WS through Technical Assistance Only

Under this alternative, WS would be restricted to making recommendations of methods and the demonstration of methods only to resolve damage. The only methods that would not be available under this alternative would be mesurol, alpha chloralose, and some formulations of DRC-1339. WS would only provide technical assistance to those persons requesting assistance with bird damage and threats. Although hazards to human safety from non-lethal methods exist, those methods are generally regarded as safe when used by trained individuals who are experienced in their use. Risks to human safety from the use of non-lethal methods were considered low when evaluated in a formal risk assessment in WS' programmatic FEIS (USDA 1997). Risks to human safety associated with non-chemical methods such as resource management methods (*e.g.*, crop selection, limited habitat modification, modification of human behavior), exclusion devices, frightening devices, and cage traps were considered low based on their use profile for alleviating damage associated with wildlife (USDA 1997). Although some risk of fire and

bodily harm exists from the use of pyrotechnics and propane cannons, when used appropriately and in consideration of those risks, they can be used with a high degree of safety.

Personnel employing nets are present at the site during application to ensure the safety of the public and operators. Although some fire and explosive hazards exist with rocket nets during ignition and storage of the explosive charges, safety precautions associated with the use of the method, when adhered to, pose minimal risks to human safety and primarily occur to the handler. Nets would not be employed in areas where public activity is high which further reduces the risks to the general public. Nets would be employed in areas where public access is restricted whenever possible to reduce risks to human safety. Overall, nets would pose minimal risks to the public.

The use of chemical methods that are considered non-lethal would also be available under this alternative. Chemical methods available would include repellents. There are few chemical repellents registered for use to manage birds in the State. Most repellents require ingestion of the chemical to achieve the desired affects on target species. Repellents that require ingestion are intended to discourage foraging on vulnerable resources and to disperse birds from areas where the repellents are applied. The active ingredients of repellents that are currently registered for use to disperse birds include methyl anthranilate and polybutene. Another common active ingredient in repellents intended to disperse other bird species contain the active ingredient anthraquinone. Currently, no repellents are currently registered for use to disperse birds in the State that contain the active ingredient anthraquinone. Methyl anthranilate (grape derivative) and anthraquinone (plant extract) are naturally occurring chemicals. Repellents, when used according to label directions, are generally regarded as safe especially when the ingredients are considered naturally occurring. Some risk of exposure to the chemical occurs to the applicator and to others from the potential for drift as the product is applied. Some repellents also have restrictions on whether application can occur on edible plants with some restricting harvest for a designated period after application. All restriction on harvest and required personal protective equipment would be included on the label and if followed, would minimize risks to human safety associated with the use of those products.

The recommendation by WS that birds be harvested during the regulated hunting season which is established by the MDWFP would not increase risks to human safety above those risks already inherent with hunting birds. Recommendations of allowing hunting on property owned or managed by a cooperator to reduce bird populations which could then reduce bird damage or threats would not increase risks to human safety. Safety requirements established by the MDWFP for the regulated hunting season would further minimize risks associated with hunting. Although hunting accidents do occur, the recommendation of allowing hunting to reduce localized bird populations would not increase those risks.

The recommendation of shooting with firearms either as a method of direct lethal take could occur under this alternative. Safety issues due arise related to misusing firearms and the potential human hazards associated with firearms use when employed to reduce damage and threats. When used appropriately and with consideration for human safety, risks associated with firearms are minimal. If firearms are employed inappropriately or without regard to human safety, serious injuries could occur. Under this alternative, recommendations of the use of firearms by WS would include human safety considerations. Since the use of firearms to alleviate bird damage would be available under any of the alternatives and the use of firearms by those persons experiencing bird damage could occur whether WS was consulted or contacted, the risks to human safety from the use of firearms would be similar among all the alternatives.

If non-chemical methods are employed according to recommendations and as demonstrated by WS, the potential risks to human safety would be similar to the proposed action. If methods are employed without guidance from WS or applied inappropriately, the risks to human safety could increase. The extent of the increased risk would be unknown and variable. Non-chemical methods inherently pose minimal risks to human safety given the design and the extent of the use of those methods.

Given the use profile of many methods to manage damage and threats associated with birds, the risks to human safety from the use of those methods are low (USDA 1997). The cooperator requesting assistance is also made aware of threats to human safety associated with the use of those methods. SOPs for methods are discussed in Chapter 3 of this EA. Risks to human safety from activities and methods recommended under this alternative would be similar to the other alternatives since the same methods would be available. If misused or applied inappropriately, any of the methods available to alleviate bird damage could threaten human safety. However, when used appropriately, methods available to alleviate damage would not threaten human safety.

Alternative 3 – No Bird Damage Management Conducted by WS

Under the no bird damage management alternative, WS would not be involved with any aspect of managing damage associated with birds in the State, including technical assistance. Due to the lack of involvement in managing damage caused by birds, no impacts to human safety would occur directly from WS. This alternative would not prevent those entities experiencing threats or damage from birds from conducting damage management activities in the absence of WS' assistance. Many of the methods discussed in Appendix B would be available to those persons experiencing damage or threats and could be used to take birds if permitted by the USFWS and/or the MDWFP. The direct burden of implementing permitted methods would be placed on those experiencing damage.

Non-chemical methods available to alleviate or prevent damage associated with birds generally do not pose risks to human safety. Since most non-chemical methods available for bird damage management involve the live-capture or harassment of birds, those methods are generally regarded as posing minimal risks to human safety. Habitat modification and harassment methods are also generally regarded as posing minimal risks to human safety. Though some risks to safety are likely to occur with the use of pyrotechnics, propane cannons, and exclusion devices, those risks are minimal when those methods are used appropriately and in consideration of human safety. The only methods that would be available under this alternative that would involve the direct lethal taking of birds are shooting and nest destruction. Under this alternative, shooting and nest destruction would be available to those persons experiencing damage or threats of damage when permitted by the USFWS and/or the MDWFP. Firearms, when handled appropriately and with consideration for safety, pose minimal risks to human safety.

Similar to the technical assistance only alternative, DRC-1339, alpha-chloralose, and mesurol would not be available under this alternative to those persons experiencing damage or threats from birds. Chemical methods that would be available to the general public would include repellents and if a person obtained the appropriate restricted use pesticide license, a product with the same active ingredient as DRC-1339, if registered in the State, could be applied. Since most methods available to resolve or prevent bird damage or threats are available to anyone, the threats to human safety from the use of those methods are similar between the alternatives. However, methods employed by those persons not experienced in the use of methods or are not trained in their proper use, could increase threats to human safety. Overall, the methods available to the public, when applied correctly and appropriately, pose minimal risks to human safety.

Issue 4 - Effects on the Aesthetic Values of Birds

People often enjoy viewing, watching, and knowing birds exist as part of the natural environment and gain aesthetic enjoyment in such activities. Those methods available to alleviate damage are intended to disperse and/or remove birds. Non-lethal methods are intended to exclude or make an area less attractive which disperses birds to other areas. Similarly, lethal methods are intended to remove those birds

identified as causing damage or posing a threat of damage. The effects on the aesthetic value of birds as it relates to the alternatives are discussed below.

Alternative 1 - Continuing the Current Integrated Approach to Managing Bird Damage (Proposed Action/No Action)

Under the proposed action, methods would be employed that would result in the dispersal, exclusion, or removal of individuals or small groups of birds to resolve damage and threats. In some instances where birds are dispersed or removed, the ability of interested persons to observe and enjoy those birds would likely temporarily decline.

Even the use of exclusionary devices can lead to the dispersal of wildlife if the resource being damaged was acting as an attractant. Thus, once the attractant has been removed or made unavailable, the wildlife would likely disperse to other areas where resources are more vulnerable.

The use of lethal methods would result in temporary declines in local populations resulting from the removal of birds to address or prevent damage and threats. The goal under the proposed action is to respond to requests for assistance and to manage those birds responsible for the resulting damage. Therefore, the ability to view and enjoy birds would still remain if a reasonable effort is made to locate birds outside the area in which damage management activities occurred. Those birds removed by WS are those that could be removed by the person experiencing damage.

All activities are conducted where a request for assistance has been received and only after agreement for such services have been agreed upon by the cooperator. Some aesthetic value would be gained by the removal of birds and the return of a more natural environment, including the return of native wildlife and plant species that may be suppressed or displaced by high bird densities.

Since those birds removed by WS under this alternative could be removed with a depredation permit issued by the USFWS, under depredation orders, under control orders, without the need for a permit (non-native species), or the regulated hunting seasons, WS' involvement in taking those birds would not likely be additive to the number of birds that could be taken in the absence of WS' involvement.

WS' take of birds from FY 2005 through FY 2011 has been of low magnitude when compared to population estimates, trending data, and other available information. WS' activities would not likely be additive to the birds that would be taken in the absence of WS' involvement. Although birds removed by WS are no longer present for viewing or enjoying, those birds would likely be taken by the property owner or manager if WS was not involved in the action since take by the property owner or manager could occur under a depredation permit, under depredation orders for blackbirds and cormorants, control order for Muscovy ducks, during the regulated hunting seasons, or if the birds are non-native, take could occur without the need for a permit. Given the limited take proposed by WS under this alternative when compared to the known sources of mortality of birds, WS' bird damage management activities conducted pursuant to the proposed action would not adversely affect the aesthetic value of birds. The impact on the aesthetic value of birds and the ability of the public to view and enjoy birds under the proposed action would be similar to the other alternatives and is likely low.

Alternative 2 - Bird Damage Management by WS through Technical Assistance Only

If those persons seeking assistance from WS were those persons likely to conduct bird damage management activities in the absence of WS' involvement, then technical assistance provided by WS would not adversely affect the aesthetic value of birds in the State similar to Alternative 1. Birds could be lethally taken under this alternative by those entities experiencing bird damage or threats which would

result in localized reductions in the presence of bird at the location where damage was occurring. The presence of birds where damage was occurring would be reduced where damage management activities are conducted under any of the alternatives. Even the recommendation of non-lethal methods is likely to result in the dispersal of birds from the area if those non-lethal methods recommended by WS are employed by those persons receiving technical assistance. Therefore, technical assistance provided by WS would not prevent the aesthetic enjoyment of birds since any activities conducted to alleviate bird damage could occur in the absence of WS' participation in the action, either directly or indirectly.

Under this alternative, the effects on the aesthetic values of birds would be similar to those addressed in the proposed action. When people seek assistance with managing damage either from WS or another entity, the damage level has often reached an unacceptable economic threshold for that particular person. Therefore, in the case of bird damage, the social acceptance level of those birds has reached a level where assistance is requested and those persons are likely to apply methods or seek those entities that would apply those methods based on recommendations provided by WS or by other entities. Based on those recommendations, methods are likely to be employed by the requestor that would result in the dispersal and/or removal of birds responsible for damage or threatening safety. If those birds causing damage are dispersed or removed by those persons experiencing damage based on recommendations by WS or other entities, the potential effects on the aesthetic value of those birds would be similar to the proposed action alternative.

The impacts on aesthetics from a technical assistance program would only be lower than the proposed action if those individuals experiencing damage are not as diligent in employing those methods as WS would be if conducting an operational program. If those persons experiencing damage abandoned the use of those methods then birds would likely remain in the area and available for viewing and enjoying for those persons interested in doing so. Similar to the other alternatives, the geographical area in which damage management activities occurs is not such that birds would be dispersed or removed from such large areas that opportunities to view and enjoy birds would be severely limited.

Alternative 3 – No Bird Damage Management Conducted by WS

Under the no bird damage management by WS alternative, the actions of WS would have no impact on the aesthetic value of birds in the State. Those persons experiencing damage or threats from birds would be responsible for researching, obtaining, and using all methods as permitted by federal, state, and local laws and regulations. The degree to which damage management activities would occur in the absence of assistance by any agency is unknown but likely lower compared to damage management activities that would occur where some level of assistance was provided. Birds could still be dispersed or removed under this alternative by those persons experiencing damage or threats of damage. The potential impacts on the aesthetic values of birds could be similar to the proposed action if similar levels of damage management activities are conducted by those persons experiencing damage or threats or is provided by other entities. If no action is taken or if activities are not permitted by the USFWS, then no impact on the aesthetic value of birds would occur under this alternative.

Since birds could continue to be taken under this alternative, despite WS' lack of involvement, the ability to view and enjoy birds would likely be similar to the other alternatives. The lack of WS' involvement would not lead to a reduction in the number of birds dispersed or taken since WS' has no authority to regulate take or the harassment of birds in the State. The USFWS and the MDWFP with management authority over birds would continue to adjust all take levels based on population objectives for those bird species in the State. Therefore, the number of birds lethally taken annually through hunting and under the depredation permits and orders are regulated and adjusted by the USFWS and the MDWFP.

Those persons experiencing damage or threats would continue to use those methods they feel appropriate to resolve bird damage or threats, including lethal take. WS' involvement in bird damage management is therefore, not additive to the birds that could be taken in the State. The impacts to the aesthetic value of birds would be similar to the other alternatives.

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

The issue of humaneness and animal welfare concerns associated with methods available for use to manage bird damage has been raised. 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 the MDWFP. The humaneness of methods available for use in Mississippi, as the use of those methods relates to the alternatives, is discussed below.

Alternative 1 - Continuing the Current Integrated Approach to Managing Bird Damage (Proposed Action/No Action)

Under the proposed action, WS would integrate methods using 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, non-lethal methods would be used by WS which are generally 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 chemicals, nest/egg 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 individuals believe any use of lethal methods to resolve damage associated with wildlife is inhumane because the resulting fate is the death of the animal. Others 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 is to use methods as humanely as possible to effectively resolve 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 methods addressed when attempting to resolve 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, a cage trap is generally considered by most members of the public as "*humane*". Yet, without proper care, live-captured wildlife in a cage trap can be treated inhumanely if not attended to appropriately.

Therefore, the goal is to effectively 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.

Although some issues of humaneness could occur from the use of cage traps, nets, 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 are from injuries to animals while restrained and 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 are to be live-captured by WS, WS' personnel would be present on-site during capture events or methods would be checked frequently to ensure birds captured are addressed timely and to prevent injury. Although stress could occur from being restrained, 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 resolve requests for assistance to resolve or prevent bird damage and threats. Lethal methods would include shooting, DRC-1339, the recommendation that birds be harvested during regulated hunting seasons, and euthanasia after birds are live-captured. WS' use of euthanasia methods under the proposed action would follow those required by WS' directives (WS Directive 2.505) and recommended by the AVMA for use on free-ranging wildlife under field conditions (AVMA 2007).

The euthanasia methods being considered for use under the proposed action for live-captured birds are cervical dislocation and carbon dioxide. The AVMA guideline on euthanasia lists cervical dislocation and carbon dioxide as an acceptable method of euthanasia for free-ranging birds which can lead to a humane death (AVMA 2007). 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 guideline also lists 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 (AVMA 2007). WS' 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.

Although the mode of action of DRC-1339 is not well understood, it appears to cause death primarily by nephrotoxicity in susceptible species and by central nervous system depression in non-susceptible species (Decino et al. 1966, Westberg 1969, Schafer, Jr. 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 ingested DRC-1339 slightly above the LD_{50} for starlings appeared normal for 20 to 30 hours, but water consumption doubled after 4 to 8 hours and decreased thereafter. Food consumption remained fairly constant until about 4 hours before death, at which time starlings refused food and water and became listless and inactive. The birds perched with feathers fluffed as in cold weather and appeared to doze, but were responsive to external stimuli. As death nears, breathing increased slightly in rate and became more difficult; the birds no longer responded to external stimuli and became comatose. Death followed 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 which probably occurs 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. Certain formulations of DRC-1339 to manage damage caused by certain species of birds are only available to WS' personnel for use. A similar product containing the same active ingredient is commercially available as a restricted use

pesticide for use to manage damage associated with blackbirds and starlings but at the time this document was developed was not registered for use in Mississippi.

The chemical repellent under the tradename Avitrol acts as a dispersing agent when birds ingest treated bait particles which causes them to become hyperactive which elicits a flight response by other members of a flock. 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 merely 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.

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 in Appendix B to alleviate bird damage and/or threats in the State, except for DRC-1339, alpha chloralose, and mesurol, could be used under any of the alternatives by those persons experiencing damage regardless of WS' direct involvement. Therefore, the issue of humanness associated with methods would be similar across any of the alternatives since those methods could be employed. 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.

Alternative 2 - Bird Damage Management by WS through Technical Assistance Only

The issues of humaneness of methods under this alternative are likely to be perceived to be similar to humaneness issues discussed under the proposed action. This similarity is derived from WS' recommendation of methods that some consider inhumane. WS would not directly be involved with damage management 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 requester in resolving 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 resolve 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 in the proposed action.

Those persons 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 address 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 are not as diligent or timely in checking methods. Similar to Alternative 3, it is difficult to evaluate the behavior of individual people and what may occur under given circumstances. Therefore, only the availability of WS' assistance can be evaluated under this alternative since 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 since pain and distress of birds would likely be higher.

Alternative 3 – No Bird Damage Management Conducted by WS

Under this alternative, the issues of the humaneness of methods would not be considered by WS. WS would have no involvement in any aspect of bird damage management in the State. Those persons experiencing damage or threats associated with birds could use those methods legally available and permitted by the USFWS, the MDWFP, and 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 general public since 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 a humane method could be employed in inhumane ways if employed by those persons inexperience in the use of those methods or if those persons are 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 general public to use to resolve damage and threats caused by birds. Therefore, those methods considered inhumane would continue to be available for use under this alternative. If those persons experiencing bird damage apply those methods considered to be humane methods 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.

Issue 6 – Effects of Bird Damage Management Activities on the Regulated Harvest of Birds

The populations of several migratory bird species are sufficient to allow for annual harvest seasons that typically occur during the fall migration periods of those species. Migratory bird hunting seasons are established under frameworks developed by the USFWS and implemented in the State by the MDWFP. Those species addressed in this EA that have established hunting seasons include: snow geese, wood ducks, gadwall, mallards, blue-winged teal, American coots, common snipe, mourning doves, and crows. For many migratory bird species considered harvestable during a hunting season, the number of birds harvested during the season is reported by the USFWS and/or the MDWFP in published reports.

Alternative 1 - Continuing the Current Integrated Approach to Managing Bird Damage (Proposed Action/No Action)

WS' bird damage management activities would primarily be conducted on populations in areas where hunting access is restricted (*e.g.*, airports) or has been ineffective (*e.g.*, urban areas). The use of non-lethal or lethal methods often disperses birds from areas where damage is occurring to areas outside the damage area which could serve to move birds from those less accessible areas to places accessible to hunters.

The magnitude of take addressed in the proposed action would be low when compared to the mortality of birds from all known sources. When WS' proposed take of those bird species considered harvestable was included as part of the known mortality of those species from 2005 through 2011 and compared to the estimated populations of those species, the impact on those species' population was consistent with management goals set by the USFWS and MDWFP. The USFWS would determine the number of birds taken annually by WS through the issuance of depredation permits and by regulating take through the depredation orders and control orders.

Bird damage management activities conducted by WS would occur after consultation and approval by the USFWS. With oversight by the USFWS, the number of birds allowed to be taken by WS would not limit the ability of those persons interested to harvest those bird species during the regulated season. All take by WS would be reported to the USFWS annually to ensure take by WS is incorporated into population management objectives established for the populations of those bird species. Based on the limited take proposed by WS and the oversight of by the USFWS, WS' take of birds annually under the proposed action would have no effect on the ability of those persons interested to harvest birds during the regulated harvest season.

