ENVIRONMENTAL ASSESSMENT

Managing Damage to Resources and Threats to Human Safety Caused by Birds in the State of Maryland

Prepared by

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

In cooperation with:

UNITED STATES DEPARTMENT OF THE INTERIOR
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MIGRATORY BIRD PROGRAM
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TABLE OF CONTENTS

ACRONYMS ..... *iii*

CHAPTER 1: PURPOSE AND NEED FOR ACTION
1.1 PURPOSE 1
1.2 NEED FOR ACTION 3
1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT 26
1.4 RELATIONSHIP OF THIS DOCUMENT TO OTHER ENVIRONMENTAL DOCUMENTS . 29
1.5 AUTHORITY OF FEDERAL AND STATE AGENCIES 30
1.6 COMPLIANCE WITH LAWS AND STATUTES 32
1.7 DECISIONS TO BE MADE 37

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES
2.1 AFFECTED ENVIRONMENT 37
2.2 ISSUES ASSOCIATED WITH BIRD DAMAGE MANAGEMENT ACTIVITIES 41
2.3 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE 49

CHAPTER 3: ALTERNATIVES
3.1 DESCRIPTION OF THE ALTERNATIVES 55
3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL 60
3.3 STANDARD OPERATING PROCEDURES FOR BIRD DAMAGE MANAGEMENT 63
3.4 ADDITIONAL STANDARD OPERATING PROCEDURES SPECIFIC TO THE ISSUES 64

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES
4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL 67
4.2 CUMULATIVE IMPACTS OF THE PROPOSED ACTION BY ISSUE 156

CHAPTER 5: LIST OF PREPARERS AND PERSONS CONSULTED
5.1 LIST OF PREPARERS AND REVIEWERS 166
5.2 LIST OF PERSONS CONSULTED 166

LIST OF APPENDICES

APPENDIX A LITERATURE CITED A-1

APPENDIX B METHODS AVAILABLE FOR ALLEVIATING OR PREVENTING BIRD DAMAGE IN MARYLAND B-1

APPENDIX C FEDERAL THREATENED AND ENDANGERED SPECIES IN MARYLAND C-1

APPENDIX D MARYLAND ENDANGERED ANIMALS D-1

ACRONYMS

AI	Avian Influenza
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
AQDO	Aquaculture Depredation Order
BBS	Breeding Bird Survey
BCR	Bird Conservation Region
CBC	Christmas Bird Count
CDC	Centers for Disease Control and Prevention
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DNC	Dinitrocarbanilide
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FR	Federal Register
FY	Fiscal Year
HDP	4,4'-dinitrocarbanilide
INAD	Investigational New Animal Drug
IPN	Infectious Pancreatic Necrosis
IUCN	International Union for Conservation of Nature
LD_{50}	Median Lethal Dose
LC_{50}	Median Lethal Concentration
MANEM	Mid-Atlantic/New England/Maritime
MBTA	Migratory Bird Treaty Act
MDA	Maryland Department of Agriculture
MDNR	Maryland Department of Natural Resources
MOU	Memorandum of Understanding
NAS	National Audubon Society
NASS	National Agricultural Statistics Service
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NWRC	National Wildlife Research Center
PBR	Potential Biological Removal
PL	Public Law
PRDO	Public Resources Depredation Order
ROD	Record of Decision
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
USC	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
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 Maryland and the Migratory Bird Program within Region 5 of the United States Fish and Wildlife Service (USFWS)[2] continue to receive requests for assistance or anticipate receiving requests for assistance to alleviate or prevent damage occurring to agricultural resources, natural resources, and property, including threats to human safety associated with snow geese (*Chen caerulescens*), mute swans (*Cygnus olor*), mallards (*Anas platyrhynchos*), feral and free-ranging waterfowl[3], double-crested cormorants (*Phalacrocorax auritus*), great blue herons (*Ardea herodius*), great egrets (*Ardea alba*), snowy egrets (*Egretta thula*), cattle egrets (*Bubulcus ibis*), black vultures (*Corgyps atratus*), turkey vultures (*Cathartes aura*), ospreys (*Pandion haliaetus*), Northern harriers (*Circus cyaneus*), sharp-shinned hawks (*Accipiter striatus*), Cooper's hawks (*Accipiter cooperii*), red-shouldered hawks (*Buteo lineatus*), broad-winged hawks (*Buteo platypterus*), red-tailed hawks (*Buteo jamaicensis*), American coots (*Fulica americana*), killdeer (*Charadrius vociferus*), Bonaparte's gulls (*Chroicocephalus philadelphia*), laughing gulls (*Leucophaeus atricilla*), ring-billed gulls (*Larus delawarensis*), herring gulls (*Larus argentatus*), great black-backed gulls (*Larus marinus*), rock pigeons (*Columba livia*), mourning doves (*Zenaida macroura*), barn owls (*Tyto alba*), great horned owls (*Bubo virginianus*), barred owls (*Strix varia*), chimney swift (*Chaetura pelagica*), red-headed woodpeckers (*Melanerpes erythrocephalus*), red-bellied woodpeckers (*Melanerpes carolinus*), yellow-bellied sapsuckers (*Sphyrapicus varius*), downy woodpeckers (*Picoides pubescens*), hairy woodpeckers (*Picoides villosus*), Northern flickers (*Colaptes auratus*), pileated woodpeckers (*Dryocopus pileatus*), American kestrels (*Falco sparverius*), blue jays (*Cyanocitta cristata*), tree swallows (*Tachycineta bicolor*), Northern rough-winged swallows (*Stelgidopteryx serripennis*), bank swallows (*Riparia riparia*), cliff swallows (*Petrochelidon pyrrhonota*), barn swallows (*Hirundo rustica*), gray catbirds (*Dumetella carolinensis*), Northern mockingbirds (*Mimus polyglottos*), European starlings (*Sturnus vulgaris*), Northern cardinals (*Cardinalis cardinalis*), red-winged blackbirds (*Agelaius phoeniceus*), Eastern meadowlarks (*Sturnella magna*), common grackles (*Quiscalus quiscula*), brown-headed cowbirds (*Molothrus ater*), house finches (*Haemorhous mexicanus*), and house sparrows (*Passer domesticus*).

All federal actions are subject to the National Environmental Policy Act (NEPA; Public Law 9-190, 42 USC 4321 et seq.), including the actions of WS[4] and the USFWS. The NEPA sets forth the requirement that all 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 the Council of Environmental Quality (CEQ) through regulations in 40 CFR 1500-1508. The NEPA and the CEQ guidelines generally outline five broad types of activities to be accomplished as part of projects

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[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).

[2]The USFWS is responsible for managing and regulating bird species under the Migratory Bird Treaty Act (MBTA). The take of migratory birds is prohibited by the MBTA. However, the USFWS can issue depredation permits for the take of protected 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.

[3]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 free ranging domestic waterfowl include, but are not limited to, mute swans; Muscovy ducks (*Cairina moschata*); mallard (*Anas platyrhynchos domestica*) derived breeds including Pekin ducks, Rouen ducks, Cayuga ducks, Swedish ducks, and Khaki Campbell ducks; swan goose (*Anser cygnoides*) derived breeds including Chinese geese; and graylag goose (*Anser anser domesticus*) derived breeds including Toulouse geese, Embden geese, and pilgrim geese. Feral ducks may include a combination of domesticated mallards, mallard derived breeds, Muscovy ducks, and mallard-Muscovy hybrids, as well as hybrids of domestic breeds with wild mallards or American black ducks.

[4]The WS program follows the CEQ regulations implementing the NEPA (40 CFR 1500 et seq.) along with USDA (7 CFR 1b) and APHIS Implementing Guidelines (7 CFR 372) as part of the decision-making process.

conducted by a federal agency. Those five types of activities are public involvement, analysis, documentation, implementation, and monitoring.

Pursuant to the NEPA and the CEQ regulations, WS and the USFWS are preparing this Environmental Assessment (EA)[5] to document the analyses associated with proposed federal actions and to inform decision-makers and the public of reasonable alternatives capable of avoiding or minimizing adverse effects. This EA will also serve as a decision-aiding mechanism to ensure that the policies and goals of the NEPA are infused into the actions of each agency. Preparing the EA will assist in determining if the proposed cumulative management of bird damage could have a significant impact on the environment based on previous activities conducted and based on the anticipation of conducting additional efforts to manage bird damage. Because the goal of WS would be to conduct a coordinated program to alleviate bird damage in accordance with plans, goals, and objectives developed to reduce damage, and because the program's goals and directives[6] would be to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional damage management efforts could occur. Thus, this EA anticipates those additional efforts and the analyses would be intended to apply to actions that may occur in any locale and at any time within Maryland as part of a coordinated program.

More specifically, WS and the USFWS are preparing this EA to: 1) facilitate planning between agencies, 2) promote interagency coordination, 3) streamline program management, 4) clearly communicate to the public the analysis of individual and cumulative impacts of proposed activities; 5) evaluate and determine if there could be any potentially significant or cumulative effects associated with managing bird damage, and 6) to comply with the NEPA. Developing this EA will assist WS and the USFWS with determining if the proposed action or the other alternatives could potentially have significant individual and/or cumulative effects on the quality of the human environment that would warrant the preparation of an Environmental Impact Statement (EIS). This EA addresses potential impacts associated with managing damage and threats to human safety caused by birds in the State to analyze individual and cumulative impacts and to provide a thorough analysis of individual projects conducted by WS.

This EA analyzes the potential effects of bird damage management when requested, as coordinated between WS, the USFWS, and the Maryland Department of Natural Resources (MDNR). 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 other environmental documents.

The 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 alternative approaches to meeting the need for action while addressing the identified issues. The issues and alternatives associated with bird damage management were initially developed by WS and the USFWS, in consultation with the MDNR. The USFWS has overall regulatory authority to manage populations of bird species, while the MDNR has the authority to manage wildlife populations in the State of Maryland. To assist with identifying additional issues and alternatives to managing damage, this EA will be made available to the public for review and comment prior to the issuance a Decision[7].

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[5]The CEQ defines an EA as documentation that "*...(1) briefly provides sufficient evidence and analysis for determining whether to prepare an* [Environmental Impact Statement]*; (2) aids an agency's compliance with NEPA when no environmental impact statement is necessary; and (3) facilitates preparation of an Environmental Impact Statement when one is necessary*" (CEQ 2007).

[6]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.

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

1.2 NEED FOR ACTION

Some species of wildlife have adapted to and have thrived in human altered habitats. Those species, in particular, are often responsible for the majority of conflicts between people and wildlife. Those conflicts often lead people to request assistance with reducing damage to resources and to reduce threats to human safety. Wildlife can have either positive or negative values depending on the perspectives and circumstances of individual people. In general, people regard wildlife as providing economic, recreational, and aesthetic benefits. Knowing that wildlife exists in the natural environment provides a positive benefit to some people. However, activities associated with wildlife may result in economic losses to agricultural resources, natural resources, property, and threaten human safety. Therefore, an awareness of the varying perspectives and values are required to balance the needs of people and the needs of wildlife. When addressing damage or threats of damage caused by wildlife, wildlife damage management professionals must consider not only the needs of those people 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 alleviate 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. The biological carrying capacity is the ability of the land or habitat 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). Those 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. The available habitat may have a biological carrying capacity to support higher populations of wildlife; however, 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 2010). 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 animals 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 can often be unique to an 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 an 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. However, damage 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 Maryland arises from requests for assistance[8] received by WS and the USFWS to reduce and prevent damage from occurring to four major categories. Those four major categories are agricultural resources, natural resources, property, and threats to human safety. WS has 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 and assessments of the threat of bird strike hazards at airports in the State. Table 1.1 shows WS' technical assistance projects involving bird damage or threats of bird damage to those four major resource types in Maryland from the federal fiscal year[9] (FY) 2006 through FY 2012. Table 1.1 does not include direct operational assistance projects conducted by WS where WS was requested to provide assistance through the direct application of methods.

Table 1.1 – Technical assistance projects conducted by WS from FY 2006 through FY 2012[†]

Species	Projects	Species	Projects
Snow Goose	14	**Mourning Dove**	167
Mute Swan	39	**Barn Owl**	4
Mallard	755	**Great Horned Owl**	91
Feral Waterfowl	3	**Barred Owl**	55
Double-crested Cormorant	25	**Chimney Swift**	17
Great Blue Heron	174	**Red-headed Woodpecker**	27
Great Egret	23	**Red-bellied Woodpecker**	9
Snowy Egret	7	**Yellow-bellied Sapsucker**	5
Cattle Egret	3	**Downy Woodpecker**	176
Black Vulture	424	**Hairy Woodpecker**	39
Turkey Vulture	668	**Northern Flicker**	13
Vultures (mixed)	10	**Pileated Woodpecker**	35
Osprey	233	**American Kestrel**	12
Northern Harrier	3	**Blue Jay**	69
Sharp-shinned Hawk	18	**Tree Swallow**	2
Cooper's Hawk	123	**Barn Swallow**	37
Red-shouldered Hawk	48	**Gray Catbird**	46
Broad-winged Hawk	16	**Northern Mockingbird**	173
Red-tailed Hawk	339	**European Starling**	810
American Coot	1	**Northern Cardinal**	85
Killdeer	15	**Blackbirds (mixed)**	57
Bonaparte's Gull	1	**Red-winged Blackbird**	20
Laughing Gull	55	**Eastern Meadowlark**	3
Ring-billed Gull	52	**Common Grackles**	62
Herring Gull	78	**Brown-headed Cowbird**	1
Great Black-backed Gull	29	**House Finch**	31
Rock Pigeon	307	**House Sparrow**	427
		TOTAL	**5,936**

[†]Table does not include direct operational assistance projects conducted by WS where WS was requested to provide assistance through the direct application of methods and does not include bird species not addressed in this EA

[8] 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.

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

Technical assistance is provided by WS to those people requesting assistance with resolving damage or the threat of damage by providing information and recommendations on damage management activities that can be conducted by the requestor without WS' direct involvement in managing or preventing the damage. WS' technical assistance activities will be discussed further in Chapter 3 of this EA.

The technical assistance projects conducted by WS are representative of the damage and threats that could be caused by birds in Maryland. As shown in Table 1.1, WS has conducted 5,936 technical assistance projects in Maryland that addressed damage and threats associated with those bird species addressed in this assessment. WS conducted 1,102 technical assistance projects involving damage or threats of damage associated with turkey vultures and black vultures between FY 2006 and FY 2012. 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.

Vultures can also 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 often leads 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 Maryland. Many of the bird species addressed in this EA can cause damage to or pose threats to a variety of resources. In Maryland, most requests for assistance received by WS are related to threats associated with those bird species being struck by aircraft at or near airports in the State. Bird strikes can cause substantial damage to aircraft requiring costly repairs. In some cases, bird strikes can lead to the catastrophic failure of the aircraft, which can threaten passenger safety.

Many of the species addressed in this assessment are gregarious (*i.e.*, form large flocks), especially during the fall and spring migration periods. Although damage and threats can occur throughout the year, damage or the threat of damage is often 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, herons, cormorants, and gulls. 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 can increase 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 – Primary bird species addressed by WS in Maryland and the resource types damaged

Species	Resource[a]				Species	Resource			
	A	N	P	H		A	N	P	H
Snow Goose	X		X	X	**Great Horned Owl**	X	X	X	X
Mute Swan		X	X	X	**Barred owl**	X	X	X	X
Mallard			X	X	**Chimney Swift**			X	X
Feral Waterfowl		X	X	X	**Red-headed Woodpecker**			X	
Double-crested Cormorant	X	X	X	X	**Red-bellied Woodpecker**			X	
Great Blue Heron	X		X	X	**Yellow-bellied Sapsucker**			X	
Great Egret	X		X	X	**Downy Woodpecker**			X	

Species	Resource[a]				Species	Resource			
	A	N	P	H		A	N	P	H
Snowy Egret	X		X	X	**Hairy Woodpecker**			X	
Cattle Egret	X		X	X	**Northern Flicker**			X	
Black Vulture	X		X	X	**Pileated Woodpecker**			X	
Turkey Vulture	X		X	X	**American kestrel**	X	X	X	X
Osprey		X	X	X	**Blue Jay**			X	X
Northern Harrier	X	X	X	X	**Tree Swallow**			X	X
Sharp-shinned Hawk		X	X	X	**Northern Rough-winged Swallow**			X	X
Cooper's Hawk	X	X	X	X	**Bank Swallow**			X	X
Red-shouldered Hawk	X	X	X	X	**Cliff Swallow**			X	X
Broad-winged Hawk	X	X	X	X	**Barn Swallow**	X		X	X
Red-tailed Hawk	X		X	X	**Gray Catbird**			X	X
American Coot			X	X	**Northern Mockingbird**			X	X
Killdeer			X	X	**European Starling**	X	X	X	X
Bonaparte's Gull			X	X	**Northern Cardinal**			X	
Laughing Gull	X	X	X	X	**Red-winged Blackbird**	X		X	X
Ring-billed Gull	X	X	X	X	**Eastern Meadowlark**			X	X
Herring Gull	X	X	X	X	**Common Grackle**	X	X	X	X
Great black-backed Gull		X	X	X	**Brown-headed Cowbird**	X	X	X	X
Rock Pigeon	X	X	X	X	**House Finch**			X	X
Mourning Dove			X	X	**House Sparrow**	X	X	X	X
Barn Owl	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 Maryland 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 to Alleviate Bird Damage to Agricultural Resources

Agriculture is an important industry in Maryland with over 2 million acres devoted to agricultural production in 2010 (USDA 2011*b*). The total market value of agricultural products sold in the State was over $1.8 billion in 2007 (USDA 2011*b*). The value of grain crops, oilseeds, dry beans, and dry peas production in the State was over $307 million in 2007 (USDA 2011*b*). The cattle and calf inventory for Maryland was over 195,000 head during 2007 with a sales value of over $58 million (USDA 2011*b*). The value of sales from aquaculture production in the State during 2007 was over $4 million (USDA 2011*b*).

A variety of bird species can cause damage to agricultural resources in the State. Damage and threats of damage to agricultural resources is often associated with bird species that exhibit flocking behaviors (*e.g.*, red-winged blackbirds) or colonial nesting behavior (*e.g.*, pigeons). Damage occurs through direct consumption of agricultural resources, the contamination of resources from fecal droppings, or the threat of disease transmission to livestock from contact with fecal matter.

Damage to Aquaculture Resources

Damage to aquaculture resources occurs primarily from the economic losses associated with birds consuming fish and other commercially raised aquatic organisms. Damage can also result from the death

of fish and other aquatic wildlife from injuries associated with bird predation as well as the threat of disease transmission from one impoundment to another or from one aquaculture facility to other facilities as birds move between sites. Aquaculture in Maryland consists of both commercial fish production for the consumer market by private industry, and sport fish production in hatcheries operated by MDNR and the USFWS. The commercial aquaculture industry has recently begun to develop in Maryland producing approximately $4 million in total aquaculture sales in Maryland during 2007 (USDA 2011*b*).

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). Of those birds shown in Table 1.2 associated with damage, of primary concern to aquaculture facilities in Maryland are various species of herons and egrets, double-crested cormorants, herring gulls, ring-billed gulls, and ospreys. Those birds prey on young fry and fingerlings, adult fish ready for stocking or sale, or brood fish at fish rearing facilities (Salmon and Conte 1981). From FY 2006 through FY 2011, aquaculture facilities in Maryland reported $996,160 in damages to WS associated with bird species.

Double-crested cormorants can feed heavily on fish being raised for human consumption, and on fish commercially raised for bait and restocking (USFWS 2003). The frequency of cormorant occurrence at a given aquaculture facility can be a function of many interacting factors, including: (1) size of the regional and local cormorant population; (2) the number, size, and distribution of aquaculture facilities; (3) the size distribution, density, health, and species composition of fish populations at facilities; (4) the number, size, and distribution of wetlands in the immediate area; (5) the size distribution, density, health, and species composition of free-ranging fish populations in the surrounding landscape; (6) the number, size, and distribution of suitable roosting habitat; and (7) the variety, intensity and distribution of local damage abatement activities. Cormorants are adept at seeking out the most favorable foraging and roosting sites. As a result, cormorants are rarely distributed evenly over a given region but are often highly clumped or localized. Damage abatement activities can shift bird activities from one area to another; thereby, not eliminating predation but only reducing damage at one site while increasing damage at another location (Aderman and Hill 1995, Mott et al. 1998, Reinhold and Sloan 1999, Tobin et al. 2002). Thus, some aquaculture producers in a region suffer little or no economic damage from cormorants, while others experience exceptionally high losses.

In addition to cormorants, great blue herons, great egrets, and other wading birds are also known to forage at aquaculture facilities. Those species have been associated with depredations on trout (Parkhurst et al. 1992, Pitt and Conover 1996, Glahn et al. 1999*a*), baitfish (Hoy et al. 1989), and ornamental fish (Avery et al. 1999). The two primary wading bird species implicated in depredations on catfish are the great blue heron and the great egret (Hodges 1989, Ross 1994, Glahn et al. 1999*b*). Herons and egrets occur at most catfish farms throughout the year (Glahn and King 2004). However, recent research has clarified that great blue herons and great egrets mostly eat catfish that are unhealthy, or they eat live, healthy catfish that are close to the surface and margins of the pond, such as during feeding operations. Studies showed that almost half of great blue heron diets consisted of live catfish, but the other half was already dead catfish and wild fish, including sunfish and *gambusia sp*. (Stickley et al. 1995, Glahn et al. 1999*b*). Of the live catfish consumed by herons in the fall and winter, most were identified as being diseased (Glahn et al. 2002). By contrast, most of the live fish consumed during the summer were healthy (Glahn et al. 2002).

The assumption was that when catfish were actively being fed in the summer, herons consumed more healthy live fish as they are near the pond edge or at the surface eating feed. Based on heron numbers and their seasonal consumption rate of live, healthy catfish at these times, Glahn et al. (2002) projected an annual loss per pond of 575 fish or less than 1% of catfish populations in either grow-out or fingerling ponds. Still, great blue herons and great egrets are widespread at aquaculture facilities, and little is known about their potential to spread parasitic diseases to fish. Great blue herons are thought to have a greater impact on baitfish, trout, brood fish, and minnow production. 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 cormorants and herons, other bird species have also been identified as causing damage or posing threats to aquaculture facilities. In 1984, a survey of fish producing facilities identified 43 species of birds as foraging on fish at those facilities, including egrets, mallards, osprey, red-tailed hawks, northern harriers, owls, gulls, common grackles, and brown-headed cowbirds (Parkhurst et al. 1987).

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 fingerlings 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 were 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).

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 switched to alternative food sources at those 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 organisms inside impoundments at aquaculture facilities and the high densities of those organisms in those impoundments, the introduction

of a disease could result in substantial economic losses. Although 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, Viral Hemorrhagic Septicaemia, and Infectious Pancreatic Necrosis (European Inland Fisheries Advisory Commission 1989). Viral Hemorrhagic Septicaemia and Infectious Pancreatic Necrosis are known to occur in North America (Price and Nickum 1995). Spring Viraemia of Carp has also been documented to occur in North America (USDA 2003). Peters and Neukirch (1986) found the Infectious Pancreatic Necrosis virus in the fecal droppings of herons when the herons were fed Infectious Pancreatic Necrosis infected trout. Olesen and Vestergard-Jorgensen (1982) found herons could transmit the Viral Hemorrhagic Septicaemia (Egtved virus) from beak to fish when the beaks of herons were contaminated with the virus. However, Eskildsen and Vestergard-Jorgensen (1973) found the Egtved virus did not pass through the digestive tracks into the fecal droppings of black-headed gulls (*Chroicocephalus 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 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 Enteric Septicemia of Catfish 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 that 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 documentation that birds, primarily herons and cormorants, can pose as vectors of diseases known to infect fish, the rate of transmission is currently unknown and is likely very low. 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). 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 Maryland. Economic damage can occur from birds feeding on livestock feed, from birds feeding on livestock, from birds feeding on newly-planted seed, and from the increased risks of disease transmission associated with large concentrations of birds. Birds also defecate while feeding increasing the possibility of disease transmission through livestock directly contacting or consuming fecal droppings. Birds can also cause damage by defecating on fences, shade canopies, and other structures, which can accelerate corrosion of metal components and can be aesthetically displeasing. Large concentrations of birds at livestock feeding operations can also pose potential health hazards to feedlot/dairy operators and their personnel through directly contacting fecal droppings or by droppings creating unsafe working conditions.

Although damage and disease threats to livestock operations can occur throughout the year, damage can be highest during those periods when birds are concentrated into large flocks, such as during 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. Of primary concern to livestock feedlots and dairies in Maryland are starlings, red-winged blackbirds, common grackles, cowbirds, house sparrows, pigeons, and

to a lesser extent 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 affect 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, which is economically critical (Feare 1984). Glahn and Otis (1986) reported that starling damage was also associated with proximity to roosts, snow, 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. Depenbusch et al. (2011) estimated that feed consumption by European Starlings increased the daily production cost by $0.92 per animal.

Agricultural areas provide ideal habitat for many bird species, which can be attracted in large numbers to those locations. Large concentrations of birds feeding, roosting, or loafing in those areas can increase the possibility of and the concern over the transmission of diseases from birds to livestock. This concern is important and can have far-reaching implications (Daniels et al. 2003, Fraser and Fraser 2010, Miller et al. 2012). Birds feeding alongside livestock in open livestock feeding areas or feeding on stored livestock feed can leave fecal deposits, which can be consumed by livestock. Fecal matter can also be deposited in sources of water for livestock, which increases the likelihood of disease transmission and can contaminate other surface areas 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 and pose not only 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. 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.

A number of diseases that affect livestock have been associated with rock pigeons, European starlings, and house sparrows (Weber 1979, Carlson et al. 2010). Rock pigeons, starlings, and house sparrows have been identified as carriers of several bacteria that are known to cause diseases in livestock and pets, including erysipeloid, salmonellosis, pasteurellosis, avian tuberculosis, streptococcosis, vibrosis, and

listeriosis (Weber 1979, Gough and Beyer 1981). 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.

Contamination of livestock facilities through fecal accumulation by various birds species has been identified as an important concern. Numerous diseases are spread through feces, with salmonellosis and *Escherichia coli* being two diseases of concern. Salmonellosis is an infection with bacteria called *Salmonella* and numerous bird species have been documented as reservoirs for this bacterium (Friend and Franson 1999, Tizard 2004). *E. coli* is a fecal coliform bacteria associated with the fecal material of warm-blooded animals. Multiple studies have found that birds can be an important source of *E. coli* contamination of both land and water sources (Fallacara et al. 2001, Kullas et al. 2002, Hansen et al. 2009, Silva et al. 2009). Multiple species have been documented as carrying dangerous strains of *E. coli*, including gulls, geese, pigeons, and starlings (Pedersen and Clark 2007). Numerous studies have focused on starlings and the transmission of *E. coli* (Gaulker et al. 2009, LeJeune et al. 2008, Cernicchiaro et al. 2012). European starlings have been found to harbor various strains of *E. coli* (Gaulker et al. 2009), including O157:H7, a strain that has been documented as causing human mortalities (LeJeune et al. 2008, Cernicchiaro et al. 2012). LeJeune et al. (2008) found that starlings could play a role in the transmission of *E. coli* between dairy farms.

Carlson et al. (2010) found *Salmonella enterica* in the gastrointestinal tract of starlings at cattle feedlots in Texas and suggested starlings could contribute to the contamination of cattle feed and water. Salmonella contamination levels can be directly related to the number of European starlings present (Carlson et al. 2010, Carlson et al. 2011). Poultry operations can be highly susceptible to diseases spread by wild birds, including those from starlings and house sparrows. This includes salmonella, campylobacter, and clostridium (Craven et al. 2000).

Salmonella transmission by gulls to livestock can also be a concern (Williams et al. 1977, Johnston et al. 1979, Coulson et al. 1983). Williams et al. (1977) and Johnston et al. (1979) reported that gulls can transmit salmonella to livestock through droppings and contaminated drinking water. Pedersen and Clark (2007) did an extensive review of the literature and found geese, gulls, pigeons, house sparrows, cowbirds, grackles, blackbirds and starlings have the potential to play a role in the direct transmission of *E. coli* and *S. enterica* among cattle at feedlots and dairies and from livestock operation to livestock operation. Migratory birds are capable of spreading diseases over a larger area, and domestic species might serve as reservoirs within farm operations. The birds also cause damage by defecating on fences, shade canopies, and other structures, which can accelerate corrosion of metal components and can be aesthetically displeasing. Large concentrations of birds at livestock feeding operations can also pose potential health hazards to feedlot/dairy operators and their personnel through directly contacting fecal droppings or by droppings creating unsafe working conditions.

Although it is difficult to document, there is a strong association of wild birds and the contamination of food and water sources at livestock facilities. The potential for introduction of *E. coli* or salmonella to a livestock operation or the transmission of these pathogens between sites by wild birds is a strong possibility (Pedersen and Clark 2007).

Starlings and gulls, as well as other species, have been documented as transferring species-specific diseases, such as transmittable gastroenteritis (Faulkner 1966, Gough et al. 1979). Many bird species that use barn areas, pastures, manure pits, or carcass disposal areas can directly or indirectly pick-up a disease and transfer it to another farm or to healthy animals at the same farm. In some cases, if carcasses were not disposed of correctly, then scavenging birds, such as vultures and crows, could infect healthy animals though droppings or by the transfer of disease carrying particles on their bodies. Due to the ability of

those bird species to move large distances and from one facility to another, farm-to-farm transmission can be an important concern.

Waterfowl, including ducks, geese, and swans, can also be a concern to livestock producers. Waterfowl droppings in and around livestock ponds can affect water quality and can be a source of a number of different types of bacteria. The transmission of diseases through drinking water is one of the primary concerns for a safe water supply for livestock. Bacteria levels for livestock depend on the age of the animal since adults are more tolerant of bacteria than young animals (Mancl 1989). The bacteria guidelines for livestock water supplies are <1000 fecal coliform/100 ml for adult animals and < 1 fecal coliform/100 ml for young animals (Mancl 1989). Salmonella causes shedding of the intestinal lining and severe diarrhea in cattle. If undetected and untreated, salmonella can kill cattle and calves. Additionally, the contamination of feed by waterfowl through dropping in pastures, crops, or harvested grasses can also be a method of disease transmission to livestock (Fraser and Fraser 2010).

Wild and domestic waterfowl, as well as a variety of other bird species, are the acknowledged natural reservoirs for a variety of avian influenza viruses (Davidson and Nettles 1997, Alexander 2000, Stallknecht 2003, Pedersen et al. 2010). Avian influenza (AI) circulates among these birds without clinical signs and is not an important mortality factor in wild waterfowl (Davidson and Nettles 1997, Clark and Hall 2006). However, the potential for AI to produce devastating disease in domestic poultry makes its occurrence in waterfowl an important issue (Davidson and Nettles 1997, Clark and Hall 2006, Gauthier-Clerc et al. 2007). Although low pathogenic strains of AI are often found in wild birds (Stallknecht 2003, Pedersen et al. 2010), high pathogenic strains have also been found to exist in wild waterfowl species (Brown et al. 2006, Keawcharoen et al. 2008). The ability for wild birds to carry these highly pathogenic strains increases the potential for transmission to domestic poultry facilities, which are highly susceptible to high pathogenic these strains of AI (Nettles et al. 1985, Gauthier-Clerc et al. 2007, Pedersen et al. 2010). The potential impacts from a severe outbreak of high pathogenic AI in domestic poultry could be devastating, and possibly cripple the multi-billion dollar industry through losses in trade, consumer confidence, and eradication efforts (Pedersen et al. 2010).

Some diseases that could affect the poultry industry and might originate in wild bird species include exotic Newcastle disease, chlamydiosis, high-pathogenic AI, low-pathogenic AI, salmonellosis, and pasteurellosis (Clark and McLean 2003). A single outbreak of high-pathogenic AI in 1984 cost the poultry industry $63 million in destroyed or sick birds and clean-up costs, and the price of poultry food products rose in the six months following the outbreak (Hahn and Clark 2002). When adjusted for inflation, those costs were equivalent to nearly $1 billion in 2003 (Clark 2003). Similarly, a low-pathogenic strain of AI virus was isolated in Virginia in March 2002. The control and containment efforts cost $13 million in destruction of flocks, $50 million in paid indemnities, and an overall cost of $129 million to the industry in an effort to minimize the trade impacts (Hahn and Clark 2002). Genetic evidence and documented temporal associations between AI prevalence in wild waterfowl and poultry flocks suggests that wild waterfowl can be a source of infection to poultry (Clark 2003, Clark and Hall 2006). In samples of over 260,000 wild birds, the prevalence of low-pathogenic AI across the United States in 2007 and 2008 was 9.7 and 11%, respectively and the prevalence of high-pathogenic AI in the same years was 0.5 and 0.06%, respectively (Deliberto et al. 2009). The majority of those wild birds were dabbling ducks, geese, swans, and shorebirds (Deliberto et al. 2009).

Newcastle disease is a contagious viral disease that can infect birds, which is caused by the virulent avian paramyxovirus serotype 1. More than 230 species of birds have been determined to be susceptible to natural or experimental infections with avian paramyxoviruses, but in most cases were asymptomatic. In wild birds, the effects appear to vary depending on the species of bird and the virulence of the particular strain of avian paramyxovirus. Newcastle disease can cause high rates of mortality in some bird populations, such as double-crested cormorants, but often show little effect on other species (Glaser et al.

1999), although poultry have been found to be highly susceptible (Alexander and Senne 2008, Docherty and Friend 1999). Other species may carry avian paramyxoviruses, including pigeons, which because of their use of agricultural settings and possible interactions with livestock, may pose a risk of transmission (Kommers et al. 2001).

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.

Certain bird species are also known to prey upon livestock, which can result in economic losses to livestock producers. In Maryland, direct damage to livestock occurs primarily from vultures, but can also include raptors. Economic damages occur from vultures and raptors 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). While both turkey vultures and black vultures have been documented harassing expectant cattle, damages are primarily attributed to black vultures. Vulture predation on livestock is distinctive. Black vultures killed pigs by pulling their eyes out followed by attacks to the rectal area or directly attacking the rectal area (Lovell 1947, Lovell 1952, Lowney 1999). During a difficult delivery, vultures will peck at the half-expunged calf and kill it. A livestock producer in Kent County, Maryland requested WS' assistance after 70 to 100 vultures killed as many as 20 lambs and injured several calves on the farm. A livestock facility in Queen Anne's County, Maryland has also addressed damage associated with approximately 40 black vultures threatening and causing damage to calves. Reports of calf depredation occur throughout Maryland but are not necessarily common.

In a study conducted by Milleson et al. (2006), Florida ranchers were surveyed to the extent and severity of cattle losses associated with vultures. Respondents of the survey reported that 82.4% of all livestock lost attributed to vultures were newborn calves, which exceed the reported predation of all other livestock species and livestock age classes (Milleson et al. 2006). Ranchers reported during the survey period a total loss of 956 calves, 25 yearlings (cattle), and 101 adult cattle with a total value estimated at $316,570 and a mean value lost estimated at $2,595 (Milleson et al. 2006). Predation associated with vultures was reported to occur primarily from November through March, but predation was reported to occur throughout the year (Milleson et al. 2006). Lowney (1999) also reported vulture predation on swine, as well as goats, horses, sheep, fallow deer, dogs, cats, and turkeys.

Economic losses can also result from raptors, particularly red-tailed hawks, feeding on domestic fowl, such as chickens quail, guineas, racing/show pigeons, and waterfowl (Hygnstrom and Craven 1994). Free-ranging fowl or fowl allowed to range outside of confinement 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 occurs primarily from the consumption of crops (*i.e*., loss of the crop and revenue), but also consists of trampling of emerging crops and compaction of soil by waterfowl, consumption of cover crops used to prevent erosion and condition soil, damage to fruits associated with feeding, and fecal contamination. Damage to agricultural crops by all bird species reported to WS by the public from FY 2006 through FY 2011 averaged $69,148 per year in Maryland.

Several studies have shown that European starlings can pose a great economic threat to agricultural producers (Besser et al. 1968, Dolbeer et al. 1978, Feare 1984). Starlings and sparrows can also have a detrimental effect on agricultural food production by feeding at vineyards, orchards, gardens, crops, and feedlots (Weber 1979). For example, starlings feed on numerous types of fruits such as, cherries, figs, blueberries, apples, apricots, grapes, nectarines, peaches, plums, persimmons, strawberries, and olives (Weber 1979). Starlings were also found to damage ripening corn (Johnson and Glahn 1994) and are known to feed on the green, milk, and dough stage kernels of sorghum (Weber 1979). Additionally, starlings may pull sprouting grains, especially winter wheat, and feed on planted seed (Johnson and Glahn 1994). Sparrows damage crops by pecking seeds, seedlings, buds, flowers, vegetables, and maturing fruits (Fitzwater 1994), and localized damage can be great because sparrows often feed in large flocks on a small area (Fitzwater 1994).

Wildlife damage to apples, grapes, and blueberries has been estimated at $41 million annually, with most of the damage attributed to birds (USDA 1999). Fruit and nut crops can be damaged by robins, starlings, red-winged blackbirds, grackles, cowbirds, and woodpeckers. In 2007, the production of fruits, tree nuts, and berries in Maryland had a market value estimated at over $19 million (NASS 2009).

Besser (1985) estimated bird damage to grapes, cherries, and blueberries exceeded $1 million 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 woodpeckers are also known to cause damage to blueberries (Besser 1985). Damage to blueberries typically occurs from birds plucking and consuming the berry or from knocking the berries from the bushes (Besser 1985). During a survey conducted in 15 states and British Columbia, Avery et al. (1992) found that 84% of respondents to the survey considered bird damage to blueberries to be "*serious*" or "*moderately serious*". Respondents of the survey identified starlings, robins, and grackles as the primary cause of damage (Avery et al. 1992). However, house finches, gulls, northern mockingbirds, and blue jays were also identified as causing damage to blueberries (Avery et al. 1992). Avery et al. (1992) estimated bird damage to blueberry production in the United States cost growers $8.5 million in 1989.

Damage to apples can occur from beak punctures, which makes the apples unmarketable (Besser 1985). Crows, robins, and starlings 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 caused by birds makes the ear of corn unmarketable because the damage is unsightly to the consumer (Besser 1985). Large flocks of red-winged blackbirds are responsible for most of the damage reported to sweet corn with damage also occurring from grackles and starlings (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, but red-winged blackbirds are also known to cause damage to sprouting corn (Stone and Mott 1973). Additionally, starlings may pull sprouting grains and feed on planted seed (Johnson and Glahn 1994). Damage to

sprouting corn is likely localized and highest in areas where breeding colonies of grackles exist in close proximity to agricultural fields planted with corn (Stone and Mott 1973, Rogers, Jr. and Linehan 1977). Rogers, Jr. and Linehan (1977) found grackles damaged two corn sprouts per minute on average when present at a field planted near a breeding colony of grackles.

Need to Alleviate 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 behavior (*i.e*., found together in large numbers), such as blackbirds, vultures, waterfowl, pigeons, swallows, house sparrows, and starlings. The close association of those bird species with human activity can pose threats to human safety from disease transmission and threaten the safety of air passengers if aircraft struck birds. In addition, excessive droppings can be aesthetically displeasing, accumulations of nesting material can pose a fire risk in buildings and on electrical transmission structures, and aggressive behavior, primarily from raptors and waterfowl, can pose risks to human safety.

Threat of Disease Transmission

Birds can play a role in the transmission of diseases where humans may encounter fecal droppings of those birds. Few studies are available on the occurrence of zoonotic diseases in wild birds and on the risks to humans from transmission of those diseases (Clark and McLean 2003). 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 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.

Fecal droppings in and around water resources can affect water quality and can be a source of a number of different types of pathogens and contaminants. For example, concerns about water quality and double-crested cormorants exist from both contaminants and pathogens (USFWS 2003). Waterbird excrement can contain coliform bacteria, streptococcus bacteria, *Salmonella*, toxic chemicals, and nutrients, and it is known to compromise water quality, depending on the number of birds, the amount of excrement, and the size of the water body. Elevated contaminant levels associated with breeding and/or roosting concentrations of cormorants and their potential effects on water supplies can be concerns.

Birds can play a role in the transmission of diseases to humans such as encephalitis, West Nile virus, psittacosis, and histoplasmosis. Birds may also play a direct and indirect role in transmission of *Escherichia coli* and *S. enterica* to humans through contact with infected cattle feces, watering troughs, and agriculture fields fertilized with manure slurries (Pedersen and Clark 2007). For example, as many as 65 different diseases transmittable to humans or domestic animals have been associated with pigeons, European starlings, and house sparrows (Weber 1979). Public health officials and residents at such sites express concerns for human health related to the potential for disease transmission where fecal droppings accumulate. 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. For example, workers at an ethanol plant in eastern Nebraska became ill with histoplasmosis after

breathing in spores from construction in an area that had a starling roost (Mortality and Morbidity Weekly Report 2004). Viable *H. capsulatum* remains in the soil and can be contracted several years after a roost is abandoned (Clark and McLean 2003).

Ornithosis (*Chlamydia psittaci*) is another respiratory disease that can be contracted by people, livestock, and pets that can be associated with accumulations of bird droppings. Waterfowl, herons, and rock pigeons are the most commonly infected wild birds in North America (Locke 1987). Pigeons are most commonly associated with the spread of Ornithosis to people. Ornithosis is a virus that can be spread through infected bird droppings when viral particles become airborne after infected bird droppings are disturbed.

Waterfowl may affect human health through the distribution and incubation of various pathogens and through nutrient loading. Public swimming beaches, private ponds, and lakes can be affected by waterfowl droppings. There are several pathogens involving waterfowl that may be contracted by people; however, the Centers for Disease Control and Prevention (CDC) states the risk of infection is likely low (CDC 1998). The primary route of infection would be through incidental contact with contaminated material. Direct contact with fecal matter would not be a likely route of transmission of waterfowl zoonoses unless ingested directly. Although intentional contact with feces is not likely, transmission can occur when people unknowingly contact and ingest contaminated material. Therefore, the risk to human health from waterfowl zoonoses is low and a direct link of transmission from waterfowl to humans can be difficult to determine. Linking the transmission of diseases from waterfowl to people can be especially difficult since many pathogens occur naturally in the environment and pathogens can be attributed to contamination from other sources. However, the presence of disease causing organisms in waterfowl feces can increase the risk of exposure and transmission of zoonoses wherever people may encounter large accumulations of feces from waterfowl.

Cryptosporidiosis is a disease caused by the parasite *Cryptosporidium parvum*, which was not known to cause disease in people until 1976 (CDC 1998). A person can be infected by drinking contaminated water or by direct contact with the fecal material of infected animals (CDC 1998). Exposure can occur from swimming in lakes, ponds, streams, and pools, and from swallowing water while swimming (Colley 1996). *Cryptosporidium* can cause gastrointestinal disorders (Virginia Department of Health 1995) and can produce life-threatening infections, especially in people with compromised or suppressed immune systems (Roffe 1987, Graczyk et al. 1998). Cryptosporidiosis has been recognized as a disease with implications for human health (Smith et al. 1997).

People may contract Salmonella (*Salmonella* spp.) by handling materials soiled with bird feces (Stroud and Friend 1987). Several types of the Salmonella bacteria can be carried by wild birds with varying degrees of impact on people and livestock. Salmonella has been isolated from the gastrointestinal tract of starlings (Carlson et al. 2010). Friend (1999) reported relative rates of detection of *Salmonella* spp. in free ranging birds. *Salmonella* spp. isolates were frequent in songbirds, common in doves and pigeons, and occasional in starlings, blackbirds and cowbirds. Salmonella causes gastrointestinal illness, including diarrhea. 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*.

Chlamydiosis (*Chalmydiosis psitticai*) is a common infection in birds. However, when it infects people, the disease is referred to as psitticosis and can be transmitted to people via a variety of birds (Bonner et al. 2004). Severe cases of chlamydiosis have occurred among people handling waterfowl, pigeons, and other birds (Wobeser and Brand 1982, Locke 1987). Infected birds shed the bacteria through feces and nasal discharge, but it can be transmitted if the bacteria become airborne (Locke 1987). Chlamydiosis can be

fatal to humans if not treated with antibiotics. Humans normally manifest infection by pneumonia (Johnston et al. 2000). However, unless people are working with waterfowl or involved in the removal or cleaning of bird feces, the risk of infection is quite low (Bradshaw and Trainer 1966, Palmer and Trainer 1969). Waterfowl, herons, and rock pigeons are the most commonly infected wild birds in North America (Locke 1987).

E. coli are fecal coliform bacteria associated with fecal material of warm-blooded animals. There are over 200 specific serological types of *E. coli* with the majority of serological types being harmless (Sterritt and Lester 1988). The serological type of *E. coli* that is best known is *E. coli* O157:H7, which is usually associated with cattle (Gallien and Hartung 1994). Many communities monitor water quality at swimming beaches and lakes, but lack the financial resources to pinpoint the source of elevated fecal coliform counts. When fecal coliform counts at swimming beaches exceed established standards, the beaches are often temporarily closed, which can adversely affect the enjoyment of those areas by the public, even though the serological type of the *E. coli* is unknown. Unfortunately, linking the elevated bacterial counts to the frequency of waterfowl use and attributing the elevated levels to human health threats has been problematic until recently. Advances in genetic engineering have allowed microbiologists to match genetic code of coliform bacteria to specific animal species and link those animal sources of coliform bacteria to fecal contamination (Simmons et al. 1995, Jamieson 1998). For example, Simmons et al. (1995) used genetic fingerprinting to link fecal contamination of small ponds on Fisherman Island, Virginia to waterfowl. Microbiologists were able to implicate waterfowl and gulls as the source of fecal coliform bacteria at the Kensico Watershed, a water supply for New York City (Klett et al. 1998, Alderisio and DeLuca 1999). In addition, fecal coliform bacteria counts coincided with the number of gulls roosting at the reservoir.

Research has shown that gulls carry various species of bacteria such as *Bacillus* spp., *Clostridium* spp., *Campylobacter* spp., *E. 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, Reilly et al. (1981) and Monaghan et al. (1985) both suggested that gulls were the source of contamination for cases of human salmonellosis. Gulls can threaten the safety of municipal drinking water sources by potentially causing dangerously high levels of coliform bacteria from their fecal matter. Contamination of public water supplies by gull feces has been stated as the most plausible source for disease transmission (*e.g.*, Jones et al. 1978, Hatch 1996). 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.

Wild and domestic waterfowl are the acknowledged natural reservoirs for a variety of AI viruses (Davidson and Nettles 1997, Pedersen et al. 2010). However, AI viruses can be found amongst a variety of other bird species (Alexander 2000, Stallknecht 2003). AI can circulate among those birds without clinical signs and is not an important mortality factor in wild waterfowl (Davidson and Nettles 1997, Clark and Hall 2006). Although AI is primarily a disease of birds, there can be concerns over the spread of the H5N1 high pathological strain that has shown transmission potential to humans with potential for mortalities (Gauthier-Clerc et al. 2007, Peiris et al. 2007, Majumdar et al. 2011). Outbreaks of other avian influenza strains have also shown the potential to be transmissible to humans during severe outbreaks when people handle infected poultry (Koopmans et al. 2004, Tweed et al. 2004). A pandemic outbreak of avian influenza could have severe impacts on human health and economies (World Health Organization 2005, Peiris et al. 2007).

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, Blankespoor and Reimink 1991, Graczyk et al. 1997, Saltoun et al. 2000). In worst-case scenarios,

infections may even be life threatening for people with suppressed or compromised immune systems (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. 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. Several of the bird species addressed in this EA are closely associated with the activities of people and they often exhibit gregarious roosting and nesting behavior. This gregarious behavior can lead to accumulations of fecal droppings that could be considered a threat to human health and safety due to the close association of those species of birds with people. Accumulations of bird droppings in public areas are aesthetically displeasing and are often in areas where people may come in direct contact with fecal droppings. 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, the risk of disease transmission would be the primary reason people request assistance. 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 engine failure. 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 transportation industry as a whole (Conover et al. 1995). Wildlife strikes pose increasing risks and economic losses to the aviation industry worldwide. Annual economic losses from wildlife strikes with civil average $677 million annually in the United States (Dolbeer et al. 2012).

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 during 1960 when 62 people were killed in the crash of an airliner that collided with a flock of European starlings (Terres 1980). From 1990 through 2010, 1,185 birds have been reported as struck by aircraft in Maryland (Dolbeer et al. 2012).

Target bird species can represent a threat to aviation safety. Threats can occur when large flocks or flight lines of birds enter or exit a roost at or near airports or when present in large flocks foraging on or near an airport. Vultures and raptors can also present a risk to aircraft because of their large body mass and slow-flying or soaring behavior. Vultures are considered 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). Mourning Doves also present 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 increases the risk of bird-aircraft collisions.

From 1990 through 2011, 119,917 wildlife strikes have been reported to the Federal Aviation Administration (FAA) in the United States (Dolbeer et al. 2012). Birds were involved with over 97% of those reported strikes to civil aircraft in the United States (Dolbeer et al. 2012). The number of bird strikes actually occurring is likely much greater since Dolbeer (2009) estimated that only 39% of civil wildlife strike are actually reported. In Maryland, over 93% of the reported aircraft strikes from 1990 to 2010 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 to the aircraft. Bird strikes can cause catastrophic failure of aircraft systems (*e.g.*, ingesting birds into engines), which can cause the plane to become uncontrollable leading to crashes. Since 1988, more than 229 people worldwide have died in aircraft that have crashed after striking wildlife (Dolbeer et al. 2012). 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 can also occur to pilots and passengers from bird strikes. 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).

DeVault et al. (2011) concluded that snow geese, duck species, turkey vultures, great-horned owls, and double-crested cormorants were among the most hazardous birds to aircraft. Those hazards were based upon the number of strikes involving those birds, the amount of damage strikes involving those birds have caused to aircraft, the effect on the flight after the strike, and the body mass the bird (DeVault et al. 2011). Species of birds that congregate into large flocks or bird species that form large flight lines entering or exiting a roost at or near airports are those most hazardous species.

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 people. When wildlife species begin to habituate to the presence of people and human activity, a loss of apprehension can occur, which can lead those species to exhibit threatening behavior or abnormal behavior toward people. This behavior continues to increase as human populations expand and the populations of those species that adapt to human activity increase. Threatening or abnormal behavior can occur in the form of aggressive posturing or a general lack of apprehension toward people. 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. In April 2012, a man drowned in Des Plains, Illinois when he was attacked by a mute swan that knocked him out of his kayak (Golab 2012).

Feral waterfowl often nest in high densities in areas used by people for recreational purposes, such as parks, beaches, and sports fields (VerCauteren and Marks 2004). If people unknowingly approach

waterfowl or their nests at those locations, injuries could occur if those waterfowl reacted aggressively to the presence of those people or pets. Additionally, the buildup of feces from waterfowl on docks, walkways, and other areas of foot traffic can create slipping hazards. 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 Alleviate 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 Maryland. 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. Woodpeckers also cause direct damage to property through excavating holes in buildings either for nesting purposes, attracting a mate, or to locate food which can remove insulation and allows water and other wildlife to enter the building. 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.

Property Damage to Aircraft from Bird Strikes

Target bird species can present a safety threat to aviation when those species occur in areas on and around airports. Species of birds that occur in large flocks or flight lines entering or exiting a roost at or near airports or when present in large flocks foraging on airport property can result in aircraft strikes involving several individuals of a bird species, which can increase damage and increase the risks of catastrophic failure of the aircraft. Vultures and raptors can also present a risk to aircraft because of their large body mass and slow-flying or soaring behavior. Vultures are considered one of the most hazardous birds 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). DeVault et al. (2011) concluded that snow geese, duck species, turkey vultures, great-horned owls, and double-crested cormorants were among the most hazardous birds to aircraft.

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 strikes involving 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.

Other Property Damage Associated with Birds

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 (*i.e.*, found together in large numbers), especially during the fall and spring migration periods. Although damage and threats can occur throughout the year, damage can be 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 droppings under bird roosts can lead to constant cleaning costs for property owners. Property losses associated with cormorants include impacts to privately owned lakes that are stocked with fish; damage to boats and marinas or other properties found near cormorant breeding or roosting sites; and damage to vegetation on privately owned land (USFWS 2003).

Birds frequently damage structures on private property, or public facilities, with fecal contamination. 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 uric acid from bird droppings. Electrical utility companies frequently have problems with birds and bird droppings causing power outages by shorting out transformers and substations. This can result in hundreds of thousands of dollars of outage time for power companies. In addition to causing power outages noted above, property damage from black vultures can include tearing and consuming latex window caulking or rubber gaskets sealing windowpanes, asphalt and cedar roof shingles, vinyl seat covers from boats, patio furniture, and ATV seats. Black vultures and turkey vultures also cause damage to cell phone and radio towers by roosting on critical tower infrastructure. Persons and businesses concerned about these types of damage may request WS' assistance.

Large numbers of gulls can be attracted to landfills and they often use landfills as feeding and loafing areas throughout North America (Mudge and Ferns 1982, Patton 1988, Belant et al. 1995*a*, Belant et al. 1995*b*, Belant et al. 1998, Gabrey 1997). In the 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 and nest 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.

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. Many bird species are colonial nesters meaning they nest together in large numbers. Gulls, cormorants, egrets, and herons nest in large colonies. Swallows can also nest in large colonies. Colonies of gulls nesting on building rooftops has been well documented. The presence of nesting gulls on rooftops can cause damage to urban and industrial structures. Nesting gulls peck at spray-on-foam roofing and rubber roofing material, including caulking. This creates holes that must be repaired or leaks

in the roof can result. Gulls transport large amounts of nest material and food remains to the rooftops, which can obstruct roof drainage systems and lead to structural damage or roof failure if clogged drains result in rooftop flooding (Vermeer et al. 1988, Blokpoel and Scharf 1991, Belant 1993). Nesting material and feathers can also clog ventilation systems resulting in cleaning and repairs.

Osprey nests are often constructed of large sticks, twigs, and other building materials that can cause damage and prevent access to critical areas when those nests are built on man-made structures (*e.g.*, power lines, cell towers, boats). Disruptions in the electrical power supply can occur when nests are located on utility structures and can inhibit access to utility structures for maintenance by creating obstacles to workers. For example, the average nest size of osprey in Corvallis, Oregon weighed 264 pounds and was 41-inches in diameter (USGS 2005). In 2001, 74% of occupied osprey nests along the Willamette River in Oregon occurred on power pole sites (USGS 2005).

Waterfowl sometimes congregate at golf courses, parks, recreational areas, and business complexes that have ponds or watercourses and cause damage by grazing on turf and by deposition of droppings. In Maryland, WS responded to requests for assistance from FY 2006 through FY 2011 to address $1.2 million in damage caused by waterfowl at various facilities. Damage caused by waterfowl included $401,955 in damages at golf courses and $310,145 in damages to landscaping, turf, and other types of property. Economic damage has been in the form of cleanup of parking lots, retention ponds, sidewalks, patios, and lawns at business, residential and recreational locations. At golf courses, costs have been associated with restoration of greens and other turf areas, cleanup of human use areas, and lost revenue from loss of memberships. Members and the club's management were also concerned about possible health hazards from exposure to the droppings. WS provided technical assistance to those facilities, and operational assistance to live capture and remove offending waterfowl.

Persons and businesses concerned about these types of damage may request WS' assistance. The total value of property damage by birds reported to WS in Maryland from FY 2006 through FY 2011 was approximately $2,718,564 with the annual average being $453,094. This included property damage reported for residential and non-residential buildings, landscaping and turf, and structures.

Need to Alleviate Bird Damage Occurring to Natural Resources

Birds can also negatively affect natural resources through habitat degradation, through direct depredation on natural resources, and competition with other wildlife. Habitat degradation can occur when large concentrations of birds in a localized area negatively affect characteristics of the surrounding habitat, which can adversely affect other wildlife species and can be aesthetically displeasing. 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. Competition can occur when two species compete (usually to the detriment of one species) for available resources, such as food or nesting sites.

For example, brood parasitism by brown-headed cowbirds has become a concern for many wildlife professionals where those birds are plentiful. Somewhat unique in their breeding habits, brown-headed 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 (Lowther 1993). Cowbirds provide no parental care with the raising of cowbird young occurring by the host species. Young cowbirds often out-compete the young of the host species (Lowther 1993). Due to this, brown-headed cowbirds can have adverse effects on the reproductive success of other species (Lowther 1993) and can threaten the viability of a population or even the survival of a host species (Trial and Baptista 1993).

Gulls will consume a variety of food items, including the eggs and chicks of other birds (Pierotti and Good 1994, Burger 1996, Good 1998, Pollet et al. 2012). Some of the species listed as threatened or endangered under the Endangered Species Act of 1973 (ESA) are preyed upon or otherwise could be adversely affected by certain bird species. Impacts on the productivity and survivorship of rare or threatened colonial waterbirds can be severe when nesting colonies become targets of avian predators. Fish eating birds such as cormorants, egrets, herons, and osprey also have the potential to impact fish and amphibian populations, and especially those of T&E species.

Double-crested cormorants can have a negative effect on wetland habitats (Jarvie et al. 1999, Shieldcastle and Martin 1999) and wildlife, including T&E species (Korfanty et al. 1999). Concentrations of gulls often affect the productivity and survivorship of rare or endangered colonial species such as terns (United States Department of Interior 1996) and prey upon the chicks of colonial waterbirds. Common grackles, red-winged blackbirds, northern harriers, and American kestrels can also feed on nesting colonial water birds and shorebirds, their chicks and/or eggs (Hunter and Morris 1976, Farraway et al. 1986, Rimmer and Deblinger 1990, Ivan and Murphy 2005, United States Army Corps of Engineers 2009).

Double-crested cormorants can displace other colonial nesting waterbird species, such as herons, egrets, and terns through competition for nest sites (USFWS 2003). Cuthbert et al. (2002) examined potential impacts of cormorants on great blue herons and black-crowned night-herons in the Great Lakes and found that cormorants have not negatively influenced breeding distribution or productivity of either species at a regional scale, but did contribute to declines in heron presence and increases in site abandonment in certain site-specific circumstances. Similarly, gulls can also displace other colonial nesting birds (USFWS 1996). European starlings and house sparrows can be aggressive and often out-compete native species, destroying their eggs, and killing nestlings (Cabe 1993, Lowther and Cink 2006). Miller (1975) and Barnes (1991) reported European starlings were responsible for a severe depletion of the eastern bluebird (*Sialis sialis*) population due to nest competition. Nest competition by European starlings has been known to displace American kestrels (Von Jarchow 1943, Nickell 1967, Wilmer 1987, Bechard and Bechard 1996), 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 were displaced by starling nest competition, and Mason et al. (1972) reported European starlings evicting bats from nest holes.

Degradation of habitat can occur from the continuous accumulation of fecal droppings under nesting colonies of birds or under areas where birds consistently roost. Over time, the accumulation of fecal droppings under those areas can lead to the loss of vegetation from the ammonium nitrogen found in the fecal droppings of birds. Hebert et al. (2005) noted that ammonium toxicity caused by an accumulation of fecal droppings from double-crested cormorants might be an important factor contributing to the declining presence of vegetation on some islands in the Great Lakes. Cuthbert et al. (2002) found that cormorants could have a negative effect on normal plant growth and survival on a localized level in the Great Lakes region. Wires and Cuthbert (2001) identified vegetation die off as an important threat to 66% of the colonial waterbird sites designated as conservation sites of priority in the Great Lakes. Of 29 conservation priority sites reporting vegetation die off as a threat in the Great Lakes, Wires and Cuthbert (2001) reported cormorants were present at 23 of those sites. Based on survey information provided by Wires et al. (2001), biologists in the Great Lakes region reported cormorants as having an effect to herbaceous layers and trees where nesting occurred. Damage to trees was mainly caused by fecal deposits, and resulted in tree die off at breeding colonies and roost sites. Effects to the herbaceous layer of vegetation were also reported due to fecal deposition, and often this layer was reduced or eliminated from the colony site. In addition, survey respondents reported that the effects to avian species from cormorants occurred primarily from habitat degradation and from competition for nest sites (Wires et al. 2001).

Damage to vegetation can also occur when birds strip leaves for nesting material or when the weight of many nests, especially those of colonial nesting waterbirds breaks branches (Weseloh and Ewins 1994). In some cases, those effects can be so severe on islands that all woody vegetation is eliminated (Cuthbert et al. 2002) and some islands can be completely denuded of vegetation (USDA 2003). Lewis (1929) considered the killing of trees by nesting cormorants to be local and limited, with most trees having no commercial timber value. However, tree damage may be perceived as a problem if those trees are rare species, or aesthetically valued (Bédard et al. 1999, Hatch and Weseloh 1999). Similarly, a study conducted in Oklahoma found fewer annual and perennial plants in locations where crows roosted over several years (Hicks 1979).

Additionally, degradation of vegetation can reduce nesting habitat for other birds (Jarvie et al. 1999, Shieldcastle and Martin 1999) and wildlife, including T&E species (Korfanty et al. 1999). In some cases, the establishment of colonial waterbird nesting colonies on islands has led to the complete denuding of vegetation within three to 10 years of areas being occupied (Lewis 1929, Lemmon et al. 1994, Weseloh and Ewins 1994, Bédard et al. 1995, Weseloh and Collier 1995, Weseloh et al. 1995, Korfanty et al. 1999, Hebert et al. 2005). Cormorants can have a negative effect on vegetation that provides nesting habitat for other birds (Jarvie et al. 1999, Shieldcastle and Martin 1999) and wildlife, including state and federally listed T&E species (Korfanty et al. 1999). Although loss of vegetation can have an adverse effect on many species, some colonial waterbirds such as pelicans and terns prefer sparsely vegetated substrates.

Severe grazing by waterfowl can result in the loss of turf that stabilizes soil on manmade levees. Heavy rains on the bare soil of levees can result in erosion, which would not have occurred if the levee had been vegetated. Large accumulations of fecal droppings under crow roosts 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).

As the population of double-crested cormorants has increased, so has concern for sport fishery populations (USFWS 2003). Double-crested cormorants are opportunistic feeders that will feed on a wide diversity of fish species depending on location (USFWS 2003). Cormorants can have a negative effect on recreational fishing on a localized level (USFWS 2003). The degree to which cormorant predation affects sport fishery populations in a given body of water is dependent on a number of variables, including the number of birds present, the time of year at which predation is occurring, prey species composition, and physical characteristics such as depth or proximity to shore (which affect prey accessibility). In addition to cormorant predation, environmental and human-induced factors affect aquatic ecosystems. Those factors can be classified as biological/biotic (*e.g.*, overexploitation, exotic species), chemical (*e.g.*, water quality, nutrient and contaminant loading), or physical/abiotic (*e.g.*, dredging, dam construction, hydropower operation, siltation). Such activities may lead to changes in species density, diversity, and/or composition due to direct effects on year class strength, recruitment, spawning success, spawning or nursery habitat, and/or competition (USFWS 1995).

During a study on the predation effects associated with double-crested cormorants on yellow perch (*Perca flavescens*) in Les Cheneaux, Michigan, researchers questioned whether predation pressure from the abundant and growing populations of cormorants was contributing to the further decline of yellow perch fisheries or preventing its recovery (Diana and Maruca 1997, Fielder 2004). Since the late 1970s, the yellow perch fishery near the Les Cheneaux Islands had experienced a notable decline (Lucchesi 1988), with the fishery remaining relatively stable through the mid-1990s and then abruptly declining to a near total collapse in 2000 (Fielder 2004). The waters of the Les Cheneaux Islands comprise a dynamic area of physical and biological complexity with both natural and human induced factors potentially affecting the fisheries resource in the area (USFWS 2003). Despite the recent collapse in angler harvest and fishing pressure, the total annual mortality rate in yellow perch remained high, ranging from 67% to 78% from

1997 through 2002. During this same period, the mean age of perch declined from 4.5 years to 1.5 years (Fielder 2004). Concurrent with the decline and collapse of the fishery and loss of perch in certain areas of the islands, nesting cormorants were proliferating the area (Fielder 2004). Nesting populations in the area had increased considerable since the early 1990s to a local breeding population of over 5,500 nests in 2002 (Fielder 2004). As described by USFWS (2003), fisheries investigations carried out in 1995 concurrently with cormorant diet investigations in the Les Cheneaux Islands area found that cormorants removed only 2.3% of the available yellow perch biomass and accounted for less than 20% of the total annual mortality of perch during that year. Overall, cormorants accounted for 0.8% of the mortality of legal-sized perch (178 mm); whereas, summer sport fishing accounted for 2.5% of the mortality. The conclusion at the time was that cormorants had minimal effect on the local perch population during that year because of the relatively high abundance of perch and because predation was buffered for much of the year by abundant alewives (*Alsoa pseudoharengus*) (Fielder 2004, USFWS 2003). However, in the late 1990s, the abundant populations of alewives that were fed upon by cormorants during the 1995 study became scarce, raising the question of whether cormorant predation on perch may have been greater than previously measured (Fielder 2004). Fielder (2004) speculated that the timing of the rise in the cormorant population coincided closely with the collapse of the yellow perch fishery, and such a predation scenario would account for the continued high total annual mortality rate and decline in mean perch age. Fielder (2004) further concluded the collapse of the fishery and range contraction of perch was caused, at least in part, by the predatory effects of cormorants, and that cormorants may have contributed to the ongoing suppression of the perch population in the region.

Recreational fishing benefits local and regional economies in many areas of the United States, with some local economies relying heavily on income associated with recreational fisheries (USFWS 2003). As participation in a recreational fishery increases, the total amount of money entering local and regional economies also can increase. In this way, growth of recreational fishing can stimulate economic activity (Ross 1997). The collapse of sport fisheries can have negative economic effects on businesses and can result in job losses (Shwiff and DeVault 2009).

The health of a lake's fishery can have an effect on the economies surrounding that lake. For example, when the walleye (*Sander vitreus*) and yellow perch fishery collapsed on Oneida Lake in New York after the colonization of the lake by cormorants (VanDeValk et al. 2002, Rudstam et al. 2004), research biologists with the National Wildlife Research Center (NWRC) sought to identify the actual monetary damage associated with the declines of those sport fish populations. The total estimated revenue lost in the Oneida Lake region from 1990 to 2005 due to declines in the sport fisheries on the lake ranged from $122 million to $539 million. That lost revenue from the collapse of the fisheries resource resulted in the loss of 3,284 to 12,862 jobs in the Oneida Lake region from 1990 to 2005 (Shwiff and DeVault 2009). In 1998, the WS program in New York was requested to assist with managing damage associated with cormorants on Oneida Lake. Cormorant damage management activities conducted on Oneida Lake from 1998 to 2005 prevented the loss of an estimated $48 million to $171 million in revenue, which allowed between 1,446 and 5,014 jobs to be retained in the Oneida Lake region (Shwiff and DeVault 2009).

It has been well documented that birds can carry a wide range of bacterial, viral, fungal, and protozoan diseases that can affect other bird species, as well as mammals. A variety of diseases that birds can carry can affect natural resources (*e.g*., see Friend and Franson 1999, Forrester and Spalding 2003, Thomas et al. 2007). Potential impacts from diseases found in wild birds may include transmission to a single individual or a local population, transmission to a new habitat, and transmission to other species of wildlife including birds, mammals, reptiles, amphibians, and fish species. Birds may also act as a vector, reservoir, or intermediate host as it relates to diseases and parasites. Diseases like avian botulism, avian cholera, and Newcastle disease can account for the death of hundreds to thousands of bird species across the natural landscape (Friend et al. 2001). For example, an avian botulism outbreak in Lake Erie was responsible for a mass die-off of common loons (*Gavia immer*) (Campbell et al. 2001) as well as other

species that may have fed on the carcasses or on fly larva associated with the carcasses (Duncan and Jensen 1976). Although diseases spread through populations of birds, it is often difficult to determine the potential impacts they will have on other wildlife species due to the range of variables that are involved in a disease outbreak (Friend et al. 2001).

Establishing and Protection nesting habitat of least terns on Poplar Island

The USFWS is attempting to establish and protect nesting habitat for threatened least terns (*Sternula antillarum*) at the Paul S. Sarbanes Ecosystem Restoration Project on Poplar Island, as well as re-establish previously degraded wetland habitat. WS has assisted the USFWS with managing nesting herring gulls on Poplar Island that are competing for nesting habitat with least terns. Herring gulls are a predation risk to nesting least terns and cause damage to wetland restoration sites by removing recently planted vegetation for use as nesting material. Thousands of grass plugs were plucked by herring gulls from planting sites requiring costly replanting efforts. WS has also assisted the USFWS with managing great horned owl predation on least terns at the nesting colony.

Royal terns and black skimmers - Skimmer Island, Sinnepuxent Bay Islands Wildlife Management Area

WS has assisted the Wildlife and Heritage Service of the MDNR with destroying nests of herring gulls and great black-backed gulls on Skimmer Island near Ocean City, Maryland to discourage nesting. Skimmer Island is a barren sand habitat for colonial-nesting waterbird species and is considered the most valuable habitat of its kind in Maryland. Over the last few years, there has been an increase in use of the island by breeding gulls, which has led to competition for nesting habitat and depredation on eggs and chicks of barren ground nesting bird species. This has resulted in abandonment of the habitat by breeding common terns (*Sterna hirundo*), black skimmers (*Rynchops niger*), sandwich terns (*Thalasseus sandvicensis*), and gull-billed terns (*Gelochelidon nilotica*) since 2004, with royal terns (*Thalasseus maximus*) absent since 2006. Royal terns, gull-billed terns, and black skimmers are listed as state endangered species in Maryland. The goal of the MDNR is to help reclaim the island for use as nesting habitat by species of high conservation interest and to dissuade gulls from nesting there.

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 alleviate damage to property, natural resources, and agricultural resources on federal, state, tribal, municipal, and private land within the State of Maryland wherever such management is requested by a cooperator. This EA discusses the issues associated with conducting damage management activities in the State to meet the need for action and evaluates different alternatives to meet that need while addressing those issues. In addition, this EA evaluates the permitting of bird take through the issuance of depredation permits by the USFWS to WS and to other entities within the State.

The methods available for use to manage bird damage are discussed in Appendix B. The alternatives and Appendix B also discuss how methods would be employed to manage damage and threats associated with birds. 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.

Native American Lands and Tribes

The WS program in Maryland would only conduct damage management activities on Native American lands when requested by a Native American Tribe. Activities would only be conducted after a Memorandum of Understanding (MOU) or cooperative service agreement had been signed between WS and the Tribe requesting assistance. Therefore, the Tribe would determine when WS' assistance was 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 be available for use to alleviate damage on Tribal properties when the use of those methods had 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 when agreed upon by the Tribe and WS.

Federal, State, County, City, and Private Lands

WS could continue to provide assistance on federal, state, county, municipal, and private land in Maryland when the appropriate resource owner or manager requested assistance under two of the alternatives analyzed in detail. In those cases where a federal agency requested 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.

Period for which this EA is Valid

If the analyses in this EA indicates an EIS is not warranted, this EA would remain valid until WS and the USFWS, in consultation with the MDNR, 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, if appropriate, supplemented pursuant to the NEPA. WS would review the EA to ensure that activities implemented under the selected alternative occur within the parameters evaluated in the EA. If the alternative analyzing no involvement in damage management activities by WS were selected, no additional analyses by WS would occur based on the lack of involvement by WS. The monitoring of activities by WS and the USFWS would ensure the EA remained appropriate to the scope of activities conducted by WS and the USFWS under the selected alternative.

Site Specificity

Actions could be taken to reduce threats to human health and safety, reduce damage to agricultural resources, alleviate property damage, and protect native wildlife, including T&E species, in the State. As mentioned previously, WS would only conduct damage management activities when requested by the appropriate resource owner or manager. In addition, WS' activities that could involve the lethal removal 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 effects of alternative approaches to managing damage associated with birds that WS could conduct on private and public lands in Maryland where WS and the appropriate entities have entered into an agreement through the signing of a MOU, cooperative service agreement, or other comparable document. This EA also addresses the potential impacts of conducting damage management approaches in areas where additional MOUs cooperative service agreements or other comparable documents may be signed in the future. Because the need for action is to reduce damage and because the goals and directives of WS would be to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional efforts could occur. Thus, this EA anticipates those additional efforts 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; therefore, damage or threats of damage associated with those bird species could occur wherever those birds occur. Planning for the management of bird damage must be viewed as being conceptually similar to the actions of other entities 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 departments, police departments, emergency clean-up organizations, and insurance companies. Some of the sites where bird damage could occur can be predicted; however, 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 and the USFWS to manage damage associated with birds is often unique to the individual; therefore, predicting where and when WS would receive such a request for assistance would be difficult. This EA emphasizes major issues as those issues relate to specific areas whenever possible; however, many issues apply wherever bird damage occurs and those issues are treated as such in this EA.

Chapter 2 of this EA identifies and discusses issues relating to bird damage management in Maryland. The standard WS Decision Model (Slate et al. 1992) 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). 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 the State. In this way, the EA meets the intent of the NEPA with regard to site-specific analysis and that this is the only practical way for WS and the USFWS to comply with the NEPA and still be able to address damage and threats associated with birds in the State.

Summary of Public Involvement

Issues related to bird damage management and the alternatives to address those issues were initially developed by WS and the USFWS, in consultation with the MDNR. Issues were defined and preliminary alternatives were identified through the scoping process. As part of this process, and as required by the

CEQ and APHIS' NEPA implementing regulations, this document will be noticed to the public for review and comment. This EA will be noticed to the public through legal notices published in local print media, through direct mailings to interested parties, and by posting the EA on the APHIS website at http://www.aphis.usda.gov/wildlife_damage/nepa.shtml.

WS and the USFWS will make the EA available for a minimum of 30 days for the public and interested parties to provide new issues, concerns, and/or alternatives. Through the public involvement process, WS and the USFWS 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 identified after publication of notices announcing the availability of the EA will be fully considered to determine whether the EA should be revisited and, if appropriate, revised prior to issuance of a Decision.

1.4 RELATIONSHIP OF THIS DOCUMENT TO OTHER ENVIRONMENTAL DOCUMENTS

Double-crested Cormorant Management in the United States Final Environmental Impact Statement: The USFWS has issued a FEIS that evaluated the management of double-crested cormorants (USFWS 2003). WS was a formal cooperating agency during the development of the FEIS. WS has adopted the FEIS to support program decisions involving the management of cormorant damage. WS completed a Record of Decision (ROD) on November 18, 2003 (see 68 FR 68020).

Extended Management of Double-crested Cormorants under 50 CFR 21.47 and 21.48 Final Environmental Assessment: The cormorant management 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). 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).

USFWS Light Goose Management FEIS: The USFWS has issued a FEIS that 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 lesser snow goose (*Chen caerulescens caerulescens*), the greater snow goose (*C. c. atlantica*), and the Ross's goose (*C. rossii*) 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.

Waterbird Conservation Plan: 2006-2010, Mid-Atlantic/New England/Maritimes Region: The Mid-Atlantic/New England/Maritime (MANEM) Working Group developed a regional waterbird conservation plan for the MANEM region of the United States and Canada (MANEM Waterbird Conservation Plan 2006). The MANEM region consists of Bird Conservation Region (BCR) 14 (Atlantic Northern Forest) and BCR 30 (New England/Mid-Atlantic Coast) along with the Pelagic Bird Conservation Region 78 (Northeast United States Continental Shelf) and Pelagic Bird Conservation Region 79 (Scotian Shelf). The plan consists of technical appendices that address: (1) waterbird populations including occurrence, status, and conservation needs, (2) waterbird habitats and locations within the region that are critical to waterbird sustainability, (3) MANEM partners and regional expertise for waterbird conservation, and (4) conservation project descriptions that present current and proposed research, management, habitat acquisition, and education activities (MANEM Waterbird Conservation Plan 2006). Information in the Plan on waterbirds and their habitats provide a regional perspective for local conservation action.

Atlantic Flyway Mute Swan Management Plan 2002-2013: In response to increasing populations of mute swans along the Atlantic Flyway, the Atlantic Flyway Council developed a mute swan plan to reduce swan populations in the Flyway to minimize negative ecological damages occurring to wetland habitats from the overgrazing of submerged aquatic vegetation by swans. Another goal of the Plan is to reduce swan populations in the Flyway to reduce competition between swans and native wildlife and to prevent the further expansion of mute swans (Atlantic Flyway Council 2003).

Mute Swans in Maryland: A Statewide Management Plan: The management plan for mute swans in Maryland describes the status and impacts of mute swans in Maryland and provides guidance to the MDNR on the direction and objectives associated with managing swan populations in the State (MDNR 2003).