Alternative 2 - Bird Damage Management by WS through Technical Assistance Only

Under the technical assistance only alternative, WS would have no direct impact on bird populations in the State. If WS recommends the use of non-lethal methods and those non-lethal methods are employed by those persons experiencing damage, birds are likely to be dispersed from the damage area to areas outside the damage area which could serve to move those birds from those less accessible areas to places accessible to hunters. Although lethal methods could be recommend by WS under a technical assistance only alternative, the use of those methods could only occur after the property owner or manager received a depredation permit from the USFWS, under depredation orders, or take could occur during the regulated hunting season. WS' recommendation of lethal methods could lead to an increase in the use of those methods. However, the number of birds allowed to be taken under a depredation permit, under depredation orders, control orders, and during the regulated hunting seasons is determined by the USFWS and/or the MDWFP. Therefore, WS' recommendation of shooting or hunting under this alternative would not limit the ability of those persons interested to harvest birds during the regulated season since the USFWS and MDWFP determines the number of birds that may be taken during the hunting season, under depredation permits, under depredation orders, and under control orders.

Alternative 3 – No Bird Damage Management Conducted by WS

WS would have no impact on the ability to harvest birds under this alternative. WS would not be involved with any aspect of bird damage management. The USFWS and the MDWFP would continue to regulate populations through adjustments of the allowed take during the regulated harvest season and the continued use of depredation orders, control orders, and depredation permits.

Issue 7 - Effectiveness of Bird Damage Management Methods

A common issue when addressing wildlife damage is the effectiveness of the methods being employed to resolve the damage. When those persons experiencing wildlife damage request assistance from other entities, the damage occurring has likely reached or would reach an economic threshold that is unacceptable to those persons requesting assistance. Therefore, methods being employed to resolve damage must be effective at resolving damage or threats within a reasonable amount of time to prevent further economic loss. The issue of method effectiveness as it relates to each alternative analyzed in detail is discussed below.

Alternative 1 - Continuing the Current Integrated Approach to Managing Bird Damage (Proposed Action/No Action)

Under the proposed action, WS would continue the use of an adaptive approach using an integration of methods to resolve bird damage. WS would continue to provide both technical assistance and direct operational assistance to those persons requesting assistance. WS only provides assistance after a request has been received and a cooperative service agreement or other comparable document has been signed by WS and the requesting entity in which all methods used to address birds causing damage are agreed upon. Methods employed to manage bird damage, whether non-lethal or lethal, are often temporary with the duration dependent on many factors, including bird densities in the area, the availability of suitable habitat in the area, and the availability of methods. WS employs only those methods as agreed upon by the requestor after available methods are discussed.

A common issue raised is that the use of lethal methods is ineffective because additional birds are likely to return to the area, either after removal occurs or the following year when birds return to the area which gives the impression of creating a financial incentive to continue the use of only lethal methods. This assumes birds only return to an area where damage was occurring if lethal methods are used. However, the use of non-lethal methods is also often temporary which could result in birds returning to an area where damage was occurring once those methods are no longer used. The common factor when employing any method is that birds would return if suitable habitat continues to exist at the location where damage was occurring and bird densities are sufficient to occupy all available habitats. Therefore, any reduction or prevention of damage from the use of methods addressed in Appendix B would be temporary if habitat conditions continue to exist that attract birds to an area where damage occurs.

Dispersing birds using pyrotechnics, aversive noise, effigies, repellents, or any other non-lethal method addressed in Appendix B often requires repeated application to discourage birds which increases costs, moves birds to other areas where they could cause damage, and are temporary if habitat conditions remain unchanged. Dispersing and the translocating of birds could be viewed as moving a problem from one area to another which would require addressing damage caused by those birds at another location. WS' recommendation of or use of techniques to modifying existing habitat or making areas unattractive to birds is discussed in Appendix B. WS' objective is to respond to request for assistance with the most effective methods and to provide for the long-term solution to the problem using WS' Decision Model to adapt methods in an integrated approach to managing bird damage that is agreed upon by the cooperator.

As part of an integrated approach to managing bird damage, WS would have the ability to adapt methods to damage situations to effectively reduce or prevent damage from occurring. Under the proposed integrated approach, all methods, individually or in combination, could be employed as deemed appropriate through WS' Decision Model to address requests for assistance. WS' objective when receiving a request for assistance under the proposed action is to reduce damage and threats to human safety or to prevent damage from occurring using an integrated approach to managing bird damage. Therefore, under the proposed action, WS would employ methods adaptively to achieve that objective.

Managing damage caused by birds can be divided into short-term redistribution approaches and long-term population and habitat management approaches (Cooper and Keefe 1997). Short-term approaches focus on redistribution and dispersal of birds to limit use of an area where damage or threats were occurring. Short-term redistribution approaches may include prohibiting feeding, hazing with vehicles, effigies, adverse noise, erecting access barriers such as wire grids or fences, and taste aversion chemicals (Cooper and Keefe 1997). Population reduction by limiting survival or reproduction, removing birds, and habitat modification are considered long-term solutions to managing damage caused by birds (Cooper and Keefe 1997).

Redistribution methods are often employed to provide immediate resolution to damage occurring until long-term approaches can be implemented or have had time to reach the desired result. The USFWS has evaluated and implemented long-term approaches to managing snow geese populations with the intent of reducing damage to breeding areas (USFWS 2007). Dispersing birds are often short-term solutions that move birds to other areas where damages or threats could occur (Smith et al. 1999, Gorenzel et al. 2000, Gorenzel et al. 2002, Avery et al. 2008, Chipman et al. 2008). Chipman et al. (2008) found that crows could be dispersed from roost locations using non-lethal methods but crows would return to the original roost site within 2 to 8 weeks. The re-application of non-lethal methods to disperse crow roosts was required every year to disperse crows from the original roost or from roosts that had formed in other areas where damages were occurring (Chipman et al. 2008). Some short-term methods may become less effective in resolving damage as a bird population increases, as birds become more acclimated to human activity, and as birds become habituated to harassment techniques (Smith et al. 1999, Chipman et al. 2008). Non-lethal methods often require a constant presence at locations when birds are present and must be repeated every day until the desired results are achieved which can increase the costs associated with those activities. During a six-year project using only non-lethal methods to disperse crows in New York, the number of events required to disperse crows remained similar amongst years and at some locations, the number of events required to harass crows increased from the start of the project (Chipman et al. 2008). Long-term solutions to resolving bird damage often require management of the population (Smith et al. 1999) and identifying the habitat characteristics which attract birds to a particular location (Gorenzel and Salmon 1995).

For example, Cooper (1991) reported that the removal of geese posing or likely to pose a hazard to air safety at airports considerably reduced the population of local geese, decreased the number of goose flights through airport operations airspace, and significantly reduced goose-aircraft collisions at Minneapolis-St. Paul International Airport. In addition, Dolbeer et al. (1993*a*) demonstrated that an integrated approach (including removal of offending birds) reduced bird hazards at airports and substantially reduced bird collisions with aircraft by as much as 89%. Jensen (1996) also reported that an integrated approach that incorporated the removal of geese, reduced goose-aircraft collisions by 80% during a two year period.

The use of only non-lethal methods to alleviate damage involving other bird species has had similar results requiring constant application and re-application. Recent research has indicated that non-lethal harassment programs can reduce bird numbers at specific sites, but those programs do little to reduce the overall population of nuisance birds locally and may shift the problem elsewhere. Preusser et al. (2008) found that 12 of 59 geese banded at a study site in Orange County, New York that were hazed regularly were observed at an unmanaged location 1.2 km away on 161 occasions during 2004. This is similar to findings by Holevinski et al. (2007) who documented hazed radio-marked geese moved an average of 1.18 km at an urban site in Brighton, New York. Although Canada geese are not specifically addressed in this EA, the discussion of those examples of management methods employed to address goose damage are likely representative of the results achieved by those methods when applied to any bird species that

exhibit similar behaviors such as those species addressed in this assessment. Boyd and Hall (1987) showed that a 25% reduction in a local crow roost resulted in reduced hazards to a nearby airport.

Often of concern with the use of lethal methods is that birds that are lethally taken would only be replaced by other birds either during the application of those methods (*e.g.*, from other birds that immigrate into the area) or by birds the following year (*e.g.*, increase in reproduction and survival that could result from less competition). As stated previously, the use of lethal methods are not intended to be used as population management tools (except for hunting) over broad areas. The use of lethal methods are intended to reduce the number of birds present at a location where damage is occurring by targeting those birds causing damage or posing threats. The intent of employing lethal methods is to target those birds causing damage and not to manage entire bird populations; therefore, those lethal methods are not ineffective because birds return the following year.

As state previously, Chipman et al. (2008) found that crows returned to roosts previously dispersed using non-lethal methods within 2 to 8 weeks. In addition, Chipman et al. (2008) found that the use of non-lethal methods had to be re-applied every year during a six-year project evaluating the use of only non-lethal methods. At some roost locations, Chipman et al. (2008) found the number of crows that returned each year to roosts over a six-year period actually increased despite the use of non-lethal methods each year. Despite the need to re-apply non-lethal methods yearly, the return of birds to roost locations previously dispersed, and the number of crows using roost locations increasing annually at some roost locations, Chipman et al. (2008) determined the use of non-lethal methods could be effective at dispersing urban crow roosts in New York. Similar results were found by Avery et al. (2008) during the use of crow effigies and other non-lethal methods to disperse urban crow roosts in Pennsylvania. Crows returned to roost locations in Pennsylvania annually despite the use of non-lethal methods and effigies (Avery et al. 2008). Gorenzel et al. (2002) found that crows returned to roost locations after the use of lasers. Therefore, the use of both lethal and non-lethal methods may require repeated use of those methods. The return of birds to areas where damage management methods were previously employed does not indicated previous use of those methods were ineffective since the intent of those methods are to reduce the number of birds present at a site where damage is occurring at the time those methods are employed.

Another concern when employing methods to resolve bird damage associated with bird roosts is the apparent success of methods being claimed when birds actually have dispersed from an area naturally. This could apply to both lethal and non-lethal methods. Bird migration periods vary during the spring and fall depending on the geographical region and other natural stimuli (Verbeek and Caffrey 2002). Many of the studies evaluating methodologies for alleviating crow damage occurred during periods of time when crows could have been dispersing naturally which must be considered when evaluating the success of methods in reducing damage. Boyd and Hall (1987) determined a reduction of the number of crows in roost by 25% using DRC-1339 could reduce damage occurring from crows using local roosts in Arkansas and Kentucky. However, work conducted using DRC-1339 occurring in January and February when roosts could have been breaking up naturally as crows disperse to breeding areas. Chipman et al. (2008) found the use of non-lethal methods could be effective in dispersing urban crow roosts in New York. However, hazing projects did not occur until after pre-treatment assessments of crow roosts were conducted from November through January during the six-year project (Chipman et al. 2008). Thus, similar to the work conducted by Boyd and Hall (1987), those non-lethal methods employed by Chipman et al. (2008) in New York occurred in January and could have occurred during the period of time when crows begin to disperse naturally. Avery et al. (2008) noted that the use of effigies and other non-lethal methods at crow roosts in Pennsylvania during December 2005 were successful in breaking up the large roost into smaller roosts but the roosts did not begin to disperse until January. Therefore, to effectively evaluate the future use of methods, in bird damage management activities, WS would consider the time of year those methods were employed in relationship to when birds may have dispersed naturally.

Based on the evaluation of the damage situation, the most effective methods would be employed individually or in combination based on the prior evaluations of methods or combinations of methods in other damage management situations. Once employed, methods would be further evaluated for effectiveness based on a continuous evaluation of activities by WS. Therefore, the effectiveness of methods is considered as part of the decision making-process under WS' use of the Decision Model described in Chapter 3 for each damage management request based on continual evaluation of methods and results.

This alternative would be more effective than any of the other alternatives in reducing or minimizing damage caused by birds. Population limiting techniques (*e.g.*, hunting, capture and euthanize, shooting, and nest/egg destruction) may have long-term effects and can slow population growth or even reduce the size of a bird population (Cooper and Keefe 1997). This alternative would give WS the option to implement lethal management in response to human health and safety concerns and damage to property and other resources. This alternative would enhance WS' effectiveness and ability to address a broader range of damage problems.

Alternative 2 - Bird Damage Management by WS through Technical Assistance Only

With WS providing technical assistance but no direct management under this alternative, entities requesting assistance with bird damage management would either take no action, which means conflicts and damage would likely continue or increase in each situation as bird numbers are maintained or increased, or implement WS' recommendations for non-lethal and lethal control methods. Methods of frightening or dispersing birds have been effective at specific sites. In most instances however, these methods have simply shifted the problem elsewhere (Conover 1984, Aguilera et al. 1991, Swift 1998). Of the non-lethal techniques commonly used by the public to reduce conflicts with birds (*e.g.*, feeding ban, habitat modification, repellents, fencing, aversive noise, people or vehicles), only fencing was reported to have been highly effective (Cooper and Keefe 1997). Habitat modifications, while potentially effective, are poorly accepted, not widely employed, and many are not biologically sound (*e.g.*, draining or reducing water levels in wetlands). Long-term solutions usually require some form of local population reduction to stabilize or reduce bird population size (Smith et al. 1999). Population reduction would be limited to applicable state and federal laws and regulations authorizing take of birds, including legal hunting and take pursuant to depredation permits. However, individuals or entities that implement management may not have the experience necessary to efficiently and effectively conduct the actions.

Under this alternative, most of the methods described in Appendix B would be recommended and/or demonstrated. WS would recommend methods using the WS Decision Model based on information provided by those persons requesting assistance or through site visits. WS would describe and demonstrate the correct application of those lethal and non-lethal methods available. If those persons receiving technical assistance apply methods as recommended and demonstrated by WS, those methods when employed to resolve bird damage are reasonably anticipated to be effective in resolving damage occurring. Under this alternative, those persons requesting assistance would be provided information on bird behavior to ensure methods are applied when the use of those methods are likely to be most effective.

The effectiveness of methods under this alternative would be similar to the other alternatives since many of the same methods would be available. If methods are employed as intended and with regard to the behavior of the bird species causing damage, those methods are likely to be effective in resolving damage. The demonstration of methods and the information provided on bird behavior provided by WS through technical assistance under this alternative would likely increase the effectiveness of the methods employed by those persons requesting assistance. However, if methods are employed that are not recommended or if those methods are employed incorrectly by those persons requesting assistance, methods could be less effective in resolving damage or threats.

Alternative 3 – No Bird Damage Management Conducted by WS

The methods available to those persons experiencing damage under this alternative would be similar to those methods that would be available under the other alternatives. The only method that would not be available under this alternative would be the use of DRC-1339, mesurol, and alpha-chloralose which are restricted to use by WS only. WS would not be directly involved with application of any methods to resolve damage caused by birds in the State under this alternative. The recommendation of methods and the use of methods would be the responsibility of other entities and/or those persons experiencing damage. When available methods are employed as intended, a reasonable amount of effectiveness is expected. If methods are employed incorrectly due to a lack of knowledge of the correct use of those methods or if methods are employed without consideration of the behavior of birds causing damage, those methods being employed are likely to be less effective.

Since those methods available for resolving bird damage would be available to those persons experiencing damage or threats, the effectiveness of those methods when used as intended would be similar among the alternatives. Those non-lethal methods discussed in Appendix B would be available to those persons experiencing bird damage despite WS' lack of involvement under this alternative. The use of lethal methods under this alternative would continue to be available, as permitted by the USFWS. Since WS would not be involved with any aspect of bird damage management under this alternative, the use of methods and the proper application of methods would occur as decided by the persons experiencing damage or by other entities providing assistance.

4.2 CUMULATIVE IMPACTS OF THE PROPOSED ACTION BY ISSUE

Cumulative impacts, as defined by CEQ (40 CFR 1508.7), are impacts to the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts may result from individually minor, but collectively significant, actions taking place over time.

Under Alternative 1 and Alternative 2, WS would address damage associated with birds either by providing technical assistance (Alternative 2) or by providing technical assistance and direct operational assistance (Alternative 1) in the State. WS would be the primary agency conducting direct operational bird damage management in the State under Alternative 1 and Alternative 2. However, other federal, State, and private entities could also be conducting bird damage management in the State. The take of native migratory bird species requires a depredation permit from the USFWS pursuant to the MBTA, which requires permit holders to report all take occurring under the permit. Take of blackbirds can occur under depredation orders without the need for a depredation permit. Muscovy ducks can be lethally taken pursuant to a control order. Free-ranging or feral domestic waterfowl, rock pigeons, Eurasian collared-doves, European starlings, and house sparrows can be lethally taken without the need for a depredation permit since they are considered non-native species. Several species of birds addressed in this assessment can be harvested during the annual regulated harvest season.

WS does not normally conduct direct damage management activities concurrently with such agencies or other entities in the same area, but may conduct bird damage management activities at adjacent sites within the same time frame. In addition, commercial pest control companies may conduct bird damage management activities in the same area. The potential cumulative impacts analyzed below could occur either as a result of WS' damage management program activities over time, or as a result of the aggregate effects of those activities combined with the activities of other agencies and private entities. Through ongoing coordination and collaboration between WS, the USFWS, and the MDWFP, activities of each

agency and the take of birds would be available. Bird damage management activities in the State would be monitored to evaluate and analyze activities to ensure they are within the scope of analysis of this EA.

Issue 1 - Effects of Damage Management Activities on Target Bird Populations

Evaluation of activities relative to target species indicated that program activities would likely have no cumulative adverse effects on bird populations when targeting those species responsible for damage. WS' actions would be occurring simultaneously, over time, with other natural processes and human generated changes that are currently taking place. These activities include, but are not limited to:

- Natural mortality of birds
- Human-induced mortality of birds through private damage management activities
- Human-induced mortality through regulated harvest
- Human and naturally induced alterations of wildlife habitat
- Annual and perennial cycles in wildlife population densities

All those factors play a role in the dynamics of bird populations. In many circumstances, requests for assistance arise when some or all of those elements have contrived to elevate target species populations or place target species at a juncture to cause damage to resources. The actions taken to minimize or eliminate damage are constrained as to scope, duration, and intensity for the purpose of minimizing or avoiding impacts to the environment. WS uses the Decision Model to evaluate damage occurring, including other affected elements and the dynamics of the damaging species; to determine appropriate strategies to minimize effects on environmental elements; applies damage management actions; and subsequently monitors and adjusts/ceases damage management actions (Slate et al. 1992, USDA 1997). This process allows WS to take into consideration other influences in the environment, such as those listed above, in order to avoid cumulative adverse impacts on target species.

With management authority over bird population, the USFWS and the MDWFP can adjust take levels, including the take of WS, to ensure population objectives for birds are achieved. Consultation and reporting of take by WS would ensure the USFWS and the MDWFP considers any activities conducted by WS.

WS' take of birds in Mississippi from FY 2005 through FY 2011 was of a low magnitude when compared to the total known take and when compared to available population information. The USFWS considers all known take when determining population objectives for birds and can adjust the number of birds that can taken during the regulated harvest season and the number of birds taken for damage management purposes to achieve the population objectives. Any take by WS would occur at the discretion of the USFWS. Any bird population declines or increases would be the collective objective for bird populations established by the USFWS through the regulation of take. Therefore, the cumulative take of birds annually or over time by WS would occur at the desire of the USFWS as part of management objectives for birds in the State. No cumulative adverse impacts on target and non-target wildlife are expected from WS' bird damage management actions based on the following considerations:

Historical outcomes of WS' damage management activities on wildlife

Bird damage management activities are conducted by WS only at the request of a cooperator to reduce damage that is occurring or to prevent damage from occurring and only after methods to be used are agreed upon by all parties involved. WS would monitor activities to ensure any potential impacts are identified and addressed. WS works closely with state and federal resource agencies to ensure damage management activities are not adversely impacting bird populations and that WS' activities are considered as part of management goals established by those agencies. Historically, WS' activities to manage birds

in Mississippi have not reached a magnitude that would cause adverse impacts to bird population in the State.