Mute Swan Management Plan for the Chesapeake Bay: The Chesapeake Bay Mute Swan Working Group prepared a plan to manage mute swan populations in Chesapeake Bay (Chesapeake Bay Mute Swan Working Group 2004). The goal of the plan is to manage the mute swan population in the Bay "*…to a level that a) minimizes the impacts on native wildlife, important habitats, and local economies; b) minimizes conflict with humans; c) is in agreement with Chesapeake 2000 Agreement goals for* [submerged aquatic vegetation] *and invasive species; and d) is in agreement with the Atlantic Flyway Mute Swan Management Plan*."

***WS' Environmental Assessments*:** WS previously developed an EA that analyzed the need for action to manage damage associated with crows (USDA 2009). WS has also prepared a separate EA to evaluate the need to manage damage associated with Canada geese (USDA 2011*a*). Those EAs identified the issues associated with managing damage associated with crows and geese in the State and analyzed alternative approaches to meet the specific need identified in those EAs while addressing the identified issues.

1.5 AUTHORITY OF FEDERAL AND STATE AGENCIES

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

WS' Legislative Authority

The primary statutory authorities for the 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 animals. WS' directives define program objectives and guide WS' activities with managing animal damage and threats.

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 for the continuing benefit of the American people. 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 species 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 migratory birds. Under depredation/control orders, lethal removal can occur when those bird species are causing damage or when those species are about to cause damage without the need for a depredation permit.

The USFWS authority for migratory bird management 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 former 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 FR 2731, 53 Stat. 1433.

United States Environmental Protection Agency (EPA)

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, avicides and repellents available for use to manage bird damage.

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.

Maryland Department of Natural Resources

The MDNR is specifically charged by the General Assembly of the State with the management of the State's wildlife resources (Annotated Code of Maryland, Subtitle 2). The primary statutory authorities include the protection, reproduction, care, management, survival, and regulation of wild animal populations regardless of whether the wild animals are present on public or private property in Maryland (Annotated Code of Maryland, 10-202-210). Annotated Code of Maryland, 10-407 authorizes the Department to authorize hunting seasons for wetland game birds. Natural Resources Article, Section 10-206 authorizes the MDNR to reduce the wildlife population in any county, election district, or other identifiable area after a thorough investigation reveals that protected wildlife is seriously injurious to

agricultural or other interests in the affected area. The method of reducing the population occurs at the discretion of the MDNR.

The MDNR currently has an MOU with WS that establishes a cooperative relationship between the two agencies. Responsibilities include planning, coordinating, and implementing policies to address wildlife damage management and facilitating exchange of information.

Maryland Department of Agriculture (MDA)

The Pesticide Regulation Section of the MDA enforces state laws pertaining to the use and application of pesticides. Under the Maryland Pesticide Applicators Law 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 Maryland Pesticide Applicators Law the Section licenses restricted use pesticide dealers and registers all pesticides for sale and distribution in the State of Maryland.

1.6 COMPLIANCE WITH LAWS AND STATUTES

Several laws or statutes authorize, regulate, or otherwise would affect activities conducted by WS and the USFWS. WS and the USFWS would comply with those laws and statutes and consults with other agencies as appropriate. 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 managing bird damage 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 USFWS follow the CEQ regulations implementing the NEPA (40 CFR 1500 et seq.). In addition, WS follows the 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 the CEQ through regulations in 40 CFR 1500-1508. In accordance with the CEQ and USDA regulations, APHIS guidelines concerning the implementation of the NEPA, as published in the Federal Register (44 CFR 50381-50384), provide guidance to WS regarding the NEPA process.

Pursuant to the NEPA and the CEQ regulations, this EA documents the analyses of potential federal actions, informs decision-makers, and the public of reasonable alternatives that could be capable of avoiding or minimizing adverse effects, 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 alternatives. 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. European starlings, rock pigeons, house sparrows, and feral waterfowl, including Mute Swans, are considered non-native species in the United States and are afforded no protection under the MBTA. A depredation permit from the USFWS is not required to take starlings, pigeons, house sparrows, mute swans, and feral waterfowl.

All actions conducted in this EA would comply with the regulations of the MBTA, as amended. The law was further clarified to include only those birds afforded protection from take in 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). In addition to the issuance of depredation permits for the take of migratory birds, the Act allows for the establishment of depredation and control orders that allow migratory birds to be taken without a depredation permit when certain criteria are met.

Depredation Order for Double-crested Cormorants at Aquaculture Facilities (50 CFR 21.47)

The AQDO was established to reduce cormorant depredation of aquacultural stock at private fish farms and state and federal fish hatcheries. Under the AQDO, cormorants can be lethally taken at commercial freshwater aquaculture facilities and state and federal fish hatcheries in 13 States. However, the AQDO does not include facilities in Maryland. The Order authorizes landowners, operators, and tenants, or their employees/agents, that are actually engaged in the production of aquacultural commodities to lethally take cormorants causing or about to cause damage at those facilities without the need for a depredation permit. Those activities can only occur during daylight hours and only within the boundaries of the aquaculture facility. The AQDO also authorizes WS to take cormorants at roost sites near aquaculture facilities at any time, from October through April, without the need for a depredation permit when appropriate landowner permissions have been obtained.

Depredation Order for Double-crested Cormorants to Protect Public Resources (50 CFR 21.48)

The purpose of the PRDO is to reduce the actual occurrence, and/or minimize the risk, of adverse impacts of cormorants to public resources. Public resources, as defined by the PRDO, are natural resources managed and conserved by public agencies. Public resources include fish (free-swimming fish and stocked fish at federal, State, and tribal hatcheries that are intended for release in public waters), wildlife, plants, and their habitats. The Order authorizes WS, state fish and wildlife agencies, and federally recognized Tribes in 24 states to conduct damage management activities involving cormorants without the need for a depredation permit from the USFWS, but does not include Maryland. It authorizes the take of cormorants on "*all lands and freshwaters*" including public and private lands. However, landowner/manager permission must be obtained before cormorant damage management activities may be conducted at any site.

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 on 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).

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 lethally remove 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 could be lethally taken under the blackbird depredation order that are addressed in the assessment include red-winged blackbirds, common grackles, and brown-headed cowbirds.

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)).

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 Maryland, including the use of or recommendation of repellents are registered with and regulated by the EPA and the MDA, and used or recommended by WS in compliance with labeling procedures and requirements.

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 methods described in this EA that could be available for use under the alternatives cause 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 by WS under the relevant 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 were planned under an alternative selected because 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 animals 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 alleviate 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 could 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.

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 until a reasonable effort has been made to protect the items and the proper authority has been notified.

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.

Controlled Substances Act of 1970 (21 USC 821 et seq.)

This law requires an individual or agency to have a special registration number from the federal DEA to possess controlled substances, including those that are used in wildlife capture and handling.

Federal Food, Drug, and Cosmetic Act (21 USC 360)

This law places administration of pharmaceutical drugs, including those used in wildlife capture and handling, under the FDA.

Investigational New Animal Drug (INAD)

The FDA can grant permission to use investigational new animal drugs commonly known as INAD (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.

Environmental Justice in Minority and Low-income Populations (Executive Order 12898)

Executive Order 12898 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. Executive Order 12898 requires federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies, and activities on minority and low-income persons or populations. All activities are evaluated for their impact on the human environment and compliance with Executive Order 12898.

WS would only use legal, effective, and environmentally safe methods, tools, and approaches. Chemical methods employed by WS would be regulated by the EPA through FIFRA, the MDA, the FDA, by MOUs with land managing agencies, and by WS' Directives. WS would properly disposes of any excess solid or hazardous waste. It is not anticipated that the alternatives would result in any adverse or disproportionate environmental impacts to minority and low-income people or populations. In contrast, two of the alternatives analyzed in detail may benefit minority or low-income populations by reducing threats to public health and safety and property damage.

Protection of Children from Environmental Health and Safety Risks (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. WS and the USFWS make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children. WS and the USFWS have considered the impacts that this proposal might have on children. The proposed activities 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 and the USFWS conclude that it would not create an environmental health or safety risk to children from implementing the proposed action alternative or the other alternatives.

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, to develop and implement a MOU with the USFWS that shall promote the conservation of migratory bird populations. APHIS has developed a MOU with the USFWS as required by this Executive Order and WS would abide by the MOU.

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.

1.7 DECISIONS TO BE MADE

Management of migratory birds is the responsibility of the USFWS. As the authority for the overall 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 MDNR is responsible for managing wildlife in the State of Maryland, including birds. The MDNR establishes and enforces regulated hunting seasons in the State, including the establishment of hunting seasons that allow the harvest of snow geese, mallards, coots, and mourning doves. For migratory birds, the MDNR can establish hunting seasons for those species under frameworks determined by the USFWS. WS' activities to reduce and/or prevent bird damage in the State would be coordinated with the USFWS and the MDNR, which would ensure WS' actions were incorporated into population objectives established by those agencies for bird populations in the State. The take of many of the bird species addressed in this EA can only occur when authorized by a depredation permit issued by the USFWS and the MDNR; therefore, the take of those bird species to alleviate damage or reduce threats of damage would only occur at the discretion of those agencies.

Based on the scope of this EA, the decisions to be made are: 1) should WS, in cooperation with the USFWS, conduct bird damage management to alleviate damage to agriculture, property, natural resources, and threats to human safety, 2) should the Migratory Bird Program in USFWS Region 5 issue depredation permits to WS and other entities to conduct bird damage management activities when requested, 3) should WS conduct disease surveillance and monitoring in the bird population when requested by the MDNR, the USFWS, and other agencies, 4) should WS, in cooperation with the USFWS, implement an integrated damage management strategy, including technical assistance and direct operational assistance, to meet the need for bird damage management, 5) if not, should WS and/or the USFWS attempt to implement one of the other alternatives described in the EA, and 6) would the alternatives result in effects to the human 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 were identified but will not be considered in detail, with rationale. Pertinent portions of the affected environment will be included in this chapter during the discussion of the issues. Additional descriptions of affected environments will be incorporated into the discussion of the environmental effects in Chapter 4.

2.1 AFFECTED ENVIRONMENT

Damage or threats of damage caused by those bird species addressed in this EA can occur statewide in Maryland wherever those species of birds occur. However, assistance would only be provided by WS when requested by a landowner or manager and only on properties where a cooperative service agreement or other comparable document had been signed between WS and the 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. Those bird species addressed in this EA 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. Additional information on the affected environment is provided in Chapter 4.

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 Maryland 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 Maryland 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 potential impacts of bird damage management in the State where additional agreements may be signed in the future. The USFWS would only issue a depredation permits for the take of birds when requested; therefore, this EA evaluates information from depredation permits issued previously by the USFWS to alleviate damage.

The affected environment could include 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, but would not necessarily be limited to 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.

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 affect natural resources on the facility or the aesthetic value of property or landscaping. Examples of those types of 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. 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.

Bird Conservation Regions

BCRs are areas in North America that are characterized by distinct ecological habitats that have similar bird communities and resource management issues. The State of Maryland lies within the Appalachian Mountains (BCR 28), the Piedmont (BCR 29), and the New England/Mid-Atlantic Coast (BCR 30) regions. The majority of the State lies within the New England/Mid-Atlantic Coast region.

The Appalachian Mountains region is characterized by rugged terrain that includes the Blue Ridge, the Ridge and Valley Region, the Cumberland Plateau, the Ohio Hills, and the Allegheny Plateau. Vegetation is dominated by oak-hickory and other deciduous forest types at lower elevations and at higher elevations, pine, hemlock, spruce, and fir dominate the landscape. The majority of the region is forested but some agricultural practices occur in the flatter portions of the landscape (USFWS 2000). This region extends from southern New York south and west along the Appalachian Mountain range to northeastern Alabama. In Maryland, the Appalachian Mountains region covers the extreme western portion of the State.

Areas within the State along the Appalachian Mountains lie within the Piedmont region (BCR 29). The Piedmont overlaps Georgia, South Carolina, North Carolina, Virginia, and a small part of Alabama extending northward into Maryland, Pennsylvania, and New Jersey. The region is characterized as a transitional area between the Appalachian Mountains and the flat coastal plain of the Atlantic Ocean consisting of a patchwork of various hardwood, grassland, and urban settings (USFWS 2000).

The New England/Mid-Atlantic Coast region overlaps the eastern portion of the State. The New England/Mid-Atlantic Coast region encompasses the coastal areas of States ranging from southern Maine to Virginia. Of all the BCRs in the United States, the New England/Mid-Atlantic Coast region has the highest human population densities. Much of the region was converted to agricultural production as human settlements expanded in the region, but today is dominated by forest and residential use (USFWS 2000).

The other Bird Conservation Region that dominates the northeastern United States is the Atlantic Northern Forest region (BCR 14), which encompasses most of Maine, Vermont, New Hampshire, and parts of New York, Massachusetts, and Connecticut. Although the Atlantic Northern Forest region does not include any of the land area of Maryland, several of the bird species addressed in this EA have breeding colonies that occur within the region. Those bird species with nesting colonies in the Atlantic Northern Forest region also cause damage or pose a threat of damage in Maryland, especially during the migration periods. For example, several of the gull species addressed in this EA do not have breeding colonies in the State; however, those species often cause damage or pose threats of damage, primarily during the migration periods. Several of the analyses in Chapter 4 of this EA will address birds with breeding populations that occur primarily in the Atlantic Northern Forest region.

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 from a non-federal entity conducting the action 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, invasive species, or unprotected wildlife species.

Most bird species are protected under state and/or federal law and to address damage associated with those species, a permit must be obtained from the appropriate federal and/or state agency. However, in some situations, with the possible exception of restrictions on methods (*e.g.*, firearms restrictions, pesticide regulations), some species can be managed without the need for a permit when they are causing damage (*e.g.*, take under depredation/control orders, unprotected bird species). For some bird species, take during the hunting season is regulated pursuant to the MBTA by the USFWS through the issuance of frameworks, that include the allowable length of hunting seasons, methods of harvest, and harvest limits, which are implemented by the MDNR. Under the blackbird depredation order (see 50 CFR 21.43), blackbirds can be lethally removed by any entity without the need to obtain a depredation permit when those species identified in the order are found committing damage, when about to commit damage, or when posing a human safety threat. In addition, Muscovy ducks can also be addressed under a control order. Pursuant to the MBTA, the USFWS can issue depredation permits to those entities experiencing damage associated with birds, when deemed appropriate.

If a bird species is not afforded protection under the MBTA (see 50 CFR 10.13), then a depredation permit from the USFWS is not required to address damage or threats of damage associated with those species. Free-ranging or feral domestic waterfowl, including mute swans, European starlings, house sparrows, and rock pigeons are not afforded protection under the MBTA and a depredation permit is not required to address damage associated with those species.

When a non-federal entity (*e.g.*, agricultural producers, health agencies, municipalities, counties, private companies, individuals, or any other non-federal entity) takes an action involving a bird species, the action is not subject to compliance with the NEPA due to the lack of federal involvement[10] in the action. Under such circumstances, the environmental baseline or status quo must be viewed as an environment

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

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 should be used, WS' involvement in the action would not affect the environmental status quo since the entity could take the action in the absence of WS' involvement. Since take could occur during hunting seasons, under depredation/control orders, through the issuance of depredation permits, or for some species take can occur at any time without the need for a depredation permit, an entity could take an action in the absence of WS' involvement. WS' involvement would not change the environmental status quo if the requestor had conducted the action in the absence of WS' involvement in the action.

In addition, most methods for resolving damage would be available to WS and to other entities. Therefore, WS' decision-making ability would be restricted to one of three alternatives. Under those three alternatives, WS could provide technical assistance with managing damage only, take the action using the specific methods as decided upon by the non-federal entity, or take no action. If no action were taken by WS, the non-federal entity could take the action anyway either without the need for a permit, during the hunting season, under a depredation/control order, or through the issuance of a depredation permit by the USFWS and the MDNR. 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 would be trained in the use of methods, which increases the likelihood that damage management methods would be employed appropriately concerning 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 birds in Maryland. 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.

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. Those issues identified in the cormorant management FEIS (USFWS 2003) were considered during the development of this EA. Issues related to managing damage associated with birds in Maryland were developed by WS in consultation with the USFWS and the MDNR. This EA will also be made available to the public for review and comment to identify additional issues.

The issues as those issues relate to the possible implementation of the alternatives, including the proposed action alternative, are discussed in Chapter 4. The issues analyzed in detail 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 alleviate damage or threats to human safety are categorized into non-lethal and lethal methods. Non-lethal methods available 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 were employed. Lethal methods would also be available to remove a bird or those birds responsible for causing damage or posing threats to human safety. Therefore, if WS used lethal methods, the removal of a bird or birds could result in local population reductions in the area where damage or threats were occurring. The number of individuals from a target species that could be removed from a population using lethal methods under the alternatives would be dependent on the number of requests for assistance received, the number of individual birds involved with the associated damage or threat, and the efficacy of methods employed.

The analysis to determine the magnitude of impacts on the populations of those species addressed in this EA from the use of lethal methods would be based on a measure of the number of individuals lethally removed in relation to the abundance of that species. Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations would be based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations would be based on population trends and harvest trend data, when available. Take would be monitored by comparing the number of birds lethally removed with overall populations or trends. Lethal methods would only be used by WS at the request of a cooperator seeking assistance and only after the take of those bird species had been permitted by the USFWS pursuant to the MBTA and the MDNR, when required.

In addition, some of the bird species addressed in this EA can be harvested in the State during annual hunting seasons. Therefore, any 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 alleviate 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) to identify possible techniques. The effects on the populations of target bird populations in Maryland 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 along roadways for a set duration along a pre-determined route. Routes are 24.5 miles long and are surveyed once per year with the observer stopping every 0.5 miles along the route to conduct the survey. The numbers of birds observed and heard within 0.25 miles of each of the survey points are recorded during a 3-minute sampling period at each point. 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. 2012). The BBS is a combined set of over 3,700 roadside survey routes primarily covering the continental United States and southern Canada. The primary objective of the BBS has been to generate an estimate of population change for all breeding birds. Populations of birds tend to fluctuate, especially locally, because of variable local habitat and climatic conditions. Trends can be determined using different population equations and 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. 2012).

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. Survey data 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 the data can be used as an indicator of trends in a 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 (Rich et al. 2004, Blancher et al. 2013). Using relative abundances derived from the BBS conducted between 1998 and 2007, the Partners in Flight Science Committee (2013) 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) and updated by the Partners in Flight Science Committee (2013) makes assumptions on the detectability of birds, which can vary for each species (Blancher et al. 2013). 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, Blancher et al. 2013).

Annual Harvest Data

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 MDNR. Snow geese, mallards, coots, and mourning doves are the only species of birds addressed in this EA that have established hunting seasons in the State. For many migratory bird species considered harvestable during a hunting season, the number of birds harvested during the season is estimated and reported by the USFWS and/or the MDNR in published reports.

Atlantic Flyway Breeding Waterfowl Plot Survey

The Atlantic Flyway Technical Section initiated the Atlantic Flyway Breeding Waterfowl Plot Survey during 1989 across 11 northeast states ranging from New Hampshire to Virginia. The survey collects breeding population abundance data used to support effective management of eastern waterfowl breeding populations. Prior to the initiation of the survey, populations of waterfowl in the eastern part of the continent were managed based on data collected for mid-continent populations. The Atlantic Flyway Breeding Waterfowl Plot Survey has been described in detail by Heusmann and Sauer (1997, 2000), and involves monitoring 1-km plots apportioned randomly across physiographic strata. Plots are monitored once each year during the April/May nesting period by ground and/or aerial surveys. Observers record numbers and species of all waterfowl seen on the plot.

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

The potential for effects on non-target species and 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 that were 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 chemical methods. Chemical methods that would be available to manage damage or threats of damage associated with birds include the avicide DRC-1339, Avitrol, alpha chloralose, nicarbazin, and taste repellents. Chemical methods that could be available for use to manage damage and threats associated with birds in Maryland 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. As part of the scoping process to facilitate interagency cooperation, WS consulted with the USFWS pursuant to Section 7 of the ESA 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 that were legally available, selective for target species, and were effective at alleviating the damage associated with the target species. Still, some concerns exist regarding the safety of methods despite their legality. As a result, this EA will analyze the potential for proposed methods to pose a risk to members of the public and employees of WS.

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

Safety of Chemical Methods Employed

The issue of using chemical 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 remove birds lethally. DRC-1339 is the only avicide currently being considered for use to manage damage in this assessment. DRC-1339 is currently registered with the EPA for use by WS to manage damage associated with pigeons, starlings, red-winged blackbirds, brown-headed cowbirds, common grackles, and gulls. However, formulations registered with the EPA must also be registered with the MDA for use in the State. During the development of this EA, formulations of DRC-1339 were registered with the MDA for use to manage damage associated with pigeons, starlings, and blackbirds.

Several avian repellents are commercially available to disperse birds from an area or discourage birds from feeding on desired resources. Avitrol is a flock dispersal method available for use to manage damage associated with some bird species. For those species addressed in this assessment, Avitrol is registered with the EPA to manage damage associated with red-winged blackbirds, common grackles, brown-headed cowbirds, European starlings, house sparrows, and rock pigeons. Other repellents are also available with the most common ingredients being polybutene, anthraquinone, and methyl anthranilate.

Alpha chloralose, which is a sedative, is also being considered as a method that could be employed under the alternatives to manage damage associated with waterfowl. Alpha chloralose could be used to sedate waterfowl temporarily and lessen stress on the animal from handling and transportation from the capture site. Drugs delivered to immobilize waterfowl would occur on site with close monitoring to ensure proper care of the animal. Alpha chloralose is reversible with a full recovery of sedated animals occurring. Reproductive inhibitors containing the active ingredient nicarbazin could also be available under the alternatives. Nicarbazin is the only reproductive inhibitor currently registered with the EPA for use to manage local populations of pigeons and waterfowl by reducing or eliminating the hatchability of eggs laid. The use of chemical methods would be regulated by the EPA through the FIFRA, by the FDA, the MDA, and by WS' directives. Chemical methods are further discussed in Appendix B of this EA.

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 employed to reduce damage and threats to safety caused by birds, if misused, could potentially be hazardous to human safety. 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 was 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, eyespot balloons, or nest

destruction. Other mechanical methods could include live-traps, mist nests, cannon nets, net guns, shooting, or recommending a local population of harvestable birds be reduced through hunting.

Many of the non-chemical methods available would only be activated when triggered by attending personnel (*e.g*., cannon nets, firearms, pyrotechnics, lasers), are passive live-capture methods (*e.g*., walk-in style live-traps, mist nets), or are passive harassment methods (*e.g*., effigies, exclusion techniques, anti-perching devices, electronic distress calls). The primary safety risk of most non-chemical methods occurs directly to the applicator or those people 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 Maryland 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.

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 in Chapter 1 under the need for action section. 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 flight crews and passengers. If the use of certain methods to address the threat of aircraft striking birds was limited or were excluded from use, the unavailability of those methods 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 in the area where damage management activities occur. 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, many households have indoor or outdoor pets. However, some people may consider individual wild animals as "*pets*" or exhibit affection toward those animals, especially people who enjoy viewing and feeding 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). Those benefits include direct benefits related to consumptive and non-consumptive uses, indirect benefits derived from vicarious wildlife related experiences, and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (Bishop 1987). Direct benefits are derived from a personal relationship with animals, which may take the form of direct consumptive use (*e.g.*, using parts of or the entire animal) or non-consumptive use (*e.g.*, viewing the animal in nature) (Decker and Goff 1987).

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

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. 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. Those human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment.

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."*

The American Veterinary Medical Association (AVMA) as has previously described suffering as a *"…highly unpleasant emotional response usually associated with pain and distress*." (AVMA 1987). However, suffering *"…can occur without pain…,"* and *"…pain can occur without suffering…"*; therefore, suffering carries with it the implication of occurring over time, a case could be made for *"…little or no suffering where death comes immediately…"* (California Department of Fish and Game 1991). Pain and physical restraint 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. 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 has previously stated, "*...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 has previously stated

that "[f]*or 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*" (Kreeger et al. 1988). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness (Bateson 1991).

The decision-making process can involve trade-offs between the above aspects of pain and humaneness. Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering.

The issue of humanness and animal welfare concerns, as those concerns relate to the methods available for use, will be further discussed 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 damage management activities conducted by WS would affect the ability of persons to harvest those bird species during the regulated hunting seasons either by reducing local populations through the lethal removal of birds or by reducing the number of birds present in an area through dispersal techniques. Those species that are addressed in this EA that also can be hunted during regulated seasons in the State include snow geese, mallards, coots, and mourning doves.

Potential impacts could arise from the use of non-lethal or lethal damage management methods. Non-lethal methods used to reduce or alleviate damage caused by those birds species are used to reduce bird densities through dispersal in areas where damage or the threat of damage is occurring. 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. The most effective approach to resolving any wildlife damage would be to use an

adaptive integrated approach, which may call for the use of several management methods simultaneously or sequentially (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[11]. 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 would be to reduce damage, risks, and conflicts with birds as requested and not to necessarily reduce/eliminate populations. Localized population reduction could be short-term since new individuals may immigrate to an area, be released at the site, or new individuals could 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 return to pre-management population levels eventually does not mean individual management actions were unsuccessful, but that periodic management 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, 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 would be 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 MDNR, and the USFWS during the scoping process of this EA. The following issues were considered; however, those issues will not receive detailed analyses for the reasons provided.

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 Maryland 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 describe accurately such locations or times in an EA or an 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 the 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

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

procedures implementing the NEPA, WS' individual wildlife damage management actions could be categorically excluded (7 CFR 372.5(c)). The intent in developing this EA is to determine if the proposed action could potentially have significant individual and/or cumulative impacts on the quality of the human environment that would warrant the preparation of an EIS. This EA addresses impacts of 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 were made through this EA that the proposed action or the other alternatives could potentially have significant effects on the quality of the human environment, then an EIS would be prepared. Based on previous requests for assistance, the WS program in Maryland would continue to conduct 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 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 would frequently be temporary because immigration from adjacent areas or reproduction would replace the animals removed. WS operates on a small percentage of the land area in Maryland and would only target those birds identified as causing damage or posing a threat. Therefore, activities conducted pursuant to any of the alternatives 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 alleviate 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. In addition, 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 the plaintiffs' motion for a preliminary injunction. In part, the court found that to establish a need for wildlife damage management a forest supervisor needs only to show that damage from wildlife was threatened (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 damage management actions.

Bird Damage Management Should Not Occur at Taxpayer Expense

An issue identified is the concern that wildlife damage management should not be provided at the expense of the taxpayer or that activities should be fee-based. Funding for activities could be 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 Maryland. The remainder of the WS program would be entirely fee-based. Technical assistance would be 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 service agreements between the requester and WS. Therefore, in most cases, the entity requesting assistance would be providing the funding for activities conducted by 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 would not be essential to making a reasoned choice among the alternatives being considered. However, the methods determined to be most effective at reducing damage and threats to human safety caused by birds and that prove to be the most cost effective would receive the greatest application. As part of an integrated approach, evaluation of methods would continually occur to allow for those methods that were most effective at resolving damage or threats to be employed under similar circumstances where birds were causing damage or posed a threat. Additionally, management operations may be constrained by cooperator funding and/or objectives and needs. The cost effectiveness of methods and the effectiveness of methods are linked. The issue of cost effectiveness as it relates to the effectiveness of methods is discussed further in Section 2.2 of this EA.

Impacts of Avian Influenza on Bird Populations

AI is caused by a virus in the Orthomyxovirus group. Viruses in this group vary in the intensity of illness (*i.e*., virulence) they may cause. Wild birds, in particular waterfowl and shorebirds, are considered the natural reservoirs for AI (Davidson and Nettles 1997, Alexander 2000, Stallknecht 2003, Pedersen et al. 2010). 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 that 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).

There are two types of AI viruses, low pathogenic and high pathogenic (USGS 2013). The low and high refer to the potential of the viruses to kill domestic poultry (USGS 2013). In wild birds, low pathogenic avian influenza rarely cause signs of illness and it is not an important mortality factor for wild birds (Davidson and Nettles 1997, Clark and Hall 2006). In contrast, high pathogenic avian influenza has sickened and killed large numbers of wild birds in China (USGS 2013). However, there have been reports of apparently healthy wild birds being infected with high pathogenic avian influenza (USGS 2013). High pathogenic strains have only been found to exist in wild waterfowl species in China (Brown et al. 2006, Keawcharoen et al. 2008, USGS 2013).

Recently, the occurrence of highly pathogenic 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 highly pathogenic H5N1 AI. Highly pathogenic H5N1 AI has been circulating in Asian poultry and fowl resulting in death to those species. Highly pathogenic 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 highly pathogenic form of AI has been recorded in wild birds. Numerous potential routes for introduction of the virus into the United States exist including the 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 the natural reservoirs for AI. Tens of thousands of birds have been tested, but there has been no evidence of the highly pathogenic H5N1 virus in North America. Currently, there is no evidence to suggest AI has negatively affected bird populations in North America. As stated previously, most strains of AI do not cause severe illnesses or death in bird populations.

Bird Damage Should Be Managed By Private Nuisance Wildlife Control Agents

Wildlife control agents and private entities could be contacted to reduce bird damage when deemed appropriate by the resource owner. The MDNR maintains a website with contact information for licensed Nuisance Wildlife Control Cooperators in the State[12]. In addition, WS could refer persons requesting assistance to other entities under all of the alternatives fully evaluated in the EA.

WS Directive 3.101 provides guidance on establishing cooperative projects and interfacing with private businesses. WS only responds to requests for assistance received. When responding to requests for assistance, WS would inform requesters that other service providers, including private entities, might be available to provide assistance.

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 remove birds lethally. As described in Appendix B, the lethal removal of birds with firearms by WS to alleviate damage or threats could occur using a shotgun or rifle, including an air rifle. 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 USFWS Migratory Bird Permit Program has implemented the requirement to use non-toxic shot as defined under 50 CFR 20.21(j) as part of the standard conditions of depredation permits issued pursuant to the MBTA for the lethal take of birds under 50 CFR 21.41. In 2011, the depredation order for blackbirds (see 50 CFR 21.43(b)) was amended to include the requirement for use of non-toxic shot, as defined under 50 CFR 20.21(j), in most cases. However, this prohibition does not apply if an air rifle, an air pistol, or a .22 caliber rimfire firearm was used for removing depredating birds under the depredation order. 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 and air rifles could be employed to remove some species. To reduce risks to human safety and property damage from bullets passing through birds, the use of rifles, including air rifles, would be applied in such a way (*e.g.*, caliber, bullet weight, distance) to ensure the bullet does not pass through birds, and if the bullet does pass through or misses the target, it impacts in a safe location. Birds that were 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 lead 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 that may be contained within the carcass.

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

[12]The website can be accessed at http://www.dnr.state.md.us/wildlife/Plants_Wildlife/nw.asp; accessed May 23, 2013.

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 ground water or surface water. 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. Stansley et al. (1992) believed the lead contamination near the parking lot was due to runoff from the lot, and not from the shooting range areas. The study also indicated that even when lead shot was highly accumulated in areas with permanent water bodies present, the lead did not necessarily cause elevated lead levels in 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 naturally serves to reduce the potential for ground or surface water contamination (Craig et al. 1999). Those 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 from such sources would be minimal to nonexistent.

Since the take of birds could occur by other entities during regulated hunting seasons, through the issuance of depredation permits, under depredation/control orders, or without the need to obtain a depredation permit, WS' assistance with removing birds would not be additive to the environmental status quo. WS' assistance 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 activities due to efforts by WS to ensure projectiles do not pass through, but are contained within the bird carcass, which would limit 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 would further reduce the potential for lead to be deposited in the soil from misses or from projectiles passing through carcasses. In addition, WS' involvement would ensure efforts were made to retrieve bird carcasses lethally removed using firearms to prevent the ingestion of lead in carcasses by scavengers. WS' involvement would also ensure carcasses were disposed of properly to limit the availability of lead. 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. As stated previously, when using shotguns, only non-toxic shot would be used by WS pursuant to 50 CFR 20.21(j). Additionally, WS may utilize non-toxic ammunition in rifles and air rifles as the technology improves and ammunition become more effective and available.

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, overall, 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 conflict could develop when habitat alteration was used to disperse a bird roost. This concern would be heightened in large metropolitan areas where the likelihood of birds dispersed from a roost finding a new roost location and not coming into conflict would be very low. WS and the USFWS have developed alternatives to minimize the potential of dispersing bird roosts in urban/suburban areas by evaluating a management option to depopulate a bird roost.

In urban areas, WS would often work with the community or municipal leaders to address bird damage involving large bird roosts that would likely be affecting several people. Therefore, WS often consults not only with the property owner where roosts were located but also with community leaders to allow for community-based decision-making on the best management approach. In addition, funding would often be provided by the municipality where the roost was located, which would allow activities to occur within city limits where bird roosts occurred. This would allow roosts that relocated to other areas 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) 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 requests for assistance.

As discussed previously, one EA analyzing effects for the entire State would provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. A single EA would also allow for a better cumulative impact analysis. If a determination were made through this EA that the alternatives developed to meet the need for action could result in a significant effect on the quality of the human environment, then an EIS would be prepared.

CHAPTER 3: ALTERNATIVES

Chapter 3 contains a discussion of the alternatives that 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). 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 Maryland 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 (Slate et al. 1992; see WS Directive 2.201), to reduce damage and threats caused by birds in the State. A major goal of the program would be to alleviate and prevent bird damage and to reduce threats to human safety[13]. To meet this goal, WS, in cooperation with the USFWS and in consultation with the MDNR, would continue to respond to requests for assistance with, at a minimum, technical assistance, or when funding was available, operational damage management.

Therefore, 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. Funding for activities conducted by WS could occur through federal appropriations; however, in most cases, those entities requesting assistance would provide the funding for activities conducted by WS.

A key component of assistance provided by WS would be providing information to the requester about wildlife and wildlife damage. 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. When responding to a request for assistance, WS would provide those entities with information regarding the use of appropriate methods. Property owners or managers requesting assistance would be provided with information regarding the use of effective and practical techniques and methods. In addition to the routine dissemination of recommendations and information to individuals or organizations experiencing damage, WS provides lectures, courses, and demonstrations to producers, homeowners, state and county agents, colleges and universities, and other interested groups. WS frequently cooperates 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. Providing information about bird damage and methods would be a primary component of technical assistance and direct operational assistance available from WS under this alternative.

The WS program in Maryland 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 extent of the damage, and previous methods that the cooperator has employed to alleviate the problem. WS would then provide information

[13] All management actions conducted or recommended by WS would comply with appropriate federal, state, and local laws in accordance with WS Directive 2.210.

on appropriate methods that the cooperator may consider to alleviate 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 2006 and FY 2012, WS has conducted 5,936 technical assistance projects in Maryland associated with birds addressed in this assessment. Technical assistance provided by WS would occur as described in Alternative 2 of this EA.

Direct operational damage management assistance would include damage management activities that would be directly conducted by or supervised by personnel of WS. Operational damage management assistance may be initiated when the problem could not effectively be alleviated through technical assistance alone and there was a MOU, cooperative service agreement, or other comparable document signed between WS and the entity requesting assistance. The initial investigation would define the nature, history, and extent of the problem; species responsible for the damage; and methods available to alleviate the problem.

Under this alternative, the WS program 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 a local decision-maker(s) to reduce damage or threats. WS and other state and federal wildlife management agencies may facilitate discussions at local community meetings when resources are available. Those entities requesting assistance could choose to use the services of private businesses, use volunteer services of private organizations, implement WS' recommendations on their own (*i.e*., technical assistance), request direct assistance from WS (*i.e*., direct operational assistance), or take no action. Generally, a decision-maker seeking assistance would be part of a community, municipality, business, governmental agency, and/or a private property owner.

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 was made. By involving decision-makers in the process, damage management actions can be presented to allow 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 presentations by WS on activities to manage damage. This process allows decisions to be made based on local input.

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 can be more complex because business 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 operational assistance could be provided by WS only if

requested by the local community decision-maker, funding was provided, and if the requested assistance was compatible with WS' recommendations.

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

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.

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 alleviate using available methods since birds are conditioned to feed, roost, loaf, and are familiar with a particular location. Subsequently, making that area unattractive using 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.

In general, the most effective approach to resolving damage would be to integrate the use of several methods simultaneously or sequentially. This adaptive approach to managing damage associated with birds would integrate the use of the most practical and effective methods as determined by a site-specific evaluation for each request after applying the WS Decision Model. The philosophy behind an adaptive approach would be to integrate the best combination of methods in a cost-effective[14] 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), and local population reduction, or any combination of these, depending on the circumstances of the specific damage problem.

When WS received a request for direct operational assistance, WS would conduct site visits to assess the damage or threat of damage, would identify the species responsible, and would apply the Decision Model described by Slate et al. (1992) and WS Directive 2.201 to determine the appropriate methods to alleviate or prevent damage. WS' personnel would assess the damage or threat of damage and then evaluate the appropriateness and availability (legal and administrative) of strategies and methods that would be based on biological, economic, and social considerations. Following this evaluation, methods that were deemed practical for the situation would be incorporated into a strategy to alleviate or prevent damage. After this strategy was implemented, monitoring would be conducted and evaluation would continue to assess the effectiveness of the strategy. If the strategy were effective at alleviating or preventing damage, the need

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

for further management would be ended. In terms of the WS Decision Model, most efforts would consist of continuous feedback between receiving the request and monitoring the results of the strategy to alleviate or prevent damage. The Decision Model is not a written documented process, but a mental problem-solving process common to most, if not all, professions, including WS. WS' Decision Model would be the implementing mechanism for selecting methods under the proposed action alternative that would be adapted to each request.

Methods available to alleviate or prevent damage under this alternative could be considered lethal methods or non-lethal methods. Preference would be given to non-lethal methods when practical and effective under this alternative (see WS Directive 2.101). Non-lethal methods that would be available for use by WS would include, but would not be limited to, habitat/behavior modification, nest/egg destruction, lure crops, visual deterrents, live traps, translocation, exclusionary devices, frightening devices, alpha chloralose, reproductive inhibitors, and chemical repellents (see Appendix B for a complete list and description of potential methods). Lethal methods that would be available to WS would include live-capture followed by euthanasia, DRC-1339, the recommendation of take during hunting seasons, and firearms. Euthanasia of live-captured birds would occur in accordance with WS Directive 2.505. WS would employ cervical dislocation, carbon dioxide, or firearms to euthanize target birds once those birds were live-captured using other methods. Carbon dioxide, cervical dislocation, and the use of firearms are considered acceptable forms of euthanasia for free-ranging birds with conditions[15] (AVMA 2013).