SOPs built into the WS program

SOPs are designed to reduce the potential negative effects of WS' actions on birds, and are tailored to respond to changes in wildlife populations which could result from unforeseen environmental changes. This would include those changes occurring from sources other than WS. Alterations in programs are defined through SOPs and implementation is insured through monitoring, in accordance with the WS' Decision Model (Slate et al. 1992, USDA 1997).

Issue 2 - Effects on Non-target Wildlife Species Populations, Including T&E Species

Potential effects on non-target species from conducting bird damage management arise from the use of non-lethal and lethal methods to alleviate or prevent those damages. The use of non-lethal methods during activities to reduce or prevent damage caused by birds has the potential to exclude, disperse, or capture non-target wildlife. However, the effects of non-lethal methods are often temporary and often do not involve the take (killing) of non-target wildlife species. When using exclusion devices and/or repellents, both target and non-target wildlife can be prevented from accessing the resource being damaged. Since exclusion does not involve lethal take, cumulative impacts on non-target species from the use of exclusionary methods would not occur but would likely disperse those individuals to other areas. Exclusionary methods are often expensive and require constant maintenance or application to ensure effectiveness. Therefore, the use of exclusionary devices would be somewhat limited to small, high-value areas and not used to the extent that non-targets are excluded from large areas that would cumulatively impact populations from the inability to access a resource, such as potential food sources or nesting sites. The use of visual and auditory harassment and dispersion methods are generally temporary with non-target species returning after the cessation of those activities. Dispersal and harassment do not involve the take (killing) of non-target species and similar to exclusionary methods are not used to the extent or at a constant level that would prevent non-targets from accessing critical resources that would threaten survival of a population.

The use of lethal methods or those methods used to live-capture target species followed by euthanasia also have the potential to impact non-target wildlife through the take (killing) or capture of non-target species. Capture methods used are often methods that are set to confine or restrain target wildlife after being triggered by a target individual. Capture methods are employed in such a manner as to minimize the threat to non-target species by placement in those areas frequently used by target wildlife, using baits or lures that are as species specific as possible, and modification of individual methods to exclude non-targets from capture. With all live-capture devices, non-target wildlife captured can be released on site if determined to be able to survive following release. SOPs are intended to ensure take of non-target wildlife is minimal during the use of methods to capture target wildlife.

The use of firearms and euthanasia methods are essentially selective for target species since identification of an individual is made prior to the application of the method. Euthanasia methods are applied through direct application to target wildlife. Therefore, the use of those methods would not impact non-target species.

Chemical methods available for use under the proposed action are repellents, nicarbazin, mesurol, alpha-chloralose, and DRC-1339 which are described in Appendix B. Except for repellents that are applied directly to the affected resource, all chemical methods are employed using baits that are highly attractive to target species and used in areas where exposure to non-targets are minimal. The use of those methods requires an acclimation period and monitoring of potential bait sites for non-target activity. All chemicals

would be used according to product label which ensure that proper use would minimize non-target threats. WS' adherence to Directives and SOPs governing the use of chemicals also ensures non-target hazards are minimal.

All chemical methods would be tracked and recorded to ensure proper accounting of used and unused chemicals occurs. All chemicals would be stored and transported according with WS' Directives and relevant federal, state, and local regulations. The amount of chemicals used or stored by WS would be minimal to ensure human safety. Based on this information, WS' use of chemical methods, as part of the proposed action, would not have cumulative impacts on non-targets.

All label requirements of DRC-1339 would be followed to minimize non-target hazards. As required by the label, all potential bait sites are pre-baited and monitored for non-target use as outlined in the pre-treatment observations section of the label. If non-targets are observed feeding on the pre-bait, the plots are abandoned and no baiting would occur at those locations. Once sites are baited, sites are monitored daily to further observe for non-target feeding activity. If non-target birds are observed feeding on bait, those sites are abandoned. WS would retrieve all dead birds to the extent possible, following treatment with DRC-1339 to minimize secondary hazards associated with scavengers feeding on bird carcasses.

Only those repellents registered for use in the State by the EPA and the MDAC would be used or recommended by WS as part of an integrated approach to managing damage and threats associated with birds. The recommendation and/or use of repellents would also follow all label instructions approved by the EPA. Repellents are registered in accordance with the FIFRA through a review process administered by the EPA. The FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. Repellents available for use to disperse birds from areas of application must be registered with the EPA according to the FIFRA. Although some hazards exist from the use of repellents, hazards occur primarily to the handler and applicator. When repellents that are registered for use by the EPA in accordance to the FIFRA and are applied according to label requirements, no adverse effects to non-targets are expected.

The active ingredient in numerous commercial repellents is methyl anthranilate which is a derivative of grapes and used as a flavoring in food and as a fragrance in cosmetics. Other repellents available contain the active ingredient polybutene, which when applied, creates a sticky surface which is intended to prevent perching. Although not registered for use to disperse birds in Mississippi, other bird repellents registered contain the active ingredient anthraquinone, which is a naturally occurring plant extract. Characteristics of these chemicals and potential use patterns indicate that no significant cumulative impacts related to environmental fate are expected from their use in WS' programs in Mississippi when used according to label requirements.

The use of immobilizing chemicals, reproductive inhibitors, and euthanasia methods are essentially selective for target species since identification of an individual is made prior to the application of the method. Immobilizing chemicals and reproductive inhibitors are applied using hand baiting which targets individuals or groups of target species in which the birds have been acclimated to feeding on the bait in a certain location. With immobilizing drugs and reproductive inhibitors, all unconsumed bait must be retrieved after each application which further limits non-target exposure. With immobilizing chemicals, the applicator is present on-site at all times to retrieve sedated birds which allows for constant monitoring for non-targets in the area of application. Euthanasia methods require the target bird species to be restrained before application which allows for any non-targets to be released if captured. Therefore, the use of those methods would not impact non-target species.

The methods described in Appendix B all have a high level of selectivity and can be employed using SOPs to ensure minimal impacts to non-targets species. No non-targets were taken by WS during bird

damage management activities from FY 2005 through FY 2011. Based on the methods available to resolve bird damage and/or threats, WS does not anticipate the number of non-targets taken to reach a magnitude where declines in those species' populations would occur. Therefore, take under the proposed action of non-targets would not cumulatively impact non-target species. WS' has reviewed the T&E species listed by the MDWFP, the USFWS, and the National Marine Fisheries Services and has determined that bird damage management activities proposed by WS would not likely adversely affect T&E species. Cumulative impacts would be minimal on non-targets from any of the alternatives discussed**.**

Issue 3 - Effects of Damage Management Methods on Human Health and Safety

All non-chemical methods described in Appendix B are used within a limited time frame, are not residual, and do not possess properties capable of inducing cumulative adverse impacts on human health and safety. All non-chemical methods are used after careful consideration of the safety of those persons employing methods and to the public. Capture methods would be employed where human activity is minimal to ensure the safety of the public, whenever possible. Capture methods also require direct contact to trigger ensuring that those methods, when left undisturbed would have no effect on human safety. All methods are agreed upon by the requesting entities which are made aware of the safety issues of those methods when entering into a MOU, cooperative service agreement, or other comparable document between WS and the cooperating entity. SOPs also ensure the safety of the public from those methods used to capture or take wildlife. A formal risk assessment conducted by APHIS determined that WS' non-chemical methods, when used as intended, poses a low risk to human safety (USDA 1997). Firearms used to alleviate or prevent damage, though hazards do exist, are employed to ensure the safety of employees and the public.

Personnel employing non-chemical methods would continue to be trained to be proficient in the use of those methods to ensure safety of the applicator and to the public. Based on the use patterns of non-chemical methods, those methods would not cumulatively impact human safety.

Repellents have been available for use to disperse birds from areas of application are available. All repellents must be registered with the EPA according to the FIFRA and registered for use in the State by the MDAC. Many of the repellents currently available for use have active ingredients that are naturally occurring and are generally regarded as safe. Although some hazards exist from the use of repellents, hazards occur primarily to the handler and applicator. When repellents are applied according to label requirements, no adverse effects to human safety would be expected.

Chemical methods available for use under the proposed action are repellents, reproductive inhibitors, immobilizing drugs, and euthanizing chemicals described in Appendix B. Repellents are commercially available to the public and can be applied over large areas to discourage birds from feeding in an area. The active ingredients of those repellents available for birds are methyl anthranilate and anthraquinone. Methyl anthranilate, which has been classified by the FDA as a product that is "*generally recognized as safe*", is a naturally occurring chemical found in grapes, and is synthetically produced for use as a grape food flavoring and for perfume (see 21 CFR 182.60). The EPA exempts methyl anthranilate from the requirement of establishing a tolerance for agricultural applications (see 40 CFR 180.1143). The final ruling published by the EPA on the exemption from the requirement of a tolerance for methyl anthranilate concludes with reasonable certainty that no harm would occur from cumulative exposure to the chemical by the public, including infants and children, when applied according to the label and according to good agricultural practices (see 67 FR 51083-51088). Based on the use patterns of methyl anthranilate and the conclusions of the FDA and the EPA on the toxicity of the chemical, WS' use of methyl anthranilate and the recommendation of the use the chemical would not have cumulative impacts.

Additional repellents contain the active ingredient anthraquinone. Overall, the EPA considers the toxicological risk from exposure to anthraquinone to be negligible (EPA 1998). The EPA also considers the primary cumulative exposure is most likely to occur to handlers and/or applicators from dermal, oral, and inhalation exposure but consider the exposure risks, when appropriate measures are taken, to be negligible (EPA 1998). Therefore, the EPA concluded that cumulative effects were not expected from any common routes of toxicity (EPA 1998). Based on the known use patterns and the conclusions of the EPA, no cumulative effects are expected from WS' use of anthraquinone or the recommendation of the use of anthraquinone.

DRC-1339 may be used by WS or recommended by WS for use to manage damage or threats associated with birds in Mississippi. DRC-1339 has been evaluated for possible residual effects which might occur from buildup of the chemical in soil, water, or other environmental sites. DRC-1339 is formulated on baits and placed in areas only after pre-baiting has occurred and in only those areas where non-targets are not present or would not be exposed to treated baits. Baits treated with DRC-1339 are placed on platforms or other hard surfaces where they seldom come into contact with soil, surface water, and/or ground water. All uneaten bait is recovered and disposed of according to EPA label requirements.

DRC-1339 exhibits a low persistence in soil or water, and bioaccumulation of the chemical is unlikely (USDA 1997). Additionally, the relatively small quantity of DRC-1339 that could potentially be used in bird damage management programs in Mississippi, the chemical's instability which results in degradation of the product, and application protocols used in WS' programs further reduces the likelihood of any environmental accumulation. The use of DRC-1339 under the proposed action and in other bird damage management activities is not expected to increase to a level that adverse effects would occur from the cumulative use of the chemical. Based on potential use patterns, the chemical and physical characteristics of DRC-1339, and factors related to the environmental fate, no cumulative impacts are expected from the lethal chemical components used or recommended by the WS program in Mississippi.

The immobilizing drug alpha chloralose is only available to WS for use to capture waterfowl. To capture waterfowl, alpha chloralose tablets are inserted into a dough ball made out of bread and/or the powder form is formulated onto whole kernel corn or mixed and used with bread baits. After an acclimation period where waterfowl are habituated to feeding on certain bait, being fed at a certain time, and at a certain location, treated baits are substituted for the pre-bait. As required by WS' use of alpha chloralose under the INAD, all unconsumed bait must be retrieved. Since target wildlife are habituated to feed at a certain location and a certain time on a similar pre-bait, a general estimate of the needed bait can be determined and bait is readily consumed by target species which limits the amount of time bait is exposed. Application of alpha chloralose is limited in duration given that baiting ceases once the target birds are removed. Through acclimation, the majority of target birds can be conditioned to feed at a certain time and location which allows for the majority of target birds to be removed after an initial application of alpha chloralose treated baits. Some follow-up baiting could occur to remove any remaining waterfowl that were not captured during the initial baiting efforts. In compliance with FDA use restrictions, the use of alpha chloralose is prohibited for 30 days prior to and during the hunting season on waterfowl and other game birds that could be hunted. Given the use patterns of alpha chloralose described, no cumulative impacts from the use of alpha chloralose to capture waterfowl are expected.

WS' personnel are required to attend training courses and be certified in the application of alpha chloralose to ensure proper care and handling, to ensure the proper doses are administered, and to ensure human safety.

Direct application of chemical methods to target species would ensure that there are no cumulative impacts to human safety. All chemical methods would be tracked and recorded to ensure proper

accounting of used and unused chemicals occurs. All chemicals would be stored and transported according to FDA and DEA regulations, including the directives of the cooperating agencies. The amount of chemicals used or stored by WS and cooperating agencies would be minimal to ensure human safety. Based on this information, the use of chemical methods as part of the proposed action by WS and cooperating agencies would not have cumulative impacts on human safety.

The only euthanasia chemical proposed for use by WS is carbon dioxide, which is an approved method of euthanasia for birds by the AVMA. Carbon dioxide is naturally occurring in the environment ranking as the fourth most abundant gas in the atmosphere. However, in high concentrations carbon dioxide causes hypoxia due to the depression of vital centers and is considered a moderately rapid form of euthanasia (AVMA 2007). Carbon dioxide is commercially available as a compressed bottled gas. Carbon dioxide is a colorless, odorless, non-flammable gas used for a variety of purposes, such as in carbonated beverages, dry ice, and fire extinguishers. Although some hazards exist from the inhalation of high concentrations of carbon dioxide during application for euthanasia purposes, when use appropriately, the risks of exposure are minimal. Since carbon dioxide is a common gas found in the environment, the use of and/or recommending the use of carbon dioxide for euthanasia purposes with not have cumulative impacts.

WS has received no reports or documented any adverse effects to human safety from WS' bird damage management activities conducted from FY 2005 through FY 2011. No cumulative adverse effects from the use of those methods discussed in Appendix B are expected given the use patterns of those methods for resolving bird damage in the State.

Issue 4 - Effects on the Aesthetic Values of Birds

The activities of WS would result in the removal of birds from those areas where damage or threats were occurring. Therefore, the aesthetic value of birds in those areas where damage management activities were being conducted would be reduced. However, for some people, the aesthetic value of a more natural environment would be gained by reducing bird densities, including the return of native plant species that may be suppressed or killed by accumulations of fecal dropping by high bird densities found under roost areas.

Some people experience a decrease in aesthetic enjoyment of wildlife because they feel that overabundant species are objectionable and interfere with their enjoyment of wildlife in general. Continued increases in numbers of individuals or the continued presence of birds may lead to further degradation of some people's enjoyment of any wildlife or the natural environment. The actions of WS could positively affect the aesthetic enjoyment of wildlife for those people that are being adversely affected by the target species identified in this EA.

Bird population objectives are established and enforced by the USFWS and the MDWFP through the regulating of take after consideration of other known mortality factors. Therefore, WS has no direct impact on the status of the bird population since all take by WS occurs at the discretion of the USFWS and/or the MDWFP. When damage caused by birds has occurred, any removal of birds by the property or resource owner would likely occur whether WS was involved with taking the birds or not. Therefore, the activities of WS are not expected to have any cumulative adverse effects on this element of the human environment if occurring at the request of a property owner and/or manager.

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

WS continues to seek new methods and ways to improve current technology to improve the humaneness of methods used to manage damage caused by wildlife. Cooperation with individuals and organizations

involved in animal welfare continues to be an agency priority for the purpose of evaluating strategies and defining research aimed at developing humane methods.

All methods not requiring direct supervision during employment (*e.g.*, live traps) would be checked and monitored to ensure any wildlife confined or restrained are addressed in a timely manner to minimize distress of the animal. All euthanasia methods used for live-captured birds would be applied according to AVMA guidelines for free-ranging wildlife. Shooting would occur in limited situations and personnel would be trained in the proper use of firearms to minimize pain and suffering of birds taken by this method.

WS employs methods as humanely as possible by applying measures to minimize pain and that allow wildlife captured to be addressed in a timely manner to minimize distress. Through the establishment of SOPs that guide WS in the use of methods to address damage and threats associated with birds in the State, the cumulative impacts on the issue of method humaneness are minimal. All methods would be evaluated annually to ensure SOPs are adequate to ensure those methods continue to be used to minimize suffering and that wildlife captured are addressed in a timely manner to minimize distress.

Issue 6 – Effects of Bird Damage Management Activities on the Regulated Harvest of Birds

As discussed in this EA, the magnitude of WS' bird take for damage management purposes from FY 2005 through FY 2011 was low when compared to the total take of birds and when compared to the estimated statewide population. Since all take of birds is regulated by the USFWS and the MDWFP, the take of birds by WS that would occur annually and cumulatively would occur pursuant to bird population objectives established in the State. WS' take of birds (combined take) annually to alleviate damage would be a minor component to the known take that occurs annually during the harvest seasons.

The populations of several migratory bird species are sufficient to allow for annual harvest seasons that typically occur during the fall migration periods of those species. Migratory bird hunting seasons are established under frameworks developed by the USFWS and implemented in the State by the MDWFP. Those species addressed in this EA that have established hunting seasons include: Snow geese, wood ducks, gadwall, mallards, blue-winged teal, American coots, common snipe, mourning doves, and crows.

With oversight of bird take, the USFWS and the MDWFP maintains the ability to regulate take by WS to meet management objectives for birds in the State. Therefore, the cumulative take of birds is considered as part of the USFWS and the MDWFP objectives for bird populations in the State.

Issue 7 - Effectiveness of Bird Damage Management Methods

As discussed in Chapter 2, the effectiveness of any damage management program could be defined in terms of losses or risks potentially reduced or prevented which is based on how accurately practitioner's diagnosis the problem, the species responsible for the damage, and how actions are implemented to correct or mitigate risks or damages. The most effective approach to resolving any damage problem is to use an adaptive integrated approach which may call for the use of several management methods simultaneously or sequentially (USDA 1997, Courchamp et al. 2003).

Effectiveness is based on the types of methods employed, the application of the method, restrictions on the use of the method(s), the skill of the personnel using the method and, for WS' personnel, the guidance provided by WS' Directives and policies. The goal of the WS' program is to reduce damage, risks, and conflicts with wildlife as requested. WS recognizes that localized population reduction could be short-term and that new individuals may immigrate, be released at the site, or be born to animals remaining at the site (Courchamp et al. 2003). The ability of an animal population to sustain a certain level of removal

and to eventually return to pre-management levels; however, does not mean individual management actions are unsuccessful, but that periodic management may be necessary.

Correlated with the effectiveness of methods at reducing or alleviating damage or threats is the costs associated with applying methods to reduce damage or threats. If methods are ineffective at reducing or alleviating damage or if methods require re-application after initially being successful, the costs associated with applying those methods increases. An analysis of cost-effectiveness in many bird damage management situations is difficult or impossible to determine because the value of benefits may not be readily calculable and personal perspectives differ about damage. For example, the potential benefit of eliminating feral waterfowl from defecating on public use areas could reduce incidences of illness among an unknown number of users. Since some bird-borne diseases are potentially fatal, or severely debilitating, the value of the benefit may be high. However, no studies of disease problems with and without bird damage management have been conducted, and, therefore, the number of cases prevented because of damage management are not possible to estimate. Also, it is rarely possible to conclusively prove that birds are responsible for individual disease cases or outbreaks which were discussed in the EA in Chapter 1.