As discussed in Chapter 1, the lethal removal of many bird species to alleviate damage would be prohibited unless authorized by the USFWS pursuant to the MBTA. The take of birds can 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 would be required. For some bird species (*e.g*., mallards, coots, doves), lethal take can occur during a hunting season. In addition, a permit from the MDNR may be required to alleviate damage caused by birds in the State. In most cases, the use of non-lethal dispersal methods and the destruction of inactive nests would not require a permit from the USFWS and/or the MDNR.

The use of many lethal and non-lethal methods would be short-term attempts at reducing damage occurring at the time those methods were employed. Long-term solutions to managing bird damage would include limited habitat manipulations and changes in cultural practices that are addressed in Chapter 4. Appendix B contains a discussion of the methods that would be available for use in an integrated approach under this alternative. The WS program also researches and actively develops methods to address bird damage through the NWRC. The NWRC functions as the research unit of WS by providing scientific information and by developing methods to address damage caused by animals. Research biologists with the NWRC work closely with wildlife managers, researchers, and others to develop and evaluate methods and techniques. For example, research biologists from the NWRC were involved with developing and evaluating the reproductive inhibitor nicarbazin. Research biologists with the NWRC have authored hundreds of scientific publications and reports based on research conducted involving wildlife and methods.

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

Under this alternative, WS would provide those cooperators requesting assistance with technical assistance only. Technical assistance would provide those cooperators experiencing damage or threats

[15]The AVMA (2013) defines acceptable with conditions as "A *method considered to reliably meet the requirements of euthanasia when specified conditions are met."*

associated with birds with information, demonstrations, and recommendations on available and appropriate methods available. The implementation of methods and techniques to alleviate 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 were of limited availability for use by private entities (*e.g.*, loaning of propane cannons). Similar to the proposed action alternative, a key component of assistance provided by WS would be providing information to the requester about wildlife and wildlife damage. Educational efforts conducted under the proposed action alternative would be similar to those conducted under this alternative.

Technical assistance would include collecting information about the species involved, the nature and extent of the damage, and previous methods that the cooperator had used to alleviate the problem. WS would then provide information on appropriate methods that the cooperator may consider to alleviate 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.

Generally, several management strategies would be described to the requester for short and long-term solutions to managing damage based on the level of risk, need, and the practicality of their application. Only those methods legally available for use by the appropriate individual would be recommended or loaned by WS. Similar to Alternative 1, those methods described in Appendix B would be available to those people experiencing damage or threats associated with birds in the State, except for alpha chloralose and DRC-1339, which are only available for use by WS.

Those entities seeking assistance with reducing damage could seek direct operational assistance from other governmental agencies, private entities, or conduct activities on their own. In situations where non-lethal methods were ineffective or impractical, WS could 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 and/or the MDNR, when a permit was required. WS could evaluate damage occurring or the threat of damage and complete a Migratory Bird Damage Report, which would include information on the extent of the damages or risks, the number of birds present, and a recommendation for the number of birds that should be taken to best alleviate damage or the threat of damage. Following review by the USFWS 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 using methods to alleviate damage on the resource owner, other governmental agencies, and/or private businesses. Those entities could take action using those methods legally available to alleviate 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 would preclude any 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 alleviate damage caused by birds would be referred to the USFWS, to the MDNR, and/or to 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. Therefore, under this alternative, entities seeking assistance with addressing damage caused by birds could contact WS but WS would immediately refer the requester to

other entities. The requester could then contact other entities for information and assistance, could take actions to alleviate damage without contacting any entity, or could take no further action.

Many of the methods listed in Appendix B would be available for use by other agencies and private entities to manage damage and threats associated with birds. All methods described in Appendix B would be available for use by those persons experiencing damage or threats, except for the use of DRC-1339 for blackbirds, pigeons, and gulls and the use of alpha chloralose for waterfowl.

3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

In addition to those alternatives identified in Section 3.1, several alternatives were also identified during the scoping process by the interagency team. The following issues were identified and considered but will not be analyzed in detail for the reasons provided:

Use of Non-lethal Methods by WS before Lethal Methods

This alternative would require that non-lethal methods or techniques described in Appendix B be applied by WS to requests for assistance to reduce damage and threats to safety from birds in the State. If the use of non-lethal methods failed to alleviate the damage situation or reduce threats to human safety in 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 people experiencing bird damage.

Those people 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 the diligence of the requester 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) would be similar to a non-lethal before lethal alternative because the use of non-lethal methods would be considered before lethal methods by WS (see WS Directive 2.101). Adding a non-lethal before lethal alternative and the associated analysis would not add additional information to the analyses in this 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 Maryland. 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 the MDNR, when required. The non-lethal methods that could be employed or recommended by WS under this alternative would be identical to those methods identified in any of the alternatives. Non-lethal methods would be employed by WS in an integrated approach under this alternative.

Although some people may disagree, the destruction of active nests is often considered a non-lethal method. If considered a non-lethal method, the take of nests and eggs could occur under this alternative. Since the destruction of nests and eggs would be prohibited by the MBTA, the USFWS and the MDNR would still be required to issue depredation permits for the take of bird nests under this alternative, when required. The USFWS and the MDNR could continue to issue depredation permits to those people 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 overhead 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, agricultural 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 methods identified in any of the alternatives. WS would not 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 MDNR, the USFWS, local municipalities, 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 activities related to wildlife damage management. State agencies with responsibilities for migratory birds would likely have to provide this information if depredation permits were 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 the proposed action/no action alternative.

Property owners or managers could conduct management using any non-lethal or lethal method that was legal, once a permit had 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 a private or public entity other than WS. Property owners/managers frustrated by the lack of WS' assistance with the full range of methods 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 was necessary to alleviate bird damages and conflicts because agencies, businesses, and organizations may 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 could effectively alleviate damage caused by 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. The USFWS and the MDNR 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 could be inappropriate when attempting to address threats to human safety expeditiously, primarily at airports.

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. 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 some bird damage. For example, the use of non-lethal methods has been effective in dispersing urban crow roosts 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, 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 by WS

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

The translocation of birds causing damage or posing a threat of 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. In addition, hundreds or thousands of birds would need to be captured and translocated to solve some damage problems (*e.g.*, urban bird roosts); therefore, translocation would be unrealistic in those circumstances. Translocation of wildlife is also discouraged by WS policy (see 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 alleviate 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 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 issues, and other factors.

Reproductive control for wildlife could be accomplished through sterilization (permanent) or contraception (reversible). Sterilization could be accomplished through: 1) surgical sterilization (vasectomy, castration, and tubal ligation), 2) chemosterilization, and 3) 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 effective 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 reproductive 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 proven effective in reducing localized bird populations, the use of the inhibitor could be evaluated as a method available under the alternatives. This EA would be reviewed and supplemented to the degree necessary to evaluate the use of the reproductive inhibitor. Currently, the only reproductive inhibitor registered with the EPA is nicarbazin, which is registered for use to manage local populations of Canada geese, domestic mallards, Muscovy ducks, other feral waterfowl, and pigeons. However, the only reproductive inhibitor currently available in Maryland is the formulation of nicarbazin to manage local pigeon populations. Reproductive inhibitors for the other bird species addressed in this EA do not currently exist.

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. 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) 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

WS' directives and SOPs improve the safety, selectivity, and efficacy of those methods available to alleviate or prevent damage. WS' directives and SOPs would be incorporated into activities conducted by WS when addressing bird damage and threats in the State.

Some key SOPs pertinent to the alternatives include the following:

- The WS Decision Model, which is designed to identify effective 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.

- Material Safety Data Sheets for pesticides would be provided to all WS' personnel involved with specific damage management activities.

- Non-target animals captured in traps would be released unless it was determined that the animal would not survive and/or that the animal could not 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 MDNR to determine the potential risks to T&E species in accordance with the ESA and State laws.

- All personnel who use chemicals would be 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.

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

- The lethal removal of birds would only occur when authorized by the USFWS and the MDNR, when applicable, and only at levels authorized.

3.4 ADDITIONAL STANDARD OPERATING PROCEDURES SPECIFIC TO THE ISSUES

Several additional SOPs would be applicable to the alternatives and the issues identified in Chapter 2 including the following:

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

- Lethal take of birds by WS would be reported and monitored by WS, by the USFWS, and by the MDNR to evaluate population trends and the magnitude of cumulative 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 damage management strategies.

- WS would monitor 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.

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 placement, and capture devices that were 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 was possible and safe to do so.

- Carcasses of birds retrieved after damage management activities had 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 MDNR to evaluate activities to resolve bird damage and threats to ensure the protection of T&E species.

- WS' personnel would be present during the use of live-capture methods or live-traps would be checked frequently to ensure non-target species were released immediately or would be prevented from being captured.

- 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 were not possible, then activities would be conducted during periods when human activity is low (*e.g.*, early morning).

- The use of firearms would occur during times when public activity and access to the control areas was restricted, when possible. Personnel involved in the use of firearms 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 for those chemicals are outlined in WS Directive 2.401 and WS Directive 2.430.

- All chemical methods used by WS or recommended by WS would be registered with the FDA, the EPA, and/or the MDA, when applicable.

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

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

- The NWRC would continue to conduct research to improve the selectivity and humaneness of wildlife damage management devices used by personnel in the field.

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

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

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

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

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

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

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

- WS would continue to recommend the use of hunting to address local bird populations in areas where hunting was permitted.

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 alleviate 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 because of any of the 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 MDNR, and the USFWS.

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 were employed. WS would maintain ongoing contact with

the USFWS and the MDNR to ensure activities occurred within management objectives for those species. WS would submit annual activity reports to the USFWS. The USFWS would monitor the total take of birds from all sources and would factor in survival rates from predation, disease, and other mortality data. Ongoing contact with the USFWS and the MDNR would assure local, state, and regional knowledge of bird population trends were considered.

As discussed previously, methods available to address bird damage or threats of damage in the State that would be available for use or recommendation by WS under Alternative 1 (technical and operational assistance) and Alternative 2 (technical assistance only) would be either lethal methods or non-lethal methods. Under Alternative 2, WS could recommend lethal and non-lethal methods as part of an integrated approach to resolving requests for assistance but would provide no direct operational assistance. Alternative 1 addresses requests for assistance received by WS through technical and operational assistance where an integrated approach to methods could be employed and/or recommended. Non-lethal methods would include, but would not be limited to habitat/behavior modification, lure crops, visual deterrents, lasers, live traps, translocation, alpha chloralose, nest/egg destruction, exclusionary devices, frightening devices, nets, 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. Target birds would be euthanized using cervical dislocation, carbon dioxide, or firearms once birds were live-captured using other methods. Cervical dislocation, carbon dioxide, and firearms are considered conditionally acceptable forms of euthanasia for birds (AVMA 2013). 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 (see WS Directive 2.101). However, non-lethal methods would not necessarily be employed to alleviate every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model. For example, if a cooperator requesting assistance had already used non-lethal methods, WS would not likely recommend or continue to employ those particular methods since their use had already been proven ineffective in adequately resolving the damage or threat. Non-lethal methods would be used to exclude, harass, and disperse target wildlife from areas where damage or threats were 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 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 would generally be regarded as having minimal effects on overall populations of target bird species since those birds would be unharmed. Non-lethal methods would not be 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.

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 would be essential in effectively dispersing those birds causing damage. Employing methods soon after damage begins or soon after threats were identified would increase 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. The use of non-lethal methods would not have adverse effects on populations of birds in the State under any of the alternatives.

Lethal methods would be employed or recommended to alleviate 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 would be 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; thereby, leading to a reduction in damage at the location where those birds were dispersed. The intent of using lethal methods would be similar to the objective trying to be achieved when using non-lethal methods, which would be to reduce the number of birds in the area where damage was occurring; thereby, leading 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 would most often be used to supplement and reinforce the noise associated with non-lethal methods (*e.g.*, pyrotechnics). The capture of birds using live-traps and subsequently euthanizing those birds would be employed to reduce the number of birds using a particular area where damage was occurring. Similarly, the recommendation that birds be harvested during the regulated hunting season for those species in the State would be intended to manage those populations in an area where damage was occurring.

The avicide DRC-1339 could also be used under the proposed action and applied as part of an integrated approach. The intent in using DRC-1339 would be to reduce the number of birds present at a location where damages or threats of damage were occurring. Reducing the number of birds at a location where damage or threats were occurring either using non-lethal methods or lethal methods could lead to a reduction in damage. The dispersal of birds using non-lethal methods can reduce the number of birds using a location, which has been correlated with a reduction in damage occurring at that location (Avery et al. 2008, Chipman et al. 2008). This scenario could 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 move into the area) or by birds the following year (increase in reproduction that could result from less competition for limited resources). As stated previously, lethal methods that would be available for use are not intended to be population management tools over broad areas. The use of lethal methods, including the use of DRC-1339, would be intended to reduce the number of birds present at a location where damage was occurring by targeting those birds causing damage or posing threats. Therefore, the intent of lethal methods would be to manage those birds causing damage and not to manage entire bird populations.

Chipman et al. (2008) found that crows returned to roosts previously dispersed using non-lethal methods within two to eight 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 that evaluated 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 would be to reduce the number of birds present at a site where damage was occurring at the time those methods were 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 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 MDNR 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.

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)

WS would work with those people 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 could be difficult to alleviate using available methods since birds would be conditioned to feed, roost, loaf, and would be familiar with a particular location. Subsequently, making that area unattractive using available methods could be difficult to achieve once damage was 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. WS would employ and/or recommend those methods described in Appendix B in an adaptive approach that would integrate methods to reduce damage and threats associated with birds in the State. Under the proposed action alternative, WS could employ only non-lethal methods when determined to be appropriate for each request for assistance to alleviate damage or reduce threats of damage using the WS Decision Model. However, could also use or recommend the use of lethal methods under this alternative. When employing lethal methods, a depredation permit may be required from the USFWS and/or the MDNR.

The USFWS could issue depredation permits to WS and to those entities experiencing bird damage when requested and when deemed appropriate by the USFWS for those species that require a permit. When applying for a depredation permit, the requesting entity would submit with the application the number of birds requested to be taken to alleviate the damage. Therefore, under this alternative, the USFWS could: 1) deny an application for a depredation permit when requested to alleviate bird damage, 2) could issue a depredation permit at the take levels requested, or 3) could issue permits at levels below those take levels requested. The MDNR could issue a permit to take the same number of birds authorized by the USFWS or the MDNR could issue a permit authorizing the lethal removal of less than the number permitted by the USFWS. However, the take authorized by the MDNR cannot exceed the take level authorized by the USFWS.

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 for lethal take. 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 review by the USFWS 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 could commence the authorized activities and would be required to submit a written report of their activities upon expiration of their permit. Permits may be renewed annually as needed to alleviate 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 would be the immobilizing drug alpha chloralose and the avicide DRC-1339, which are methods that can only be used by WS.

Under this alternative, WS would submit an application to the USFWS for a one-year depredation permit in anticipation of receiving requests for assistance to manage bird damage. The application submitted by WS would estimate the maximum number of birds of each species that could be lethally removed as part of an integrated approach. When submitting an application for a depredation permit each year, WS would use adaptive management principles to adjust the requested number of birds that could be lethally removed. Adjustments on the requested lethal take levels would be made based on anticipated needs using activities conducted previously as a guide. WS would not submit a Migratory Bird Damage Report as part of the application process. The USFWS would conduct an independent review of the application, and if acceptable, would issue a permit as allowed under the depredation permit regulations. WS could request an amendment to a permit to increase the number of birds that could be taken to address unpredicted and emerging damage or threats.

Therefore, the USFWS could: 1) deny WS' application for a depredation permit, 2) issue a depredation permit for the take of birds at a level below the number requested by WS, or 3) issue a depredation permit for the number of birds requested by WS. In addition, WS could be listed as subpermittees under depredation permits issued to other entities. 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; however, the primary concern would be from the use of lethal methods to address damage. The lethal take of birds would be 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 effects to the viability of native species' populations. The potential impacts on the populations of target bird species from the implementation of the proposed action are analyzed for each species below.

Snow Goose Biology and Population Impact Analysis

Snow geese breed across the extreme northern portions of Canada and along the arctic coast (Mowbray et al. 2000). No breeding populations of snow geese occur in Maryland. However, snow geese are common migrants through Maryland with large concentrations of snow geese overwintering in the State (Mowbray et al. 2000). The fall migration period occurs from September through November with the spring migration occurring from late February through the first part of June (Mowbray et al. 2000). The number of snow geese observed overwintering in the State during the CBC has shown a general increasing trend since 1966 (NAS 2010). Since 1966, 45,489 snow geese have been observed on average per year in the State during the CBC. Between 2002 and 2011, the number of snow geese observed in areas of the State surveyed during the CBC averaged 79,137 geese annually, with the highest number observed occurring in 2008 when 154,901 geese were observed in areas surveyed. The lowest number of geese observed in areas surveyed between 2002 and 2011 during the CBC occurred in 2002 when 33,079 geese were observed.

Like other waterfowl species, snow geese can be harvested during regulated hunting seasons, including hunting seasons in Maryland. Snow geese, like many waterfowl species, can be harvested during a regular hunting season that traditionally occurs during the fall migration period of waterfowl. However, snow geese can also be harvested during their spring migration period under a Conservation Order established by the USFWS that includes Maryland (50 CFR 21.60), which was authorized under the Arctic Tundra Habitat Emergency Conservation Act (Public Law 106-108, Nov. 24, 1999, 113 Stat. 1491; see also USFWS 2007). The Conservation Order is intended to allow for the maximum number of snow geese to be taken annually in attempts to reduce the overall population of snow geese. The overall

population of snow geese has increased dramatically since the mid-1970s and has reached historic highs across their breeding and wintering range. The current population level of snow geese has led to the damage of fragile arctic habitats on their breeding grounds from overgrazing (USFWS 2007).

Under regulations in Maryland available during the development of this EA, snow geese could be harvested during a regular season, which extends from October through January and during the Conservation Order season that extends from January through April. During the regular harvest season, up to 25 geese could be harvested daily with no possession limit. Under the Conservation Order season, there is no daily limit on the number of snow geese that can be harvested and no possession limit (MDNR 2013). During the 2010 snow goose harvest season, an estimated 3,629 snow geese were harvested in the State, which compares to 5,676 snow geese harvested during the 2011 harvest season (Raftovich et al. 2012).

Based upon past requests for WS' assistance and in anticipation of additional efforts to address damage and threats of damage associated with snow geese, WS anticipates that up to 200 snow geese could be lethally removed by WS annually under the proposed action. The lethal removal of snow geese by WS would occur only after a depredation permit had been issued by the USFWS. Permits could be issued directly to WS or WS could conduct activities pursuant to permits issued to another entity. If a permit were issued to another entity other than WS, WS participation in damage management activities requiring lethal removal would occur as a subpermittee of the cooperating entity under the depredation permit. Other than WS' take of snow geese, no depredation permits have been issued by the USFWS to take snow geese in Maryland.

As stated previously, the number of snow geese observed during the CBC conducted annually in the State from 2002 through 2011 has ranged from a low of 33,079 geese to a high of 154,901 geese, with an average annual count of 79,137 geese. The average number of snow geese observed during the CBC conducted in the State since 1966 has been 45,489 geese. If WS lethally removed up to 200 snow geese annually to alleviate damage or threats, the lethal take would represent 0.4% of the average number of geese observed in the State since 1966. The lethal removal of up to 200 geese would represent 0.6% of the lowest number of geese observed during the CBC conducted annually from 2002 through 2011.

Given the unlimited take allowed during the hunting seasons for snow geese and the desire of management agencies to reduce the overall population of snow geese to alleviate damage occurring to fragile habitat on their breeding grounds (USFWS 2007), the limited take proposed by WS to alleviate damage and threats would not adversely impact snow goose populations. WS' limited proposed take would not limit the ability of those interested persons to harvest snow geese in the State during the hunting seasons. WS' proposed take would be a limited component of the overall take occurring of snow geese.

Mute Swan Biology and Population Impact Analysis

A large white swan with an orange bill, mute swans are native to parts of Europe and Asia and are thought to have been introduced into the United States prior to 1900 (Ciaranca et al. 1997). Today, mute swan populations have expanded to include much of the northeastern United States, the Upper Great Lakes region, and the Pacific Northwest. Mute swans often have negative effects on native wildlife because they consume large quantities of submerged aquatic vegetation that are essential to native fish and wildlife species (Ciaranca et al. 1997). Fenwick (1983) found that female mute swans in Chesapeake Bay could consume an average of 43% of their body weight daily while male mute swans could consume an average of 35% of their body weight daily. Thus, large concentrations of mute swans can have adverse effects on submerged aquatic vegetation beds essential to many fish, wildlife, and invertebrate species (Atlantic Flyway Council 2003). Along with habitat destruction from feeding and trampling vegetation,

mute swans can also disperse native bird species from breeding sites, particularly the state endangered black skimmer (*Rynchops niger*), when they establish territories and become aggressive towards other wildlife species. Mute swans aggressively defend large nesting territories, often excluding native wildlife from those areas (Ciaranca et al. 1997, Atlantic Flyway Council 2003). Mute swans have also been known to attack jet skiers and other participants in recreational water sports in Maryland.

The earliest known sightings of mute swans in Maryland occurred in 1954 (Atlantic Flyway Council 2003). In 1986, 264 mute swans were observed in Maryland during mid-summer surveys. By 2002, the number of swans observed in Maryland during the same mid-summer survey had increased to 3,624 swans, which represented an increase of 1,272.7% in the number of swans observed during the survey from 1986 to 2002 (Atlantic Flyway Council 2003). Based on the need to minimize the impacts to native species and habitat associated with mute swans in Maryland and to minimize human conflicts, the MDNR developed a statewide mute swan management plan in 2003 (MDNR 2003). After implementation of the management plan by the MDNR, the number of swans observed during the mid-summer surveys conducted during 2005 declined to 2,146 swans and by 2008, the number observed during the survey declined to 581 swans (Atlantic Flyway Council 2009).

The number of mute swans observed in areas surveyed in Maryland during the BBS has shown an increasing trend since 1966 estimated at 14.6% annually; however, from 2001 through 2011, the number of swans observed has declined -6.0% annually (Sauer et al. 2012). The number of mute swans observed in areas of the State observed during the CBC has shown a similar trend with the number observed showing a general increasing trend until the late 1990s. Since 1998, the number of swans observed during the CBC has shown a general declining trend with steeper declines occurring between 2005 and 2011 (NAS 2010).

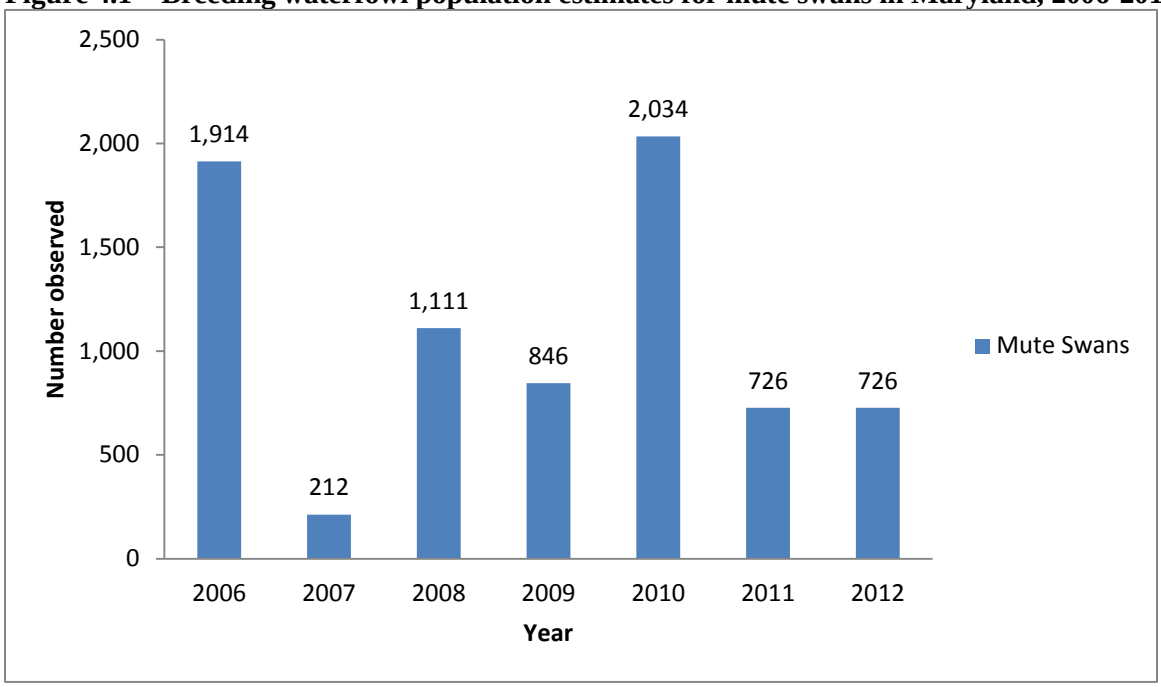
The number of mute swans estimated in the State from the Atlantic Flyway Breeding Waterfowl Plot Survey, conducted between 2006 and 2012, are shown in Figure 4.1. The number of mute swans observed in the State during the Atlantic Flyway Breeding Waterfowl Plot Survey conducted in 2012 was estimated at 726 swans (Klimstra and Padding 2012).

Mute swans are considered a non-native species under the MBTA, as amended by the Migratory Bird Treaty Reform Act of 2004. Therefore, mute swans are afforded no protection under the Act. Mute swans are considered by many wildlife biologists and ornithologists to be an undesirable component of North American wild and native ecosystems due to their detrimental effects (Atlantic Flyway Council 2003, MDNR 2003, Chesapeake Bay Mute Swan Working Group 2004). Given the invasive status of mute swans, any reduction in mute swan populations, even completely removing populations, could be considered as providing some benefit to the natural environment since native habitats and the fish, wildlife, and invertebrates that rely on them are being negatively affected by the presence of mute swans. Executive Order 13112 directs Federal agencies to use their programs and authorities to prevent the spread or to control populations of invasive species that cause economic or environmental harm, or harm to human health.

In 2003, the Atlantic Flyway Council adopted a Mute Swan Management Plan with the goals of reducing mute swan populations in the Flyway to levels that would minimize negative impacts on wetland habitats and native waterfowl, and prevent range expansion into unoccupied areas. To minimize negative impacts on wetlands and native waterfowl, the Plan called for a reduction of the mute swan population in the Atlantic Flyway to less than 3,000 swans by 2013 (Atlantic Flyway Council 2003). During a survey conducted along the Atlantic Flyway in 2008, the population of mute swans was estimated at 10,541 swans (Atlantic Flyway Council 2009). During the 2012 Atlantic Flyway Breeding Waterfowl Plot Survey, Klimstra and Padding (2012) estimated a population of 30,606 swans in Massachusetts, Connecticut, Rhode Island, New York, Pennsylvania, New Jersey, and Maryland. One of the objectives

identified in the mute swan management plan for Maryland was to reduce the statewide population to less than 500 swans (Atlantic Flyway Council 2003, MDNR 2003).

Figure 4.1 – Breeding waterfowl population estimates for mute swans in Maryland, 2006-2012



During FY 2006, WS lethally removed 26 mute swans to alleviate damage in the State and 29 swans were lethally removed during FY 2007. WS has not received requests for assistance associated with mute swans from FY 2008 through FY 2012. Based on the number of requests received and the number of mute swans addressed previously to alleviate those requests, WS anticipates that up to 50 mute swans could be lethally taken annually in the State. In addition, WS could destroy the eggs in up to 50 mute swan nests through oiling, addling, puncturing, or breaking open the egg.

The lethal removal of up to 50 mute swans annually would represent 8.6% of the minimum population estimated at 581 swans during the 2008 Mid-Summer Mute Swan Surveys. The lethal removal of up to 50 mute swans would represent 6.9% of the 726 mute swans observed during the Atlantic Flyway Breeding Waterfowl Plot Survey conducted in the State during 2012. Because mute swans are considered a non-native species and a target population of less than 500 mute swans has been set under the statewide mute swan management plan for Maryland (Atlantic Flyway Council 2003, MDNR 2003), any lethal take by WS would occur within the management goal. The goal of the Atlantic Flyway Council and the MDNR is to reduce the mute swan population in the Atlantic Flyway and Maryland to a level that would minimize adverse effects to wetland habitats and native migratory birds and to prevent further range expansion into unoccupied areas (Atlantic Flyway Council 2003, MDNR 2003).

Mallard Biology and Population Impact Analysis

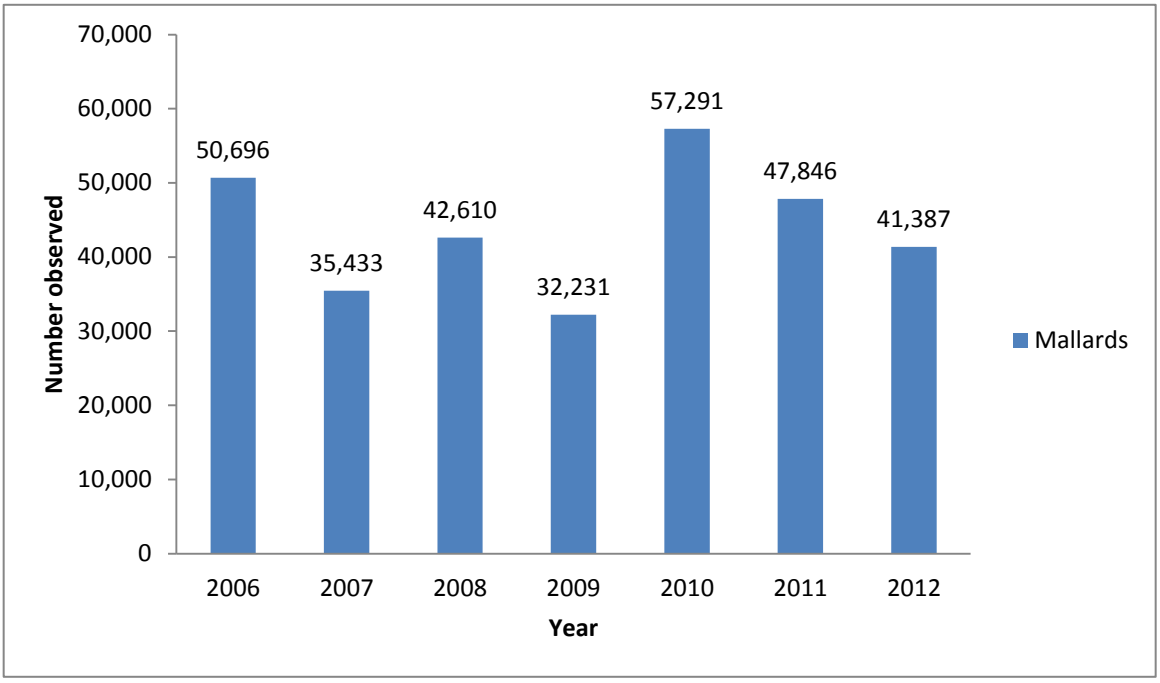
Mallards are one of the most recognizable waterfowl species and they are considered the most abundant waterfowl species with the widest breeding range (Drilling et al. 2002). Mallards can be found wintering as far north as weather conditions allow. In Maryland, mallards can be found throughout the year (Drilling et al. 2002) and are considered common to locally abundant resident across the State. Releases of captive-reared birds for hunting into the eastern and northeastern states have hastened the spread of mallards across the region. In Maryland, it is estimated that more than 260,000 mallards were released

under the Maryland Waterfowl Stamp Program between 1974 and 1987 to supplement hunter harvest and increase local breeding stocks (Ellison 2010). Breeding habitat varies as nesting occurs in primarily upland habitats with dense vegetation near water; however, nesting also occurs in agricultural fields, low woody cover, fallen logs, stands of dense saplings, dead treetops, hollow bases of trees, abandoned raptor or crow nests, and other dense herbaceous growth (Drilling et al. 2002).

Like other waterfowl species, mallards often form large flocks during the migration periods. Densities often increase as mallards move between wintering and breeding areas during the migration periods. The large flocks can pose increased risks when those flocks occur on airport property or in the surrounding area. Large flocks near airfields increased the likelihood of aircraft striking multiple birds, which increases damage and increases the potential for catastrophic failure of the aircraft to occur. Large flocks of mallards can also cause damage to agricultural resources, primarily by trampling and consuming sprouting crops in the spring. The fall migration period begins in early August and continues through early-December with the peak occurring from early September through the end of November. The spring migration begins in early February and continues through early April with the peak occurring from mid-February through the end of May (Drilling et al. 2002).

The number of mallards observed in the State during the BBS has increased an estimated rate of 1.8% annually since 1966; however, from 2001 through 2011, the number of mallards observed during the BBS has declined in the State estimated at -8.5% annually (Sauer et al. 2012). In the New England/Mid-Atlantic Coast (BCR 30) region, a similar upward trend has been observed with the number of mallards observed during the BBS increasing at an 1.9% annual rate since 1966, with a 0.3% annual increase occurring from 2001 through 2011 (Sauer et al 2012). Mallards can be observed breeding throughout the State of Maryland (Drilling et al. 2002). As shown in Figure 4.2, the number of mallards observed in the State during the Atlantic Flyway Breeding Waterfowl Plot Survey conducted from 2006 to 2012 has ranged from a low of 32,231 mallards observed in 2009 to a high of 57,291 mallards observed in 2010.

Figure 4.2 – Breeding waterfowl population estimates for mallards in Maryland, 2006 - 2012

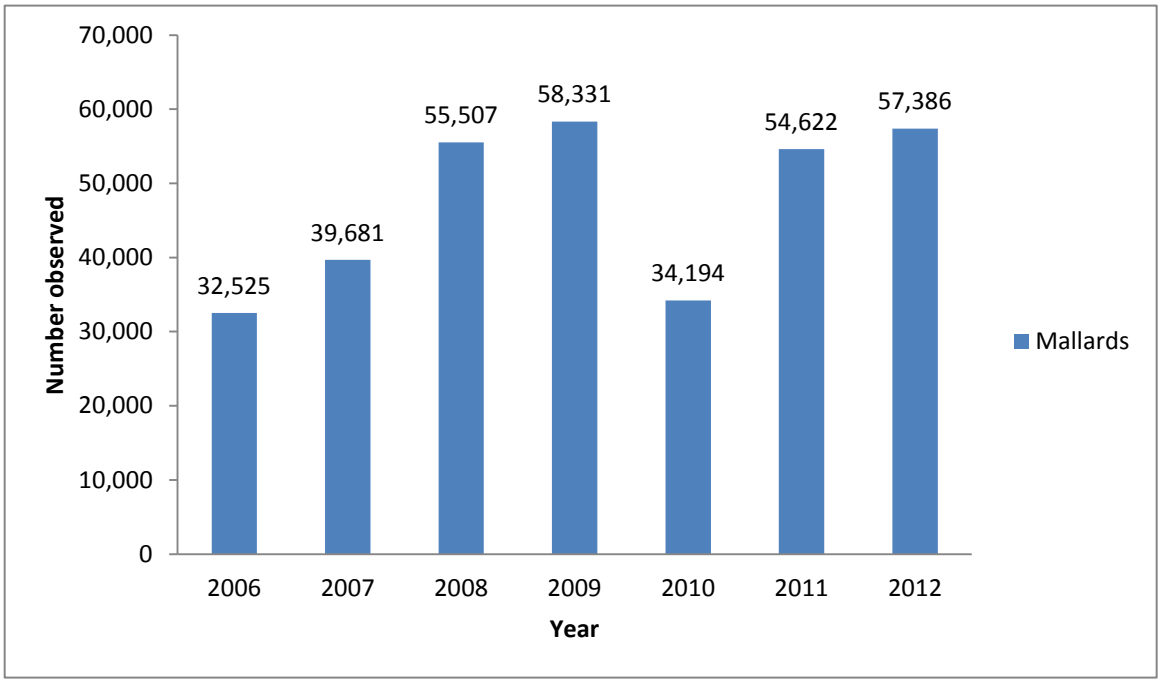


Mallards are also present in the State during the annual migration periods with wintering populations found statewide. The number of mallards observed in areas surveyed during the CBC shows a general

increasing trend since 1966, with a more stable trend observed since the mid-1980s (NAS 2010). The average number of mallards observed in areas surveyed during the CBC between the 2002 survey and the 2011 survey has been 20,631 mallards. The lowest number observed occurred in 2003 when 10,865 mallards were observed in areas surveyed during the CBC. The highest number observed occurred in 2007 when 26,620 mallards were observed during the CBC. As shown in Figure 4.3, the number of mallards observed in the State during the Midwinter Waterfowl Survey conducted in 2012 was estimated at 57,386 mallards, which represented an increase from the 54,622 mallards observed in 2011. From 2008 through 2012, 52,008 mallards have been observed per year on average during the Midwinter Waterfowl Survey conducted in Maryland (Klimstra and Padding 2012).

Like many other waterfowl populations, mallards can be harvested in the State during regulated hunting seasons. During the 2010 hunting season, an estimated 36,855 mallards were harvested in Maryland while an estimated 32,541 mallards were harvested in the State during the 2011 hunting season (Raftovich et al. 2012). Between 2006 and 2011, 276,064 mallards have been harvested in the State during the annual hunting season, which is an average of 46,011 mallards harvested annually in the State (see Table 4.1).

Figure 4.3 – Midwinter Waterfowl Survey estimates for mallards in Maryland, 2006 - 2012



In addition to the take of mallards during the hunting season, the USFWS has authorized the lethal removal of mallards to alleviate damage or threats of damage, primarily at airports within the State. In total, the USFWS has authorized the lethal removal of 6,050 mallards by all entities from 2006 through 2012. The highest annual total take authorized by the USFWS was 1,030 mallards, which occurred in 2012. Under depredation permits issued by the USFWS, WS has lethally removed 276 mallards from FY 2006 through FY 2012. Between 2006 and 2012, 544 mallards have been lethally removed by all entities issued depredation permits in the Maryland. From FY 2007 through FY 2011, WS has translocated, freed, and dispersed 983 mallards to reduce damage to property, aircraft, and protect human safety in the State. From 2006 through 2011, the take of mallards under depredation permits represented 0.2% of the total number of mallards taken in the State by hunters.