As part of an integrated approach to managing bird damage, WS has the ability to adapt methods to damage situations to effectively reduce or prevent damage from occurring. Under the proposed integrated approach, all methods, individually or in combination, could be employed as deemed appropriate through WS' Decision Model to address requests for assistance. WS' objective when receiving a request for assistance under the proposed action is to reduce damage and threats to human safety or to prevent damage from occurring using an integrated approach to managing bird damage. Therefore, under the proposed action, WS would employ methods adaptively to achieve that objective.

In regards to the effectiveness of methods used, Avery (2002) cited studies where lethal damage management did reduce losses to crops (Elliott 1964, Larsen and Mott 1970, Palmer 1970, Plesser et al. 1983, Tahon 1980, Glahn et al. 2000*a* as cited in Avery 2002) and posed little danger to non-target species (Glahn et al. 2000*a*). Avery (2002) also stated that it seems reasonable that local, short-term crop protection could be achieved through reduction in depredating bird populations; however, quantification of the relationship between the numbers of birds killed and the associated reduction in crop damage is lacking. Avery (2002) only states that studies demonstrating economic benefit from the use of lethal methods are lacking but does not state that lethal methods to resolve damage are not economically effective.

CEQ does not require a formal, monetized cost-benefit analysis to comply with the NEPA (40 CFR 1508.14) and consideration of this issue is not essential to making a reasoned choice among the alternatives being considered. WS' programmatic FEIS (USDA 1997) states:

"Cost effectiveness is not, nor should it be, the primary goal of the APHIS WS program. Additional constraints, such as the environmental protection, land management goals, and others, are considered whenever a request for assistance is received. These constraints increase the cost of the program while not necessarily increasing its effectiveness, yet they are a vital part of the APHIS WS Program."

As stated in this EA, WS only provides assistance after a request has been received and a cooperative service agreement or other comparable document has been signed by WS and the requesting entity in which all methods used to address birds causing damage are agreed upon. Methods employed to manage bird damage, whether non-lethal or lethal, are often temporary with the duration dependent on many factors discussed in the EA. WS employs only those methods as agreed upon by the requestor after available methods are discussed.

Concern is often raised that birds only return to an area where damage was occurring if lethal methods are used which creates a financial incentive to continue the use of only lethal methods. However, as stated throughout the EA, the use of non-lethal methods are also often temporary which could result in birds returning to an area where damage was occurring once those methods are no longer used. Birds would return if suitable habitat continues to exist at the location where damage was occurring and bird densities are sufficient to occupy all available habitats. Therefore, any reduction or prevention of damage from the use of methods addressed in the EA would be temporary if habitat conditions continue to exist. Any method that disperses or removes birds from areas would only be temporary if habitat continues to exist the following year when birds return to nest. Dispersing birds using pyrotechnics, repellents, effigies, or any other non-lethal method addressed in the EA often requires repeated application to discourage birds which increases costs, moves birds to other areas where they could cause damage, and are temporary if habitat conditions remain unchanged. Dispersing birds could be viewed as moving problem birds from one area to another which would require addressing damage caused by those birds at another location. WS' recommendation of or use of techniques to modifying existing habitat or making areas unattractive to birds was addressed in the EA and in Appendix B. Therefore, WS' objective is to respond to request for assistance with the most effective methods and to provide for the long-term solution to the problem using WS' Decision Model to adapt methods in an integrated approach to managing bird damage that is agreed upon by the cooperator. WS' legislative authority to manage wildlife damage was also addressed in this EA.

CHAPTER 5 - LIST OF PREPARERS AND PERSONS CONSULTED

5.0 LIST OF PREPARERS AND REVIEWERS

Kristina Casscles Godwin, State Director	USDA-APHIS-Wildlife Services
Ryan Wimberly, Environmental Coordinator	USDA-APHIS-Wildlife Services
Scott Alls, District Supervisor	USDA-APHIS-Wildlife Services

5.1 LIST OF PERSONS CONSULTED

Ed Penny, Wildlife Bureau Director	MDWFP
K. David Godwin, Wild Turkey Program Coordinator	MDWFP
Libby Hartfield, Director	Mississippi Museum of Natural Sciences
Scott Peyton, Collections Manager	Mississippi Museum of Natural Sciences
Terri Jacobson, Acting Field Supervisor	USFWS
Loretta McNamee, NEPA Compliance	TVA

APPENDIX A
LITERATURE CITED

Aguilera, E., R. L. Knight, and J. L. Cummings. 1991. An evaluation of two hazing methods for urban Canada geese. Wildl. Soc. Bull. 19:32-35.

Allen, R.W., and M.M. Nice. 1952. A study of the breeding biology of the Purple Martin (*Progne subis*). Am. Midl. Nat. 47: 606-665.

AVMA. 1987. Panel report on the colloquium on recognition and alleviation of animal pain and distress. Journal of the American Veterinary Medical Association. 191:1186-1189.

AVMA. 2007. AVMA guidelines on euthanasia. American Veterinary Medical Association. http://www.avma.org/issues/animal_welfare/euthanasia.pdf. Accessed on February 2, 2009.

Apostolou, A. 1969. Comparative toxicology of the avicides 3-chloro-*p*-toluidine and 2-chloro-4-acetotoluidide in birds and mammals. PhD. Dissertation, University of California, Davis, USA.

Arhart, D.K. 1972. Some factors that influence the response of European starlings to aversive visual stimuli. M.S. Thesis., Oregon State University, Corvallis, Oregon.

Avery, M. L. 2002. Behavioral and ecological considerations for managing bird damage to cultivated fruit. Pp. 467-744 *in* D.J. Levey, W.R. Silva, and M. Galetti, eds. Seed Dispersal and Frugivory: Ecology and Conservation, Oxford Press.

Avery, M.L., and D.G. Decker. 1994. Responses of captive fish crows to eggs treated with chemical repellents. Journal of Wildlife Management 58:261-266.

Avery, M.L., J.S. Humphrey, and D.G. Decker. 1997. Feeding deterrence of anthraquinone, anthracene, and anthrone to rice-eating birds. Journal of Wildlife Management 61:1359-1365.

Avery, M.L., E.A. Tillman, and J.S. Humphrey. 2008. Effigies for dispersing urban crow roosts. Pp. 84-87 *in* R.M. Timm and M.B. Madon, eds. Proc. 23rd Vertebr. Pest Conf., University of California-Davis.

Avery, M. L., J. S. Humphrey, E. A. Tillman, K. O. Phares, and J. E. Hatcher. 2002. Dispersal of vulture roosts on communication towers. J. Raptor. Res. 36:44-49.

Avery, M. L., J. S. Humphrey, T. S. Daughtery, J. W. Fischer, M. P. Milleson, E. A. Tillman, W. E. Bruce, and W. D. Walter. 2011. Vulture flight behavior and implications for aircraft safety. Journal of Wildlife Management 75:1581-1587.

Barnes, T. G. 1991. Eastern bluebirds, nesting structure design and placement. College of Agric. Ext. Publ. FOR-52. Univ. of Kentucky, Lexington, KY, 4 pp.

Beaver, B.V., W. Reed, S. Leary, B. McKiernan, F. Bain, R. Schultz, B.T. Bennett, P. Pascoe, E. Shull, L. C. Cork, R. Franis-Floyd, K.D. Amass, R. Johnson, R.H. Schmidt, W. Underwood, G.W. Thorton, and B. Kohn. 2001. 2000 Report of the AVMA Panel on Euthanasia. J. Am. Vet. Med. Assoc. 218:669-696.

Beeton, A. M., and L. Wells. 1957. A bronzed grackle (*Quiscalus quiscula*) feeding on live minnows. Auk 74:263-264.

Belant, J.L., and R.A. Dolbeer. 1993. Population status of nesting laughing gulls in the United States, 1977-1991. American Birds 47: 220-224.

Belant, J.L., S.K. Ickes, and T.W. Seamans. 1998. Importance of landfills to urban-nesting herring and ring-billed gulls. Landscape and Urban Planning 43:11-19.

Belant, J.L., T.W. Seamans, S.W. Gabrey, and R.A. Dolbeer. 1995. Abundance of gulls and other birds at landfills in northern Ohio. American Midland Naturalist 134: 30-40.

Belant, J.L., T.W. Seamans, L.A. Tyson, and S.K. Ickes. 1996. Repellency of methyl anthranilate to pre-exposed and naive Canada geese. Journal of Wildlife Management 60:923-928.

Bent, A. C. 1921. Life histories of North American gulls and terns. U. S. National Museum Bulletin 113. 345pp.

Besser, J. F. 1964. Baiting starlings with DRC-1339 at a large cattle feedlot, Ogden, Utah, January 21 - February 1, 1964. U. S. Fish and Wildl. Serv., Denver Wildl. Res. Ctr., Denver, CO. Suppl. Tech. Rep. Work Unit F9.2.

Besser, J.F. 1985. A grower's guide to reducing bird damage to U.S. agricultural crops. Denver Wildl. Res. Cent., Bird Damage Res. Rep. 340.

Besser, J.F., W.C. Royal, and J.W. DeGrazio. 1967. Baiting European starlings with DRC-1339 at a cattle feedlot. Journal of Wildlife Management 3:48-51.

Besser, J.F., J.W. DeGrazio, and J.L. Guarino. 1968. Costs of wintering European starlings and red-winged blackbirds at feedlots. Journal of Wildlife Management 32:179-180.

Bishop, R.C. 1987. Economic values defined. Pp 24-33 *in* D. J. Decker and G. R. Goff, eds. Valuing wildlife: economic and social perspectives. Westview Press, Boulder, CO. 424 p.

Blackwell, B.F., G.E. Bernhardt, and R.A. Dolbeer. 2002. Lasers as non-lethal avian repellents. Journal of Wildlife Management 66:250-258.

Blandespoor, H.D., and R.L. Reimink. 1991. The control of swimmer's itch in Michigan: past, present and future. Michigan Academ. XXIV, p. 7-23.

Blokpoel, H., and G.D. Tessier. 1986. The ring-billed gull in Ontario: a review of a new problem species. Occasional Paper Number 57. Canadian Wildlife Service. Ottawa, Ontario. 34pp.

Blokpoel, H., and G.D. Tessier. 1992. Control of ring-billed gulls and herring gulls nesting at urban and surburban industrial sites in Ontario, 1987-1990. Proc. East. Wildl. Damage Conf. 5:51-57.

Bomford, M. 1990. Ineffectiveness of a sonic device for deterring European Starlings. Wild. Soc. Bull. 18:151-156.

Booth, T.W. 1994. Bird dispersal techniques. Pp E-19-E-23 *in* S.E. Hygnstrom, R. M. Timm, and G. E. Larson, eds. Prevention and control of wildlife damage. Cooperative Extension Service. University of Nebraska, Lincoln, Nebraska.

Boyd, F.L., and D.I. Hall. 1987. Use of DRC-1339 to control crows in three roosts in Kentucky and Arkansas. Third Eastern Wildlife Damage Control Conference 3:3-7.

Brauning, D.W., ed. 1992. Atlas of breeding birds in Pennsylvania. Univ. Pittsburgh Press, Pittsburgh, Pa. 484 pp.

Bruce, R.D. 1985. An Up-and-Down procedure for acute toxicity testing. Fundamentals of Applied Toxicology 5:151-157.

Bruce, R.D. 1987. A confirmatory study of the up-and-down method for acute oral toxicity testing. Fundamentals of Applied Toxicology 8:97-100.

Bruleigh, R.H., D.S. Slate, R.B. Chipman, M. Barden, C. Allen, J. Janicke, and B. Noviello. 1998. Abstract: Management of gulls at landfills to reduce public health and safety concerns. The Wildlife Society, Sept. 22-26. Buffalo, New York.

Buckley, N.J. 1999. Black Vulture (*Coragyps atratus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/411.

Bull, J., and J. Farrand, Jr. 1977. The Audubon Society Field Guide to North American Birds, Eastern Region. Alfred A. Knopf, Inc., New York, NY.

Bunn, A.G., W. Klein, and K.L. Bildstein. 1995. Time-of-day effects on the numbers and behavior of non-breeding raptors seen on roadside surveys in eastern Pennsylvania. J. Field Ornithol. 66:544–552.

Burger, J. 1996. Laughing Gull (*Leucophaeus atricilla*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/225.

Butterfield J., J.C. Coulson, S.V. Kearsey, P. Monaghan, J.H. McCoy, and G.E. Spain. 1983. The herring gull, *Larus argentatus*, as a carrier of *Salmonella*. Journal of Hygiene, Camb. 91:429-436.

California Department of Fish and Game. 1991. Final environmental document - bear hunting. Title 14 Calif. Code of Regs. Calif. Dept. of Fish and Game, State of California, April 25, 1991. 337 pp.

Chipman, R.B., T.L. Devault, D. Slate, K.J. Preusser, M.S. Carrara, J.W. Friers, and T.P. Algeo. 2008. Non-lethal management to reduce conflicts with winter urban crow roosts in New York: 2002 – 2007. Pp. 88-93 *in* R.M. Timm and M.B. Madon, eds. Proc. 23rd Vertebr. Pest Conf., University of California-Davis.

Clark, L. 1997. Dermal contact repellents for European Starlings: foot exposure to natural plant products. Journal of Wildlife Management 61:1352-1358.

Clark, L., and J. Hall. 2006. Avian influenza in wild birds: status as reservoirs, and risk to humans and agriculture. Ornithological Monographs 60:3-29.

Cleary, E.C., R.A. Dolbeer, and S.E. Wright. 2005. Wildlife strikes to civil aircraft in the United States, 1990–2004. U.S. Dept. of Trans., Federal Aviation Admin., Serial Report No. 11 DOT/FAA/AS/00-6 (AAS-310). Washington DC. 53 pp.

Coleman, J. S. and J. D. Fraser. 1989. Habitat use and home ranges of black and turkey vultures. Journal of Wildlife Management 53:782–792.

Conover, M.R. 1982. Evaluation of behavioral techniques to reduce wildlife damage. Proc. Wildl.-Livestock Relation. Sym. 10:332-344.

Conover, M. R. 1984. Comparative effectiveness of avitrol, exploders, and hawk-kites in reducing blackbird damage to corn. J. Wildl. Manage. 48:109-116.

Conover, M.R., W.C. Pitt, K.K. Kessler, T.J. Dubow, and W.A. Sanborn. 1995. Review of human injuries, illnesses and economic-based losses caused by wildlife in the United States. Wildl. Soc. Bull. 23:407-414.

Cooper, J.A. 1991. Canada goose management at the Minneapolis, St. Paul International Airport. Pp. 175-183 *in* Adams, L.W. and Leedy, D.L., Eds. Wildlife Conservation in Metropolitan Environments. Proceedings of the National Symposium on Urban Wildlife, National Institute for Urban Wildlife, Columbia, Maryland.

Cooper, J.A., and T. Keefe. 1997. Urban Canada goose management: policies and procedures. Trans. No. Am. Wildl. And Natural Resour. Conf. 62:412-430.

Cornell News. 2004. Invasive vs. Native Bird Species. www.news.cornell.edi/releases/April04/TBN.04.amv.html. Accessed on December 7, 2011.

Courchamp F., J. L. Chapuis, and M. Pascal. 2003. Mammal invaders on islands: impact, control and control impact. Biol. Rev. 78:347-383.

Craig, J.R., J.D. Rimstidt, C.A. Bonnaffon, T.K. Collins, and P.F. ScanIon. 1999. Surface water transport of lead at a shooting range. Bull. Environ. Contam. Toxicol. 63:312-319.

Cristol, D.A. 2001. American crows cache less preferred walnuts. Animal Behaviour 62:331-336.

Cristol, D.A. 2005. Walnut-caching behavior of American crows. J. Field Ornithol. 76:27-32.

Cummings, J.L., P.A. Pochop, J.E. Davis, Jr., and H.W. Krupa. 1995. Evaluation of Rejex-It AG-36 as a Canada goose grazing repellent. Journal of Wildlife Management 59:47-50.

Cummings, J.L., J.F. Glahn, E.A. Wilson, J.E. Davis, Jr., D.L. Bergman, and G.A. Harper. 1992. Efficacy and nontarget hazards of DRC-1339 treated rice baits used to reduce roosting populations of depredating blackbirds in Louisiana. Denver Wildlife Research Center, Bird Section Res. Rep. No. 481. 40pp.

Cunningham, D.J., E.W. Schafer, and L.K. McConnell. 1979. DRC-1339 and DRC-2698 residues in starlings: Preliminary evaluation of their effects on secondary hazard potential. Pp 31-35 *in* W.B. Jackson, S.S. Jackson, and B.A. Jackson, eds. Proceedings Eighth Bird Control Seminar. October 30 – November 1, 1979. Bowling Green State University, Bowling Green, Ohio.

Cunningham, D.J., E.W. Schafer, and L.K. McConnell. 1981. DRC-1339 and DRC-2698 residues in European Starlings: preliminary evaluation of their effects on secondary hazard potential. Proc. Bird Control Semin. 8:31-37.

Darden, T. 1974. Common grackles preying on fish. Wilson Bulletin 86:85-86.

Day, G.I., S.D. Schemnitz, and R.D. Taber. 1980. Capturing and marking wild animals. Pp. 61-88 *in* S. D. Schemnitz, ed.Wildlife management techniques manual. The Wildlife Society, Inc. Bethesda, MD. 686 pp.

Decino, T.J., D.J. Cunningham, and E.W. Schafer. 1966. Toxicity of DRC-1339 to European starlings. Journal of Wildlife Management 30:249-253.

Decker, D.J., and G.R. Goff. 1987. Valuing Wildlife: Economic and Social Perspectives. Westview Press. Boulder, Colorado, 424 p.

Decker, D.J., and K.G. Purdy. 1988. Toward a concept of wildlife acceptance capacity in wildlife management. Wildl. Soc. Bull. 16:53-57.

Decker, D.J., and L.C. Chase. 1997. Human dimensions of living with wildlife - a management challenge for the 21st century. Wildl. Soc. Bull. 25:788-795.

DeHaven, R.W., and J.L. Guarino. 1969. A nest box trap for European starlings. Bird Banding 40:49-50.

Dimmick, C.R., and L.K. Nicolaus. 1990. Efficiency of conditioned aversion in reducing depredation by crows. J. of Applied Ecology 27:200-209.

Dixon, W.J., and A.M. Mood. 1948. A method for obtaining and analyzing sensitive data. Journal of the American Statistical Association 43:109-126.

Dolbeer, R.A. 1998. Population dynamics: the foundation of wildlife damage management for the 21st century. Pp. 2-11 *in* Barker, R. O. and Crabb, A. C., Eds. Eighteenth Vertebrate Pest Conference (March 2-5, 1998, Costa Mesa, California). University of California at Davis, Davis, California.

Dolbeer, R.A. 2000. Birds and aircraft: fighting for airspace in crowded skies. Proc. Vert. Pest Conf. 19:37-43.

Dolbeer, R.A., and S.E. Wright. 2008. Wildlife strikes to civil aircraft in the United States, 1991 - 2007. Federal Aviation Administration. Airport Safety and Operations. Washington, DC. 34p.

Dolbeer, R.A., J.L. Belant, and J.L. Sillings. 1993*a*. Shooting gulls reduces strikes with aircraft at John F. Kennedy International Airport. Wildlife Society Bulletin 21:442- 450.

Dolbeer, R.A., J.L. Belant, and L. Clark. 1993*b*. Methyl anthranilate formulations to repel birds from water at airports and food at landfills. Proc. Great Plains Wildl. Damage Contr. Workshop. 11:42-52.

Dolbeer, R.A., L. Clark, P.P. Woronecki, and T.W. Seamans. 1992. Pen tests of methyl anthranilate as a bird repellent in water. Proc. East. Wildl. Damage Control Conf. 5:112-116.

Dolbeer, R.A., M.A. Link, and P.P. Woronecki. 1988. Naphthalene shows no repellency for European Starlings. Wildlife Society Bulletin. 16:62-64.

Dolbeer, R.A., T.W. Seamans, B.F. Blackwell, and J.L. Belant. 1998. Anthraquinone formulation (Flight Control) shows promise as avian feeding repellent. Journal of Wildlife Management 62:1558-1564.

Dolbeer, R.A., P.P. Woronecki, A.R. Stickley, Jr., and S.B. White. 1978. Agricultural impact of winter population of blackbirds and starlings. Wilson Bull. 90: 31-44.

Dolbeer, R. A., P. P. Woronecki, and R. L. Bruggers. 1986. Reflecting tapes repel blackbirds from millet, sunflowers, and sweet corn. Wildlife Society Bulletin 14:418-425.

Dolbeer, R.A., S.E. Wright, and E.C. Cleary. 2000. Ranking the hazard level of wildlife species to aviation. Wildlife Society Bulletin. 28:372-378.

Dolbeer, R.A., S.E. Wright, J. Weller, and M.J. Begier. 2012. Wildlife strikes to civil aircraft in the United States, 1990-2010. Federal Aviation Administration, National Wildlife Strike Database, Serial Report Number 17.

Dove C.J., N.F. Dahlan, and M. Heacker. 2009. Forensic birdstrike identification techniques used in an accident investigation at Wiley Post Airport, Oklahoma, 2008. Human Wildlife Conflicts 3:179–185.

Drilling, N., R. Titman, and F. Mckinney. 2002. Mallard (*Anas platyrhynchos*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/658doi:10.2173/bna.658. Accessed August 24, 2009.

Ehrlich, P.R., D.S. Dobkin, and D. Wheye. 1988. The birder's handbook: A field guide to the natural history of North American birds. Simon & Schuster, Inc. New York. 785pp.

Eisenmann, E. 1963. Is the black vulture migratory? Wilson Bull. 75:244-249.

Eisemann, J.D., P.A. Pipas, and J.L. Cummings. 2003. Acute and chronic toxicity of compound DRC-1339 (3-chloro-4-methylaniline hydrochloride) to birds. Pp. 49-63 *in* G.M. Linz, ed. Management of North American blackbirds. National Wildlife Research Center, Fort Collins, Colorado.

Elliot, H. N. 1964. Starlings in the Pacific Northwest. Proceedings of the Second Vertebrate Pest Conference. 2:29-39.

EPA. 1982. Avian single-dose oral LD_{50} test, Guideline 71-1. Pp. 33-37 *in* Pesticide assessment guidelines, subdivision E, hazard evaluation wildlife and aquatic organisms. U. S. Environmental Protection Agency PB83-153908, Washington, D.C.

EPA. 1995. R.E.D. Facts — Starlicide (3-chloro-p-toluidine hydrochloride). USEPA, Prevention, Pesticides and Toxic Substances. EPA-738-F-96-003. 4 p.

EPA. 1998. Anthraquinone Fact Sheet. United States Environmental Protection Agency. http://www.epa.gov/pesticides/biopesticides/ingredients/factsheets/factsheet_122701.htm. Accessed November 12, 2010.

EPA. 1999. ECOFRAM terrestrial draft report. Ecological Committee on FIFRA Risk Assessment Methods. U. S. Environmental Protection Agency, Washington, D. C. http://www.epa.gov/oppefed1/ecorisk/terreport.pdf.

Eskildsen, U.K., and P.E. Vestergard Jorgensen. 1973. On the possible transfer of trout pathogenic viruses by gulls. Rivista Italiana di Piscicultura e Ittiopatologia 8:104–105.

European Inland Fisheries Advisory Commission. 1989. Report of the EIFAC Working Party on prevention and control of bird predation in aquaculture and fisheries operations. EIFAC Tech. Pap. 51, Rome.

Feare, C. 1984. The Starling. Oxford University Press. Oxford New York.

Feare, C., A. J. Isaacson, P. A. Sheppard, and J. M. Hogan. 1981. Attempts to reduce starling damage at dairy farms. Protection Ecol. 3(2):173-181.

Felsenstein, W.C., R.P. Smith, and R.E. Gosselin. 1974. Toxicological studies on the avicide 3-chloro-ptoluidine. Toxicology and Applied Pharmacology 28:110-1125.

Fenlon, D.R. 1981. Seagulls (*Larus* spp.) as vectors of salmonellae: An investigation into the range of serotypes and numbers of salmonellae in gull faeces. Journal of Hygiene, Camb. 86: 195-202.

Fitzwater, W. D. 1994. House Sparrows. Pp. 101-108 *in* S. Hyngstrom, R. Timm, and G. Larson, eds. Prevention and control of wildlife damage. Coop. Ext. Serv. Univ. of Nebr.-Lincoln.

FDA. 2003. Bird poisoning of federally protected birds. Office of Criminal Investigations. Enforcement Story 2003.

Forbes, J. E. 1995. European Starlings are expensive nuisance on dairy farms. Ag. Impact. 17:4.

Ford, H.S. 1967. Winter starling control in Idaho, Nevada, Oregon. Proceedings: Third Vertebrate Pest Conference 3:104-110.

Fuller-Perrine, L.D., and M.E. Tobin. 1993. A method for applying and removing bird exclusion netting in commercial vineyards. Wildlife Society Bulletin 21:47-51.

Gabrey, S.W. 1997. Bird and small mammal abundance at four types of waste-management facilities in northeast Ohio. Landscape and Urban Planning 37:223-233.

Gamble, L.R., K.M. Johnson, G. Linder, and E.A. Harrahy. 2003. The Migratory Bird Treaty Act and concerns for nontarget birds relative to spring baiting with DRC-1339. Pp. 8-12 *in* G.M. Linz, ed. Management of North American blackbirds. National Wildlife Research Center, Fort Collins, Colorado.

Giri, S.N., D.H. Gribble, and S.A. Peoples. 1976. Distribution and binding of radioactivity in starlings after IV administration of 14C 3-chloro-p-toluidine. Federation Proceedings 35:328.

Glahn, J.F. 1982. Use of starlicide to reduce starling damage at livestock feeding operations. Proc. Great Plains Wildl. Damage Control Workshop. 5:273-277.

Glahn, J.F. 1983. Blackbird and starling depredations at Tennessee livestock farms. Proc. Bird Control Semin. 9:125-134.

Glahn, J. F., and D. L. Otis. 1981. Approach for assessing feed loss damage by European Starlings at livestock feedlots. ASTM Spec. Tech. Publ. No.752. p.38-45.

Glahn, J.F., and D.L. Otis. 1986. Factors influencing blackbird and European Starling damage at livestock feeding operations. Journal of Wildlife Management 50:15-19.

Glahn, J.F., and E.A. Wilson. 1992. Effectiveness of DRC-1339 baiting for reducing blackbird damage to sprouting rice. Proc. East. Wildl. Damage Cont. Conf. 5:117-123.

Glahn, J. F., S. K. Timbrook, and D. J. Twedt. 1987. Temporal use patterns of wintering European Starlings at a southeastern livestock farm: implications for damage control. Proc. East. Wildl. Damage Control Conf. 3:194-203.

Glahn, J.F., E.S. Rasmussen, T. Tomsa, and K.J. Preusser. 1999*a*. Distribution and relative impact of avian predators at aquaculture facilities in the Northeastern United States. North American Journal of Aquaculture 61:340-348.

Glahn, J.F., T. Tomsa, and K.J. Preusser. 1999*b*. Impact of great blue heron predation at trout-rearing facilities in the Northeastern United States. North American Journal of Aquaculture 61:349-354.

Glahn, J.F., M.E. Tobin, and J.B. Harrel. 1999*c*. Possible effects of catfish exploitation on overwinter body condition of double-crested cormorants. Pg 107-113 *in* M.E. Tobin, ed. Symposium on double-crested cormorants: Population status and management issues in the Midwest. 9 December 1997, Milwaukee, WI. Tech. Bull. 1879.

Glahn, J.F., E.A. Wilson, and M.L. Avery. 1990. Evaluation of a DRC-1339 baiting program to reduce sprouting rice damage caused by spring roosting blackbirds. U. S. Department of Agriculture, Animal Damage Control, Denver Wildl. Res. Ctr., Bird Sect. Res. Rep. No. 448.

Glahn, J.F., B. Dorr, J.B. Harrel, and L. Khoo. 2002. Foraging ecology and depredation management of great blue herons at Mississippi catfish farms. Journal of Wildlife Management 66:194-201.

Glahn, J. F., J. D. Palacios, amd M. V. Garrison. 2000*a*. Controlling great-tailed grackle damage to citrus in the lower Rio Grande valley, Texas. *In* Parkhurst, J. A., ed. Proceedings Eighth Eastern Wildlife Damage Control Conference, Asheville, North Carolina.

Glahn, J.F., G. Ellis, P. Fiornelli, and B. Dorr. 2000*b*. Evaluation of low to moderate power lasers for dispersing double-crested cormorants from their night roosts. Proceedings of the 9th Wildlife Damage Management Conference. 9:34-35.

Gorenzel, W.P., and T.P. Salmon. 1993. Tape-recorded calls disperse American crows from urban roosts. Wildlife Society Bulletin 21:334-338.

Gorenzel, W.P., and T.P. Salmon. 1995. Characteristics of American crow urban roosts in California. Journal of Wildlife Management 59:638-645.

Gorenzel, W.P., B.F. Blackwell, G.D. Simmons, T.P. Salmon, and R.A. Dolbeer. 2002. Evaluation of laser to disperse American crows, *Corvus brachyrhynchos*, from urban night roosts. Int. J. Pest Manage. 48:327-331.

Gorenzel, W.P., T.P. Salmon, G.D. Simmons, B. Barkhouse, and M.P. Quisenberry. 2000. Urban crow roosts – a nationwide phenomenon? Proc. Wildl. Damage Manage. Conf. 9:158-170.

Grabill, B.A. 1977. Reducing starling use of wood duck boxes. Wildl. Soc. Bull. 5:67-70.

Graczyk, T.K., M.R. Cranfield, R. Fayer, J. Tout, and J.J. Goodale. 1997. Infectivity of *Cryptosporidium parvum* oocysts is retained upon intestinal passage through a migratory waterfowl species (Canada goose, *Branta canadnsis*). Tropical Med. International Heal. 2:341-347.

Graczyk, T.K., R. Fayer, J.M. Trout, E.J. Lewis, C.A. Farley, I. Sulaiman, and A.A. Lal. 1998. *Giardia* sp. cysts and infectious *Cryptosporidium parvum* oocysts in the feces of migratory Canada geese (*Branta canadensis*). Applied and Environmental Microbiology 64:2736-2738.

Graves, G.E., and W.F. Andelt. 1987. Prevention and control of woodpecker damage. Service in Action, Colo. St. Univ. Coop. Ex. Serv. Publ. no 6.516. Ft. Collins, Colo. 2 pp.

Hamilton, Jr., W.J. 1951. The food of nestling bronzed grackles, *Quiscalus quiscula versicolor*, in central New York. Auk 68:213-217.

Harris, H. J., J. A. Ladowski, and D. J. Worden. 1981. Water-quality problems and management of an urban waterfowl sanctuary. J. of Wildl. Manage. 45:501-507.

Henny, C.J. 1990. Mortality. Pages 140 - 151 In Birds of Prey. I. Newton, P. Olsen, and T. Pyrzalowski, eds. Facts on File, NY, NY. 240 pp.

Heusmann, H.W., and R. Bellville. 1978. Effects of nest removal on starling populations. Wilson Bull. 90:287-290.

Heusmann, H.W., W.W. Blandin, and R.E. Turner. 1977. Starling deterrent nesting cylinders in wood duck management. Wildl. Soc. Bull. 5:14-18.

Hicks, R.E. 1979. Guano deposition in an Oklahoma crow roost. The Condor 81:247-250.

Hill, G.A., and D.J. Grimes. 1984. Seasonal study of freshwater lake and migratory waterfowl for *Campylobacter jejuni*. Canadian Journal of Microbiology 30:845-849.

Holevinski, R.A., P.D. Curtis, and R.A. Malecki. 2007. Hazing of Canada Geese is unlikely to reduce nuisance populations in urban and suburban communities. Human –Wildlife Conflicts 1:257-264.

Holler, N.R., and E.W. Schafer, Jr. 1982. Potential secondary hazards of Avitrol baits to sharp-shinned hawks and American kestrels. Journal of Wildlife Management 46:457-462.

Hunter, W.C., W. Golder, S. Melvin, and J. Wheeler. 2006. Southeast United States Regional Waterbird Conservation Plan. Waterbird Conservation for the Americas. http://www.waterbirdconservation.org/. Accessed May 12, 2010.

Ingold, D. J. 1994. Influence of nest site competition between European starlings and woodpeckers. Wilson Bull. 1106:227-241.

Jackson, B. J., and J. A. Jackson. 2000. Killdeer (*Charadrius vociferus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/517.

Jensen, M.A. 1996. Overview of methods used to reduce gull, geese, raptor, and deer hazards to aircraft at O'Hare International Airport (abstract only). Proc. ann. Meeting Bird Strike Committee, USA.

Johnson, R.J. 1994. American Crows. Pp 33-40 *in* S. E. Hyngstrom, R. M. Timm, and G. E. Larson, eds. Prevention and control of wildlife damage. Univ. Of Nebraska, Lincoln, NE.

Johnson, R.J., and J.F. Glahn. 1994. European Starlings. Pp 109 - 120 *in* S. E. Hygnstrom, R.M. Timm, and G.E. Larson, eds. Prevention and control of wildlife damage - 1994. Univ. NE Coop. Ext., Instit. o f Ag. and Nat. Res., Univ. of NE-Lincoln, USDA, APHIS, ADC, Great Plains Ag. Council Wildl. Committee.

Johnston, W. S., G. K. MacLachlan and G. F. Hopkins. 1979. The possible involvement of seagulls (*Larus* spp.) In the transmission of salmonella in dairy cattle. Veterinary Record 105:526-527.

Johnston, J.J., D.B. Hurlbut, M.L. Avery, and J.C. Rhyans. 1999. Methods for the diagnosis of acute 3-chloro-p-toluidine hydrochloride poisoning in birds and the estimation of secondary hazards to wildlife. Environ. Toxicology and Chemistry. 18:2533-2537.

Kassa, H., B. Harrington, and M.S. Bisesi. 2001. Risk of occupational exposure to *Cryptosporidium, Giardia,* and *Campylobacter* associated with the feces of giant Canada geese. Appl. Occup. And Env. Hygiene. 16:905-909.

Kendall, R.J., T.E. Lacher, Jr., C. Bunck, B. Daniel, C. Driver, C.E. Grue, F. Leighton, W. Stansley, P.G. Watanabe, and M. Whitworth. 1996. An ecological risk assessment of lead shot exposure in non-waterfowl avian species: Upland game birds and raptors. Environ. Toxicol. and Chem. 15:4-20.

Kerpez, T.A. and N.S. Smith. 1990. Competition between European starlings and native woodpeckers for nest cavities in saguaros. Auk. 107:367-375.

Kilham, L. 1989. The American crow and the common raven. Texas A&M Univ. Press, College Station.

Knittle, C.E., and J.L. Guarino. 1976. Reducing a local population of European Starlings with nest-box traps. Proc. Bird Control. Semin. 7:65-66.

Knittle, C.E., E.W. Schafer, Jr., and K.A. Fagerstone. 1990. Status of compound DRC-1339 registration. Vertebr. Pest Conf. 14:311-313.

Knutsen, G.A. 1998. Avian use of rice-baited and unbaited stubble fields during spring migration in South Dakota. M.S. Thesis, North Dakota State University, Fargo, North Dakota.

Kreps, L.B. 1974. Feral pigeon control. Proc. Vertebr. Pest. Conf. 6:257-262.

Kushlan, J. A., M. J. Steinkamp, K. C. Parsons, J. Capp, M. Acosta Cruz, M. Coulter, I. Davison, L. Discson, N. Edelson, R. Elliot, R. M. Erwin, S. Hatch, S. Kress, R. Milko, S. Miller, K. Mills, R.

Paul, R. Phillips, J. E. Saliva, B. Sydeman, J. rapp, J. Wheeler, and K. Wohl. 2002. Waterbird conservation for the Americas: The North American Waterbird Conservation Plan, Version 1. Waterbird Conservation for the Americas, Washington, DC. 78 pp.

Laidlaw, M.A., H.W. Mielke, G.M. Filippelli, D.L. Johnson, and C.R. Gonzales. 2005. Seasonality and children's blood lead levels: Developing a predictive model using climatic variables and blood lead data from Indianapolis, Indiana, Syracuse, New York, and New Orleans, Louisiana (USA). Environ. Health Persp. 113:793-800.

Lanyon, W.E. 1995. Eastern Meadowlark (*Sturnella magna*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/160.

Larsen, K. H., and D. F. Mott. 1970. House finch removal from a western Oregon blueberry planting. Murrelet 51:15-16.

Leck, C.F. 1984. The status and distribution of New Jersey's birds. Rutgers University Press, New Brunswick, NJ. 214 pp.

Link, W.A., and Sauer, J.R. 1998. Estimating population change from count data: application to the North American Breeding Bird Survey. Ecological Applications 8:258-268.

Link, W. A., and J. R. Sauer. 2002. A hierarchical model of population change with application to Cerulean Warblers. Ecology 83:2832-2840.

Linnell, M.A., M.R. Conover, and T.J. Ohashi. 1996. Analysis of bird strikes at a tropical airport. Journal of Wildlife Management 60:935-945.

Linz, G.M., H.J. Homan, and W.J. Bleier. 1999. Blackbird densities and sunflower damage in North Dakota and South Dakota: 1996-1998. Pp. 136-139 *in* L. Kroh, ed. Proceedings of the 21st Sunflower Research Workshop. (January 14-15, 1999, Fargo, North Dakota). National Sunflower Association, Bismarck, North Dakota.

Linz, G.M., D.A. Schaaf, R.L. Wimberly, H.J. Homan, T.L. Pugh, B.D. Peer, P. Mastrangelo, and W.J. Bleier. 2000. Efficacy and potential nontarget impacts of DRC-1339 avicide use in ripening sunflower fields: 1999 progress report. Pp. 162-169 *in* L. Kroh, ed.Proceedings of the 22nd Sunflower Research Workshop. (January 18-19, 2000, Fargo, North Dakota). National Sunflower Association, Bismarck, North Dakota.

Lipnick, R., J.A. Cotrouvo, R.N. Hill, R.D. Bruce, D.A. Stitzel, A.P. Walker, I. Chu, M. Goddard, L. Segal, J.A. Springer, and R.C. Meyers. 1995. Comparison of the Up-and-Down, conventional LD_{50}, and Fixed-Dose Acute Toxicity procedure. Food Chemistry and Toxicology 33:223-331.