Table 4.1 – Number of mallards addressed annually in Maryland, 2006 - 2012

Year	WS' Dispersed[1]	WS' Take[1]	Hunter Harvest	Depredation Take[2]
2006	82	40	54,254	85
2007	105	34	41,217	28
2008	212	36	61,634	62
2009	129	50	49,563	144
2010	86	19	36,855	33
2011	258	58	32,541	116
2012	111	39	N/A[†]	76
TOTAL	**983**	**276**	**276,064**	**544**

[1]WS' take is reported by federal fiscal year

[2]Depredation take is reported by calendar year

[†]Data is currently not available

Based on the number of requests received for assistance previously and in anticipation of additional efforts to address damage or threats of damage, an annual take of up to 250 mallards could occur under the proposed action alternative by WS. WS anticipates the number of airports requesting assistance with managing threats associated with mallards on or near airport property will increase. Since 2006, the average number of mallards harvested annually in the State has been 46,011 mallards. Based on the average harvest of mallards from 2006 through 2011 during the hunting season, take of up to 250 mallards by WS would have represented 0.5% of the estimated average harvest. If the USFWS had authorized the lethal take of up to 1,030 mallards annually since 2006, the authorized take would represent 2.2% of the average number of mallards harvested annually in the State since 2006.

If WS had removed 250 mallards during 2012, WS' take of mallards would have represented 0.6% of number of mallards estimated in the State during the Atlantic Flyway Breeding Waterfowl Plot Survey conducted in 2012. Between 2006 and 2012, the fewest number of mallards observed during the Atlantic Flyway Breeding Waterfowl Plot Survey occurred in 2009 when 32,231 mallards were estimated in the State. If WS had lethally removed 250 mallards during 2009, the removal would have represent 0.8% of the fewest number of mallards observed in the State during the Atlantic Flyway Breeding Waterfowl Plot Survey conducted annually from 2006 through 2012.

Take of up to 250 mallards would represent 1.2% of the average number of mallards observed per year in areas surveyed during the CBC from 2002 through 2011. When compared to the lowest number of mallards observed during the CBC from 2002 through 2011, the lethal removal of 250 mallards would have represented 2.3% of the number of mallards observed in areas surveyed within the State. CBC data is best interpreted as an indication of long-term trends in the number of birds observed wintering in the State and is not intended to represent population estimates of wintering bird populations. However, the information was used in this analysis and compared to WS' proposed take to evaluate the magnitude of take that could occur by WS when compared to the number of mallards observed in the State during the CBC. The number of mallards observed in areas surveyed within the State during 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.

Take of 250 mallards would represent 0.4% of the 57,386 mallards observed in Maryland during the Midwinter Waterfowl Survey conducted in 2012 along the Atlantic Flyway. Similarly, the take of 250 mallards by WS would represent 0.5% of the 52,008 mallards observed on average per year in Maryland during the Midwinter Waterfowl Survey conducted along the Atlantic Flyway between 2008 and 2012. If the USFWS continued to authorize the cumulative take of 1,030 mallards in the State, the cumulative take

would present 2.0% of the average number of mallards observed per year in Maryland during the Midwinter Waterfowl Survey since 2008.

As shown in Table 4.1, the lethal removal of 144 mallards during 2009 under depredation permits issued by the USFWS represented the highest removal of mallards from 2006 through 2011. If the USFWS continued to authorize the lethal take of mallards and 144 mallards per removed per year, the combined take of WS and other entities could total nearly 400 mallards. The cumulative take would represent 0.7% of the number of mallards estimated in the State during the 2012 Midwinter Waterfowl Survey and 0.8% of the average number of mallards observed on the Survey from 2008 through 2012. Take of 400 mallards by all entities would represent 1.9% of the average number of mallards observed in areas surveyed during the CBC from 2002 through 2011 and 3.7% of the lowest number of mallards observed during the CBC from 2002 through 2011.

Based on the known take of mallards in the State, take of up to 250 mallards annually by WS to alleviate damage would not adversely affect mallard populations in Maryland. All take by WS would occur under a depredation permit issued by the USFWS, which would ensure the cumulative take of mallards from all known sources was considered when establishing population objectives for mallards.

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 can be highly variable and often does not resemble that of the wild mallard duck. Urban mallard ducks 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 blond 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 or for consumption, but might not always remain at the release sites; thereby, becoming feral. Feral waterfowl could be 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.

Federal law does not protect domestic varieties of waterfowl (see 50 CFR 21), nor are domestic waterfowl specifically protected by law in Maryland. Domestic and feral waterfowl may be of mixed heritage and may show feather coloration of wild waterfowl. Some domestic and feral ducks are incapable of sustained flight, while some are incapable of flight at all due to hybridization. Domestic waterfowl may at times crossbreed 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 as providing a benefit to other native bird species since they compete with native wildlife for resources. Domestic and feral waterfowl are usually 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 domestic birds are often found in areas where resident Canada geese inhabit. Currently, there are no population estimates for domestic and feral waterfowl in Maryland. Domestic and feral waterfowl are not protected by federal or 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 Maryland would be 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 Maryland. The USFWS now prohibits sale, transfer, or propagation of Muscovy ducks for hunting and any other purpose other than food production, and allows their removal in locations in which the species does not occur naturally in United States, including Maryland. 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 control of Muscovy ducks, their nests, and eggs.

In anticipation of receiving requests for assistance by WS, take of up to 100 feral ducks and up to 100 feral geese could occur annually under the proposed action. In addition, up to 50 nests (including eggs) could be destroyed by WS to alleviate problems. Since feral waterfowl often compete with native wildlife species for resources, any take of feral waterfowl could be viewed as providing some benefit to the natural environment. The number of feral waterfowl inhabiting Maryland 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 100 feral ducks and up to 100 feral geese, including destroying up to 50 nests, would not adversely affect populations of those feral species.

Double-crested Cormorant Biology and Population Impact Analysis

Double-crested cormorants are large fish-eating colonial waterbirds widely distributed across North America (Hatch and Weseloh 1999). As stated in the cormorant management FEIS developed by the USFWS, the recent increase in the double-crested cormorant population in North America, and the subsequent range expansion, has been well documented along with concerns of negative effects associated with the expanding cormorant population (USFWS 2003). Wires et al. (2001) and Jackson and Jackson (1995) have suggested that the current cormorant resurgence may be, at least in part, a population recovery following years of DDT-induced reproductive suppression and unregulated take prior to protection under the MBTA. There appears to be a correlation between increasing cormorant populations and growing concern about associated negative impacts; thus, creating a management need to address those concerns (USFWS 2003, USFWS 2009).

The double-crested cormorant is one of six species of cormorants breeding in North America and has the widest range (Hatch 1995). Double-crested cormorants range throughout North America, from the Atlantic coast to the Pacific coast (USFWS 2003). During the last 20 years, the cormorant population has expanded to an estimated 372,000 nesting pairs with the population (breeding and non-breeding birds) in

the United States estimated to be greater than 1 million birds (Tyson et al. 1999). The USFWS estimated the continental population at approximately 2 million cormorants during the development of the cormorant management FEIS (USFWS 2003). Tyson et al. (1999) found that the cormorant population increased about 2.6% annually during the early 1990s. The greatest increase was in the Interior region, which was the result of a 22% annual increase in the number of cormorants in Ontario and those states in the United States bordering the Great Lakes (Tyson et al. 1999). From the early 1970s to the early 1990s, the Atlantic population of cormorants increased from about 25,000 pairs to 96,000 pairs (Hatch 1995). While the number of cormorants in this region declined by 6.5% in the early to mid-1990s, some populations were still increasing during this period (Tyson et al. 1999). The number of breeding pairs of cormorants in the Atlantic and Interior population was estimated at over 85,510 and 256,212 nesting pairs, respectively (Tyson et al. 1999).

The Mid-Atlantic/New England/Maritimes population was estimated at over 173,000 breeding pairs, with 16,860 pairs occurring in the Southern New England area, which includes Maryland. The New England/Mid-Atlantic Coast (BCR 30) region has approximately 29,700 nesting pairs, while neighboring BCR 14 has approximately 143,400 nesting pairs (MANEM Waterbird Conservation Plan 2006). From the early 1970s to the early 1990s, the Atlantic population of cormorants increased from about 25,000 pairs to 96,000 pairs (Hatch 1995).

Cormorants are most commonly found in Maryland during the spring, summer, and fall months when the breeding and migrating populations are present (Wires et al. 2001, USFWS 2003). Those cormorants found in Maryland during those periods are composed of birds from the Atlantic populations of cormorants (Tyson et al. 1999, USFWS 2003). Breeding habitat includes lakes, rivers, swamps, and seacoasts where nesting can occur on the ground, in trees, and on coastal cliffs (MANEM Waterbird Management Plan 2006). Breeding populations of cormorants in Maryland occur primarily along the coast. Following the establishment of the first breeding colony of double-crested cormorants at Poplar Island in 1991, the population has expanded rapidly in Maryland (Ellison 2010). From 2002 through 2006, the number of double-crested cormorants in Maryland increased from 1,246 to 1,890 breeding pairs (Ellison 2010). During 2006, approximately 300 pairs attempted to nest on the understructure of the Chesapeake Bay Bridge, but their nests were removed to discourage continued expansion of nesting on artificial structures (Ellison 2010). Currently, the breeding population of cormorants in the State is estimated at 1,890 pairs.

The number of cormorants observed in the State along routes surveyed during the BBS has shown an increasing trend since 1966 estimated at 13.6% annually, with a 11.3% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). In the Eastern BBS Region, the number of cormorants observed during the BBS has shown an increasing trend estimated at 3.6% annually since 1966, with an 10.8% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). Cormorants observed in the New England/Mid-Atlantic Coast (BCR 30) region have also shown an increasing trend estimated at 12.0% annually since 1966, with a 22.8% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). Since 1966, the number of cormorants observed during the CBC has shown a general increasing trend in the State (NAS 2010). As stated previously, the number of cormorants present in the State fluctuates throughout the year with the highest numbers occurring during the migration periods and during the breeding season.

To address cormorant damage to aquaculture resources and other resources, the USFWS, in cooperation with WS, prepared a FEIS that evaluated alternative strategies to managing cormorant populations in the United States (USFWS 2003). The selected alternative in the FEIS modified the existing AQDO and established a PRDO that allow for the take of cormorants without a depredation permit when cormorants are committing or about to commit damage to those resource types. The modified AQDO allows cormorants to be taken in 13 States without a depredation permit to reduce depredation on aquaculture

stock at private fish farms and state and federal fish hatcheries but does not include aquaculture facilities in Maryland (see 50 CFR 21.47). The PRDO allows for the take of cormorants without a depredation permit in 24 states when those cormorants cause or pose a risk of adverse effects to public resources (*e.g.*, fish, wildlife, plants, and their habitats) but does not include public resources in Maryland (see 50 CFR 21.48). All take of cormorants in Maryland to alleviate damage or the threat of damage requires a depredation permit issued by the USFWS.

The cormorant management FEIS developed by the USFWS predicted the number of cormorants taken by authorized entities under the PRDO would increase by 4,140 cormorants per State above the take level that had occurred previously in each of the 24 States covered under the PRDO (USFWS 2003). The FEIS estimated that authorized entities would take 99,360 cormorants annually pursuant to the PRDO in those 24 States where take would be authorized (USFWS 2003). The cormorant management FEIS developed by the USFWS estimated the number of cormorants lethally taken under an alternative implementing a PRDO, an expanded AQDO, and under depredation permits would increase to 159,635 cormorants taken annually (USFWS 2003). The FEIS determined the lethal take of up to 159,635 cormorants annually under the depredation orders and under permits would represent approximately 8.0% of the continental cormorant population.

The take of cormorants from 2004 through 2011 under the depredation orders and under depredation permits in the 24 States included in the PRDO are shown in Table 4.2. Between 2004 and 2011, an average of 40,844 cormorants have been taken under the two depredation orders (PRDO and AQDO) and under depredation permits issued by the USFWS in those 24 States authorized to take cormorants. The USFWS (2009) estimated the take of cormorants under the depredation orders and depredation permits involved primarily those cormorants that were considered a part of the Interior cormorant population. Those cormorants found in Maryland are considered part of the Atlantic population of cormorants (Tyson et al. 1999).

Table 4.2 – Double-crested cormorant take in the 24 States included in the PRDO*

Year	Take by Depredation Order or Permit		Total Take
	PRDO	AQDO and Permits	
2004	2,395	27,882	**30,277**
2005	11,221	23,869	**35,090**
2006	21,428	32,617	**54,045**
2007	19,960	18,818	**38,778**
2008	18,782	21,523	**40,305**
2009	25,562	20,192	**45,754**
2010	18,363	19,516	**37,879**
2011	28,473	16,146	**44,619**
2012	26,112	N/A†	**N/A**

*preliminary take data provided by the USFWS

†N/A=data is currently unavailable

As shown in Table 4.2, the annual take of cormorants from 2004 through 2011 has not exceeded 159,635 cormorants in any given year. The highest level of cormorant take occurred in 2006 when 54,045 cormorants were lethally taken, which represents 34.3% of the 159,635 cormorants evaluated in the cormorant management FEIS. The FEIS determined an annual take of 159,635 cormorants would be sustainable at the State, regional, and national level (USFWS 2003, USFWS 2009). The take that has occurred since the implementation of the preferred alternative in the FEIS that created a PRDO and modified the existing AQDO, has only reached a high of 34.3% of the level evaluated in the FEIS, which determined the higher level of take would be sustainable at the State, regional, and national level. Upon

further evaluation, the USFWS determined the implementation of the preferred alternative in the FEIS that has allowed the annual take level of cormorants under the PRDO, the AQDO, and under depredation permits had not reached a level where undesired adverse effects to cormorant populations would occur (USFWS 2009). The USFWS subsequently extended the expiration dates of the PRDO and the current AQDO (USFWS 2009).

In addition, the USFWS determined the destruction of nests, including the destruction of eggs, allowed under the PRDO and under permits would not reach a level where an undesired decline in the cormorant populations would occur (USFWS 2003). The USFWS further evaluated nest destruction activities from 2004 through 2008 and determined the number of nests destroyed since 2004 and the continued destruction of nests evaluated in the FEIS would not reach a magnitude that would cause undesired declines in cormorant populations (USFWS 2009).

Bird band recovery models have been developed to estimate temporal trends in hatch-year, second-year, and after second-year survival of cormorants banded in the Great Lakes region from 1979 through 2006 (Seamans et al. 2008). The period evaluated encompassed the period of rapid cormorant population increase in the Great Lakes, the establishment of the AQDO in 1998 by the USFWS, and the establishment of the PRDO and changes to the AQDO implemented in 2003 by the USFWS. Survival in hatch-year birds decreased throughout the study period. In addition, survival was negatively correlated with abundance estimates for cormorants in the Great Lakes area. The decline may have been related to density-dependent factors. However, there was also evidence that the depredation orders were contributing to the decreasing survival in hatch-year birds. The data was unclear on whether the depredation orders were reducing the survival of second-year or after-second year cormorants even though lethal removal of cormorants in the Great Lakes increased after the implementation of the depredation orders. Seamans et al. (2008) found that the survival rates of second-year and after second-year cormorants did decrease from 2004 through 2006 based on banding data, but survival rates for those two age classes were still within the range observed for previous years. Additional time may be required before the models used by Seamans et al. (2008) detect any changes in mortality rates resulting from the establishment of the PRDO and the modification of the AQDO that occurred in 2003 due to a lag effect.

Blackwell et al. (2000) examined the relationship between the number of fish-eating birds reported killed under depredation permits issued by the USFWS to aquaculture facilities in New York, New Jersey, and Pennsylvania and population trends of those bird species lethally taken within those respective States. Blackwell et al. (2000) found that the USFWS issued 26 depredation permits to nine facilities from 1985 through 1997 allowing the lethal take of eight species of fish-eating birds but only six species were reported killed to reduce aquaculture damage. Those species lethally taken under those permits included black-crowned night herons, double-crested cormorants, great blue herons, herring gulls, ring-billed gulls, and mallards. The number of birds reported killed, relative to systematic long-term population trends, was considered to have had negligible effects on the population status of those species (Blackwell et al. 2000).

Between 2006 and 2012, the highest level of cormorant take authorized in the State occurred in 2010 and 2012 when the USFWS permitted that take of up to 280 cormorants in the State (see Table 4.3). In total, the USFWS has authorized, through the issuance of depredation permits, the take of 860 cormorants in the State between 2006 and 2012. However, the total take of cormorants by all entities issued depredation permits has been 205 cormorants between 2006 and 2012. Between FY 2006 and FY 2012, 90 cormorants have been lethally removed by WS in the State. The highest level of take level occurred during FY 2007 when 40 cormorants were lethally removed by WS pursuant to depredation permits.

Although only limited cormorant damage management activities have been conducted by WS in Maryland, WS anticipates the number of requests for assistance to manage damage caused by cormorants

will increase based on the increasing number of cormorants observed in the region during the breeding season. If an increase in the number of requests for assistance occurs, under the proposed action, the number of cormorants lethally taken annually by WS would also likely increase to address those requests for assistance, likely to address threats occurring to natural resources. Threats to natural resources could occur if cormorants were competing with other colonial waterbirds for nest sites. Based on increasing trends in the number of cormorants in the region observed during the development of this EA, WS anticipates that up to 500 cormorants total could be lethally taken by WS annually to alleviate damage under depredation permits. In addition, up to 2,000 nests, including eggs, could be destroyed annually to discourage nesting in areas where damages were occurring or in areas where competition with other wildlife is a concern.

Table 4.3 – Number of double crested cormorants addressed in Maryland from 2006 to 2012

Year	Dispersed by WS[1]	USFWS Authorized Take[2]	Take under Depredation Permits	
			WS' Take[1]	Total Take[2,3]
2006	0	80	0	18
2007	0	30	40	12
2008	0	30	0	9
2009	0	80	0	31
2010	0	280	0	5
2011	0	80	19	14
2012	0	280	31	116
TOTAL	**0**	**860**	**90**	**205**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year
[3]Total take by all entities authorized under depredation permits issued by the USFWS

As stated previously, the cormorant management FEIS developed by the USFWS predicted the number of cormorants taken by authorized entities under just the PRDO would total 4,140 cormorants per State in each of the States included in the PRDO (USFWS 2003). The take under the PRDO would be in addition to take occurring under the AQDO and under depredation permits. Furthermore, the USFWS predicted through the analyses in the cormorant population management FEIS that the authorized take of cormorants and their eggs for the management of double-crested cormorant damage, including those taken in Maryland, was anticipated to have no long-term adverse effects on regional or continental double-crested cormorant populations (USFWS 2003, USFWS 2009). This includes cormorants that may be killed in the State under USFWS issued depredation permits. Cormorants are a long-lived bird and egg destruction programs are anticipated to have minimal effects on regional or continental cormorant populations (USFWS 2003, USFWS 2009).

The average total take of cormorants under the PRDO, AQDO, and depredation permits from 2004 through 2011 has been 40,844 cormorants with the highest level of take occurring in 2006 when 54,045 cormorants were taken by all entities in the 24 States listed under the PRDO and AQDO (USFWS 2009). The highest total take and the average annual take that has occurred by all entities covered under the PRDO and the AQDO from 2004 through 2011 is below the 160,000 cormorants taken annually addressed in the cormorant management FEIS.

WS' proposed take of up to 500 cormorants and the destruction of up to 2,000 nests annually to address damage and threats fall within the parameters of take evaluated within the cormorant management FEIS (USFWS 2003, USFWS 2009). If WS' anticipated take of up to 500 cormorants were included with the average take by all entities from 2006 through 2011, the combined take would be below the level of take analyzed in the FEIS. Although the USFWS could issue depredation permits to other entities in the State,

when the permitting of the take occurs within the impacts parameters of the cormorant population management FEIS (USFWS 2003, USFWS 2009), the cumulative take of cormorants in the State would not reach a level where undesired declines would occur.

Great Blue Heron Biology and Population Impact Analysis

One of the tallest birds in Maryland, the great blue heron stands about 38 inches tall and has a wingspan of about 70 inches (Vennesland and Butter 2011). The head of the great blue heron is largely white with dark under parts and the body is primarily bluish in color. Great blue herons are a common widespread wading bird that can be found throughout most of North America and can be found year-around in most of the United States, including Maryland (Butler 1992). Great blue herons are considered a common permanent resident across the State (Ellison 2010). Great blue herons are most often located in freshwater and brackish marshes, lakes, rivers, and lagoons (MANEM Waterbird Plan 2006). Herons are known to nest in trees, on rock ledges, and on coastal cliffs and may travel up to 30 km to forage with a mean forage distance of 2.6 to 6.5 km (MANEM Waterbird Plan 2006). Great blue herons feed mainly on fish and frogs but they will also feed on crabs, crayfish, snakes, small mammals, and birds (Ellison 2010).

Most nesting great blue heron colonies in the northeastern United States occur along the coastal areas located in BCR 14 and BCR 30. As discussed previously, the majority of Maryland lies within BCR 30. In BCR 14, the breeding population has been estimated at 12,000 herons while the breeding population in BCR 30 has been estimated at nearly 31,000 herons (MANEM Waterbird Conservation Plan 2006). The breeding populations of great blue herons in BCR 14 and BCR 30 have been given a conservation ranking of lowest concern (MANEM Waterbird Conservation Plan 2006). The overall population objective for herons in the northeastern United States is to maintain current population levels (MANEM Waterbird Conservation Plan 2006).

Between 1966 and 2011, the number of herons observed along routes surveyed in BCR 14 during the BBS has shown an increasing trend estimated at 0.2% annually, with a 1.1% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). In BCR 30, the number of herons observed in areas surveyed during the BBS has shown increasing trends estimated at 2.6% annually since 1966 ,with a 2.4% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). Great blue herons are showing statistically significant increases across all survey routes of the BBS. Since 1966, the number of great blue herons observed across all routes surveyed during the BBS has increased at an annual rate of 0.8%, with a 1.6% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). In Maryland, herons observed on BBS routes are showing an increasing trend estimated at 1.9% annually from 1966 through 2011; however, the number of herons observed in areas surveyed from 2001 through 2011 has declined -1.8% annually (Sauer et al. 2012). The current population of great blue herons is estimated at 14,114 pairs (Ellison 2010). Herons observed in areas surveyed during the CBC within Maryland have shown a general increasing trend since 1966 (NAS 2010).

In total, WS has lethally removed 44 great blue herons in Maryland and employed non-lethal methods to disperse 96 herons from FY 2006 through FY 2012 (see Table 4.4). In total, 10 great blue herons have been killed unintentionally and two herons have been unintentionally live-captured and released during other damage management activities conducted from FY 2006 through FY 2012. The USFWS has also issued depredation permits to other entities for the lethal removal of herons. From 2006 through 2012, 470 herons were lethally removed in the State by all entities to alleviate damage or threats associated with great blue herons. In 2012, the USFWS authorized the lethal removal of up to 115 herons in the State to alleviate damage or threats of damage, which represents the highest annual authorized take between 2006 and 2012.

Table 4.4 – Number of great blue herons addressed in Maryland from 2006 to 2012

Year	Dispersed by WS[1]	USFWS Authorized Take[2]	Take under Depredation Permits	
			WS' Take[1,3]	Total Take by All Entities[2]
2006	21	98	12	91
2007	18	60	9	54
2008	14	40	5	32
2009	8	95	1	85
2010	7	95	4	31
2011	11	95	6	91
2012	17	115	7	86
TOTAL	**96**	**598**	**44**	**470**

[1]Data reported by federal fiscal year

[2]Data reported by calendar year

[3]Data includes non-target take

To address request for assistance to manage damage associated with great blue herons in the future, up to 50 herons could be lethally taken annually by WS to alleviate damage and threats. The increased level of take analyzed when compared to the take occurring by WS from FY 2006 through FY 2012 is in anticipation of requests to address threats of aircraft strikes at airports and to reduce damage to natural resources, such as nest site competition between herons and other colonial nesting waterbirds.

The number of great blue herons present in Maryland at any given time likely fluctuates throughout the year. Based on a population estimated at 14,114 pairs of great blue herons, take of up to 50 great blue herons by WS would represent 0.2% of the estimated statewide population. The average annual take of herons by all entities in the State has been 68 herons from 2006 through 2012. If the average annual take of herons by other entities were reflective of take that would occur in the future, the combined WS' take and take by other entities would total 118 herons. If WS' proposed take of up to 50 herons were combined with the highest heron take that occurred by all entities of 91 herons, the cumulative take would be 141 herons in the State, which would represent 0.5% of the estimated breeding individuals in the State. If the USFWS continued to authorize the lethal take of up to 115 herons annually in the State, the cumulative take would represent 0.4% of the estimated breeding population in the State, if the populations remains at least stable.

Given the increasing population trends observed for herons in the region, the limited take proposed by WS when compared to the estimated breeding population, the magnitude of WS' estimated annual take could be considered low. The permitting of the take by the USFWS would ensure the cumulative take of herons in the northeastern United States, including the take proposed by WS in Maryland under this assessment, would not reach a magnitude where undesired managed declines would occur. The take of herons by WS would occur within allowed levels of take permitted by the USFWS.

Black Vulture Biology and Population Impact Analysis

Historically, black vultures occurred in the southeastern United States, Texas, Mexico, and parts of Arizona (Buckley 1999). However, black vultures have been expanding their range northward in the eastern United States and now occur as far north as New Jersey, Ohio, Pennsylvania, West Virginia and rarely into Connecticut and New York (Buckley 1999). In winter, black vultures migrate south from the most northern part of their range (Buckley 1999). Black vultures can be found in virtually all habitats but are most abundant where forest is interrupted by open land (Buckley 1999). Black vultures are highly social, roosting communally with other black vultures and turkey vultures in trees, on electric poles, and on other structures (Buckley 1999) where they can cause property damage. Roosts are often occupied for

many years and in some cases decades (Buckley 1999). The diet of black vultures consists primarily of carrion; however, vultures can also be predatory, killing and consuming young domestic livestock (pigs, lambs, calves) and young birds, mammals and reptiles, as well as fish (Buckley 1999).

Black vultures are considered a permanent resident in Maryland. Due to recent range expansion, black vultures are now commonly found throughout the State. Nesting generally occurs in the State between March and May (Ellison 2010). According to BBS trend data provided by Sauer et al. (2012), the number of black vultures observed in the State during the breeding season has increased at an annual rate of 7.6% from 1966 through 2011 with a 4.3% annual increase occurring from 2001 through 2011. Similar increasing trends have been observed for black vultures in the New England/Mid-Atlantic Coast (BCR 30) region estimated at 8.2% annually from 1966 through 2011 and 5.8% annually from 2001 through 2011 (Sauer et al. 2012). The number of black vultures observed overwintering in the State has shown a general increasing trend since 1966 (NAS 2010). No population estimates for black vultures in the State are currently available.

The black vultures addressed by WS and other entities to alleviate damage or threats are shown in Table 4.5. From FY 2006 through FY 2012, WS has lethally removed 23 black vultures in the State to alleviate damage and threats. In addition, WS has employed non-lethal harassment methods to disperse 80 black vultures in the State to address requests for assistance to manage damage. In total, 69 black vultures have been lethally removed by all entities in the State from 2006 through 2012 to alleviate damage or threats of damage.

Table 4.5 – Number of black vultures addressed in Maryland from 2006 to 2012

Year	Dispersed by WS[1]	USFWS Authorized Take[2]	Take Under Depredation Permits	
			WS' Take[1]	Total Take by All Entities[2]
2006	0	109	3	30
2007	75	76	4	12
2008	5	109	10	7
2009	0	236	0	16
2010	0	76	6	1
2011	0	196	0	1
2012	0	218	0	2
TOTAL	**80**	**1,020**	**23**	**69**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year

Based on the increasing number of black vultures in the State during the breeding season, the number of requests to assist with damage or threats of damage associated with black vultures received by WS is also likely to increase in the State. Based on the increasing trends and the possibility of additional efforts to alleviate damage, up to 150 black vultures could be lethally removed by WS annually in the State. In addition, WS could destroy up to 50 black vulture nests annually in the State to alleviate damage.

As shown in Table 4.5, 69 black vultures have been removed in the State from 2006 through 2012 to alleviate damage, which is an average of 10 vultures taken annually by all entities. Previous levels of lethal take have not reduced the number of breeding black vultures in the State based on the increasing number of black vultures observed during the BBS and the CBC conducted in the State. Similar to the other native bird species addressed in this assessment, the take of vultures could only occur when authorized through the issuance of depredation permits by the USFWS. The permitting of the take would ensure the cumulative take of black vultures annually occurred within allowable take levels to achieve

desired population objectives for the species. Therefore, the take of black 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 they 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 and tearing shingles. Turkey vultures prefer carrion but will eat virtually anything, including insects, fish, tadpoles, decayed fruit, pumpkins, and recently hatched heron and ibis chicks (Brauning 1992).

The turkey vulture is by far the most widely distributed and frequently encountered vulture in Maryland (Ellison 2010). The migration peaks are poorly defined, but on average, turkey vultures can be expected in February and November (Robbins and Blom 1996). Breeding occurs between April and June, with one to three eggs typically laid (Robbins and Blom 1996).

The statewide breeding population of turkey vultures has been estimated at 40,000 turkey vultures based on BBS data (Partners in Flight Science Committee 2013). Trending data from the BBS indicates the number of turkey vultures observed along BBS routes in the State have shown an increasing trend estimated at 3.2% annually in the State from 1966 through 2011, with a 3.0% annual increase estimated from 2001 through 2011 (Sauer et al. 2012). The number of turkey vultures observed annually in the New England/Mid-Atlantic Coast region has also shown increasing trends estimated at 3.8% from 1966 through 2011, with a 3.9% annual increase estimated from 2001 through 2011 (Sauer et al. 2012). The number of turkey vultures observed during the CBC conducted annually in the State has also shown a general increasing trend (NAS 2010).

The number of turkey vultures lethally removed in Maryland by all entities pursuant to depredation permits issued by the USFWS to alleviate damage is shown in Table 4.6. From FY 2006 through FY 2012, the WS program in Maryland has lethally removed 33 turkey vultures in the State and employed non-lethal methods to disperse 177 turkey vultures to alleviate damage. Overall, 61 turkey vultures have been lethally taken from 2006 through 2012 by all entities in the State pursuant to depredation permits issued by the USFWS. From 2006 through 2012, nine turkey vultures have been lethally removed on average per year in the State by all entities to alleviate damage pursuant to depredation permits.

Table 4.6 – Number of turkey vultures addressed in Maryland from 2006 to 2012

Year	Dispersed by WS[1]	USFWS Authorized Take[2]	Take Under Depredation Permits	
			WS' Take[1]	Total Take by All Entities[2]
2006	15	164	4	18
2007	39	126	7	7
2008	60	166	11	15
2009	5	208	1	1
2010	19	161	2	1
2011	27	156	2	7
2012	12	190	6	12
TOTAL	**177**	**1,171**	**33**	**61**

[1]Data reported by federal fiscal year

[2]Data reported by calendar year

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 the increasing number of turkey vultures in the State, WS anticipates conducting additional efforts to address damage caused by vultures. Based on the increasing trends and the possibility of additional efforts, up to 150 turkey vultures could be lethally taken annually by WS in the State to address requests for assistance. In addition, WS could destroy up to 50 turkey vulture nests annually in the State to alleviate damage or threats of damage. WS also anticipates continuing to address vultures using non-lethal dispersal methods.

If up to 150 turkeys vultures were taken annually by WS, WS' take would represent 0.4% of the estimated statewide breeding population of turkey vultures estimated at 40,000 vultures if the population remains at least stable. From 2006 through 2012, 61 vultures have been lethally removed in the State by all entities, which is an average of nine turkey vultures removed annually. When combined with a maximum take of 150 vultures annually by WS, the combined take would represent 0.4% of the estimated statewide breeding population. Between 2006 and 2011, the highest annual lethal take of vultures by all entities occurred in 2008 when 26 vultures were removed. If 26 vultures were lethally removed and WS had lethally removed 150 vultures, the cumulative take would have been 176 vultures. When compared to the statewide breeding population estimated at 40,000 vultures, the cumulative take by all entities would have represented 0.4% the estimated population. The highest authorized annual take of turkey vultures occurred in 2009 when the USFWS authorized the take of up to 208 vultures in the State. If the USFWS continued to authorize the lethal take of up to 208 vultures, the cumulative take would represent 0.5% of the estimated breeding population. The permitting of the take by the USFWS and the MDNR pursuant to the MBTA would ensure take by WS and by other entities occurred within allowable take levels to achieve the desired population objectives for turkey vultures in the State.

Osprey Biology and Population Impact Analysis

Ospreys are large raptors most often associated with shallow aquatic habitats where they feed primarily on fish (Poole et al. 2002). Historically, nests of osprey were constructed on tall trees and rocky cliffs. Today, ospreys are most commonly found nesting on man-made structures. Ospreys began accepting man-made sites almost as soon as they became available, nesting on duck blinds, channel markers, high-voltage transmission towers, communication towers, silos, and man-made nesting platforms (Poole et al. 2002, Ellison 2010). A survey of nesting osprey in New Jersey found that 75% of nesting osprey use single-post platforms erected for nesting while 8% of osprey nests occurred on cell towers, 4% occurred on channel markers, 3% nested on duck blinds, 2% occurred on dead trees, and 7% nested on other structures (Clark and Wurst 2010). Nesting in close association with humans can cause problems with noise, property damage, and aggressive behavior of the nesting hawks (Hygnstrom and Craven 1994). Osprey nests are often constructed of large sticks, twigs, and other building materials that can cause damage and prevent access to critical areas when those nests are built on man-made structures (*e.g.*, power lines, cell towers, boats). For example, the average osprey nest in Corvallis, Oregon weighed 264 pounds and was 41-inches in diameter (USGS 2005). In 2001, 74% of occupied osprey nests along the Willamette River in Oregon occurred on power pole sites (USGS 2005).

Disruptions in the electrical power supply can occur when nests are located on utility structures and can inhibit access to utility structures for maintenance by creating obstacles to workers. When osprey nests are built on electrical structures, debris from the nest can contact high voltage transformers and wires causing electrical power failures.

In Maryland, ospreys can be found nearly statewide during the breeding season in areas near aquatic habitats, such as along the coast and major river systems (Poole et al. 2002). Since 1966, the number of osprey observed along routes surveyed in the State during the BBS has shown an increasing trend

estimated at 7.2% annually (Sauer et al. 2012). Between 2001 and 2011, the number of osprey observed in the State has shown an upward trend estimated at 7.2% annually (Sauer et al. 2012). Along routes surveyed in the eastern United States during the BBS, the number of osprey observed since 1966 has shown an increasing trend estimated at 3.4% annually (Sauer et al. 2012). From 2001 through 2011, the number of osprey observed during the BBS conducted in the eastern United States has continued to show an increasing trend estimated at 5.4% annually (Sauer et al. 2012). Across all routes surveyed in the United States during the BBS, the number of osprey counted has shown an increasing trend estimated at 2.9% annually since 1966 and 5.2% annually between 2001 and 2011, which are statistically significant upward trends (Sauer et al. 2012). Based on data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of osprey was 4,000 birds. Ospreys are infrequently observed in areas surveyed during the CBC (NAS 2010). The number of osprey found wintering in the State is likely related to the availability of open water for foraging on fish.

Previous requests for assistance received by WS to alleviate damage or the threat of damage associated with ospreys has involved threats to aircraft from strikes and have been associated with nests of osprey, primarily nests on structures used for the transmission of electrical power, communication towers, bridges, and cranes. Ospreys are also known to construct nests on property utilized for human activity, such as on boats. Osprey nesting near airports can also pose risks of aircraft strikes, which could cause damage to aircraft and threatening aviation safety.

WS has responded to previous requests for assistance involving osprey by using harassment methods, nest/egg destruction, and lethal removal of adult osprey (see Table 4.7). WS dispersed 25 ospreys between FY 2006 and FY 2012 in the State to alleviate damage. Between FY 2006 and FY 2012, WS employed lethal methods to remove 16 ospreys to alleviate damage, with the highest annual take by WS occurring in FY 2011 when nine ospreys were lethally removed by WS.

Table 4.7 – Number of ospreys addressed in Maryland from 2006 to 2012

Year	Dispersed by WS[1]	USFWS Authorized Take[2]	Take Under Depredation Permits	
			WS' Take[1]	Total Take by All Entities[2]
2006	0	25	0	63
2007	1	2	2	2
2008	0	6	0	0
2009	0	24	0	30
2010	0	50	1	0
2011	23	54	9	13
2012	1	41	4	19
TOTAL	**25**	**202**	**16**	**127**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year
[†]N/A=data is currently unavailable

WS would continue to employ non-lethal methods to address requests for assistance with managing damage or threats of damage associated with osprey in the State, including destroying eggs and nests. Eggs located in nests to be removed could be destroyed, eggs could be transported to a State-approved wildlife rehabilitator to be reared until they could be released into the wild, or eggs could be relocated to other osprey nests. Based on previous requests for assistance to manage damage associated with osprey and in anticipation of additional efforts to address damage, WS could remove up to 20 nests annually. The clutch size for ospreys ranges from one to four eggs (Poole et al. 2002). If each nest to be removed contained four eggs, up to 80 eggs could be relocated to other osprey nests, could be released to wildlife

rehabilitators for rearing, and/or could be destroyed annually. Eggs could be destroyed by breaking, addling, or shaking the egg.

The relocation of up to 80 eggs or the release of up to 80 eggs to wildlife rehabilitators would not adversely affect populations of osprey in the State since those eggs would be incubated and hatched with the young reared and released into the wild once they were able to survive on their own. The destruction of bird eggs as part of damage management activities is generally considered a non-lethal method that does not adversely affect populations when the number of eggs destroyed is limited. If 80 osprey eggs were destroyed, those eggs would represent 2.0% of the current estimated statewide breeding population of osprey. However, take of up to 80 eggs annually would be unlikely given the average number of eggs per osprey nest ranges from one to four. The take of 80 eggs was analyzed to present a worst-case scenario to determine the potential for population impacts.

Hand tools would be used to destroy osprey nests. The removal of the nest and eggs would occur in an attempt to cause osprey to abandon the nest site and to disperse the osprey from the area. The removal of an osprey nest, including the removal of osprey eggs, is prohibited by the MBTA unless authorized through the issuance of a depredation permit by the USFWS pursuant to the Act. WS' proposed activities, including the removal of the nest and eggs, would only occur pursuant to the Act through the issuance of a permit for those activities.

Under the proposed action alternative, WS could be requested to use lethal methods to remove osprey when non-lethal methods were ineffective or were determined to be inappropriate using WS Decision model. An example could include osprey that pose an immediate strike threat at an airport where attempts to disperse the osprey were ineffective. Based on previous requests for assistance to manage damage associated with osprey and in anticipation of additional efforts to address damage, WS could lethally take up to 25 ospreys annually in the State.