Luechtefeld, N.W., M.J. Blaser, L.B. Reller, and W.L.L. Wang. 1980. Isolation of *Campylobacter fetus* subsp. *Jejuni* from migratory waterfowl. J. Clin. Microbiol. 12:406-408.

Lovell, H.B. 1947. Black vultures kill young pigs in Kentucky. Auk 64:131-132.

Lovell, H.B. 1952. Black vulture depredations at Kentucky woodlands. Auk 64:48-49.

Lowney, M.S. 1999. Damage by black and Turkey Vultures in Virginia, 1990-1996. Wildlife Society Bulletin. 27:715-719.

Lowther, P.E. 1993. Brown-headed cowbird (*Molothrus ater*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/047. Accessed November 2, 2010.

Lowther, P. E., and C. L. Cink. 2006. House sparrow (*Passer domesticus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/012.

MacDonald, J.W., and P.D. Brown. 1974. *Salmonella* infection in wild birds in Britain. Veterinary Record 94: 21-322.

MacKinnon, B., R. Sowden, and S. Dudley, editors. 2001. Sharing the skies: an aviation guide to the management of wildlife hazards. Transport Canada, Aviation Publishing Division, AARA, 5th Floor, Tower C, 330 Sparks Street, Ottawa, Ontario, K1A 0N8, Canada. 316 pp.

Mason, J.R. 1989. Avoidance of methiocarb-poisoned apples by Red-winged Blackbirds. Journal of Wildlife Management 53:836-840.

Mason, J. R., R. E. Stebbings, and G. P. Winn. 1972. Noctules and European Starlings competing for roosting holes. J. Zool. 166:467.

Mason, J.R., M.A. Adams, and L. Clark. 1989. Anthranilate repellency to European starlings: chemical correlates and sensory perception. Journal of Wildlife Management 53:55-64.

Mason, J.R., A.H. Arzt, and R.F. Reidinger. 1984. Evaluation of dimethylanthranilate as a nontoxic starling repellent for feedlot settings. Proc. East. Wildl. Damage Control Conf. 1:259-263.

Mason, J. R., and L. Clark. 1992. Non-lethal repellents: the development of cost-effective, practical solutions to agricultural and industrial problems. Proc. Vertebr. Pest Conf. 15:115-129.

Matteson, R.E. 1978. Acute oral toxicity of DRC-1339 to cardinals (*Cardinalis cardinalis*). U. S. Fish and Wildlife Service, Denver Wildlife Research Center, Bird Damage Research Report 84. 3pp.

McCracken, H.F. 1972. Starling control in Sonoma County. Proc. Vertebr. Pest Conf. 5:124-126.

Mccrimmon, Jr., D. A., J. C. Ogden, and G. T. Bancroft. 2011. Great egret (*Ardea alba*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/570.

McGilvrey, F. B., and F. M. Uhler. 1971. A starling deterrent wood duck nest box. Journal of Wildlife Management 35:793-797.

Miller, J.W. 1975. Much ado about European starlings. Nat. Hist. 84:38-45

MDWFP. 2011. Mississippi outdoor Digest, 2011-2012. Mississippi Department of Wildlife, Fisheries, and Parks. Jackson, Mississippi. 68 pp.

Mitterling, L.A. 1965. Bird damage on apples. Proc. Amer. Soc. Hort. Sci.87:66-72.

Monaghan, P., C.B. Shedden, C.R. Fricker, and R.W.A. Girdwood. 1985. *Salmonella* carriage by herring gulls in the Clyde area of Scotland in relation to their feeding ecology. Journal of Applied Ecology 22:669-680.

Mott., D.F. 1985. Dispersing blackbird-starling roosts with helium-filled balloons. Proc. East. Wildl. Damage Conf. 2:156-162.

Mott, D.F., and S.K. Timbrook. 1988. Alleviating nuisance Canada goose problems with acoustical stimuli. Proc. Vertebr. Pest. Conf. 13:301-305.

Mott, D.F., and C.P. Stone. 1973. Bird damage to blueberries in the United States. U.S. Bur. Sport Fisheries and Wildlife, Spec. Sci. Rept., Wildl. No. 172. 15 pp.

Mudge, G.P., and P.N. Ferns. 1982. The feeding ecology of five species of gulls (Aves: Larini) in the inner Bristol Channel. Journal of Zoology (London) 197:497-510.

Muller, L.I., R.J. Warren, and D.L. Evans. 1997. Theory and Practice of immunocontraception in wild animals. Wildlife Society Bulletin. 25:504-514.

NASS. 2011. Cattle death loss. United States Department of Agriculture, Agricultural Statistics Board, National Agricultural Statistics Service. 17 pp.

NAS. 2010. The Christmas Bird Count Historical Results [Online]. Available http://www.christmasbirdcount.org. Accessed on March 22, 2010.

Nickell, W. P. 1967. European Starlings and sparrow hawks occupy same nest box. Jack-Pine Warbler 45:55.

Nielsen, L. 1988. Definitions, considerations, and guidelines for translocation of wild animals. Pp. 12-49 *in* Translocation of Wild Animals. Edited by L. Nielsen and R. D. Brown. WI Humane Society, Inc. and Ceaser Kleberg Wildlife Research Instit. 333 p.

Norton, R.L. 1986. Case of botulism in laughing gulls at a landfill in the Virgin Islands, Greater Antilles. Florida Field Naturalist 14:97-98.

Olesen, N.J., and P.E. Vestergard-Jorgensen. 1982. Can and do herons serve as vectors for Egtved virus. European Association of Fish Pathologists 2:48.

Otis, D.L., J.H. Schulz, D. Miller, R.E. Mirarchi and T.S. Baskett. 2008. Mourning Dove (*Zenaida macroura*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/117.

Pacha, R.E., G.W. Clark, E.A. Williams, and A.M. Carter. 1988. Migratory birds of central Washington as reservoirs of *Campylobacter jejuni.* Can. J. Micro. 34:80-82.

Palmer, T.K. 1970. House finch (linnet) control in California. Proceedings of the fourth vertebrate pest conference 4:173-178.

Parkhurst, J.A., R.P. Brooks, and D.E. Arnold. 1987. A survey of wildlife depredation and control techniques at fish-rearing facilities. Wildlife Society Bulletin 15:386-394.

Parkhurst, J.A., R.P. Brooks, D.E. Arnold. 1992. Assessment of predation at trout hatcheries in Central Pennsylvania. Wildlife Society Bulletin 20:411-419.

Parmalee, P.W., and B.G. Parmalee. 1967. Results of banding studies of black vultures in eastern North America. Condor 69:146-155.

Patton, S.R. 1988. Abundance of gulls at Tampa Bay landfills. Wilson Bulletin 100:431-442.

Peer, B.D., and E.K. Bollinger. 1997. Common Grackle (*Quiscalus quiscula*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/271.

Peoples, S.A., and A. Apostolou. 1967. A comparison between the metabolism of DRC-1339 in rabbits and in starlings. Progress report on starling control. University of California, Davis.

Peters, F., and M. Neukirch. 1986. Transmission of some fish pathogenic viruses by the heron, *Ardea cinerea*. Journal of Fish Diseases T986, 9:539–544.

Peterson, R.T. 1980. Eastern Birds. Houghton Mifflin Co., Boston, MA.

Pimentel, D., L. Lech, R. Zuniga, and D. Morrison. 2000. Environmental and economic costs associated with nonindigenous species in the United States. BioScience 50:53-65.

Plesser, H., S. Omasi, and Y. Yom-Tov. 1983. Mist nets as a means of eliminating bird damage to vineyards. Crop Protection 2:503-506.

Pochop, P.A. 1998. Comparison of white mineral oil and corn oil to reduce hatchability of ring-billed gull eggs. Proc. Vertebr. Pest Conf. 18:411-413.

Pochop, P.A., J.L. Cummings, J.E. Steuber, and C.A. Yoder. 1998. Effectiveness of several oils to reduce hatchability of chicken eggs. Journal of Wildlife Management 62:395-398.

Poole, A., R.O. Bierregaard, and M.S. Martell. 2002. Osprey (*Pandion haliaetus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/683doi:10.2173/bna.683. Accessed August 28, 2009.

Portnoy, J.W. 1990. Gull contributions of phosphorous and nitrogen to a Cape Cod kettle pond. Hydrobiologia 202:61-69.

Preusser, S. A., T. W. Seamans, A. L. Gosser, and R. B. Chipman. 2008. Evaluation of a non-lethal Canada Goose management program (2004-2006). Proceedings of the 23rd Vertebrate Pest Conference. 23:66-73.

Price, I.M., and J.G. Nikum. 1995. Aquaculture and birds: the context for controversy. Colonial Waterbirds 18 (Spec. Pub. 1): 33-45.

Quessey, S., and S. Messier. 1992. Prevalence of *Salmonella* spp., *Campylobacter* spp. and *Listeria* spp. in ring-billed gulls (*Larus delawarensis*). Journal of Wildlife Disease 28:526-531.

Rabenhold, P.P., and M.D. Decker. 1989. Black and Turkey Vultures expand their ranges northward. The Eyas. 12:11-15.

Raftovich, R.V., K.A. Wilkins, S.S Williams, H.L. Spriggs, and K.D. Richkus. 2011. Migratory bird hunting activity and harvest during the 2009 and 2010 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. 68 pp.

Reilly, W.G., G.I. Forbes, G.M. Paterson, and J.C.M. Sharp. 1981. Human and animal salmonellosis in Scotland associated with environmental contamination, 1973-1979. Veterinary Record 108: 553-555.

Rich, T. D., C. J. Beardmore, H. Berlanga, P. J. Blancher, M. S. W. Bradstreet, G. S. Butcher, D. W. Demarest, E. H. Dunn, W. C. Hunter, E. E. Iñigo-Elias, J. A. Kennedy, A. M. Martell, A. O. Panjabi, D. N. Pashley, K. V. Rosenberg, C. M. Rustay, J. S. Wendt, and T. C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, New York.

Robbins, C. S. 1973. Introduction, spread, and present abundance of the house sparrow in North America. Ornithol. Monogr. 14:3-9.

Robbins, C.S., and E.A.T. Blom. 1996. Atlas of the Breeding Birds of Maryland and the District of Columbia. University of Pittsburgh Press, Pittsburgh, Pennsylvania.

Robbins, C. S., B. Bruun, and H. S. Zim. 1983. A guide to field identification birds of North America. Golden books publ. Co., Inc., Racine, Wisconsin. 360 pp.

Robinson, M. 1996. The potential for significant financial loss resulting from bird strikes in or around an airport. Proc. Bird Strike Committee Europe 22:353-367.

Roffe, T.J. 1987. Avian tuberculosis. Pp. 95-99 *in* M. Friend and C. J. Laitman, eds. Field guide to wildlife diseases. 225 pp.

Rogers, J. G., Jr., and J. T. Linehan. 1977. Some aspects of grackle feeding behavior in newly planted corn. Journal of Wildlife Management 41:444-447.

Rossbach, R. 1975. Further experiences with the electroacoustic method of driving European starlings from their sleeping areas. Emberiza 2:176-179.

Rowsell, E.V., J.A. Carnie, S.D. Wahbi, A.H. Al-Tai, and K.V. Rowsell. 1979. L-serine dehydratase and L-serine-pyruvate aminotransferase activities in different animal species. Comp. Biochem. Physiol. B Comp. Biochem. 63:543-555.

Royall, W.C., T.J. DeCino, and J.F. Besser. 1967. Reduction of a starling population at a turkey farm. Poultry Science. Vol. XLVI No. 6. pp 1494-1495.

Ryder, J.P. 1993. Ring-billed gull (*Larus delawarensis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/033.

Sallabanks, R., and F.C. James. 1999. American robin (*Turdus migratorius*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/462.

Saltoun, C.A., K.E. Harris, T.L. Mathisen, and R. Patterson. 2000. Hypersensitivity pneumonitis resulting from community exposure to Canada goose droppings: when an external environmental antigen becomes an indoor environmental antigen. Annal. Allergy Asth. Immun. 84:84-86.

Sanders, T.A., and K. Parker. 2010. Mourning dove population status, 2010. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C.

Sauer, J. R., and W. A. Link. 2011. Analysis of The North American Breeding Bird Survey Using Hierarchical Models. The Auk 128:87-98.

Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2011. The North American Breeding Bird Survey, Results and Analysis 1966 - 2010. Version 12.07.2011 USGS Patuxent Wildlife Research Center, Laurel, Maryland.

Schafer, E.W., Jr. 1972. The acute oral toxicity of 369 pesticidal, pharmaceutical and other chemicals to wild birds. Toxicol. Appl. Pharmacol. 21:315-330.

Schafer, E.W., Jr. 1981. Bird control chemicals - nature, modes of action, and toxicity. Pp. 129-139 *in* CRC handbook of pest management in agriculture. Vol. 3. CRC Press, Cleveland, OH.

Schafer, E.W., Jr. 1984. Potential primary and secondary hazards of avicides. Proc. Vert. Pest Conf. 11:217-222.

Schafer, E.W., Jr. 1991. Bird control chemicals-nature, mode of action and toxicity. Pp. 599-610 *in* CRC Handbook of Pest Management in Agriculture Vol. II. CRC Press, Cleveland, Ohio.

Schafer, E.W., Jr., and D.J. Cunningham. 1966. Toxicity of DRC-1339 to grackles and house finches. U. S. Fish and Wildl. Serv. Denver Wildlife Research Center, Typed Rept. 1 pp.

Schafer, E.W., Jr., R.B. Brunton, and N.F. Lockyer. 1974. Hazards to animals feeding on blackbirds killed with 4-aminopyrine baits. Journal of Wildlife Management 38:424-426.

Schafer, E.W., Jr., R.B. Brunton, D.J. Cunningham, and N.F. Lockyer. 1977. The chronic toxicity of 3-chloro-4-methyl benzamine HCl to birds. Archives of Environmental Contamination and Toxicology 6:241-248.

Scherer, N. M., H. L. Gibbons, K. B. Stoops, and M. Muller. 1995. Phosphorus loading of an urban lake by bird droppings. Lake and Reservoir Management 11:317–327.

Schmidt, R. 1989. Wildlife management and animal welfare. Trans. N.Amer. Wildl. And Nat. Res. Conf. 54:468-475.

Schmidt, R.H., and R.J. Johnson. 1984. Bird dispersal recordings: an overview. ASTM STP 817. 4:43-65.

Seamans, T.W. 2004. Response of roosting turkey vultures to a vulture effigy. Ohio Journal of Science 104:136-138.

Seamans, T.W., D.W. Hamershock, and G.E. Bernhardt. 1995. Determination of body density for twelve bird species. Ibis 137:424-428.

Shake, W.F. 1967. Starling wood duck interrelationships. M.S. Thesis. Western Illinois University, Macomb. 46 pp.

Shirota, Y. M., and S. Masake. 1983. Eyespotted balloons are a device to scare gray European atarlings. Appl. Ent. Zool. 18:545-549.

Slate, D.A., R. Owens, G. Connolly, and G. Simmons. 1992. Decision making for wildlife damage management. Trans. N. A. Wildl. Nat. Res. Conf 57:51-62.

Smith, J.A. 1999. Nontarget avian use of DRC-1339 treated plots during an experimental blackbird control program in eastern South Dakota. M.S. Thesis, South Dakota State University, Brookings, South Dakota.

Smith, A.E., S.R. Craven, and P.D. Curtis. 1999. Managing Canada geese in urban environments. Jack Berryman Institute Publication 16, and Cornell University Cooperative Extension, Ithaca, N.Y. 42 pp.

Stansley, W., L. Widjeskog, and D.E. Roscoe. 1992. Lead contamination and mobility in surface water at trap and Skeet Ranges. Bull. Environ. Contam. Toxicol. 49:640-647.

Sterner, R.T., D.J. Elias, and D.R. Cerven. 1992. The pesticide reregistration process: collection of human health hazards data for 3-chloro-p-toluidine hydrochloride (DRC-1339). Pp. 62-66 *in* J. E. Borrecco and R. E. Marsh, eds., Proceedings 15th Vertebrate Pest Conference, March 3-5, 1992, Newport Beach, California.

Stone, C.P., and D.F. Mott. 1973. Bird damage to ripening field corn in the United States, 1971. U.S. Bureau of Sport Fisheries and Wildlife, Wildlife Leaflet 505. 8 pp.

Sullivan, B.D., and J.J. Dinsmore. 1990. Factors affecting egg predation by American crows. Journal of Wildlife Management 54:433-437.

Swift, B. L. 1998. Response of resident Canada geese to chasing by trained border collies. Unpub. Report. NY Dept. of Environ. Conser. Delmar, NY. 6 pp.

Tahon, J. 1980. Attempts to control starlings at roosts using explosives. Pp. 56-68 *in* E.N. Wright, ed. Bird Problems in Agriculture. British Crop Protection Council, England.

Taylor, P.W. 1992. Fish-eating birds as potential vectors of *Edwardsiella ictaluri*. Journal of Aquatic Animal Health 4:240–243.

TVA. 2011*a*. Tennessee Valley Authority: Natural resources plan. https://www.tva.gov/environment/reports/nrp/index.htm. Accessed March 15, 2012.

TVA. 2011*b*. Final Environmental Impact Statement: Natural Rources Plan-Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia. https://www.tva.gov/environment/reports/nrp/index.htm. Accessed March 15, 2012.

Terres, J. K. 1980. The Audubon Society Encyclopedia of North American Birds. Wings Bros. New York, New York.

The Wildlife Society. 1992. Conservation policies of the Wildlife Society. The Wildlife Society. Washington, D.C. 20 p.

Thorpe, J. 1996. Fatalities and destroyed civil aircraft due to bird strikes: 1912-1995. Proc. Int. Bird Strike Conf. 23:17-31.

Tobin, M.E., P.P. Woronecki, R.A. Dolbeer, and R.L. Bruggers. 1988. Reflecting tape fails to protect ripening blueberries from bird damage. Wildlife Society Bulletin 16:300-303.

Turcotte, W. H., and D. L. Watts. 1999. Birds of Mississippi. University Press of Mississippi. 432 pp.

Twedt, D.J., and J.F. Glahn. 1982. Reducing starling depredations at livestock feeding operations through changes in management practices. Proc. Vertebr. Pest Conf. 10:159-163.

USDA. 1997. Animal Damage Control Program: Final Environmental Impact Statement (revised). USDA/APHIS/WS-Operational Support Staff, 4700 River Road, Unit 87, Riverdale, Maryland 20737.

USDA. 2001. Compound DRC-1339 Concentrate-Staging Areas. Tech Note. USDA/APHIS/WS. National Wildlife Research Center, Fort Collins, Colorado.

USDA. 2003. Tech Note: Spring viremia of carp. United States Department of Agriculture, Animal and Plant Protection Service, Veterinary Services. Riverdale, MD.

USDA. 2004. Environmental Assessment: Reducing Double-crested Cormorant Damage Through an Integrated Wildlife Damage Management Program in the State of Mississippi. USDA-APHIS-Wildlife Services, P.O. Drawer FW, Mississippi State, MS 39762.

USDA. 2008. Environmental Assessment (EA) - Reducing Canada goose damage throughout the State of Mississippi. USDA-APHIS-Wildlife Services, P.O. Drawer FW, Mississippi State, MS 39762.

USDA. 2009. 2007 Census of Agriculture: Mississippi State and County Data. USDA, National Agricultural Statistics Service. Volume 1, Geographic Area Series, Part 24. AC-07-A-24.

United States Department of Interior. 1996. Restoring avian diversity to Monomoy National Wildlife Refuge. U.S. Fish and Wildlife Service. MA.