Based on a statewide population estimated at 4,000 osprey and if up to 25 ospreys were removed in any given year, WS' take would represent 0.6% of the estimated population if the population remained at least stable. Between 2006 and 2012, 127 ospreys have been lethally removed in the State pursuant to depredation permits issued by the USFWS, which is an average annual take of 19 ospreys in the State. The highest annual removal occurred in 2006 when 63 ospreys were removed in the State. If the USFWS continued to authorize the lethal take of ospreys by other entities, the cumulative take could be 44 ospreys by all entities based on the average annual take that has occurred since 2006 and WS' estimated take of up to 25 ospreys. The cumulative take of osprey would represent 1.1% of a statewide breeding population estimated at 4,000 ospreys. If WS combined the highest lethal removal of ospreys by all entities that occurred during 2006 with the proposed annual take, the cumulative take would represent 2.2% of a statewide breeding population estimated at 4,000 ospreys. The take of osprey, including nest and eggs, by WS would only occur when permitted and only at levels authorized on depredation permits issued by the USFWS and the MDNR.

Red-shouldered Hawk Biology and Population Impact Analysis

Across their range, red-shouldered hawks are commonly found in mature, mixed deciduous-coniferous forests, especially in bottomland hardwoods, riparian areas, and flooded deciduous swamps (Dykstra et al. 2008). Red-shouldered hawks are considered partial migrants with birds in the northern portion of their range moving southward during the fall and winter migration periods (Dykstra et al. 2008). Like other hawk species, red-shouldered hawks have a varied diet consisting primarily of small mammal species, but with also feed on birds, crayfish, and insects (Dykstra et al. 2008). The red-shouldered hawk can be found throughout the year in central and eastern Maryland. In western Maryland, most red-shouldered hawks are migratory (Ellison 2010).

The number of red-shouldered hawks observed along routes surveyed in the State during the BBS has shown an increasing trend in the State between 1966 through 2011 estimated at 2.9% annually (Sauer et al. 2012). Between 2001 and 2011, the number of red-shouldered hawks observed in the State during the BBS has also shown an increasing trend estimated at 3.5% annually (Sauer et al. 2012). Across all routes surveyed in the United States, the number of red-shouldered hawks observed during the BBS has shown an increasing trend estimated at 2.9% between 1966 and 2011 (Sauer et al. 2012). Data gathered during the BBS conducted across all routes surveyed in the New England/Mid-Atlantic Coast (BCR 30) region shows increasing trends from 1966 through 2011 of 2.7% (Sauer et al. 2012). In areas surveyed during the CBC, the number of red-shouldered hawks observed has shown a general increasing trend in the State between 1966 through 2011 (NAS 2010). The Partners in Flight Science Committee (2013) estimated the statewide breeding population at 5,000 hawks based on BBS data.

Similar to other raptor species addressed in this assessment, most requests received by WS involve damages or threats of damages associated with red-shouldered hawks at airports within the State. Between FY 2006 and FY 2012, WS has addressed most requests for assistance associated with threats involving red-shouldered hawks using non-lethal dispersal methods (see Table 4.8). WS has addressed 36 red-shouldered hawks in the State between FY 2006 and FY 2012 using non-lethal methods with 17 red-shouldered hawks being lethally taken by WS. WS' lethal removal of red-shouldered hawks in the State occurred pursuant to depredation permits issued by the USFWS. No depredation permits were issued by the USFWS to other entities to take red-shouldered hawks in Maryland between 2006 and 2011.

Table 4.8 – Number of red-shouldered hawks addressed by WS in Maryland, FY 2006 – FY 2012

Fiscal Year	Dispersed by WS	Translocated by WS	WS' Take
2006	2	0	1
2007	4	0	2
2008	13	0	3
2009	0	0	0
2010	2	0	1
2011	5	2	9
2012	1	7	1
TOTAL	**27**	**9**	**17**

Based on the number of red-shouldered hawks addressed annually by WS and in anticipation of continuing to receive requests for assistance associated with red-shouldered hawks, WS could take up to 15 red-shouldered hawks annually in the State to alleviate damage or threats of damage. Take would only occur when authorized by the USFWS through the issuance of depredation permits and only at levels permitted. If the breeding population in the State remains at least stable, an annual take of up to 15 red-shouldered hawks would represent 0.3% of the estimated breeding population of 5,000 red-shouldered hawks in the State. Based on the limited take that could occur by WS when compared to the estimated breeding population and the permitting of the take by the USFWS, WS' take would not adversely affect red-shouldered hawk populations in the State.

In addition, up to five nests could be destroyed, including eggs contained in nests, to alleviate damage and threats, primarily associated with the aggressive behavior of hawks toward people. The WS program has previously been requested by homeowners in Maryland to assist with reducing the threat of injury caused by nesting red-shouldered hawks on their property. Breeding pairs of red-shouldered hawks with nests in trees near residences can exhibit aggressive behavior and actively attack people living near the nest. The aggressive behavior of the hawks can cause injuries as the hawks swoop down toward people causing lacerations as the hawks hit people with their talons.

Red-shouldered hawks lay eggs from early-March through late-May (Ellison 2010). Nestlings can be found from late-March through mid-July (Ellison 2010). If eggs were present in a nest, those eggs could be destroyed by shaking or breaking open the egg. The clutch size for red-shouldered hawks ranges from two to four eggs (Ellison 2010). Therefore, up to 20 red-shouldered hawk eggs could be addressed when removing up to five nests annually.

WS would use hand tools to destroy nests. The removal of nests and eggs would occur in an attempt to cause the hawks to abandon the nest site and to disperse the hawks from the area. The removal of a red-shouldered hawk nest, including the removal of eggs, is prohibited by the MBTA unless authorized through the issuance of a depredation permit by the USFWS pursuant to the Act. WS' proposed activities, including the removal of nests and eggs would occur pursuant to the Act through the issuance of a permit for those activities.

As discussed previously, the destruction of nests and eggs as part of damage management activities is generally considered a non-lethal method that does not adversely affect populations when the number of eggs destroyed is limited. If 20 eggs were destroyed, those eggs would represent 0.4% of the current estimated statewide breeding population of red-shouldered hawks. However, take of up to 20 eggs annually would be unlikely given the average number of eggs per nest ranges from two to four. The take of 20 eggs was analyzed to present a worst-case scenario to determine the potential for population impacts. WS would also work with the homeowner to prevent further nesting in areas where damage or threats of damage could occur by recommending the implementation of exclusionary devices and harassment to encourage the hawks to nest in other areas.

Red-tailed Hawk Biology and Population Impact Analysis

The red-tailed hawk is one of the most widely distributed raptor species in North America with a breeding range extending from northern Canada and Alaska southward to northern and central Mexico (Preston and Beane 2009). In the northern portion of their range, including most of Canada and Alaska, the red-tailed hawk is a common summer resident migrating southward during the fall and winter migration periods. In the conterminous United States, the red-tailed hawk is a year-round resident, including Maryland (Preston and Beane 2009). Migration movements are primarily dependent on snow cover and the availability of prey items with most migratory movements being less than 1,500 kilometers (Preston and Beane 2009). Red-tailed hawks are capable of exploiting a broad range of habitats with the availability of structures for perching, nesting, and the availability of prey items being the key factors. Red-tailed hawks are most commonly found in open areas interspersed with patches of trees or other similar structures and are tolerant of some human activity with breeding populations occurring in large, urban environments (Preston and Beane 2009).

Populations of red-tailed hawks in North America showed increasing trends during the mid- to late-1900s. These increasing trends were likely in response to the conversion of forested areas to agricultural production, which provided more open habitat environments (Preston and Beane 2009). Between 1966 and 2011, the number of red-tailed hawks observed along routes surveyed during the BBS has shown an increasing trend estimated at 1.9% annually across all routes surveyed in the United States (Sauer et al. 2012). Across all routes surveyed, the increase has been estimated at 1.7% annually (Sauer et al. 2012). The red-tailed hawk is by far the most conspicuous and widespread hawk in the State (Ellison 2010). Red-tailed hawks need large trees to support their big stick nests and an abundance of hunting perches such as snags, electric poles, power line towers, and fence posts (Ellison 2010). The diets of red-tailed hawks are extremely varied containing a large number of rodents and other small mammals. However, red-tailed hawks can occasionally cause depredation problems with free-ranging poultry and game farm fowl (Hygnstrom and Craven 1994).

Red-tailed hawks have become increasingly tolerant of humans and their habitations, frequently nesting in treed areas of suburbs and cities, sometimes even nesting on buildings (Ellison 2010). Local pairs often perch together from January onward with nest building or refurbishing of an old nest beginning in mid-February (Ellison 2010).

The statewide breeding population of red-tailed hawks has been estimated at 2,000 hawks based on BBS data (Partners in Flight Science Committee 2013). Trending data from the BBS indicates the number of red-tailed hawks observed along BBS routes in the State have shown an increasing trend of 3.4% annually in the State from 1966 through 2011, with a 2.7% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). In the New England/Mid-Atlantic Coast region, the number of red-tailed hawks observed have also shown increasing trends estimated at 3.6% annually from 1966 through 2011, with a 3.2% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). The number of red-tailed hawks observed during the CBC conducted annually in the State is also showing a general increasing trend (NAS 2010).

The open grassland habitats of airports and the availability of perching structures often attract red-tailed hawks to airports where those birds pose a strike risk with aircraft. Most requests for assistance received by WS in Maryland are associated with the threats red-tailed hawks pose to aircraft. However, WS could occasional receive requests associated with red-tailed hawks where damages or threats of damages to agricultural resources were occurring. For example, red-tailed hawks are known to capture and feed on free-ranging chickens. WS has addressed previous requests for assistance associated with red-tailed hawks with primarily non-lethal dispersal methods. From FY 2006 through FY 2012, the WS program in Maryland employed non-lethal methods to trap and translocate 33 red-tailed hawks from airports. Red-tailed hawks were live-captured using live-traps (*e.g.*, bal-chatri traps, Swedish Goshawk traps) and translocated from areas where threats to human health and safety were occurring. In addition, red-tailed hawks captured and translocated were banded for identification purposes using United States Geological Survey approved metal leg-bands appropriate for the species. Banding occurred pursuant to a banding permit issued by the United States Geological Survey.

Under the proposed action alternative, WS would continue to employ those live-traps for capturing red-tailed hawks and would continue to band and translocate hawks. Based on previous requests for assistance and in anticipation of receiving additional requests for assistance at airports in the State, up to 50 red-tailed hawks could be live-captured and translocated annually. Red-tailed hawks captured and translocated could be banded for identification purposes using United States Geological Survey approved metal leg-bands appropriate for the species. Banding would occur pursuant to a banding permit issued by the United States Geological Survey. Fair et al. (2010) stated "[w]*hen appropriate* [leg] *band sizes are used, the occurrence and rate of adverse effects on the subjects is ordinarily very low*".

Although the live-capture and translocating of red-tailed hawks would be a non-lethal method of reducing damage that would occur primarily during the migration periods, red-tailed hawks could be translocated during their nesting season, which could lower nesting success. Eggs are generally observed in nests of red-tailed hawks as early as mid- to late-March (Preston and Beane 2009). Nestlings are generally present in nests from late May through early July (Preston and Beane 2009).

Although the incubation of eggs can occur by either the male or female, incubation occurs primarily by the female while the male contributes a shorter amount of time to incubation each day (Preston and Beane 2009). Both the male and female red-tailed hawks feed the young once hatched; however, the female actually feeds the young more often while the male does more of the hunting (Preston and Beane 2009). Cooperative breeding has been documented in the red-tailed hawk, with two females and one male all

working together (Preston and Beane 2009). Information on the nesting success of red-tailed hawks after the removal of one of the adults is not available.

The average clutch size for breeding pairs of red-tailed hawks is two to three eggs, with as many as four eggs being documented. If the live-capture and translocation of 50 red-tailed hawks resulted in 50 failed nests, the total number of fledglings produced in the State could be reduced by 200 red-tailed hawks if no other factors were considered. However, the annual reproductive success rate (*i.e.*, the percentage of nesting attempts that result in at least one fledgling) has been shown to be highly variable, but an 83% success rate is generally estimated for wild populations (Preston and Beane 2009). The rate of egg hatching success is 84% with nearly 73% of hatchlings reaching the fledgling stage (Preston and Beane 2009).

Although reduced nesting success could occur by removing one of the adult pairs of red-tailed hawks during the nesting season, available information indicates the successful raising of young could occur if only one adult was left to tend to the young. The degree of success would likely be related to the sex of the adult removed, the developmental stage of the eggs or nestlings, availability of food sources, and the time of year the removal of one of the adult pairs occurred. In addition, re-nesting has been documented for red-tailed hawks after nest failures (Preston and Beane 2009). If both adults were removed, the nest would not be successful.

WS could also be requested to employ lethal methods under the proposed action alternative to address damage or threats of damage associated with red-tailed hawks. Similar to the other raptor species addressed under the proposed action alternative, lethal take would only occur when birds were identified as being an immediate threat to human safety and/or property. From FY 2006 through FY 2012, WS lethally removed 70 red-tailed hawks, with the highest annual take occurring in FY 2007 when 17 hawks were lethally removed (see Table 4.9).

Table 4.9 – Number of red-tailed hawks addressed by WS in Maryland, FY 2006 – FY 2012

Fiscal Year	Dispersed by WS	Translocated by WS	WS' Take
2006	129	0	10
2007	149	0	17
2008	79	0	10
2009	26	0	8
2010	43	1	5
2011	21	10	7
2012	11	22	13
TOTAL	**458**	**33**	**70**

Based on previous requests received by WS, up to 25 red-tailed hawks could be lethally removed by WS to alleviate damage. Based on a breeding population estimated at 2,000 red-tailed hawks, the lethal removal of up to 25 red-tailed hawks by WS would represent 1.3% of the estimated breeding population.

However, the lethal removal of red-tailed hawks is not likely to occur strictly during the breeding season. The number of red-tailed hawks present in the State likely increases during the migration periods as hawks move between breeding areas and wintering areas. In addition, the number of red-tailed hawks present in the State likely increases during the fall migration when juveniles are present. The number of red-tailed hawks present during the migration periods likely fluctuates. Therefore, the lethal removal of red-tailed hawks would likely represent a lower percentage of the actual population within the State. Take by WS would only occur when permitted by the USFWS and the MDNR and only at levels authorized, which ensures any take by WS would occur within allowable limits for the species.

American Coot Biology and Population Impact Analysis

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

Historically, American coots were commonly found in the State during the migration periods and during the winter, frequently found along all of the tidewater sections of Maryland and also inland reservoirs, ponds, and lakes (Ellison 2010). Until 1970, American coots were not known to nest in Maryland and they were described as a casual summer vagrant (Ellison 2010). The breeding season in Maryland appears to begin in late May and continue through August (Ellison 2010).

Although coots can be observed in the State during the breeding season, no data is currently available from BBS routes surveyed in the State (Sauer et al. 2012). Across all BBS routes surveyed in the United States, the number of coots observed has shown a stable trend since 1966, with a 1.3% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). The number of coots observed in the State during the annual CBC surveys has shown a variable trend but a general overall declining trend since 1966 (NAS 2010). The average number of American coots observed in areas surveyed during the CBC from 2002 through 2011 was 1,607 coots. The lowest number of coots observed during the CBC from 2002 through 2011 occurred in 2010 when 702 coots were recorded. The highest number of coots recorded in the State during the CBC between 2002 through 2011 occurred in 2006 when 3,379 coots were observed (NAS 2010). Coots also maintain sufficient population densities to allow for annual hunting seasons. During the 2011 hunting season, an estimated 400 coots were harvested in the State, which compared to 800 coots harvested in the State during the 2010 hunting season (Raftovich et al. 2012).

WS has not received requests for assistance associated with damage or threats of damage caused by coots. However, WS could receive requests to provide direct operational assistance with managing damage associated with coots in the State, primarily at airports. If requests for assistance were received, WS would employ an integrated approach using lethal and non-lethal methods. Due to the flocking behavior of coots during the migration periods, WS anticipates that up to 100 coots could be lethally removed annually as part of an integrated approach to managing damage under the proposed action.

The number of coots present in the State during the migration period and during the winter is currently unknown. However, the number of coots present in the State is likely highest during the migration periods, since the number of coots present in the State during the winter is likely related to weather conditions and the availability of open water for foraging. Requests for assistance to manage damage in the State primarily occur during the migration periods and during the winter when coots are concentrated in large numbers in the State.

If WS had lethally removed 100 coots during 2010 and 2011, WS' take would have represented 12.5% of the number of coots harvested in the State during 2010 and 25.0% of the coots harvested in the State during the 2011 hunting season. Using the average CBC observation number of 1,607 coots, WS' take of 100 coots would represent 6.2% of the average number of coots observed in areas of the State surveyed during the CBC from 2002 through 2011. Using the lowest number of CBC observations of 702 coots, the take of 100 coots would only represent 14.2% of the lowest number of coots observed in areas surveyed during the CBC conducted from 2002 through 2011.

CBC data is best interpreted as an indication of long-term trends in the number of birds observed wintering in areas surveyed and is not intended to represent population estimates of wintering bird populations. However, the information was presented in this analysis and compared to WS' proposed take to provide an indication of the take magnitude that could occur by WS when compared to the number of coots observed in the State during the CBC. The number of coots observed in areas surveyed during the CBC would be considered a minimum estimate given the survey parameters of the CBC and the survey only covering a small portion of the State.

Killdeer Biology and Population Impacts Analysis

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

Distinguishing characteristics include a dark, double banded breast, with the top band completely encircling the upper body/breast. Another band is located at the head, resembling a mask absent of the facial portion. The band is continuous, thinning while going across the face along the forehead region and above the bill, and thickening at the supercilium; extending around the eye and onward around the back of the head. Plumage is relatively absent of complexity with the exception of a vividly colored, reddish-orange rump that is visible during flight and behavioral displays. The rest the body consists of a grayish-brown coloration along the dorsal side, crown, and nape, while the ventral region is white. Sex characteristics are difficult to determine since killdeer are essentially monomorphic. The clutch of up to four eggs is laid in a ground scrape in open habitats (Leck 1984).

Since 1966, the number of killdeer observed during the breeding season in New England/Mid-Atlantic Coast region have shown a declining trend estimated at -0.5% annually with a -2.5% annual decline estimated since 2001 (Sauer et al. 2012). Across all BBS routes in the United States, the number of killdeer observed during the breeding season has shown a slightly declining trend since 1966 estimated at -0.5% annually, with a 0.1% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). In Maryland, the number of killdeer observed during the BBS has shown declining trends since 1966 estimated at -0.4% annually with a -3.2% annual decline estimated from 2001 through 2011 (Sauer et al. 2012). Currently, no breeding population data is available for killdeer in Maryland. Based on broad-scale surveys, the United States Shorebird Conservation Plan estimated the population of killdeer in the United States to be approximately 2,000,000 birds in 2001 (Brown et al. 2001). Since 1966, the number of killdeer observed in areas surveyed during the CBC has shown a variable pattern; however, overall, the number observed has shown a slightly declining trend (NAS 2010).

Requests for assistance associated with killdeer occur primarily at airports in the State. From FY 2006 through FY 2012, WS has lethally removed 183 killdeer in the State at airports to reduce damages and threats associated with aircraft striking killdeer. The highest annual lethal removal of killdeer by WS occurred in FY 2006 when 48 killdeer were lethally removed (see Table 4.10). In addition, WS has employed non-lethal methods at airports in the State to harass 1,012 killdeer from FY 2006 through FY 2012. Of those killdeer addressed by WS from FY 2006 through FY 2012, nearly 85% were addressed using non-lethal dispersal methods. In total, the USFWS authorized the lethal removal of 433 killdeer from 2006 through 2012 in the State. The highest authorized annual take allowed by the USFWS from 2006 through 2012 was 65 killdeer.

Table 4.10 – Number of killdeer addressed in Maryland from 2006 to 2012

Year	Dispersed by WS[1]	Take Authorized by USFWS[2]	Take under Depredation Permits	
			WS' Take[1]	Total Take[2]
2006	198	62	48	52
2007	215	50	41	39
2008	215	61	17	12
2009	196	65	27	37
2010	33	65	9	0
2011	91	65	29	22
2012	64	65	12	14
TOTAL	**1,012**	**433**	**183**	**176**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year

As the number of airports requesting assistance from WS to manage damage and threats associated with killdeer increases, the number of killdeer lethally taken annually is also likely to increase when lethal methods are deemed appropriate for use to resolve damage and threats. To address those additional efforts, WS could lethally remove up to 50 killdeer annually under the proposed action.

With a relative abundance of 3.3 killdeer observed per route during the BBS conducted in Maryland (Sauer et al. 2012), a population estimate for killdeer in Maryland alone could be estimated at 3,200 killdeer based on the land area of the State. With a population estimated at nearly 3,200 killdeer, WS' take of up to 50 killdeer would represent 1.5% of the estimated statewide population in Maryland. If the USFWS continued to authorize a maximum take level of 65 killdeer annually in the State, the cumulative take would represent 2.0% of a population estimated at 3,200 killdeer. The permitting of the take of killdeer by the USFWS pursuant to the MBTA ensures take would be considered as part of trending and population data available for killdeer. 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.

Bonaparte's Gull Biology and Population Impact Analysis

Bonaparte's gulls are a small gull characterized by their size, pink legs, and black beak (Burger and Gochfeld 2002). Bonaparte's gulls nest in trees of sparsely wooded areas around ponds, bogs, and bays in the taiga and boreal forests of Alaska and northern Canada (Burger and Gochfeld 2002). Bonaparte's gulls are an abundant migrant and winter visitor over much of North America with large flocks occurring in the coastal areas close to human activity. Habitat during the non-breeding season includes lakes, rivers, marshes, sewage lagoons, costal bays and harbors, sandbars and mudflats (Burger and Gochfeld 2002). An opportunistic feeder, their diet consists of invertebrates and fish (Burger and Gochfeld 2002). Like most gulls, Bonaparte's gulls are highly social. Bonaparte's gulls form flocks in the tens of thousands to migrate, roost, and forage during the non-breeding season (Burger and Gochfeld 2002).

Most Bonaparte's gulls in the northeastern United States migrate and winter in the Atlantic Northern Forest (BCR 14) region and Pelagic Bird Conservation Region (PBCR) 78 (MANEM Waterbird Conservation Plan 2006). The spring migration begins in mid-March and continues through the end of May while the fall migration begins in late-July and can continue through January (Burger and Gochfeld 2002). As inland waters freeze during the winter, Bonaparte's gulls are often pushed further south and toward the coastal areas (Burger and Gochfeld 2002). Non-breeding gulls often linger south of the breeding range (Burger and Gochfeld 2002). There are no breeding colonies of Bonaparte's gulls in Maryland. The number of Bonaparte's gulls observed in areas surveyed during the CBC conducted annually in the State has shown a cyclical pattern since 1966 but an overall general stable trend (NAS

2010), which is likely a result of the severity of winters and the availability of open water for foraging. Given the gulls isolated breeding location and wide winter distribution, population information is limited. Burger and Gochfeld (2002) indicated the population has "*increased greatly in numbers since early 1990s*". The MANEM Waterbird Conservation Plan (2006) estimated the total population of Bonaparte's gulls at 255,000 to 525,000 gulls and assigned a conservation rank of "*moderate concern*" to the total population in North America. The International Union for Conservation of Nature (IUCN) ranks Bonaparte's gulls in a category of "*least concern*" based on their wide geographical distribution, increasing population trend, and large population estimate (IUCN 2013).

The number of Bonaparte's gulls lethally removed or dispersed by WS from FY 2006 through FY 2012 and the total number of gulls taken by all entities from 2006 to 2012 to alleviate damage and threats associated with Bonaparte's gulls are shown in Table 4.11. From FY 2006 through FY 2012, WS lethally removed 40 Bonaparte's gulls and used non-lethal methods to disperse 140 gulls. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of Bonaparte's gulls. From 2006 to 2012, the USFWS authorized the lethal removal of 325 gulls per year, except in 2007 when the USFWS authorized the take of 300 gulls. In total, 40 Bonaparte's gulls were lethally removed from 2006 through 2012 pursuant to permits issued by the USFWS.

Table 4.11 – Number of Bonaparte's gulls addressed in Maryland from 2006 to 2012

Year	Dispersed by WS[1]	USFWS Authorized Take[2]	Take under Depredation Permits	
			WS' Take[1]	Total Take[2,3]
2006	0	325	0	2
2007	3	300	2	0
2008	66	325	7	7
2009	0	325	19	19
2010	0	325	0	0
2011	71	325	12	12
2012	0	325	0	0
TOTAL	**140**	**2,250**	**40**	**40**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

To address requests for assistance to manage damage and threats associated with Bonaparte's gulls in the future, up to 25 Bonaparte's gulls could be lethally removed annually by WS under the proposed action alternative to alleviate damage and threats. WS anticipates receiving requests for assistance to address damage and threats of damage occurring at airports where gulls pose a strike hazard to aircraft and at landfills where they feed and loaf causing damage to equipment and buildings from excessive accumulations of droppings. Gulls also pick up refuse at landfills and carry it off the property to feed, which could deposit garbage and fecal droppings on buildings, equipment, and vehicles in neighboring areas.

Except for 2007, the USFWS authorized the annual take of 325 Bonaparte's gulls in Maryland by all entities between 2006 and 2012. In total, 40 gulls were lethally removed pursuant to depredation permits from 2006 through 2010 in the State. The best available data estimates the population of Bonaparte's gulls in North America at 255,000 to 525,000 gulls (MANEM Waterbird Conservation Plan 2006). If the USFWS continued to authorize the lethal take of up to 325 gulls annually and the actual lethal removal reached 325 gulls, the take would represent approximately 0.1% of the estimated population in North America. If the take of 25 gulls annually by WS occurred in addition to the 325 gulls authorized annually by the USFWS, the cumulative take would continue to represent 0.1% of the estimated population in North America. The take of Bonaparte's gulls could only occur when permitted by the USFWS and the

MDNR through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized at the discretion of the USFWS and the MDNR. The take of Bonaparte's gulls by WS would only occur at levels authorized by the USFWS and the MDNR; therefore, the cumulative removal of gulls would be considered as part of population management objectives by the USFWS and the MDNR.

Laughing, Ring-billed, Herring, and Greater Blacked-backed Gull Population Impact Analysis

Biological assessments for identifying the potential impact of harvest and/or removal programs on bird populations have a long history of application in the United States, primarily with waterfowl species to determine allowable harvest during annual hunting seasons. Population modeling and extensive monitoring programs form the basis of an adaptive decision-making process used each year for setting migratory game bird harvest regulations, while ensuring that levels of take are sustainable. Increasing human-wildlife conflicts caused by migratory bird species (both game and nongame), and their potential impacts on sensitive species and their habitats, has resulted in greater use of analytical tools to evaluate the effects of authorized take to achieve population objectives (Runge et al. 2009). One such tool is referred to as the Potential Biological Removal (PBR) model (Wade 1998, Runge et al. 2004).

Although no hunting season exists for gulls, the lethal removal of gulls does occur under depredation permits issued by the USFWS to alleviate damage and threats of damage. To estimate the allowable take level for gulls, the USFWS has constructed PBR models for laughing gulls, ring-billed gulls, herring gulls, and great black-backed gulls that nest in Atlantic Northern Forest (BCR 14) region and New England/Mid-Atlantic Coast (BCR 30) region (Seamans et al. 2007). The gulls present in Maryland are those gulls likely to migrate from, or have breeding colonies in, BCR 14 and BCR 30, which covers most of the coastal and inland areas of the upper northeastern United States. Since population estimates and trends for gulls are limited, the PBR models developed by the USFWS for BCR 14 and BCR 30 were used to analyze potential population impacts to gull species under the proposed action alternative.

To determine levels of allowable take, or cumulative impacts over a large geographic area, the information required for the PBR model must include a minimum estimate of the population size using science-based monitoring programs (*e.g.*, BBS, CBC, coordinated colony surveys) and the intrinsic rate of population growth. The formula for the PBR model is:

$$\text{PBR} = \tfrac{1}{2}\, R_{max} N_{min} F_R$$

Where R_{max} is the maximum population growth rate at low densities and in the absence of removal, N_{min} is the minimum population size, and F_R is a recovery factor ranging from 0.1 to 2.0 (Runge et al. 2004). The recovery factor is a qualitative assessment that is typically set at low levels for endangered ($F_R = 0.1$) or threatened species ($F_R = 0.5$; Taylor et al. 2000), or if the status of the population is poorly known (Runge et al. 2004). However, using a recovery factor above 1.0 has been discussed for species in which the management objective is to hold the population at a smaller fraction of its carrying capacity (Runge et al. 2009).

To estimate R_{max} for gulls in BCR 14 and BCR 30, the Slade formula (Slade et al. 1998) was used:

$$1 = p\lambda^{-1} + 1_{\alpha}\, b\lambda^{-\alpha} - l_{\alpha} b p^{(\omega-\alpha+1)}\, \lambda^{-(\omega+1)}$$

where p is adult annual survival rate, $l\alpha$ is the survival rate from birth to age at first reproduction, b is the number of female offspring per female of reproductive age per year, α is the age at first reproduction, ω is the age at last reproduction, and λ is the intrinsic rate of population change. After solving the above equation for λ, R_{max} was estimated as $\ln(\lambda)$. Population parameter estimates were taken from available

literature for each gull species (see Table 4.12), or in cases where estimates were not available, surrogate estimates from closely related species were used (Seamans et al. 2007).

Table 4.12 - Demographic parameter estimates (θ) used for estimating R_{max} and the PBR of gulls in BCR 14 and BCR 30 (Seamans et al. 2007).

		Great black-backed gull[1]		Herring gull[2]		Laughing gull[3]		Ring-billed gull[4]	
Parameter	**Age class**	**(θ)**	**SE (θ)**	**(θ)**	**SE (θ)**	**(θ)**	**SE (θ)**	**(θ)**	**SE (θ)**
p	Adult	0.87	0.03	0.87	0.03	0.87	0.03	0.87	0.03
*l*α	Adult	0.42		0.42		0.56		0.56	
	Hatch Year	0.729	0.035	0.729	0.035	0.729	0.035	0.729	0.035
	Second Year	0.886	0.024	0.886	0.024	0.886	0.024	0.886	0.024
b		0.784	0.018	0.752	0.022	0.752	0.022	0.752	0.022
α		5		5		3		3	
ω		19		20		19		19	
N_{min}		250,000		390,000		270,000		54,000	
R_{max}		0.09	0.027	0.086	0.027	0.113	0.036	0.113	0.036

[1]Good 1998
[2]Pierotti and Good 1994
[3]Burger 1996, Dinsmore and Schreiber 1974
[4]Seamans et al. 2007, Pollet et al. 2012

Because there was uncertainty associated with demographic parameter estimates, allowable take levels were calculated using a simulation approach to estimate a range of R_{max} values with parameter estimates randomly drawn from normal distributions based on reported standard errors (see Table 4.12; Seamans et al. 2007). Population estimates (N_{min}) for each species were based on the number of gulls at known breeding colonies in BCR 14 and BCR 30 during the mid-1990s (MANEM Waterbird Regional Plan 2006), and adjusted using a conservative estimate of 0.75 non-breeding gulls for every breeding adult to estimate the total population (Seamans et al. 2007). Allowable take levels (± 95% CI) for each of the four gull species addressed in this assessment under three recovery factors (0.5, 1.0, 1.5) in BCR 14 and BCR 30 are presented in Table 4.13.

Table 4.13 - Potential Biological Removal (± 95% CI) of gulls in BCR 14 and BCR 30 under three recovery factors (Seamans et al. 2007).

Species	F_R = 0.5	F_R = 1.0	F_R = 1.5
Laughing Gull	7,685 (3,927–12,685)	15,274 (7,188–23,042)	26,044 (10,798–34,818)
Ring-billed Gull	1,532 (713–2,318)	3,065 (1,455–4,634)	4,588 (2,161–6,951)
Herring Gull	8,360 (3,892– 12,656)	16,725 (7,788–25,397)	25,048 (11,716–37,875)
Great Black-backed Gull	5,614 (2,764 – 8,358)	11,234 (5,561–16,670)	16,853 (8,364–25,086)

Most states in the northeastern United States periodically conduct colonial waterbird surveys to determine breeding population trends for many colonial waterbirds, including gulls. Most state-level population estimates are provided as the number of breeding pairs of gulls surveyed. Therefore, one breeding pair equals two gulls. Gulls are migratory bird species and the breeding population of gulls estimated at the state-level are only representative of the number of gulls present in a state during a short period (*i.e.*, during the breeding season). The breeding colony surveys do not account for migratory gulls present during the winter, nor do they account for the population of non-breeding gulls (*i.e.*, sub-adults and non-

breeding adults) present during the breeding season. Therefore, to better account for the mobility of gulls and the fact that gulls present in the northeastern United States are likely gulls that nest and migrate throughout BCR 14 and BCR 30, the USFWS developed models based on the geographical scope of the nesting populations of gulls. In addition, PBR models developed by the USFWS are based on breeding and non-breeding gulls, as opposed to colonial waterbird surveys. PBR models estimate allowable take by calculating a total population for each gull species using 0.75 non-breeding gulls for every breeding adult. Since the take of gulls to alleviate damage can occur throughout the year and not just during the breeding season, a comprehensive model like the PBR model, that includes non-breeding populations of gulls, allows for a systemic analysis of allowable take on gull populations.

Laughing Gull Biology and Population Impact Analysis

Laughing gulls are a small gull characterized by their black hood, red beak, and loud "*laughing*" call (Burger 1996). In the United States, laughing gulls can be found from Maine south along the Atlantic and Gulf coasts (including the coastal areas of BCR 14 and BCR 30) during the breeding season and from North Carolina south along the Atlantic and Gulf coast during the rest of the year (Burger 1996). During the breeding season, laughing gulls use coastal habitats such as salt marshes, sandy islands with patches of long grass for nesting. These areas, as well as lakes, marshes, impoundments, meadows and plowed fields are used for foraging (MANEM Regional Waterbird Plan 2006). Laughing gulls' diet consists of invertebrates, including earthworms, insects, snails, crabs, crab eggs and larva, fish, squid, berries, and garbage (Burger 1996).

Laughing gulls can be found nesting along the coastal areas of BCR 14 and BCR 30 with most breeding colonies occurring in BCR 14 (MANEM Regional Waterbird Plan 2006). In the 1970s, the breeding population of laughing gulls in BCR 14 and BCR 30 was estimated at 129,768 gulls distributed among 63 nesting sites (MANEM Regional Waterbird Plan 2006). By the 1990s, the breeding population of laughing gulls had increased to an estimated 205,348 gulls distributed among 275 nesting sites (MANEM Regional Waterbird Plan 2006). Seamans et al. (2007) estimated the minimum population of breeding and non-breeding laughing gulls in BCR 14 and BCR 30 at 270,000 gulls (see Table 4.12). Between 1966 and 2011, the number of laughing gulls observed across all BBS routes surveyed in the eastern United States has increased at an estimated rate of 3.2% annually, with a 5.3% annual increase estimated from 2001 through 2011 (Sauer et al. 2012). Across all BBS routes surveyed in BCR 30, the number of laughing gulls observed has increased annually estimated at 5.1% from 1966 through 2011, with a 4.3% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). In Maryland, the number of laughing gulls observed in areas surveyed during the BBS has shown an increasing trend estimated at 6.1% annually, with a 3.9% annual increase occurring from 2001 through 2011 (Sauer et al. 2012).

Laughing gulls are commonly seen in Maryland and have been known to nest in the State since 1915 when the first colony with 100 pairs was reported at Striking Marsh in Worcester County (Robbins and Blom 1996). With the expansion of breeding herring gulls in Maryland, laughing gulls have modified their nesting locations and they have been displaced completely from former colonies (Robbins and Blom 1996). Between 1993 and 2003, the number of laughing gulls in breeding colonies on the Delmarva Peninsula has remained relatively stable at approximately 45,000 breeding pairs (Ellsion 2010); however, population counts specific to Maryland are not available. CBC data for laughing gulls in the Commonwealth has shown a cyclical trend since 1966, with relatively few birds observed in areas surveyed (NAS 2010).

From FY 2006 through FY 2012, the WS program in Maryland has responded to requests for assistance to manage damage or threats associated with laughing gulls. The number of laughing gulls addressed by WS between FY 2006 and FY 2012 to alleviate damage or threats of damage when requested are shown in Table 4.14. WS has employed non-lethal methods to disperse 51 laughing gulls in the State since FY

2006 to alleviate damage or threats of damage. In addition, WS lethally removed 30 laughing gulls from FY 2006 through FY 2012 to alleviate damage or threats of damage. Other entities have employed lethal methods to remove 300 gulls to alleviate damage.

Table 4.14 – Number of laughing gulls addressed in Maryland from 2006 to 2012

Year	Dispersed by WS[1]	Take Authorized by USFWS[2]	Take under Depredation Permits	
			WS' Take[1]	Total Take[2]
2006	0	300	1	36
2007	6	200	0	40
2008	0	255	0	0
2009	15	207	2	49
2010	30	307	27	90
2011	0	307	0	48
2012	0	357	0	37
TOTAL	**51**	**1,933**	**30**	**300**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year

To address request for assistance to manage damage associated with laughing gulls in the future, up to 1,000 laughing gulls could be lethally taken annually by WS to alleviate damage and threats. The increased level of take analyzed when compared to the take occurring by WS from FY 2006 through FY 2012 is in anticipation of requests to address threats of aircraft strikes at airports and to reduce damage to natural resources, such as nest site competition between laughing gulls and other colonial nesting waterbirds. In addition, WS could destroy up to 500 laughing gull nests (along with eggs) annually under the proposed action alternative to discourage nesting in areas where the nests or adult gulls cause damage, pose a threat of damage, or where laughing gulls compete for nesting locations for other species. Repeated nest failures often cause birds to abandon nesting locations.

From 2003 through 2011, the lethal annual take of laughing gulls by all entities in the northeastern United States (USFWS Region 5) has ranged from 4,417 to 6,029 gulls with an average annual take of 5,326 laughing gulls. The PBR model for laughing gulls in BCR 14 and BCR 30 estimated that nearly 15,000 laughing gulls could be taken annually with no adverse effect on the current population. Current removal levels from all known entities in the breeding range of laughing gulls has not exceeded the level of annual removal that the PBR model predicts would cause a decline in the breeding laughing gull population.

The best available data estimates that the population of laughing gulls in BCR 14 and BCR 30 at 270,000 birds (Seamans et al. 2007). However, because population trends indicate an increasing laughing gull population, the population is likely greater than 270,000 birds, which is considered a minimum population (N_{min}). Based on this estimate, the annual removal of up to 1,000 laughing gulls by WS under the proposed action alternative would represent 0.4% of the population. From 2003 through 2010, the annual take of laughing gulls by all entities in the northeastern United States (USFWS Region 5) has averaged 5,238 gulls. If the take by other entities remains stable, the average annual cumulative take by all entities under the proposed action alternative would be 6,326 gulls or 2.3% of the estimated population. The PBR model for laughing gulls in BCR 14 and BCR 30 estimates 15,274 laughing gulls could be lethally removed annually with no adverse effect on the current population (see Table 4.13). Current take from all known entities has not exceeded this level of take.

Based on the best available information, WS' potential impacts to populations of laughing gulls would be expected to be insignificant to their overall viability and reproductive success. This determination is based on increasing population trends and the limited take proposed when compared to the estimated

population. The take of laughing gulls can only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the MDNR and would occur at the discretion of the USFWS and the MDNR. The take of laughing gulls would only occur at levels authorized by the USFWS and the MDNR, which would ensure the cumulative effects on the laughing gull population would be considered as part of population management objectives for laughing gulls.

Additionally, impacts due to nest removal and destruction should have little adverse impact on the laughing gull population. Nest destruction methods would generally be considered non-lethal when conducted before the development of an embryo. Laughing gulls are a long-lived species that have the ability to identify areas with regular human disturbance and low reproductive success, which can cause those birds to relocate and nesting elsewhere when confronted with repeated nest failure. Although there may be reduced fecundity for the individual laughing gulls affected by nest destruction, this activity has no long term effect on breeding adult laughing gulls. The destruction of up to 500 laughing gull nests annually by WS would occur in localized areas where nesting takes place and would not reach a level where adverse effects on laughing gull populations would occur. As with the lethal take of gulls, the take of nests must be authorized by the USFWS and the MDNR. Therefore, the number of nests taken by WS annually would occur at the discretion of the USFWS and the MDNR.

Ring-billed Gull Biology and Population Impact Analysis

Pollet et al. (2012) describes the ring-billed gull as a medium sized gull with a white head and the characteristic black ring on their bills. Ring-billed gulls are inland nesting gulls that are colonial ground nesters on sparsely vegetated islands in large lakes with occasional colonies on mainland peninsulas and near-shore oceanic islands (Pollet et al. 2012). Ring-billed gulls are commonly found in large numbers at garbage dumps, parking lots, and coastal beaches during the winter. Ring-billed Gulls are considered opportunistic feeders that feed primarily on fish, insects, earthworms, rodents, and grains (Pollet et al. 2012).

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 and, in the Great Lakes region, nesting colonies may be located on islands, parklands, slag yards, rooftops, breakwalls, and landfills (Blokpoel and Tessier 1986, Pollet et al. 2012). 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 through 1990. During the non-breeding season, ring-billed gulls can be observed along the coast and inland in agricultural fields, on golf courses, at landfills and shopping malls (Pollet et al. 2012) throughout the State. Ring-billed gulls are highly social birds nesting in colonies of 20,000 to 80,000 pairs and loafing at landfill sites in winter in groups of up to 50,000 individuals (Pollet et al. 2012).

The ring-billed gulls in BCR 14 and BCR 30 have been assigned a conservation rank of lowest concern (MANEM Regional Waterbird Plan 2006). The population of ring-billed gulls in BCR 14 and BCR 30 has increased at a rate of 8% to 11% per year since 1976 (MANEM Regional Waterbird Plan 2006). The number of ring-billed gulls observed across all routes surveyed in the United States during the BBS has increased annually estimated at 2.7% since 1966, with a 10.0% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). In the Atlantic Northern Forest (BCR 14) region, the number of gulls observed in areas surveyed during the BBS has increased annually at 4.6% since 1966, with a 7.4% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). The number of ring-billed gulls

observed along routes surveyed in the New England/Mid-Atlantic Coast (BCR 30) region has also increased annually estimated at 2.0% since 1966, with a 3.5% annual increase occurring from 2001 through 2011. An estimated 40,800 ring-billed gulls are believed to breed in BCR 14, while no breeding colonies are known to occur in BCR 30 (MANEM Regional Waterbird Plan 2006). Seamans et al. (2007) estimates the minimum population of breeding and non-breeding laughing gulls in BCR 14 and BCR 30 at 54,000 birds (see Table 4.12). In Maryland, the number of ring-billed gulls observed in areas surveyed during the BBS has shown an annual decline estimated at -0.1% since 1966, with a -2.8% annual decline occurring from 2001 through 2011 (Sauer et al. 2012). However, ring-billed gulls are not known to have nesting colonies in Maryland and ring-billed gulls present in the State during the breeding season are considered non-breeding gulls (Pollet et al. 2012).

The numbers of ring-billed gulls observed in areas surveyed during the CBC are also showing a general increasing trend in the State since 1966; however, since the mid-1990s, the number of gulls observed has shown a general declining to stable trend (NAS 2010). Between 2002 and 2011, 40,934 gulls have been observed per year on average in areas surveyed within the State during the CBC (NAS 2010). The highest total number of gulls observed during the CBC conducted from 2002 through 2011 occurred in 2008 when 64,655 gulls were counted. The lowest count occurred in 2005 when 27,821 gulls were observed during the CBC (NAS 2010).

Requests for direct operational assistance received by WS in the Maryland associated with ring-billed gulls occurs primarily from gulls feeding on or near airports. As shown in the Table 4.15, the USFWS has issued depredation permits to entities in Maryland to alleviate damage and threats, which has led to the lethal take of 864 ring-billed gulls from 2006 through 2012. WS has lethally removed 584 ring-billed gulls to alleviate damage and has employed non-lethal methods to disperse 4,777 ring-billed gulls in the State between FY 2006 and FY 2012.

Table 4.15 – Number of ring-billed gulls addressed in Maryland from 2006 to 2012

Year	Dispersed by WS[1]	Take Authorized by USFWS[2]	Take under Depredation Permits	
			WS' Take[1]	Total Take[2]
2006	842	1,150	28	172
2007	290	650	60	48
2008	832	1,060	93	118
2009	543	850	145	159
2010	451	1,350	47	33
2011	1,226	1,150	99	220
2012	593	1,350	112	114
TOTAL	**4,777**	**7,560**	**584**	**864**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year

Based on previous requests for assistance and in anticipation of receiving additional requests for assistance, up to 1,000 ring-billed gulls could be taken annually in the State to address damage and threats of damage when requests for assistance were received. The increased level of lethal removal anticipated when compared to the take occurring previously would be in anticipation of requests to address damage and threats of damage occurring at airports where they pose a strike hazard to aircraft, at landfills where they feed and loaf causing damage to equipment and buildings from excessive accumulations of droppings. Gulls can pick up refuse at landfills and carrying it off the property to feed, which can deposit garbage and droppings on buildings, equipment, vehicles, in neighboring areas. Between 2002 and 2011, 40,935 ring-billed gulls have been observed annually on average in the State during the CBC (NAS 2010). If 1,000 ring-billed gulls were lethally removed by WS, WS' take would represent 2.4% of the

average number of ring-billed gulls observed in the State during the CBC from 2002 through 2011. The number of gulls observed during the CBC in the State from 2002 through 2011 has ranged from 27,821 gulls observed in 2005 to a high of 64,655 gulls observed in 2008 (NAS 2010). Therefore, if WS had lethally removed 1,000 ring-billed gulls annually from 2002 through 2011 in the State, the annual take by WS would have represented 1.6% to 3.6% of the number of gulls observed in the State during the CBC.

As stated previously, CBC data is best interpreted as an indication of long-term trends in the number of birds observed wintering in areas surveyed and is not intended to represent population estimates of wintering bird populations. However, the information was presented in this analysis and compared to WS' proposed take to provide an indication of the take magnitude that could occur by WS when compared to the number of ring-billed gulls observed in the State during the CBC. The number of gulls observed in areas surveyed during the CBC would be considered a minimum estimate given the survey parameters of the CBC and the survey only covering a small portion of the State.

From 2003 through 2011, the number of ring-billed gulls lethally taken annually in the northeastern United States (USFWS Region 5) pursuant to depredation permits issued by the USFWS has ranged from 403 to 4,641 ring-billed gulls, with an average annual take of 2,069 ring-billed gulls. The PBR model developed by the USFWS predicted that 3,065 ring-billed gulls could be taken annually to maintain the current population levels in BCR 14 and BCR 30. The model also predicted that the removal of 4,588 ring-billed gulls would be required to hold the population at a smaller fraction of its carrying capacity. Based on the known take of ring-billed gulls occurring annually in BCR 14 and BCR 30, the average annual take level from all known sources has been below the estimated level required to cause a population decline. The USFWS has and would continue to use the PBR model to determine allowable take for ring-billed gulls when issuing permits; therefore, the number of gulls removed annually pursuant to depredation permits issued by the USFWS would remain within those levels analyzed in the models.

Based on the best available information described above, WS' potential removal of up to 1,000 ring-billed gulls would not adversely affect the overall viability and reproductive success of ring-billed gull populations. This determination is based on the increasing regional trends of ring-billed gull populations as derived from BBS data and the PBR model. The PBR model predicts ring-billed gulls in BCR 14 and BCR 30 could sustain a harvest of 3,065 individuals and maintain current population levels. In addition, up to 4,588 gulls could be removed to hold the population at a smaller fraction of its carrying capacity.

The best available data estimates that the ring-billed gull population in BCR 14 and 30 at 54,000 breeding and non-breeding birds (Seamans et al. 2007). WS' annual removal of up to 1,000 ring-billed gulls under the proposed action alternative would represent 1.9% of the population estimates for BCR 14 and BCR 30. From 2003 through 2011, the annual take of ring-billed gulls by all entities in the northeastern United States (USFWS Region 5) has averaged 2,069 gulls. If the take by other entities remains stable, the average annual cumulative take by all entities under the proposed action alternative would be 3,069 gulls or 5.7% of the estimated population in BCR 14 and BCR 30. Although the annual cumulative take by all entities has and could exceed 3,065 gulls (*e.g.*, cumulative take in 2011 was 4,641 gulls), the cumulative removal has slightly exceeded the level where the PBR model predicts the population would be maintained lower than the carrying capacity.

WS' take and all known take in the northeastern United States since 2003 has not reached a level that indicates an adverse impact to ring-billed gull populations would occur. The number of ring-billed gulls observed in areas surveyed in BCR 14 and BCR 30 during the BBS continues to show increasing trends, including increasing trends from 2001 through 2011. With management authority over migratory birds, the USFWS could impose stricter take limits if warranted based on population data. The USFWS, as the agency with migratory bird management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of populations. This

should assure that cumulative effects on ring-billed gull populations would not significantly affect the quality of the human environment.

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 are the most common gulls in the northeastern United States (Pierotti and Good 1994). In the northeastern United States, herring gulls nest along the Great Lakes and along the Atlantic Coast from Maine to northern South Carolina. During the breeding season, herring gulls use areas such as bays, estuaries, lakes, rivers, rocky or sandy coasts, islands, cliffs, building roofs or break walls for nesting (Blokpoel and Scharf 1991, MANEM Regional Waterbird Plan 2006). During the non-breeding season, herring gulls can be found along the Atlantic, Gulf and Pacific coasts (Pierotti and Good 1994, MANEM Regional Waterbird Plan 2006). In addition, gulls can be found northward from the Gulf of Mexico along the Mississippi, Ohio, and Columbia Rivers and west along the Pecos, Red, Cimarron, Arkansas, Platte, and Missouri Rivers (Pierotti and Good 1994). Gulls can be observed in coastal areas as well as in agricultural fields, at landfills, around picnic areas, or at fish-processing plants during the non-breeding season (Pierotti and Good 1994). Herring gulls will also use parking lots, fields, helipads, and airport runways as roosting and loafing sites (Pierotti and Good 1994). Herring gulls are social birds that nest in colonies and roost, loaf, and forage in groups (Pierotti and Good 1994). Herring gulls, like most gulls, are opportunistic feeders consuming fish, insects, marine invertebrates, other adult birds, and the eggs and young of other birds, as well as carrion and human refuse (Pierotti and Good 1994).

In the 1970s, the breeding population of herring gulls in BCR 14 and BCR 30 was estimated at 184,278 birds distributed among 414 nesting sites (MANEM Regional Waterbird Plan 2006). By the 1990s, the breeding population of herring gulls in BCR 14 and BCR 30 had declined 19% to 148,416 birds, while the number of nesting sites increased to 468 (MANEM Regional Waterbird Plan 2006). Almost 91,000 herring gulls are believed to breed in BCR 30. Of those herring gulls, over 36,000 occur in Southern New England, which includes those herring gull nesting colonies in and nearest to Maryland. In addition, over 196,000 herring gulls are believed to breed in neighboring BCR 14 (MANEM Regional Waterbird Plan 2006). Seamans et al. (2007) estimated the minimum population of breeding and non-breeding herring gulls in BCR 14 and BCR 30 to be 390,000 birds. In the Atlantic Northern Forest (BCR 14) region, the number of herring gulls observed in areas surveyed during the BBS have declined -4.9% annually since 1966, with a -4.6% annual decline occurring from 2001 through 2011 (Sauer et al. 2012). Similarly, the number of herring gulls observed in areas surveyed in the New England/Mid-Atlantic Coast (BCR 30) region has declined -5.0% annually since 1966, with a -2.6% annual decline occurring from 2001 through 2011 (Sauer et al. 2012). According to the MANEM Regional Waterbird Conservation Plan (2006), herring gulls are considered a species of low concern in North America. In BCR 30, the herring gull is also considered a species of low concern and herring gulls are a species of moderate concern in BCR 14 (MANEM Regional Waterbird Plan 2006).

In Maryland, herring gulls can be found throughout the year (Pierotti and Good 1994). Herring gulls are now the most abundant breeding gull in Maryland, likely due to their adaptability and tolerance of human development (Ellison 2010). The first Maryland breeding records of herring gull was of three nests found on Sharps Island in Talbot County in 1955 (Robbins and Blom 1996). Prior to 1940, herring gulls were primarily winter residents in Maryland. In 1990, the statewide population of herring gulls was estimated at 4,000 breeding pairs (Pierotti and Good 1994). In 2002, the population of herring gulls in the Maryland was estimated at approximately 3,000 pairs (Ellison 2010). In early March, herring gulls begin gathering at their breeding colonies throughout the Chesapeake and coastal bays, preferring to nest on salt marsh islands (Ellison 2010). Eggs are laid beginning in mid-April, with most clutches established by the middle of May. Chicks begin hatching in mid-May and fledge from late June into August (Ellison 2010).

Since 1966, the number of herring gulls observed along routes surveyed in the State during the BBS has increased at an estimated rate of 4.4% annually; however, from 2001 through 2011, the number observed has declined at an estimated rate of -5.8% annually (Sauer et al. 2012). The number herring gulls observed in areas surveyed in the State during the CBC showed a general increasing trend between 1966 and the mid-1990s; however, since the mid-1990s, the number observed has shown a declining trend (NAS 2010).

Herring gulls are a common species throughout the year in Maryland. Herring gulls can cause damage to agricultural resources, natural resources, property, and pose threats to human safety. To alleviate damage when requested, WS has lethally removed 688 herring gulls in Maryland and employed non-lethal methods to disperse 490 herring gulls from FY 2006 through FY 2012 (see Table 4.16). In addition to the removal of herring gulls by WS to alleviate damage or threats, the USFWS has issued depredation permits to other entities for the take of herring gulls. From 2006 through 2012, 1,490 herring gulls were lethally taken in the State by all entities to alleviate damage or threats associated with herring gulls. In total, the USFWS has authorized the lethal removal of 7,890 herring gulls between 2006 and 2012, which is an average authorized annual removal of 1,127 herring gulls. In addition, the USFWS authorized the destruction of 2,580 nests total between 2006 and 2012. Entities authorized to destroy nests reported 1,698 nests were destroyed in total from 2006 through 2012.

Table 4.16 – Number of herring gulls addressed in Maryland from 2006 to 2012

Year	Dispersed by WS[1]	Take Authorized by USFWS[2]	Take under Depredation Permits	
			WS' Take[1]	Total Take[2]
2006	2	855	9	158
2007	15	450	5	3
2008	23	1,365	4	553
2009	164	1,505	337	704
2010	122	1,805	268	3
2011	107	705	5	58
2012	57	1,205	60	11
TOTAL	**490**	**7,890**	**688**	**1,490**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year

To address request for assistance to manage damage associated with herring gulls in the future, up to 1,000 herring gulls could be lethally taken annually by WS to alleviate damage and threats. The increased level of take analyzed when compared to the take occurring by WS from FY 2006 through FY 2012 would be in anticipation of receiving requests to address threats of aircraft strikes at airports and to reduce damage to natural resources, such as nest site competition between herring gulls and other colonial nesting waterbirds. In addition, WS could destroy up to 500 nests annually to disperse nesting gulls from areas to alleviate damage or to reduce competition for nesting locations.

As previously discussed, the USFWS has developed a PBR model to estimate the allowable take of herring gulls in BCR 14 and BCR 30, which includes Maryland. Based on the model, an allowable harvest of up to 16,725 herring gulls in BCR 14 and BCR 30 would maintain current population levels in those two regions. The lethal removal of herring gulls to alleviate damage or threats of damage could occur by many different entities (*e.g.*, airports, landfills) through depredation permits issued by the USFWS and the MDNR. In the northeastern United States (USFWS Region 5), the average annual reported take of herring gulls from 2003 through 2011 has been 2,959 herring gulls by all entities issued depredation permits by the USFWS and the MDNR. The lethal removal of herring gulls by all entities has ranged from 1,772 gulls to a high of 6,122 gulls taken under depredation permits issued by the

USFWS between 2003 and 2011. Based upon the PBR model, the average annual take of herring gulls in USFWS Region 5 has been below the level of take that would lead to a population decline. With $F_R = 0.5$ (recovery factor), the PBR model predicted 8,360 herring gulls could be harvested annually in BCR 14 and BCR 30, which would likely lead to a population increase. Known take of herring gulls has been below the level that the PBR model predicts would cause a decline in the population in the northeastern United States from take permitted by the USFWS. WS' take of herring gulls along with take by other entities in Maryland would continue to have no adverse effect on herring gull populations in the State. The permitting of take by the USFWS and the MDNR would provide outside evaluation to ensure WS' lethal removal occurred within the allowed limits to maintain population objectives.

Impacts due to nest/egg removal and destruction should have no adverse effect on the herring gull population regionally and in Maryland. Nest and egg destruction methods would generally be considered non-lethal when conducted before the development of an embryo. Additionally, herring gulls are a long-lived species and have the ability to identify areas with regular human disturbance and low reproductive success, which could cause them to relocate and nest elsewhere when confronted with repeated nest failures. Although there may be reduced fecundity for the individuals affected, this activity would have no long-term effect on breeding adult herring gulls. Nest and egg removal would not be used by WS as a population management method. This method would be used by WS to inhibit nesting in an area experiencing damage due to nesting activity and would be intended to disperse a nesting pair or colony of herring gulls to an area where there were no conflicts.

Great Black-backed Population Impact Analysis

Great black-backed gulls are the largest gulls in North America and they can be easily distinguished by their white head and chest, which contrasts against their black back and wings (Good 1998). The great black-backed gull is essentially a marine species, which breeds in the North Atlantic region. Great black-backed gulls were temporarily extirpated along the East Coast because of persecution by hunters and egg collectors in the late 1800s, but they now are thriving, while learning to coexist with human populations throughout the northeastern United States (Ellison 2010). During the breeding season, great black backed gulls can be observed along the Atlantic coast north of Virginia and along the Saint Lawrence River and the Great Lakes (Good 1998, MANEM Regional Waterbird Plan 2006). During the non-breeding season, great black-backed gulls can be found along the Atlantic coast from Florida north into the Gulf of Saint Lawrence and inland across New England, New York, and Pennsylvania to the Great Lakes (Good 1998, MANEM Regional Waterbird Plan 2006).

Great black-backed gulls use seacoasts and inland bodies of water during the nesting season (MANEM Regional Waterbird Plan 2006). These areas, as well as areas up to 100 km away, are used for feeding (MANEM Regional Waterbird Plan 2006). Great black-backed gulls often nest in loose colonies with nests located as far apart as adequate habitat allows (Good 1998). During the non-breeding season, greater black-backed gulls can be observed in coastal areas as well as in parking lots fields, helipads, airport runways, and landfills (Good 1998). Great black-backed gulls are generalist predators consuming fish, insects, mammals, other adult birds, their young, and eggs, as well as carrion and human refuse (Good 1998). Great clack-backed gulls are one of the most aggressive coastal avian predators (Ellison 2010). Away from the breeding colony great black-backed gulls loaf, roost and feed in groups (Good 1998).

In BCR 14, the breeding population of great black-backed gulls has been estimated at 115,546 gulls (MANEM Regional Waterbird Plan 2006). In BCR 30, the breeding population of great black-backed gulls has been estimated at 37,372 gulls (MANEM Regional Waterbird Plan 2006). The population of great black-backed gulls in the southern New England and Mid-Atlantic Regions has been estimated at 28,000 breeding pairs (MANEM Regional Waterbird Plan 2006). Great black-backed gulls have

increased about 39% across the entire 13 northeast state region from the 1970s through the 1990s (MANEM Regional Waterbird Plan 2006). In the United States, great black-backed gulls breeding populations have increased 109% from the 1970s to 1990s (MANEM Regional Waterbird Plan 2006). According to the MANEM Waterbird Conservation Plan (2006), great black-backed gulls are considered a species of lowest concern in BCR 30 and of low concern in BCR 14. Seamans et al. (2007) estimated the minimum breeding and non-breeding great black-backed gull population in BCR 14 and BCR 30 to be 250,000 birds.

As reported by the BBS, populations of great black-backed gulls in the Eastern BBS Region have decreased annually at rates of -2.5% from 1966 through 2011; however, from 2001 through 2011, the number of great black-backed gulls observed in the Eastern BBS regions has shown an increasing trend estimated at 0.2% annually (Sauer et al. 2012). In contrast, in the New England/Mid-Atlantic Coast (BCR 30) region, the number of great black-backed gulls observed along all routes of the BBS have shown an increasing trend estimated at 3.3% annually from 1966 through 2011 and 14.5% annually from 2001 through 2011 (Sauer et al. 2012). In the Atlantic Northern Forest (BCR 14) region, the number of great black-backed gulls observed along routes surveyed during the BBS has shown a declining trend since 1966 estimated at -2.1% annually with a stable population trend occurring from 2001 through 2011 (Sauer et al. 2012).

In Maryland, great black-backed gulls can be found throughout the year along the coastal areas of the State and statewide during the winter (Good 1998). Great black-backed gulls were first found nesting on a South Point spoil island in Worcester County, Maryland during 1972 (Robbins and Blom 1996). Since first breeding in Maryland, great black-backed gulls have continued to expand within the State, reaching an estimated 560 breeding pairs in 2003 (Ellison 2010). Across all routes surveyed in Maryland, the number of great black-backed gulls observed during the BBS has shown an increasing trend estimated at 6.1% annually from 1966 through 2011, with a 1.5% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). The number of great black-backed gulls observed overwintering in the State since 1966 has generally shown an increasing trend (NAS 2010).

To alleviate damage, WS has lethally removed 138 great black-backed gulls in Maryland and employed non-lethal methods to disperse seven great black-backed gulls from FY 2006 through FY 2012 (see Table 4.17). In addition to the take of great black-backed gulls by WS to alleviate damage or threats, the USFWS has issued depredation permits to other entities lethally remove great black-backed gulls. From 2006 through 2012, 167 great black-backed gulls were lethally removed in the State by all entities to alleviate damage or threats associated with great black-backed gulls. In addition, the USFWS authorized the destruction of 675 total great black-backed gull nests from 2006 through 2012, with those entities authorized to destroy nests reporting that 118 total nests were destroyed.

To address request for assistance to manage damage associated with great black-backed gulls in the future, up to 100 great black-backed gulls could be lethally taken annually by WS to alleviate damage and threats. The increased level of take analyzed when compared to the take occurring by WS from FY 2006 through FY 2012 would be in anticipation of requests to address threats to reduce damage to natural resources, such as nest site competition between great black-backed gulls and other colonial nesting waterbirds. In addition, up to 50 great black-backed gull nests could be destroyed by WS annually in the State to alleviate damage and disperse gulls from areas where competition with other bird species was a concern.

To maintain the current population levels in BCR 14 and BCR 30, the PBR model developed by the USFWS predicts the lethal removal of 11,234 great black-backed gulls would not cause a decline in gull populations in BCR 14 or BCR 30. From 2003 through 2011, the number of great black-backed gulls taken in the northeastern United States (USFWS Region 5) has ranged from 360 to 952 gulls with an

average of 583 great black-backed gulls taken annually by all entities. The average annual take of great black-backed gulls in Region 5 of the USFWS by all entities authorized to take gulls through depredation permits has been below the level of annual take required to maintain current population levels. According to the PBR model, the average annual take by all entities in USFWS Region 5 would be below the allowable harvest for great black-backed gull populations to increase.

Table 4.17 – Number of great black-backed gulls addressed in Maryland from 2006 to 2012

Year	Dispersed by WS[1]	Take Authorized by USFWS[2]	Take under Depredation Permits	
			WS' Take[1]	Total Take[2]
2006	0	200	2	13
2007	0	75	3	0
2008	0	385	0	67
2009	5	550	76	79
2010	2	575	39	0
2011	0	225	1	7
2012	0	275	17	1
TOTAL	**7**	**2,285**	**138**	**167**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year

Based on the best available information, WS' take of up to 100 great black-backed gulls in the State would not adversely affect the statewide population nor would WS' activities to alleviate damage caused by great black-backed gulls have a cumulative impact on populations. The permitting of the take by the USFWS and the MDNR would provide outside evaluation that would ensure the lethal removal of gulls by WS occurred within the allowed limits to maintain population objectives.

Additionally, impacts due to nest removal and destruction should have little adverse effect on the great black-backed gull population. Nest destruction methods would generally be considered non-lethal when conducted before the development of an embryo. Additionally, great black-backed gulls are a long-lived species that have the ability to identify areas with regular human disturbance and low reproductive success, which allows them to relocate and nest elsewhere when confronted with repeated nest failure. Although there may be reduced fecundity for the individuals affected by nest destruction, this activity would not have long-term effects on breeding adult great black-backed gulls. The destruction of up to 50 great black-backed gull nests annually by WS would occur in localized areas where nesting takes place and would not reach a level where adverse effects on great black-backed gull populations would occur. As with the lethal take of gulls, the take of nests must be authorized by the USFWS and the MDNR. Therefore, the number of nests taken by WS annually would occur at the discretion of the USFWS and the MDNR.

Rock Pigeon Biology and Population Impact Analysis

Rock pigeons are a non-indigenous 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 people 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, farmyards, grain elevators, feed mills, and other manmade structures (Williams and Corrigan 1994). Additionally, although pigeons are primarily grain and seed eaters, they will readily feed on garbage, livestock manure, spilled grains, insects, and any other available bits of food (Williams and Corrigan 1994).

The rock pigeon is a gregarious and year-round resident in Maryland (Ellison 2010). The number of pigeons observed along routes surveyed during the BBS in the State have shown a decreasing trend since 1966 which has been estimated at -4.0% annually. From 2001 through 2011, the number of pigeons observed along routes surveyed has shown a declining trend estimated at -3.4% annually (Sauer et al. 2012). Based on data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide pigeon population at 40,000 pigeons. The number of pigeons observed in areas surveyed during the CBC has shown a general increasing trend in the State since 1966 (NAS 2010).

Since pigeons are afforded no protection under the MBTA because the species is not native to the United States, the take of pigeons to alleviate damage or to reduce threats can occur without the need for a depredation permit from the USFWS. Therefore, take of pigeons by other entities in the State to alleviate damage or threats of damage is unknown since the 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 Maryland.

Between FY 2006 and FY 2012, WS employed non-lethal harassment methods to disperse 298 rock pigeons to alleviate damage or threats of damage (see Table 4.18). In addition, WS lethally removed 1,646 pigeons between FY 2006 and FY 2012 to alleviate damage. The lethal removal of pigeons by WS from FY 2006 through FY 2012 has occurred primarily using firearms and live traps. Pigeons live-captured would be subsequently euthanized in accordance with WS Directive 2.505. Requests for assistance received by WS often arise from airports where the gregarious flocking behavior of pigeons can pose risks to aircraft at or near airports. Pigeons also cause damaging situations when the buildup of their droppings at nesting and roosting sites poses a health risk to the public, for example at a power plant or other industrial facility.

Table 4.18 – Number of rock pigeons addressed in Maryland by WS from FY 2006 to FY 2012

Fiscal Year	Dispersed	Take
2006	93	51
2007	34	211
2008	45	121
2009	59	287
2010	28	367
2011	2	365
2012	37	244
TOTAL	**298**	**1,646**

Based on previous requests for assistance and in anticipation of additional efforts, WS could annually take up to 3,000 pigeons in the State to alleviate damage. Based on a population estimated at 40,000 pigeons (Partners in Flight Science Committee 2013), take of up to 3,000 pigeons by WS would represent 7.5% of the estimated statewide population. Activities would be conducted pursuant to Executive Order 13112 to reduce invasion of exotic species and the associated damages.

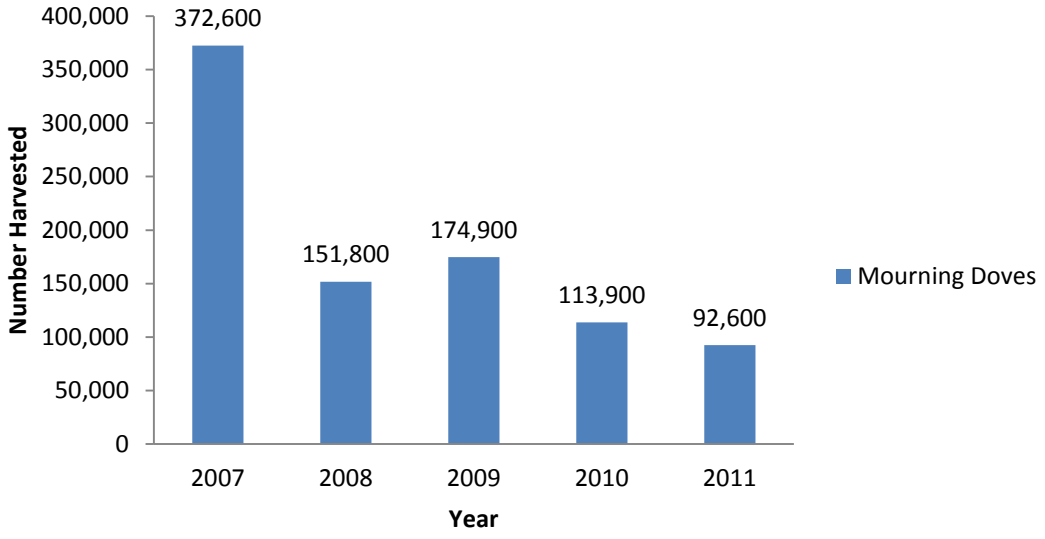
Mourning Dove Biology and Population Impact Analysis

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

In Maryland, mourning doves thrive in agricultural, suburban, and urban landscapes (Ellison 2010). The mourning dove remains one of the five most widespread nesting birds in Maryland (Ellison 2010). According to BBS trend data provided by Sauer et al. (2012), the number of mourning doves observed on routes surveyed have shown a stable trend in the State from 1966 through 2011; however, from 2001 through 2011, the number of doves observed has shown a slight decline estimated at -0.2% annually. Between 2002 through 2011, the number of doves heard and seen during the annual Mourning Dove Call-count Survey has declined -0.1% annually in Maryland and Delaware[16] (Seamans et al. 2012). Based on BBS data, the Partners in Flight Science Committee (2013) estimated the statewide breeding population at 300,000 mourning doves.

The number of mourning doves observed during the CBC had shown a general increasing trend in the State from 1966 until 1994. After 1994, the number of doves observed in areas surveyed during the CBC has shown a general declining trend (NAS 2010). Between 2002 and 2011, 9,314 doves have been observed per year on average in areas surveyed during the CBC, with the lowest count occurring in 2011 when 4,324 doves were observed. Many states have regulated annual hunting seasons for doves each year with generous bag limits. Across the United States, the preliminary mourning dove harvest in 2011 was estimated at 16.6 million doves with 92,600 doves harvested in Maryland (Raftovich et al. 2012). Figure 4.4 shows the number of doves harvested in Maryland during the annual hunting season from 2007 through 2011.

Figure 4.4 - Harvest of Mourning Doves in Maryland, 2007 - 2011



From FY 2006 through FY 2012, WS has addressed 6,239 doves to alleviate damage and threats (see Table 4.19). Of those doves addressed by WS from FY 2006 through FY 2012, 1,059 doves were

[16]Trend estimates from the annual mourning dove-count survey are combined and reported for both Delaware and Maryland.

addressed using lethally methods while 5,180 doves were addressed using non-lethal methods. Between 2006 and 2012, 1,708 doves have been lethally removed in the State to alleviate damage pursuant to depredation permits issued by the USFWS. Requests for assistance received by WS often arise from airports where the gregarious flocking behavior of doves can pose risks to aircraft at or near airports. Based on the number of requests to manage damage associated with doves received previously and in anticipation of conducting additional efforts, up to 250 mourning doves could be lethally taken by WS annually in the State to address damage or threats.

Table 4.19 – Number of mourning doves addressed in Maryland from 2006 to 2012

Year	Dispersed by WS[1]	Take Authorized by USFWS[2]	Take under Depredation Permits	
			WS' Take[1]	Total Take[2]
2006	2,275	625	198	559
2007	699	375	318	332
2008	800	945	118	31
2009	353	995	90	196
2010	406	997	126	63
2011	248	975	129	286
2012	399	995	80	241
TOTAL	**5,180**	**5,907**	**1,059**	**1,708**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year

An annual take by WS of up to 250 mourning doves would represent 0.1% of the estimated statewide breeding population of 300,000 doves based on a stable population trend. WS' take of up to 250 mourning doves annually would have represented 0.2% of the number of mourning doves harvested in the State during the 2010 harvest season and 0.3% of the number of mourning doves harvested in the State during the 2011 harvest seasons. 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 and the MDNR pursuant to the MBTA through the issuance of depredation permits. Therefore, the take of mourning doves by WS would only occur and only at levels authorized by the USFWS and the MDNR, 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 Maryland.

American Kestrel Biology and Population Impact Analysis

American kestrels are the smallest and most common North American falcon. Their range includes most of North America, except the far northern portions of Alaska and Canada (Smallwood and Bird 2002). Kestrels are commonly found inhabiting open areas with short ground vegetation where it searches for prey from elevated perches and by hovering above the ground. Prey consists of arthropods and small vertebrates (Smallwood and Bird 2002). Kestrels are often attracted to areas of human activities because of the open areas created and the numerous perching sites (Smallwood and Bird 2002). Kestrels are cavity nesters, using the excavated holes of woodpeckers and other natural cavities in trees (Smallwood and Bird 2002). The availability of suitable cavities is often a limiting factor in parts of the breeding range of the kestrel (Smallwood and Bird 2002). Kestrels are tolerant of human activity, often nesting close to human habituation and active industrial sites (Ellison 2010).

American kestrels observed in areas observed during the BBS are showing a declining trend in Maryland estimated at -2.1% annually since 1966, with a -2.1% annual decline occurring from 2001 through 2011 (Sauer et al. 2012). Kestrels observed on BBS routes in the New England/Mid-Atlantic Coast region

have also shown a declining trend estimated at -5.0% annually since 1966. Between 2001 and 2011, the number of kestrels observed in the New England/Mid-Atlantic Coast region has shown a declining trend estimated at -4.4% annually (Sauer et al. 2012). The breeding population of kestrels in Maryland has been estimated at 1,700 kestrels with the population across the United States estimated at 1.7 million individuals (Partners in Flight Science Committee 2013). Trend data available from the CBC also indicates a general decline in kestrel populations in Maryland (NAS 2010).

American kestrels could be identified as potential predators to both young and adult T&E waterbirds. In addition, WS has also received requests for assistance associated with kestrels posing aircraft strike risks at airports in the State. The WS program in Maryland has previously employed primarily non-lethal methods to address those requests for assistance to alleviate predation risks and damage threats at airports (see Table 4.20). Between FY 2006 and FY 2012, 209 kestrels have been live-captured and translocated by WS in the State. In addition, WS has employed non-lethal methods to disperse 512 kestrels total between FY 2006 and FY 2012. WS has also addressed kestrels using lethal methods to alleviate damage. Between FY 2006 and FY 2012, WS removed 60 kestrels using lethal methods, with the highest take occurring in FY 2007. According to the USFWS, 63 kestrels were lethally taken by all entities in the State between 2006 and 2012. The USFWS authorized take of up to 125 kestrels by all entities in Maryland during the same period.

Table 4.20 – Number of American kestrels addressed in Maryland from 2006 to 2012

Year	Dispersed by WS[1]	Relocated by WS	Take Authorized by USFWS[2,3]	Take under Depredation Permits	
				WS' Take[1]	Total Take[2]
2006	125	1	35	7	14
2007	162	1	25	43	44
2008	51	25	0	3	0
2009	120	40	10	3	5
2010	37	24	10	2	0
2011	16	86	10	1	0
2012	1	32	35	1	0
TOTAL	**512**	**209**	**125**	**60**	**63**

[1]Data reported by federal fiscal year

[2]Data reported by calendar year

[2]Does not include permits without take limits issued by the USFWS

Kestrels would continue to be addressed using primarily non-lethal methods, including translocation. Under the proposed action alternative, WS could live-capture kestrels and then translocate those birds from areas where threats to human health and safety were occurring. Kestrels live-captured in traps could be translocated to an area and released into appropriate habitat. In addition, kestrels captured and translocated would be banded for identification purposes using United States Geological Survey approved metal leg-bands appropriate for the species. Banding would occur pursuant to a banding permit issued by the United States Geological Survey. Fair et al. (2010) stated "[w]*hen appropriate* [leg] *band sizes are used, the occurrence and rate of adverse effects on the subjects is ordinarily very low*". As a condition of depredation permits issued by the USFWS to WS, any translocation of raptors must be coordinated and/or approved with the MDNR. Based on the requests for assistance received previously and in anticipation of additional efforts to manage threats posed by kestrels at airports and to alleviate predation risks, up to 100 kestrels could be live-captured and translocated under the proposed action.