United States Geological Survey. 2005. Ospreys in Oregon and the Pacific Northwest. United States Geological Survey. http://fresc.usgs.gov/products/fs/fs-153-02.pdf. Accessed September 28, 2009.

USFWS. 1981. Domestic Pigeon. United States Department of Interior, United States Fish and Wildlife Service. 4 pp.

USFWS. 2000. Bird conservation region descriptions. North American Bird Conservation Initiative. U.S. NABCI Committee. 44 pp.

USFWS. 2001. Inside Region 3: Ohio man to pay more than $11,000 for poisoning migratory birds. Volume 4(2):5.

USFWS. 2003*a*. Final Environmental Impact Statement: Double-crested Cormorant Management. U.S. Dept. of the Interior, USFWS, Div. of Migratory Bird Management, 4401 N. Fairfax Drive MS 634, Arlington, VA 22203.

USFWS. 2003*b*. Recovery plan for the red-cockaded woodpecker (*Picoides borealis*): second revision. United States Fish and Wildlife Service, Atlanta, GA. 296 pp.

USFWS. 2005. Final Environmental Impact Statement: Resident Canada goose management. United States Fish and Wildlife Service, Division of Migratory Birds. Arlington, Virginia. http://www.fws.gov/migratorybirds/issues/cangeese/finaleis.htm. Accessed November 24, 2009.

USFWS. 2007. Final Environmental Impact Statement: Light goose management. United States Fish and Wildlife Service, Division of Migratory Birds. Arlington, Virginia. Accessed on November 12, 2010.

USFWS. 2009. Environmental Assessment: Extended management of double-crested cormorants under 50 CFR 21.47 and 21.48. United States Fish and Wildlife Service, Division of Migratory Bird Management, 4401 N. Fairfax Drive, Mail Stop 4107, Arlington, VA 22203.

Vauk-Hentzelt, E., W. Gunkel, and K. Klings. 1987. Microbial diseases in special consideration of Coli septicaemia *Escherichia coli* of gulls Laridae around the Isle Helgoland (German Bight). Global Trends in Wildlife Management, 18th IUGB Congress, Krakow, Poland, August, 1987. Swait Press, Krakow. Pp. 273-275.

Verbeek, N.A.M. 1977. Comparative feeding ecology of herring gulls *Larus argentatus* and lesser black-backed gulls *Larus fiscus*. Ardea 65:25-42.

Verbeek, N.A., and C. Caffrey. 2002. American crow (*Corvus brachyrhynchos*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/647.

VerCauteren, K. C., and D. R. Marks. 2004. Movements of urban Canada geese: implications for nicarbazin treatment programs. Pages 151-156 *in* T. J. Moser, R. D. Lien, K. C. VerCauteren, K. F. Abraham, D. E. Anderson, J. G. Bruggink, J. M. Coluccy, D. A. Graber, J. O. Leafloor, D. R. Luukkonen,and R. E. Trost, editors. Proceedings of the 2003 International Canada Goose Symposium. Madison, Wisconsin.

Vogt, P.F. 1997. Control of nuisance birds by fogging with REJEX-IT TP-40. Proc. Great Plains Wildl. Damage Contr. Workshop 13. p. 63-66.

Von Jarchow, B.L. 1943. European starlings frustrate sparrow hawks in nesting attempt. Passenger Pigeon. 5:51.

Walsh, J., V. Elia, R. Kane, and T. Halliwell. 1999. Birds of New Jersey. New Jersey Audubon Society, Bernardsville, NJ. 704 pp.

Weber, W.J. 1979. Health Hazards from pigeons, European starlings, and English sparrows. Thompson Publ. Fresno, Calif. 138 pp.

Weeks, R.J., and A.R. Stickley. 1984. Histoplasmosis and its relation to bird roosts: a review. Denver Wildl. Res. Ctr. Bird Damage Rpt. No. 330. U.S. Fish and Wildl. Serv. 23 pp.

Weitzel, N.H. 1988. Nest site competition between the European starling and native breeding birds in northwestern Nevada. Condor. 90:515-517.

West, R.R., and J.F. Besser. 1976. Selection of toxic poultry pellets from cattle rations by European Starlings. Proc. Bird Control Semin. 7:242-244.

West, R.R., J.F. Besser, and J.W. DeGrazio. 1967. Starling control in livestock feeding areas. Proc. Vertebr. Pest Conf. San Francisco, CA.

Westberg, G.L. 1969. Comparative studies of the metabolism of 3-chloro-p-toluidine and 2-chloro-4-acetutoluidine in rats and chickens and methodology for the determination of 3-chloro-p-toluidine and metabolites in animal tissues. M.S. Thesis, University of California-Davis.

White, D.H., L.E. Hayes, and P.B. Bush. 1989. Case histories of wild birds killed intentionally with famphur in Georgia and West Virginia. Jounal of Wild. Diseases. 25:144-188.

Whoriskey, F.G., and G.J. Fitzgerald. 1985. The effects of bird predation on an estuarine stickleback (Pisces: Gasterosteidae) community. Can. J. Zool. 63:301-307.

Wilbur, S.R. 1983. The status of vultures in the western hemisphere. Pp 113-123 *in* S.R. Wilbur and J.A. Jackson, eds. Vulture biology and management. University of California Press. Berkeley.

Williams, R.E. 1983. Integrated management of wintering blackbirds and their economic impact at south Texas feedlots. Ph.D. Dissertation, Tex. A&M Univ., College Station. 282 pp.

Williams, D.E., and R.M. Corrigan. 1994. Pigeons (Rock Doves). pp E-87 to E-96 *in* S. E. Hygnstrom, R. M. Timm and G. E. Larson (eds.) Prevention and Control of Wildlife Damage. Univ. Nebraska and USDA-APHIS-WS and Great Plains Agric. Council Wildl. Comm., Lincoln, Nebr.

Williams, B.M., D.W. Richards, D.P. Stephens, and T. Griffiths. 1977. The transmission of *S. livingstone* to cattle by the herring gull (*Larus argentatus*). Veterinary Record 100:450-451.

Wilmer, T.J. 1987. Competition between European starlings and kestrels for nest boxes: a review. Raptor Res. Rep. No. 6 pp. 156-159.

Wobeser, G., and C.J. Brand. 1982. Chlamydiosis in 2 biologists investigating disease occurrences in wild waterfowl. Wildlife Society Bulletin 10170-172.

Woronecki, P.P., R.A. Dolbeer, and T.W. Seamans. 1990. Use of alpha-chloralose to remove waterfowl from nuisance and damage situations. Proc. Vertbr. Pest Conf. 14:343-349.

Wright, E.N. 1973. Experiments to control starling damage at intensive animal husbandry units. Bull. OEPP. 9:85-89.

Wright, S.E., and R.A. Dolbeer. 2005. Percentage of wildlife strikes reported and species identified under a voluntary system. *In* Proceedings of Bird Strike Committee USA/Canada meeting, Vancouver, B.C. Canada.

Yasukawa, K., and W.A. Searcy. 1995. Red-winged Blackbird (*Agelaius phoeniceus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/184. Accessed November 2, 2010.

Zottoli, S.J. 1976. Fishing behavior of the Common Grackle. Auk 93:640-642.

APPENDIX B

BIRD DAMAGE MANAGEMENT METHODS AVAILABLE FOR USE

NON-LETHAL METHODS - NONCHEMICAL

Agricultural producer and property owner practices. These consist primarily of non-lethal preventive methods such as cultural methods and habitat modification. Cultural methods and other management techniques are implemented by the agricultural producer or property owners/managers. Resource owners/managers may be encouraged to use these methods, based on the level of risk, need, and professional judgment on their effectiveness and practicality. These methods include:

Cultural methods. These may include altering planting dates so that crops are not young and more vulnerable to damage when the damage-causing species is present, or the planting of crops that are less attractive or less vulnerable to such species. At feedlots or dairies, cultural methods generally involve modifications to the level of care or attention given to livestock which may vary depending on the age and size of the livestock. Animal husbandry practices include but are not limited to techniques such as night feeding, indoor feeding, closed barns or corrals, removal of spilled grain or standing water, and use of bird proof feeders (Johnson and Glahn 1994).

Environmental/Habitat modification can be an integral part of bird damage management. Wildlife production and/or presence are directly related to the type, quality, and quantity of suitable habitat. Therefore, habitat can be managed to reduce or eliminate the production or attraction of certain bird species or to repel certain birds. In most cases, the resource or property owner is responsible for implementing habitat modifications, and WS only provides advice on the type of modifications that have the best chance of achieving the desired effect. Habitat management is most often a primary component of bird damage management strategies at or near airports to reduce bird aircraft strike problems by eliminating bird nesting, roosting, loafing, or feeding sites. Generally, many bird problems on airport properties can be minimized through management of vegetation and water from areas adjacent to aircraft runways. Habitat management is often necessary to minimize damage caused by crows and blackbirds that form large roosts during late autumn and winter. Bird activity can be greatly reduced at roost sites by removing all the trees or selectively thinning the stand.

Animal behavior modification. This refers to tactics that alter the behavior of wildlife to reduce damage. Animal behavior modification may involve use of scare tactics or fencing to deter or repel animals that cause loss or damage (Twedt and Glahn 1982). Some but not all methods that are included by this category are bird-proof barriers, electronic guards, propane exploders, pyrotechnics, distress calls and sound producing devices, chemical frightening agents, repellents, scarecrows, mylar tape, lasers, and eye-spot balloons.

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 (Arhart 1972, Rossbach 1975, Conover 1982, Shirota and Masake 1983, Schmidt and Johnson 1984, Mott 1985, Graves and Andelt 1987, Bomford 1990). Mylar tape has produced mixed results in its effectiveness to frighten birds (Dolbeer et al. 1986, Tobin et al. 1988).

Paintball guns are used as a non-lethal harassment method to disperse birds from areas using physical harassment. Paintballs can be used to produce physically and visually negative-reinforcing stimuli that can aid in the dispersement of birds from areas where damages or threats of damages are occurring.

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).

Overhead wire grids can deter crow use of specific areas where they are causing a nuisance (Johnson 1994). The birds apparently fear colliding with the wires and thus avoid flying into areas where the method has been employed. Netting can be used to exclude birds from a specific area by the placement of bird proof netting over and around the specific resource to be protected. Exclusion may be impractical in most settings (*e.g.*, commercial agriculture), however it can be practical in small areas (*e.g.*, personal gardens) or for high-value crops (*e.g.*, grapes) (Johnson 1994). Although this alternative would provide short-term relief from damage, it may not completely deter birds from feeding, loafing, staging, or roosting at that site. A few people would find exclusionary devices such as netting unsightly, trashy, and a lowering of the aesthetic value of the neighborhood when used over personal gardens.

Auditory scaring devices such as propane exploders, pyrotechnics, electronic guards, scare crows, and audio distress/predator vocalizations are effective in many situations for dispersing damage-causing bird species. These devices are sometimes effective but usually only for a short period of time before birds become accustomed and learn to ignore them (Arhart 1972, Rossbach 1975, Shirota and Masake 1983, Schmidt and Johnson 1984, Mott 1985, Bomford 1990). Williams (1983) reported an approximate 50% reduction in blackbirds at two south Texas feedlots as a result of pyrotechnics and propane cannon use. However, they are often not practical in dairy or feedlot situations because of the disturbance to livestock, although livestock can generally be expected to habituate to the noise. Birds, too, quickly learn to ignore scaring devices if the birds' fear of the methods is not reinforced with shooting or other tactics.

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

Lasers are a non-lethal technique recently evaluated by the NWRC (Glahn et al. 2000*b*, Blackwell et al. 2002). For best results and to disperse numerous birds from a roost, the laser is most effectively used in periods of low light, such as after sunset and before sunrise. In the daytime, the laser can also be used during overcast conditions or in shaded areas to move individual and small numbers of birds, although the effective range of the laser is much diminished. Blackwell et al. (2002) tested lasers on several bird species and observed varied results among species. Lasers were ineffective at dispersing pigeons and mallard with birds habituating in approximately 5 minutes and 20 minutes, respectively (Blackwell et al. 2002). As with other methods, lasers are most effective when used as part of an integrated management program.

Live traps (although live traps are non-lethal, birds may be euthanized upon capture). In most situations live trapped birds are subsequently euthanized. Relocation to other areas following live capture would not generally be 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. Translocation 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. Live traps include:

Decoy traps are used by WS for preventive and corrective damage management. Decoy traps are similar in design to the Australian Crow Trap as reported by McCracken (1972) and Johnson and Glahn (1994). Live decoy birds of the same species that are being targeted are usually placed in the trap with sufficient food and water to assure their survival. Perches are configured in the trap to allow birds to roost above the ground and in a more natural position. Feeding behavior and calls of the decoy birds attract other birds which enter and become trapped themselves. Active decoy traps are monitored daily, every other day, or as appropriate, to remove and euthanize excess birds and to replenish bait and water. Decoy traps and other cage/live traps, as applied and used by WS, pose no danger to pets or the public and if a pet is accidentally captured in such traps, it can be released unharmed.

Foot-hold traps are used by WS to live-captures birds, primarily raptors and other bird species. For example, trapping with foot-hold traps can be effective in areas where a small resident crow population is present (Johnson 1994). No. 0 or 1 foot-hold traps with padded jaws would be used to trap individual birds. Traps would be monitored a minimum of twice each day and trapped birds addressed promptly.

Nest box traps may be used by WS and are effective in capturing local breeding and post breeding European Starlings and other targeted secondary cavity nesting birds (DeHaven and Guarino 1969, Knittle and Guarino 1976).

Mist nets are more commonly used for capturing small-sized birds such as House Sparrows but can be used to capture larger birds such as ducks and ring-neck pheasants or even smaller nuisance hawks and owls. It was introduced in to the United States in the 1950s from Asia and the Mediterranean where it was used to capture birds for the market (Day et al. 1980). The mist net is a fine black silk or nylon net usually 3 to 10 feet wide and 25 to 35 feet long. Net mesh size determines which birds can be caught and overlapping pockets in the net cause birds to entangle themselves when they fly into the net.

Cannon nets are normally used for larger birds such as pigeons and use mortar projectiles to propel a net up and over birds which have been baited to a particular site.

Nest destruction is the removal of nesting materials during the construction phase of the nesting cycle. Nest destruction is generally only applied when dealing with a single bird or very few birds. This method is used to discourage birds from constructing nests in areas which may create nuisances for home and business owners. Heusmann and Bellville (1978) reported that nest removal was an effective but time-consuming method because problem bird species are highly mobile and can easily return to damage sites from long distances, or because of high populations. This method poses no imminent danger to pets or the public.

Egg addling/destruction is a method of suppressing reproduction in local nuisance bird populations by destroying egg embryos 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 destruction can be accomplished in several different ways, but the most commonly used methods are manually gathering eggs and breaking them, or by oiling or spraying the eggs with a liquid which covers the entire egg and prevents the egg from obtaining oxygen (see *Egg oiling* below). Although WS does not commonly use egg addling or destruction, it is a valuable damage management tool and has proven effective in some applications.

Lure crops/alternate foods. When damage cannot be avoided by careful crop selection or modified planting schedules, lure crops can sometimes be used to mitigate the loss potential. Lure crops are planted or left for consumption by wildlife as an alternative food source. 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.

NON-LETHAL METHODS - CHEMICAL

Avitrol is a chemical frightening agent (repellent) that is effective in a single dose when mixed with untreated baits, normally in a 1:9 ratio. Avitrol, however, is not completely non-lethal in that a small portion of the birds are generally killed (Johnson and Glahn 1994). Prebaiting is usually necessary to achieve effective bait acceptance by the target species. This chemical is registered for use on pigeons, crows, blackbirds, starlings, and House Sparrows in various situations. Avitrol treated bait is placed in an area where the targeted birds are feeding. When a treated particle is consumed affected bird begins to broadcast distress vocalizations and display abnormal flying behavior, thereby frightening the remaining flock away.

Avitrol is a restricted use pesticide that can only be sold to certified applicators and is available in several bait formulations where only a small portion of the individual grains carry the chemical. It can be used during anytime of the year, but is used most often during winter and spring. 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 availability for intake by organisms from water, is non-accumulative in tissues and rapidly metabolized by many species (Schafer, Jr. 1991).

Avitrol is acutely toxic to avian and mammalian species, however, blackbirds are more sensitive to the chemical and there is little evidence of chronic toxicity. Laboratory studies with predator and scavenger species have shown minimal potential for secondary poisoning and during field use only magpies and crows appear to have been affected (Schafer, Jr. 1991). However, a laboratory study by Schafer, Jr. et al. (1974) showed that magpies exposed to two to 3.2 times the published LD_{50} in contaminated prey for 20 days were not adversely affected and three American kestrels that were fed contaminated blackbirds for seven to 45 days were not adversely affected. Some hazards may occur to predatory species consuming unabsorbed chemical in the GI tract of affected or dead birds (Schafer, Jr. 1981, Holler and Shafer, Jr. 1982). A formal Risk Assessment found no probable risk is expected for pets and the public, based on low concentrations and low hazards quotient value for non-target indicator species tested on this compound (USDA 1997).

Methyl anthranilate (artificial grape flavoring used in foods and soft drinks for human consumption) could be used or recommended by WS as a bird repellent. Methyl anthranilate (MA) (artificial grape flavoring food additive) has been shown to be a promising repellent for many bird species, including waterfowl (Dolbeer et al. 1993*b*). Cummings et al. (1995) found effectiveness of MA declined significantly after 7 days. Belant et al. (1996) found MA ineffective as a bird grazing repellent, even when applied at triple the recommended label rate. MA is also under investigation as a potential bird taste repellent. MA may become available for use as a livestock feed additive (Mason et al. 1984, Mason et al. 1989). It is registered for applications to turf or to surface water areas used by unwanted birds. The

material has been shown to be nontoxic to bees (LD_{50} > 25 micrograms/bee[14]), nontoxic to rats in an inhalation study (LC_{50} > 2.8 mg/L[15]), and of relatively low toxicity to fish and other invertebrates. Methyl anthranilate is naturally occurring in concord grapes and in the blossoms of several species of flowers and 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. Cost of treating turf areas would be similar on a per acre basis. Also, MA completely degrades in about 3 days when applied to water which indicates the repellent effect is short-lived.

Another potentially more cost effective method of MA application is by 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 non-irritating 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.

MA is also being investigated as a livestock feed additive to reduce or prevent feed consumption by birds. Such chemicals undergo rigorous testing and research to prove safety, effectiveness, and low environmental risks before they would be registered by EPA or the FDA.

Mesurol was recently registered by WS to repel crows and ravens from bird nests of T&E species. It could be used by WS only as a bird repellent to deter predation by crows on eggs of threatened or endangered species. Dimmick and Nicolaus (1990) showed breeding pairs of crows could be conditioned with aversive chemicals to avoid eggs. However, Avery and Decker (1994) observed increased consumption of eggs treated with higher doses of Mesurol by Fish Crows. Sullivan and Dinsmore (1990) reported bird nests greater than 700 meters from crow nests were relatively safe from crow predation, thus nests beyond 700 meters from active crow nests may not need to be treated.

WS would treat eggs similar in appearance as those eggs of the species needing protection. The active ingredient is injected into eggs which are placed in artificial nests or upon elevated platforms. Upon ingestion, birds develop post-ingestional malaise (Mason 1989) and crows develop an aversion to consuming similar looking eggs (Dimmick and Nicolaus 1990). Repeated exposures may be necessary to develop and maintain aversion to threatened or endangered species eggs as the learning curve for crows can take from 23 days to 3 months (Dimmick and Nicolaus 1990, Avery and Decker 1994).

Treated areas will be posted with warning signs at access points to exclude people from endangered or threatened species nesting areas. Treated eggs are not placed in locations where threatened or endangered species may eat the treated eggs. Mesurol is highly toxic to birds and mammals and toxic to fish. It is also highly toxic to honey bees.

Particulate feed additives have been investigated for their bird-repellent characteristics. In pen trials, European Starlings rejected grain to which charcoal particles were adhered. If further research finds this method to be effective and economical in field application, it might become available as a bird repellent on livestock feed. Charcoal feed additives have been explored for use in reducing methane production in

[14] 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.

[15] 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.

livestock and should have no adverse effects on livestock, on meat or milk production, or on human consumers of meat or dairy products.

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). Compounds extracted from common spices used in cooking and applied to perches in cage tests have been shown repellent characteristics against roosting European Starlings (Clark 1997). Naphthalene (moth balls) was found to be ineffective in repelling European Starlings (Dolbeer et al. 1988).

Tactile repellents. A number of tactile repellent products are on the market which reportedly deters birds from roosting on certain structural surfaces by presenting a tacky or sticky surface that the birds avoid. However, experimental data in support of this claim are sparse (Mason and Clark 1992). The repellency of tactile products is generally short-lived because of dust, and they sometimes cause aesthetic problems and expensive clean-up costs by running down the sides of buildings in hot weather.

Egg oiling is a method for suppressing reproduction of nuisance birds by spraying a small quantity of food grade vegetable oil or mineral oil on eggs in nests. The oil prevents exchange of gases and causes asphyxiation of developing embryos and has been found to be 96-100% effective in reducing hatchability. (Pochop 1998, Pochop et al. 1998). The method has an advantage over nest or egg destruction in that the incubating birds generally continue incubation and do not re-nest. The EPA has ruled that use of corn oil for this purpose is exempt from registration requirements under FIFRA. To be most effective, the oil should be applied anytime between the fifth day after the laying of the last egg in a nest and at least five days before anticipated hatching. This method is extremely target specific and is less labor intensive than egg addling.

Alpha-chloralose is a central nervous system depressant used as an immobilizing agent to capture and remove pigeons, waterfowl and other birds. It is labor intensive and in some cases, may not be cost effective (Wright 1973, Feare et al. 1981). Alpha-chloralose is typically delivered in a well contained bait in small quantities with minimal hazards to pets and humans; single bread or corn baits are fed directly to the target birds. WS' personnel are present at the site of application during baiting to retrieve the immobilized birds. Unconsumed baits are removed from the site following each treatment. Alpha-chloralose was eliminated from more detailed analysis in USDA (1997) based on critical element screening; therefore, environmental fate properties of this compound were not rigorously assessed. However, the solubility and mobility are believed to be moderate and environmental persistence is believed to be low. Bioaccumulation in plants and animal tissue is believed to be low. Alpha-chloralose is used in other countries as an avian and mammalian toxicant. The compound is slowly metabolized, with recovery occurring a few hours after administration (Schafer, Jr. 1991). The dose used for immobilization is designed to be about two to 30 times lower than the LD_{50}. Mammalian data indicate higher LD_{50} values than birds. Toxicity to aquatic organisms is unknown (Woronecki et al. 1990) but the compound is not generally soluble in water and therefore should remain unavailable to aquatic organisms. Factors supporting the determination of this low potential included the lack of exposure to pets, non-target species and the public, and the low toxicity of the active ingredient. Other supporting rationale for this determination included relatively low total annual use and a limited number of potential exposure pathways. The agent is currently approved for use by WS as an Investigative New Animal Drug by the FDA rather than a pesticide.

LETHAL METHODS - MECHANICAL

Shooting is more effective as a dispersal technique than as a way to reduce bird densities when large numbers of birds are present. Normally shooting is conducted with shotguns, rifles or air rifles. Shooting is a very individual specific method and is normally used to remove a single offending bird. However, at times, a few birds could be shot from a flock to make the remainder of the birds more wary and to help reinforce non-lethal methods. Shooting can be relatively expensive because of the staff hours sometimes required (USDA 1997). It is selective for target species and may be used in conjunction with the use of spotlights, decoys, and calling. Shooting with shotguns, air rifles, or rim and center fire rifles is sometimes used to manage bird damage problems when lethal methods are determined to be appropriate. The birds are killed as quickly and humanely as possible. All firearm safety precautions are followed by WS when conducting BDM activities and all laws and regulations governing the lawful use of firearms are strictly complied with.

Firearm use is very sensitive and a public concern because of safety issues relating to the public and misuse. To ensure safe use and awareness, WS' employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 2 years afterwards (WS Directive 2.615). WS' employees, who carry firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

Sport hunting is sometimes recommended by WS as a viable damage management method when the target species can be legally hunted. A valid hunting license and other licenses or permits may be required by the MDWFP 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 crow damage management around crops or other resources.

Cervical dislocation is sometimes used to euthanize birds which are captured in live traps. The bird is stretched and the neck is hyper-extended and dorsally twisted to separate the first cervical vertebrae from the skull. The 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).

LETHAL METHODS - CHEMICAL

All chemicals used by WS are registered as required by the FIFRA (administered by the EPA and the MDAR). WS' personnel that use restricted-use chemical methods are certified as pesticide applicators by the State of Mississippi and are required to adhere to all certification requirements set forth in FIFRA and Mississippi pesticide control laws and regulations. Chemicals are only used on private, public, or tribal property sites with authorization from the property owner/manager.

CO_2 is sometimes used to euthanize birds which are captured in live traps. Live birds are placed in a container such as a plastic 5-gallon bucket or chamber and sealed shut. CO_2 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 AVMA (Beaver et al. 2001). CO_2 gas is a byproduct 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 CO_2 by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society.

DRC-1339 is the principal chemical method that would be used for bird damage management in the proposed action. For more than 30 years, DRC-1339 has proven to be an effective method of starling, blackbird, gull, and pigeon control 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 1982, Glahn et al. 1987), and dispersing crow roosts in urban/suburban areas (Boyd and Hall 1987). Glahn and Wilson (1992) noted that baiting with DRC-1339 is a cost-effective method of reducing damage by blackbirds to sprouting rice.

DRC-1339 is a slow acting avicide that is registered with the EPA for reducing damage from several species of birds, including blackbirds, starlings, pigeons, crows, ravens, magpies, and gulls. DRC-1339 was developed as an avicide because of its differential toxicity to mammals. DRC-1339 is highly toxic to sensitive species but only slightly toxic to non-sensitive birds, predatory birds, and mammals (Schafer, Jr. 1981, Schafer, Jr. 1991, Johnston et al. 1999). For example, starlings, a highly sensitive species, require a dose of only 0.3 mg/bird to cause death (Royall et al. 1967). Most bird species that are responsible for damage, including starlings, blackbirds, pigeons, crows, magpies, and ravens are highly sensitive to DRC-1339. Many other bird species such as raptors (Schafer, Jr. 1981), sparrows, and eagles are classified as non-sensitive. Numerous studies show that DRC-1339 poses minimal risk of primary poisoning to non-target and T&E species (USDA 1997). Secondary poisoning has not been observed with DRC-1339 treated baits, except crows eating gut contents of pigeons (Kreps 1974). 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. 1981). This can be attributed to relatively low toxicity to species that might scavenge on blackbirds and starlings killed by DRC-1339 and its tendency to be almost completely metabolized in the target birds which leaves little residue to be ingested by scavengers. Secondary hazards of DRC-1339 are almost nonexistent (Schafer, Jr. 1984, Schafer, Jr. 1991, Johnston et al. 1999). DRC-1339 acts in a humane manner producing a quiet and apparently painless death.

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

DRC-1339 has several EPA Registration Labels (56228-10, 56228-28, and 56228-30) depending on the application or species involved in the bird damage management project.

APPENDIX C

THREATENED AND ENDANGERED SPECIES THAT ARE FEDERALLY LISTED IN THE STATE OF MISSISSIPPI

Listings and occurrences for Mississippi

Notes:

- This report shows the listed species associated in some way with this state.
- This list does not include experimental populations and similarity of appearance listings.
- This list includes non-nesting sea turtles and whales in State/Territory coastal waters.
- This list includes species or populations under the sole jurisdiction of the National Marine Fisheries Service.

Animal species listed in this state and that occur in this state

Status	Species
E	Bat, Indiana (*Myotis sodalis*)
E	Bat, gray (*Myotis grisescens*)
T	Bear, Louisiana black (*Ursus americanus luteolus*)
T	Bear, American black (*Ursus americanus*)
E	Butterfly, Mitchell's satyr (*Neonympha mitchellii mitchellii*)
E	Clubshell, black (*Pleurobema curtum*)
E	Clubshell, ovate (*Pleurobema perovatum*)
E	Clubshell, southern (*Pleurobema decisum*)
E	Combshell, Cumberlandian (*Epioblasma brevidens*)
E	Combshell, southern (*Epioblasma penita*)
E	Crane, Mississippi sandhill (*Grus canadensis pulla*)
T	Darter, bayou (*Etheostoma rubrum*)
E	Frog, Mississippi gopher (*Rana capito sevosa*)
T	Heelsplitter, Alabama (=inflated) (*Potamilus inflatus*)
E	Manatee, West Indian (*Trichechus manatus*)
T	Moccasinshell, Alabama (*Medionidus acutissimus*)
T	Mucket, orangenacre (*Lampsilis perovalis*)
E	Mussel, sheepnose (*Plethobasus cyphyus*)
E	Mussel, snuffbox (*Epioblasma triquetra*)
E	Pigtoe, flat (*Pleurobema marshalli*)
E	Pocketbook, fat (*Potamilus capax*)
T	Sea turtle, green (*Chelonia mydas*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
E	Stirrupshell (*Quadrula stapes*)
T	Sturgeon, gulf (*Acipenser oxyrinchus desotoi*)

Animal species listed in this state and that occur in this state

Status	Species
E	Sturgeon, pallid (*Scaphirhynchus albus*)
T	Sturgeon, shovelnose (*Scaphirynchus platorynchus*)
E	Tern, least interior pop. (*Sterna antillarum*)
T	Turtle, ringed map (*Graptemys oculifera*)
T	Turtle, yellow-blotched map (*Graptemys flavimaculata*)
E	Turtle, Alabama red-belly (*Pseudemys alabamensis*)
T	Tortoise, gopher (*Gopherus polyphemus*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Woodpecker, red-cockaded (*Picoides borealis*)

Animal species listed in this state that do not occur in this state

Status	Species
E	Beetle, American burying (*Nicrophorus americanus*)
E	Panther, Florida (*Puma (=Felis) concolor coryi*)
E	Pigtoe, heavy (*Pleurobema taitianum*)
T	Plover, piping (*Charadrius melodus*)
T	Snake, eastern indigo (*Drymarchon corais couperi*)
E	Sturgeon, Alabama (*Scaphirhynchus suttkusi*)
E	Wolf, gray (*Canis lupus*)

Animal listed species occurring in this state that are not listed in this state

Status	Species
E	Plover, piping; Great Lakes watershed (*Charadrius melodus*)
E	Sawfish, smalltooth (*Pristis pectinata*)
E	Stork, wood (*Mycteria americana*)

Plant species listed in this state and that occur in this state

Status	Species
E	Chaffseed, American (*Schwalbea americana*)
E	Pondberry (*Lindera melissifolia*)
T	Potato-bean, Price's (*Apios priceana*)
E	Quillwort, Louisiana (*Isoetes louisianensis*)

Last updated: April 26, 2012

APPENDIX D
STATE THREATENED AND ENDANGERED SPECIES IN MISSISSIPPI

MISSISSIPPI NATURAL HERITAGE PROGRAM
LISTED SPECIES OF MISSISSIPPI
2011

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	FEDERAL STATUS	STATE STATUS	STATE RANK
ANIMALS					
BIVALVIA					
Actinonaias ligamentina	Mucket	G5		LE	S1
Cyclonaias tuberculata	Purple Wartyback	G5		LE	S1
Elliptio arctata	Delicate Spike	G3Q		LE	S1
Elliptio dilatata	Spike	G5		LE	S1
Epioblasma brevidens	Cumberlandian Combshell	G1	LE, XN	LE	S1
Epioblasma penita	Southern Combshell	G1	LE	LE	S1
Epioblasma triquetra	Snuffbox	G3		LE	S1
Hamiota perovalis	Orangenacre Mucket	G2	LT	LE	S1
Lexingtonia dolabelloides	Slabside Pearlymussel	G2	C	LE	S1
Medionidus acutissimus	Alabama Moccasinshell	G2	LT	LE	S1
Plethobasus cyphyus	Sheepnose	G3	C	LE	S1
Pleurobema curtum	Black Clubshell	G1	LE	LE	SH
Pleurobema decisum	Southern Clubshell	G2	LE	LE	S1S2
Pleurobema marshalli	Flat Pigtoe	GH	LE	LE	SX
Pleurobema perovatum	Ovate Clubshell	G1	LE	LE	S1
Pleurobema rubrum	Pyramid Pigtoe	G2		LE	S1
Pleurobema taitianum	Heavy Pigtoe	G1	LE	LE	SX
Potamilus capax	Fat Pocketbook	G1	LE	LE	S1
Potamilus inflatus	Inflated Heelsplitter	G1G2	LT	LE	S1
Ptychobranchus fasciolaris	Kidneyshell	G4G5		LE	S1
Quadrula cylindrica cylindrica	Rabbitsfoot	G3T3		LE	S1
Quadrula metanevra	Monkeyface	G4		LE	SX
Quadrula stapes	Stirrupshell	GH	LE	LE	SX
MALACOSTRACA					
Fallicambarus gordoni	Camp Shelby Burrowing Crayfish	G1		LE	S1
INSECTA					
Neonympha mitchellii mitchellii	Mitchell's Satyr	G2T2	LE		S1
Nicrophorus americanus	American Burying Beetle	G2G3	LE	LE	SX
OSTEICHTHYES					
Acipenser oxyrinchus desotoi	Gulf Sturgeon	G3T2	LT	LE	S1
Crystallaria asprella	Crystal Darter	G3		LE	S1
Etheostoma blennioides	Greenside Darter	G5		LE	S1

MISSISSIPPI NATURAL HERITAGE PROGRAM
LISTED SPECIES OF MISSISSIPPI
2011

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	FEDERAL STATUS	STATE STATUS	STATE RANK
OSTEICHTHYES					
Etheostoma rubrum	Bayou Darter	G1	LT	LE	S1
Notropis boops	Bigeye Shiner	G5		LE	S1
Notropis chalybaeus	Ironcolor Shiner	G4		LE	S2
Noturus exilis	Slender Madtom	G5		LE	S1
Noturus gladiator	Piebald Madtom	G3		LE	S1
Noturus munitus	Frecklebelly Madtom	G3		LE	S2
Percina aurora	Pearl Darter	G1	C	LE	S1
Percina phoxocephala	Slenderhead Darter	G5		LE	S1
Phenacobius mirabilis	Suckermouth Minnow	G5		LE	S1
Phoxinus erythrogaster	Southern Redbelly Dace [2]	G5		LE	S2
Scaphirhynchus albus	Pallid Sturgeon	G1	LE	LE	S1
Scaphirhynchus platorynchus	Shovelnose Sturgeon	G4	T/SA		S3?
Scaphirhynchus suttkusi	Alabama Sturgeon	G1	LE	LE	S1
AMPHIBIA					
Amphiuma pholeter	One-toed Amphiuma	G3		LE	S1
Aneides aeneus	Green Salamander	G3G4		LE	S1
Eurycea lucifuga	Cave Salamander	G5		LE	S1
Gyrinophilus porphyriticus	Spring Salamander	G5		LE	S1
Rana sevosa	Dusky Gopher Frog	G1	LE	LE	S1
REPTILIA					
Caretta caretta	Loggerhead	G3	LT	LE	S1B
Chelonia mydas	Green Turtle	G3	LE, LT	LE	SNA
Dermochelys coriacea	Leatherback	G2	LE	LE	SNA
Drymarchon couperi	Eastern Indigo Snake	G3	LT	LE	SH
Eretmochelys imbricata	Hawksbill	G3	LE	LE	SNA
Farancia erytrogramma	Rainbow Snake	G5		LE	S2
Gopherus polyphemus	Gopher Tortoise	G3	PS:LT	LE	S2
Graptemys flavimaculata	Yellow-blotched Map Turtle	G2	LT	LE	S2
Graptemys nigrinoda	Black-knobbed Map Turtle	G3		LE	S2
Graptemys oculifera	Ringed Map Turtle	G2	LT	LE	S2
Heterodon simus	Southern Hognose Snake	G2		LE	SX
Lepidochelys kempii	Kemp's or Atlantic Ridley	G1	LE	LE	S1N
Pituophis melanoleucus lodingi	Black Pine Snake	G4T3	C	LE	S2
Pseudemys alabamensis	Alabama Redbelly Turtle	G1	LE	LE	S1
AVES					
Campephilus principalis	Ivory-billed Woodpecker	G1	LE	LE	SX

MISSISSIPPI NATURAL HERITAGE PROGRAM
LISTED SPECIES OF MISSISSIPPI
2011

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	FEDERAL STATUS	STATE STATUS	STATE RANK
AVES					
Charadrius alexandrinus tenuirostris	Southeastern Snowy Plover	G4T3Q		LE	S1B,S1N
Charadrius melodus	Piping Plover	G3	LE, LT	LE	S1N
Falco peregrinus	Peregrine Falcon	G4		LE	SNA
Grus canadensis pulla	Mississippi Sandhill Crane	G5T1	LE	LE	S1
Haliaeetus leucocephalus	Bald Eagle	G5		LE	S1B,S2N
Mycteria americana	Wood Stork	G4	PS:LE	LE	S1N
Pelecanus occidentalis	Brown Pelican	G4		LE	S1N
Picoides borealis	Red-cockaded Woodpecker	G3	LE	LE	S1
Sterna antillarum athalassos	Interior Least Tern [3]	G4T2Q	PS:LE	LE	S3?B
Thryomanes bewickii	Bewick's Wren	G5		LE	S2S3B
Vermivora bachmanii	Bachman's Warbler	GH	LE	LE	SXB
MAMMALIA					
Myotis grisescens	Gray Myotis	G3	LE	LE	SNA
Myotis sodalis	Indiana Bat	G2	LE	LE	SNA
Puma concolor coryi	Florida Panther	G5T1	LE	LE	SX
Trichechus manatus	West Indian Manatee	G2	LE	LE	SNA
Ursus americanus	American Black Bear	G5	PS	LE	S1
Ursus americanus luteolus	Louisiana Black Bear	G5T2	LT	LE	S1
PLANTS [1]					
DICOTYLEDONEAE					
Apios priceana	Price's Potato Bean	G2	LT		S1
Lindera melissifolia	Pondberry	G2	LE		S2
Schwalbea Americana	Chaffseed	G2	LE		SH
ISOETOPSIDA					
Isoetes louisianensis	Louisiana quillwort	G3	LE		S2

[1] *Mississippi has no status concerning endangered plants.*

[2] *West Mississippi disjunct populations*

[3] *Interior populations nesting along the Mississippi River*

Cite the list as:
Mississippi Natural Heritage Program, 2011. Listed Species of Mississippi. Museum of Natural Science, Mississippi Dept. of Wildlife, Fisheries, and Parks, Jackson, MS. 3pp.