Although the live-capture and translocating of kestrels would be a non-lethal method of reducing predation risks, kestrels could be translocating during their nesting season which could lower nesting success. Eggs are generally observed in nests of kestrels beginning at the very end of March through

mid-June with the peak period occurring from early April through mid-May (Smallwood and Bird 2002). Nestlings are generally present in nests from early May through late August, with the peak occurring from the end of May through the end of July (Smallwood and Bird 2002).

Although the incubation of eggs can occur by either the male or female, incubation occurs primarily by the female while the male contribution to incubation appears to vary by individual males (Smallwood and Bird 2002). However, the eggs of kestrels appear to be relatively "*cold-hardy*" with embryos tending to develop more slowly rather than dying when neglect occurs or under temperature stress (Smallwood and Bird 2002). Both the male and female kestrels feed the young once hatched; however, the female kestrel appears to account for about 70% of the feeding (Smallwood and Bird 2002). Information on the nesting success of kestrels after the removal of one of the adults is not available.

The average clutch size for breeding pairs of kestrels is four to five eggs, with a range of one to seven eggs. If the live-capture and translocation of 100 kestrels resulted in 100 failed nests, the maximum number of fledglings produced in the State would be reduced by 500 kestrels if no other factors were considered. However, it is unlikely that all 100 kestrels would be translocated during the nesting season, since the majority of strike risks associated with kestrels occur during the migration periods as kestrels are moving from breeding areas and wintering areas. Translocation is also not as successful when breeding pairs are moved since kestrels are familiar with areas and often return to the same area. Translocation is most successful during the migration periods when kestrels are less likely to have an affinity for a particular area. In addition, clutch sizes vary and the annual reproductive success rate (*i.e.*, the percentage of nesting attempts that result in at least one fledgling) has been shown to be highly variable. A 67% success rate is generally estimated for wild populations (Smallwood and Bird 2002). The rate of egg hatching has ranged from 62% to 89%, with nearly 90% of hatchlings reaching the fledgling stage (Smallwood and Bird 2002). In addition, 63% to 69% of first-year kestrels do not survive their first winter (Smallwood and Bird 2002). Kestrels are also known to re-nest after a nest failure.

Although reduced nesting success could occur by removing one of the adult pairs of kestrels during nesting, available information indicates the successful raising of young could occur if only one adult was left to tend to the young. The degree of success would likely be related to the sex of the adult removed, the developmental stage of the eggs or nestlings, availability of food sources, and the time of year the removal of one of the adult pairs occurred. If both adults were removed, the nest would not be successful.

WS would continue to employ primarily non-lethal methods to address damage and threats of damage. However, lethal take could occur when immediate threats to human safety or property occur, such as when kestrels return to airports once translocated or when habituation to non-lethal methods occur. Based on previous requests for assistance associated with kestrels posing strike risks at airports, WS could lethally remove up to 25 kestrels annually in the State to address those requests for assistance.

In 2006 and 2012, the USFWS authorized the lethal removal of up to 35 kestrels annually in the State to alleviate damage, which represented the highest annual permitted take of kestrels between 2006 and 2012. The best available information estimated the statewide breeding population of American kestrels at 1,700 birds (Partners in Flight Science Committee 2013). Based on the best available population estimate, if WS' lethal take of kestrels reached 25 birds and if 35 kestrels were taken by other entities in the State, the cumulative take of American kestrels would represent 3.5% of the estimated statewide breeding population. If the annual removal of 35 kestrels represented the highest permitted take allowed by the USFWS, including take that could occur by WS, the cumulative take would represent 2.1% of the estimated breeding population.

The take of kestrels, including live-capture and translocation, could only occur when permitted by the USFWS pursuant to the MBTA through the issuance of depredation permits. Therefore, all take,

including take by WS, would be authorized by the USFWS and would occur at the discretion of the USFWS. In addition, lethal removal of kestrels could only occur when permitted by the MDNR. The take of American kestrels by WS would only occur at levels authorized by the USFWS and the MDNR.

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 became 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 with starlings occurring and breeding from Idaho to New Mexico. By 1946, the range of starlings had expanded to California and the western Canadian coasts (Miller 1975). In just 50 years, starlings had colonized the United States and expanded into Canada and Mexico and 80 years after the initial introduction had become one of the most common birds in North America (Feare 1984). The first record of European starlings in Maryland occurred in the fall of 1906 in Baltimore City (Robbins and Blom 1996). Today, starlings can be found throughout the State and are considered common permanent residents (Robbins and Blom 1996). However, some migration movements do occur within the State with large flocks often forming during the winter (Robbins and Blom 1996).

From 1966 through 2011, the number of starlings observed along routes surveyed during the BBS has shown a declining trend in the State estimated at -2.0% annually with a -2.2% decline annually occurring from 2001 through 2011 (Sauer et al. 2012). Across all routes surveyed in the United States during the BBS, the number of starlings observed has shown a declining trend estimated at a rate of -1.0% annually from 1966 through 2011, with a -0.9% annual decline occurring from 2001 through 2011(Sauer et al. 2012). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of starlings at 380,000 birds.

The number of starlings observed in those areas surveyed during the CBC in the State has shown a cyclical pattern from 1966 through 2011 with a general overall declining trend (NAS 2010). Between 2002 and 2011, observers have counted an average of 71,512 starlings in areas surveyed within the State during the CBC, with a high count of 92,578 starlings and a low count of 55,222 starlings.

Starlings are not native to Maryland and are afforded no protection under the MBTA or any State law. Therefore, a depredation permit from the USFWS or the State is not required to remove starlings to alleviate damage or threats of damage. Since the take of starlings to alleviate damage or threats of damage is not reported to the USFWS or the MDNR, the lethal take of starlings in the State to alleviate damage or threats of damage by entities other than WS is unknown. As shown in Table 4.21, WS has lethally removed 3,772 starlings between FY 2006 and FY 2012 in the State to alleviate damage. The highest level of take by WS occurred in FY 2012 when 1,083 starlings were lethally removed. The take of starlings by WS from FY 2006 through FY 2011 has occurred primarily using firearms and live traps. Starlings live-captured were subsequently euthanized in accordance with WS Directive 2.505. In addition to the use of lethal methods, WS has employed non-lethal methods to disperse 212,501 starlings between FY 2006 and FY 2012.

Based on the flocking behavior of starlings and the 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, the lethal removal of up to 10,000 starlings could occur despite the limited take that has occurred previously. The take of 10,000 starlings would represent 2.6% of the estimated 380,000 starlings breeding in the State. However, most requests to

address large roosts occur during the migration periods and during the winter when the population in the State likely increases above the 380,000 starlings estimated to nest in the State. The increase in the population in the State is a result of the arrival of migrants into the State and the presence of juveniles in the population.

Table 4.21 – Number of European starlings addressed in Maryland by WS, FY 2006 - FY 2012

Fiscal Year	Dispersed	Take
2006	26,333	338
2007	32,346	399
2008	23,355	786
2009	24,533	321
2010	11,690	142
2011	48,969	703
2012	45,275	1,083
TOTAL	**212,501**	**3,772**

Based on the average number of starlings observed in areas surveyed during the CBC from 2002 through 2011, the annual take of 10,000 starlings by WS would present 14.0% of the average. If WS had lethally removed 10,000 starlings annually from 2002 through 2011, the annual take would have ranged from 10.8% to 18.1% of the number of starlings observed annually from 2002 through 2011 during the CBC.

Starlings are not native to Maryland and are afforded no protection under the MBTA or any State law. Therefore, a depredation permit from the USFWS or the State is not required to remove starlings to alleviate damage or threats of damage. Since the take of starlings to alleviate damage or threats of damage is not reported to the USFWS or the MDNR, the lethal take of starlings in the State to alleviate damage or threats of damage by entities other than WS is unknown. Activities associated with starling would occur pursuant to Executive Order 13112, which states that each federal agency whose actions may affect the status of invasive species shall reduce invasions of exotic species and the associated damages.

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). Red-winged blackbirds are primarily associated with emergent vegetation in freshwater wetlands and upland habitats during the breeding season. Nests of red-winged blackbirds can be found in marsh vegetation in roadside ditches, saltwater marshes, rice paddies, hay fields, pastureland, fallow fields, suburban habitats, and urban parks (Yasukawa and Searcy 1995). Northern breeding populations of red-winged blackbirds migrate southward during the migration periods but red-winged blackbirds are common throughout the year 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 Maryland, red-winged blackbirds can be found throughout the year (Yasukawa and Searcy 1995) with a breeding population estimated at 300,000 birds (Partners in Flight Science Committee 2013). 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 (Sauer et al. 2012). More recent trend data from 2001 through 2011 also indicates a downward trend estimated at -3.2% annually (Sauer et al. 2012). The number of red-winged blackbirds observed during the CBC in the State

has shown a variable trend but an overall downward trend since 1966 (NAS 2010). Between 2002 and 2011, the average number of red-winged blackbirds observed in areas surveyed during the CBC has been approximately 130,400 red-winged blackbirds. The highest number of red-winged blackbirds recorded during the CBC conducted in Maryland between 2002 and 2011 occurred in 2008 when over 207,500 red-winged blackbirds were recorded (NAS 2010). The lowest number of red-winged blackbirds observed in the State during the CBC conducted between 2002 and 2011 occurred in 2003 when nearly 26,700 red-winged blackbirds were recorded (NAS 2010), which provides an indication of the fluctuations in 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 2006 and FY 2012, the WS program in Maryland dispersed 469 red-winged blackbirds from areas where damage or threats of damage were occurring (see Table 4.22). In addition, WS also dispersed 25,906 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 25,906 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 2007 when 7,280 blackbirds in mixed species flocks were addressed by WS. WS also dispersed 90 red-winged blackbirds in the State during FY 2007.

WS has also addressed damage or threats of damage associated with red-winged blackbirds using lethal methods between FY 2006 and FY 2012. WS lethally removed 115 red-winged blackbirds from FY 2006 through FY 2012 to alleviate damage or threats of damage. The highest take level by WS occurred in FY 2007 when WS employed firearms to remove 56 red-winged blackbirds, as requested, to alleviate damage or threats of damage.

Table 4.22 –Number of red-winged blackbirds addressed by WS in Maryland, FY 2007 – FY 2012

	Dispersed		Take	
Fiscal Year	**Red-winged Blackbird**	**Blackbirds (mixed)**	**Red-winged Blackbird**	**Blackbirds (mixed)**
2006	66	1,366	38	0
2007	90	7,280	56	8
2008	0	3,475	2	0
2009	0	5,940	5	10
2010	305	2,550	2	3
2011	8	5,220	12	55
2012	0	75	0	0
TOTAL	**469**	**25,906**	**115**	**76**

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 500 red-winged blackbirds annually in the State to alleviate damage or threats of damage. With a breeding population estimated at 300,000 red-winged blackbirds, take of up to 500 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 2002 through 2011, take of up to 500 red-winged blackbirds by WS would have represented 0.4% of the average number of red-winged blackbirds

observed in the State of 130,393 red-winged blackbirds. Take of up to 500 red-winged blackbirds by WS would represent a low of 0.2% to a high of 1.9% of the number of red-winged blackbirds observed in the State during the CBC.

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.

However, with the recent updates to the blackbird depredation order, reporting of take to the USFWS is now required. The take of red-winged blackbirds by other entities is expected to be of low magnitude when compared to the actual statewide population for Maryland.

Common Grackle Biology and Population Impact Analysis

Another blackbird species commonly found in mixed species flocks in Maryland 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. Grackles can be found throughout the year in the United States except for the far northern and western portions 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 has provided suitable nesting habitat for grackles. The planting of trees in residential areas has also likely 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, Peer and Bollinger 1997). During the migration periods, common grackles can be found in mixed species flocks of blackbirds.

The common grackle is one of Maryland's most abundant breeding birds, and Maryland and the surrounding areas of Delaware and Virginia have been identified as a region in which the common grackle occurs in greatest abundance (Robbins and Blom 1996). The common grackle uses a wide range of nesting habitats, especially ornamental trees planted as windbreaks, including pine, red cedar, Leland cypress, and Norway spruce. However, grackles appear to prefer conifer trees for nest sites. Nesting grackles often form loose colonies of up to 20 pairs (Ellison 2010). Although atypical, but not infrequent, nesting locations may also include shrubs and cattails in marshes, artificial duck nests, artificial and natural cavities, and niches and ledges of buildings, bridges, and other man-made structures (Brauning 1992). Nest building can occur as early as the last week of March (Ellison 2010). Winter roosts, may contain hundreds of thousands of individuals (Brauning 1992).

The breeding population of grackles in the State has been estimated at 710,000 grackles (Partners in Flight Science Committee 2013). The number of grackles observed along BBS routes surveyed in the State has shown a downward trend between 1966 and 2011 estimated at -2.9% annually (Sauer et al. 2012). Between 2001 and 2011, the number of grackles observed during the BBS has also shown a downward trend in the State estimated at -4.0% annually (Sauer et al. 2012). Downward trends have also been estimated for the number of grackles observed during the BBS conducted along routes in the New England/Mid-Atlantic Coast (BCR 30) region estimated at -2.1% annually since 1966 as well as a downward trend across all routes surveyed in the United States estimated at -1.7% annually since 1966 (Sauer et al. 2012).

The number of common grackles observed in areas surveyed during the CBC has shown a variable trend but an overall general declining trend between 1966 and 2011 (NAS 2010). During surveys conducted from 2002 through 2011, the average number of grackles observed during the CBC conducted in the State has been 149,767 grackles. The lowest number of grackles observed during the CBC from 2002 through 2011 occurred in 2004 when 14,879 grackles were recorded. The highest number of grackles recorded in the State during the CBC between 2002 and 2011 occurred in 2002 when 388,188 grackles were observed (NAS 2010), which depicts the variability in the number of grackles observed in the State during the CBC. The variability may be correlated with the severity of winters in the State, which may limit the availability of food sources.

From FY 2006 through FY 2012, 22,415 common grackles were dispersed by WS and 241 grackles were lethally removed by WS to alleviate damage (see Table 4.23). As mentioned previously, WS also dispersed 25,906 blackbirds in mixed species flocks to alleviate damage or threats of damage in the State from FY 2006 through FY 20112. Common grackles 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 25,906 blackbirds dispersed in mixed species flocks of blackbirds by WS, the number of common grackles present in those flocks is unknown. Based on the number of requests received to alleviate threats of damage associated with common grackles and the number of grackles addressed previously to alleviate those threats, WS anticipates that up to 500 grackles could be taken annually in the State to alleviate the threat of damage.

Table 4.23 –Number of common grackles addressed by WS in Maryland, FY 2006 – FY 2012

Fiscal Year	Dispersed	Take
2006	71	6
2007	329	18
2008	3,515	66
2009	1,700	51
2010	1,000	34
2011	15,800	66
2012	0	0
TOTAL	**22,415**	**241**

If up to 500 common grackles were lethally removed annually by WS, the take would represent 0.1% of the estimated 710,000 common grackles breeding within the State. Using the data from the CBC, the lethal removal of up to 500 common grackles by WS would represent 0.3% of the average number of grackles observed in areas surveyed from 2002 through 2011. If WS had lethally removed 500 common grackles annually from 2002 through 2011 in the State, the annual take by WS would have represented 0.1% to 3.4% of the number of grackles observed in the State during the CBC. CBC data is best interpreted as an indication of long-term trends in the number of birds observed wintering in the State and is not intended to represent population estimates of wintering bird populations. However, the information was used in this analysis and compared to WS' proposed take to evaluate the magnitude of take that could occur by WS when compared to the number of grackles observed in the State during the CBC. The number of grackles observed in areas surveyed within the State during 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.

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. Since the take of blackbird species, including grackles, can occur without the need for a depredation permit when

committing or about to commit damage, the number of grackles lethally removed by other entities in the State is currently unknown since reporting of take to the USFWS was not required previously. The take of common grackles by other entities is expected to be of low magnitude when compared to the actual statewide population for Maryland.

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. 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.

Cowbirds can be found throughout the year in the State (Lowther 1993). During the breeding season, the number of cowbirds observed in areas surveyed during the BBS has shown a declining trend estimated at -0.8% annually between 1966 and 2011 (Sauer et al. 2012). From 2001 through 2011, the number of cowbirds observed in the State during the BBS has shown a declining trend estimated at -0.4% annually (Sauer et al 2012). The Partners in Flight Science Committee (2013) estimated the statewide breeding population of cowbirds at 180,000 cowbirds based on data from the BBS. In the New England/Mid-Atlantic Coast (BCR 30) region, cowbirds have shown a slight increasing trend since 1966 estimated at 0.3% annually, with the number of cowbirds observed from 2001 through 2011 showing an increasing trend estimated at 0.6% annually (Sauer et al. 2012).

Similar to the other blackbird species, the number of cowbirds observed during the CBC conducted annually in the State has shown a variable pattern, with a general declining trend occurring from 1966 through 2011 (NAS 2010). Observers on the CBC have recorded on average 12,170 cowbirds each year from 2002 through 2011 (NAS 2010). During 2003, 1,160 cowbirds were observed during the CBC conducted in the State, which was the lowest number observed from 2002 through 2011 (NAS 2010). The highest number of cowbirds observed during the CBC conducted from 2002 through 2011 has been 66,659 cowbirds, which were recorded during the CBC conducted during 2005 (NAS 2010).

From FY 2006 through FY 2012, 9,238 cowbirds were dispersed by WS and 674 cowbirds were lethally removed by WS to alleviate damage (see Table 4.24). The highest number of cowbirds addressed by WS occurred during FY 2012. Overall, nearly 93% of the cowbirds addressed by WS were dispersed using non-lethal harassment methods. 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 500 cowbirds annually in the State to alleviate damage or threats of damage. Based on a statewide breeding population estimated at 180,000 cowbirds, take of up to 500 cowbirds by WS to alleviate damage or threats of damage would represent 0.3% of the estimated breeding population. As stated

previously, numbers of cowbirds present in the State likely increases during the migration periods and the winter months as cowbirds begin arriving from breeding areas further north. Take of up to 500 cowbirds by WS would represent 4.1% of the average number of cowbirds observed annually during the CBC conducted from 2002 through 2011. If WS had lethally removed 500 cowbirds annually from 2002 through 2011, the take would have represented 0.8% to 43.1% of the number of cowbirds observed in areas observed during the CBC conducted from 2001 through 2011.

Table 4.24 –Number of brown-headed cowbirds addressed by WS in Maryland, FY 2006 – FY 2012

Fiscal Year	Dispersed	Take
2006	1,288	41
2007	1,100	336
2008	1,200	140
2009	325	16
2010	125	1
2011	200	95
2012	5,000	45
TOTAL	**9,238**	**674**

CBC data is best interpreted as an indication of long-term trends in the number of birds observed wintering in the State and is not intended to represent population estimates of wintering bird populations. However, the information was used in this analysis and compared to WS' proposed take to evaluate the magnitude of take that could occur by WS when compared to the number of cowbirds observed in the State during the CBC. The number of cowbirds observed in areas surveyed within the State during 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.

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 actual statewide population.

House Sparrow Biology and Population Impact Analysis

House sparrows were introduced to North America from England in 1850. From that introduction, sparrows 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 Maryland (Lowther and Cink 2006). Nesting locations often occur in areas of human activities and house sparrows are considered "*...fairly gregarious at all times of year*" with nesting occurring in small colonies or in a 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. (2012), between 1966 and 2011, the number of house sparrows observed along routes surveyed across the United States have shown a downward trend estimated at -3.7% annually. In Maryland, the number of house sparrows observed in areas surveyed during the BBS has also shown a downward trend between 1966 and 2011 estimated at -3.4% annually (Sauer et al. 2012). The Partners in Flight Science Committee (2013) estimated the breeding population of

house sparrows in the State to be 400,000 birds. Since 1966, the number of house sparrows observed in areas surveyed in the State during the CBC has shown an overall declining trend (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 effects 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 2006 and FY 2012, WS has lethal methods to remove 90 house sparrows in the State to alleviate damage or threats of damage (see Table 4.25). Since house sparrows are afforded no protection from take under the MBTA, no depredation permits are issued for the take of house sparrows and there are 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 additional efforts, WS could take up to 250 house sparrows in the State annually to alleviate damage or threats of damage.

Table 4.25 –Number of house sparrows addressed by WS in Maryland, FY 2006 – FY 2012

Fiscal Year	Dispersed	Take
2006	0	29
2007	0	0
2008	0	0
2009	0	0
2010	0	0
2011	0	0
2012	0	61
TOTAL	**0**	**90**

If WS lethally removed up to 250 sparrows annually in the State, the take would represent 0.1% of the statewide breeding population if the population were at least stable. As stated previously, the annual take of house sparrows by other entities is currently not known. 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 Maryland. WS' take of house sparrows to reduce damage and threats would comply with Executive Order 13112.

Additional Target Bird Species

Limited numbers of additional target species have been addressed previously by WS or WS anticipates addressing a limited number of additional species under the proposed action alternative. Those species would primarily be addressed to alleviate aircraft strike risks at airports. Strike risks associated with those species often occur infrequently or involve only a few individuals. Target bird species that could be

addressed by WS in limited numbers, after receiving a request for assistance associated with those species, would include great egrets, snowy egrets, cattle egrets, Northern harriers, sharp-shinned hawks, Cooper's hawks, broad-winged hawks, barn owls, great horned owls, barred owls, chimney swift, red-headed woodpeckers, red-bellied woodpeckers, yellow-bellied sapsuckers, downy woodpeckers, hairy woodpeckers, Northern flickers, pileated woodpeckers, blue jays, tree swallows, Northern rough-winged swallows, bank swallows, cliff swallows, barn swallows, gray catbirds, Northern mockingbirds, Northern cardinals, Eastern meadowlarks, and house finches.

Based on previous requests for assistance and the take levels necessary to alleviate those requests for assistance or in anticipation of the need to address those species, WS could lethally remove up to 10 individuals of each of those species annually in the State, except for northern harriers, sharp-shinned hawks, Cooper's hawks, and broad-wing hawks. Based on previous requests for assistance, WS could lethally remove up to five individuals of each those raptor species annually. In addition, to alleviate damage or discourage nesting in areas where damages were occurring, WS could destroy up to 10 nests of each of those species annually in the State, except for northern harriers, sharp-shinned hawk, Cooper's hawks, and broad-wing hawks. WS does not anticipate receiving requests for assistance associated with nests of those raptor species. WS does not expect those bird species to be lethally removed at any level that would adversely affect populations of those species. Those bird species are afforded protection from take under the MBTA and take would only be allowed through the issuance of a depredation permit and only at those levels stipulated in the permit. Therefore, those birds and the nests of 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 and the MDNR permitting processes. The USFWS and the MDNR, as the agencies 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 effect 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 and the MDNR annually.

Under the proposed action alternative, up to 10 nests and the associated eggs of those species could be destroyed annually by WS as part of an integrated approach to managing damage, except for northern harriers, sharp-shinned hawks, Cooper's hawks, and broad-wing hawks. Nest and egg destruction methods are often considered non-lethal when conducted before the development of an embryo. Many bird species have the ability to identify areas with regular human disturbance and low reproductive success and they will relocate to nest elsewhere when confronted with repeated nest failure. Although there may be reduced fecundity for the individuals affected by nest destruction, this activity has no long-term effect on breeding adult birds. WS would not use nest and egg removal as a population management method. WS would use this method to inhibit nesting in an area experiencing damage due to nesting activity and would only be employed at a localized level. As with the lethal removal of birds, the destruction of nests can only occur when authorized by the USFWS. Therefore, the number of nests taken by WS annually would occur at the discretion of the USFWS.

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.[17] 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 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 would 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, game fowl, 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 would be 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,

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

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 sampling birds 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

Under a technical assistance only alternative, WS would recommend an integrated approach similar to the proposed action alternative (Alternative 1); however, WS would not provide direct operational assistance under this alternative. Methods and techniques recommended would be based on WS' Decision Model using information provided from the requestor or from a site visit. In some instances, wildlife-related information provided to the requestor by WS could result in tolerance/acceptance of the situation. In other instances, damage management options would be discussed and recommended.

When damage management options were discussed, WS would recommend and demonstrate for use both non-lethal and lethal methods legally available for use to alleviate bird damage. Those persons receiving technical assistance from WS could implement those methods recommended by WS, could employ other methods not recommended by WS, could seek assistance from other entities, or take no further action. However, those persons requesting assistance would likely be those people that would implement methods.

Despite no direct involvement by WS in resolving damage and threats associated with birds in the State, those persons experiencing damage caused by birds could continue to alleviate damage by employing those methods legally available. Under this alternative, those persons experiencing threats or damage associated with birds in the State could lethally take birds. In order for the property owner or manager to use lethal methods, they must apply for their own depredation permit to take birds from the USFWS and the MDNR, when required. Technical assistance could also be provided by WS as part of the application process for issuing a depredation permit by the USFWS under this alternative, when deemed appropriate. WS could evaluate the damage and complete a Migratory Bird Damage Report for the requester, 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 each bird species.

Therefore, under this alternative, the number of birds lethally taken would likely be similar to the other alternatives. Take could be similar since take could occur through the issuance of a depredation permit, take could occur under depredation/control orders, take of non-native bird species could occur without the need for a permit, and take would continue to occur during the harvest season for certain species.

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 were concerned with threats posed by birds could seek assistance from other governmental agencies, private entities, or conduct damage management on their own. Those persons experiencing damage or threats could take action using those methods legally available to alleviate or prevent bird damage as permitted by federal, State, and local laws and regulations or those persons could take no action. Therefore, bird populations in the State would not be directly impacted by WS from a program implementing technical assistance only.

With the oversight of the USFWS and the MDNR, 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 direct operational assistance could be provided by other entities, such as the MDNR, the USFWS, private entities, and/or municipal authorities. If direct operational assistance was 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 alleviate wildlife damage issues (*e.g.*, see White et al. 1989, USFWS 2001, FDA 2003).

Alternative 3 – No Bird Damage Management Conducted by WS

Under this alternative, WS would not conduct 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 alleviate damage and/or threats occurring either through depredation permits issued by the USFWS and the MDNR, 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 could 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 potential 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 alleviate damage or reduce threats associated with birds could occur by other entities despite WS' lack of involvement under this alternative.

Under this alternative, property owners/managers may have difficulty obtaining permits to use lethal 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 damage management activities. State agencies with responsibilities for migratory birds would likely have to provide this information if depredation permits were 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 take birds lethally, the permit issuance procedures would follow that described in Alternative 1 and Alternative 2.

In some cases, control methods employed by property owners or managers could be contrary to the intended use of some of the methods or in excess of what is necessary. Inappropriate use of some non-lethal methods may result in injury to humans, damage to property and increased risk to non-target species. Those problems may occur because state agencies, businesses, and organizations have less technical knowledge and experience managing wildlife damage than WS.

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 alleviate 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 occurs 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 people 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 would be experienced and trained in wildlife identification 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 effects to non-targets exists when applying both non-lethal and lethal methods to manage damage or reduce threats to safety.

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. The use of 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 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 would not be 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/egg destruction, translocation, and repellents. Live traps (*e.g.*, cage traps, walk-in traps, decoy traps) and nets (*e.g.*, cannon nets, mist nets, bow nets, dipping 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 were attended to appropriately, any non-targets captured can be released on site unharmed.

Nets could include the use of net guns, net launchers, cannon/rocket nets, drop nets, bow nets, dipping nets, and mist nets. Nets are virtually selective for target individuals since application would occur by attending personnel, with handling of wildlife occurring after deployment of the net or nets would be

checked frequently to address any live-captured wildlife. Therefore, any non-targets captured using nets could 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 net gun/launcher weights or cannon/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.

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. Non-lethal methods that use auditory and visual stimuli to reduce or prevent damage would be employed to elicit fright responses in wildlife. When employing those methods to disperse or harass target species, any non-targets near those methods when employed would also likely be dispersed from the area. Similarly, any exclusionary device constructed to prevent access by target species would also exclude access to non-target species. The persistent use of non-lethal methods would likely result in the dispersal or abandonment of those areas where non-lethal methods were employed of both target and non-target species. Therefore, any use of non-lethal methods would have similar results on both non-target and target species. Although non-lethal methods do not result in lethal take of non-targets, the use of non-lethal methods could restrict or prevent access of non-targets to beneficial resources. Overall, potential impacts to non-targets from the use of non-lethal methods would not adversely affect populations since those methods are often temporary.

Only those repellents registered with the EPA pursuant to the FIFRA and registered with the MDA 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 effects on non-target species when used according to label requirements. Most repellents for birds, except Avitrol, 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. Methyl anthranilate has been used to flavor food, candy, and soft drinks. Anthraquinone naturally occurs in plants, like aloe. Anthraquinone has been 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. 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.

Immobilizing drugs would be applied through hand baiting that would target specific individuals or groups of target species. Therefore, immobilizing drugs would only be applied after identification of the target occurred prior to application. Pre-baiting and acclimation of the target waterfowl would occur prior to the application of alpha chloralose, which would allow for the identification of non-targets that may visit the site prior to application of the bait. All unconsumed bait would be retrieved after the application session had been completed. Since sedation occurs after consumption of the bait, personnel would be present on site at all times to retrieve waterfowl. This constant presence by WS' personnel would allow for continual monitoring of the bait to ensure non-targets were not present. Based on the use pattern of alpha chloralose by WS, no adverse effects to non-targets would be expected from the use of alpha chloralose.

Since products containing the active ingredient nicarbazin could be commercially available and purchased by people with a certified applicators license, the use of the product could occur under any of the alternatives discussed in the EA; therefore, the effects of the use would be similar across all the alternatives if the product were used according to label instructions. Under the proposed action, WS could use or recommend products containing nicarbazin as part of an integrated approach to managing damages associated with geese, domestic waterfowl, and pigeons, if products were registered for use in Maryland. A product containing the active ingredient nicarbazin is currently registered in the State to manage local pigeon populations. Products containing nicarbazin are not currently registered in the State for use to manage local goose and domestic waterfowl populations. WS' use of nicarbazin under the proposed action would not be additive since the use of the product could occur from other sources, such as private pest management companies or those people experiencing damage could become a certified applicator and apply the bait themselves when the appropriate depredation permits were received[18].

Exposure of non-target wildlife to nicarbazin could occur from direct ingestion of the bait by non-target wildlife or from secondary hazards associated with wildlife consuming birds that have eaten treated bait. Several label restrictions of products containing nicarbazin are intended to reduce risks to non-target wildlife from direct consumption of treated bait (EPA 2005). The labels require an acclimation period that habituates target birds to feeding in one location at a certain time. During baiting periods, the applicator must be present on site until all bait has been consumed. Non-target risks can be further minimized by requirements on where treated baits can be placed. All unconsumed bait must also be retrieved daily, which further reduces threats of non-targets consuming treated bait.

In addition, nicarbazin is only effective in reducing the hatch of eggs when blood levels of 4,4'-dinitrocarbanilide (DNC) are sufficiently elevated in a bird species. When consumed by birds, nicarbazin is broken down into the two base components of DNC and 4,4'-dinitrocarbanilide (HDP), which are then rapidly excreted. To maintain the high blood levels required to reduce egg hatch, birds must consume nicarbazin daily at a sufficient dosage that appears to be variable depending on the bird species (Yoder et al. 2005, Avery et al. 2006). For example, to reduce egg hatch in Canada geese, geese must consume nicarbazin at 2,500 ppm compared to 5,000 ppm required to reduce egg hatch in pigeons (Avery et al. 2006, Avery et al. 2008). In pigeons, consuming nicarbazin at a rate that would reduce egg hatch in Canada geese did not reduce the hatchability of eggs in pigeons (Avery et al. 2006). With the rapid excretion of the two components of nicarbazin (DNC and HDP) in birds, non-targets birds would have to consume nicarbazin daily at sufficient doses to reduce the rate of egg hatching.

Secondary hazards also exist from wildlife consuming geese, domestic waterfowl, or pigeons that have ingested nicarbazin. As mentioned previously, once consumed, nicarbazin is rapidly broken down into the two base components DNC and HDP. DNC is the component of nicarbazin that limits egg hatchability while HDP only aids in absorption of DNC into the bloodstream. DNC is not readily absorbed into the bloodstream and requires the presence of HDP to aid in absorption of appropriate levels of DNC. Therefore, to pose a secondary hazard to wildlife, ingestion of both DNC and HDP from the carcass would have to occur and HDP would have to be consumed at a level to allow for absorption of the DNC into the bloodstream. In addition, an appropriate level of DNC and HDP would have to be consumed from a carcass daily to produce any negative reproductive affects to other wildlife since current evidence indicates a single dose does not limit reproduction. To be effective, nicarbazin (both DNC and HDP) must be consumed daily during the duration of the reproductive season to limit the hatchability of eggs. Therefore, to experience the reproductive effects of nicarbazin, geese, domestic waterfowl, or pigeons that had consumed nicarbazin would have to be consumed by a non-target species daily and a high enough level of DNC and HDP would have to be available in the carcass and consumed for

[18]A depredation permit would only be required when managing localized Canada goose populations. A depredation permit would not be required to manage pigeon or domestic waterfowl populations.

reproduction to be affected. Based on the risks and likelihood of wildlife consuming a treated carcass daily and receiving the appropriate levels of DNC and HDP daily to negatively impact reproduction, secondary hazards to wildlife from the use of nicarbazin are extremely low (EPA 2005).

Although some risks to other non-target species besides bird species does occur from the use of products containing nicarbazin, those risks would likely be minimal given the restrictions on where and how bait can be applied. Although limited toxicological information for nicarbazin exists for wildlife species besides certain bird species, available toxicology data indicates nicarbazin is relatively non-toxic to other wildlife species (World Health Organization 1998, EPA 2005, California Department of Pesticide Regulation 2007). Given the use restriction of nicarbazin products and the limited locations where bait can be applied, the risks of exposure to non-targets would be extremely low.

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 shooting, lethal traps, and DRC-1339. In addition, birds could also be euthanized once live-captured by other methods. Available methods and the application of those methods to alleviate bird damage are further discussed in Appendix B. In addition, 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.

The use of firearms would essentially be selective for target species since animals would be identified prior to application; therefore, no adverse effects to non-targets would be 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 were live-captured. Since live-capture of birds using other methods would occur prior to the administering of carbon dioxide, 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 would essentially be selective for target species and the unintentional lethal removal of non-targets would not likely increase based on WS' recommendation of the method.

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

Once sites were baited, sites would be monitored daily to observe for non-target feeding activity. If non-targets were observed feeding on bait, those sites would be abandoned. By acclimating target bird species to a feeding schedule, baiting could occur at specific times to ensure bait placed would be quickly

consumed by target bird species, especially when large flocks of target species were present. The acclimation period would allow treated bait to be present only when birds were conditioned to be present at the site. An acclimation period would also increase the likelihood that treated bait would be consumed by the target species, which would make it unavailable to non-targets. In addition, when present in large numbers, many bird species 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 would only occur when treated bait was 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})[19] 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 derive 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 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).

[19] 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.

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 that 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). 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). According to the EPA (1995), laboratory studies with raptors indicated no adverse effects when certain raptor species were fed starlings poisoned with 1% DRC-1339 treated baits. Two American kestrels survived eating 11 and 60 poisoned starlings over 24 and 141 days, respectively. Two Cooper's hawks ate 191 and 222 starlings with no observable adverse effects. Three northern harriers ate 100, 191, and 222 starlings over 75 to 104 days and survived with no apparent detrimental effects. The LD_{50} values established for other avian predators and scavengers such as crows, ravens, and owls indicate these species are acutely more sensitive to DRC-1339 than hawks and kestrels (EPA 1995). The risk to mammalian predators from feeding on birds killed with DRC-1339 appears to be low (Johnston et al. 1999).

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 around sites baited with DRC-1339. Smith (1999) did not find carcasses of non-targets that exhibited histological signs consistent with DRC-1339 poisoning. 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; therefore, DRC-1339 degrades rapidly when exposed to sunlight, heat, or ultra violet radiation and has a short half-life (EPA 1995). 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.

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; thus, 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. Treated bait

would be mixed with untreated bait before baiting an area. Mixing treated bait with untreated bait would minimize non-target hazards and reduce the likelihood of the 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 would be 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 would be 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 Maryland would be expected to be extremely low to non-existent. Non-targets have not been lethally removed by WS during prior activities targeting birds 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 affect non-targets. Methods available to alleviate 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 MDNR any non-target take to ensure take by WS is considered as part of management objectives established. The potential impacts to non-targets would be similar to the other alternatives and are considered minimal to non-existent.

T&E Species Effects

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. 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 Maryland 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.

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 nor 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 (G. LaRouche, USFWS, pers. comm. 2013).

State Listed Species **–** The current list of State listed species designated as endangered or threatened in the State as determined by the MDNR (see Appendix D) was reviewed during the development of the EA. 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.

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 people 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 DRC-1339 and alpha chloralose, which would only be available for use by WS' employees.

The potential impacts to non-targets under this alternative would be variable and based on several factors. If methods were employed, as recommended by WS, the potential impacts to non-targets would likely be 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 would occur when employing shooting as a method and if people were familiar with the identifying characteristics of the target bird species, the potential impacts to non-target species would likely be low under this alternative.

Those people 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 people experiencing damage do not implement methods or techniques correctly. Methods or techniques recommended by WS that were implemented incorrectly could lead to an increase in non-target take.

If requestors were 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 people 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 that were not implemented as recommended or were 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. When those people 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 (*e.g.*, see 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.

Those persons requesting assistance would likely be those people who would use lethal methods since a damage threshold had been met for that individual requestor that 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 alleviated by non-lethal methods could 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.

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. 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 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 could continue to be taken under depredation permits issued by the USFWS and the MDNR, take could continue to occur during the regulated harvest season, non-native bird species could continue to be taken without the need for a permit, and birds could still be taken under their respective depredation/control orders. Risks to non-targets and T&E species would continue to occur from those people who implement damage management activities on their own or through recommendations by the other federal, state, and private entities. Although some risks would occur from those people that implement bird damage management in the absence of any involvement by WS, those risks would likely be low, and would be 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 would be available across the alternatives. If those methods available were applied as intended, risks to non-targets would be minimal to non-existent. If methods available were 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 caused those persons experiencing bird damage to use methods that were 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 alleviate wildlife damage that have resulted in the lethal take of non-target wildlife (*e.g.*, see White et al. 1989, USFWS 2001, FDA 2003).

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

A common concern is the potential adverse effects that available methods 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 would be 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. Therefore, the cooperator would be made aware of the use of those methods on property they own or manage prior to the initiation of any project, which would assist with identifying 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 alleviate 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 alleviate 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 could be employed as part of direct operational assistance by WS would be similar to those risks addressed in the other alternatives.

Although hazards to human safety from non-lethal methods exist, those methods would generally be regarded as safe when used by trained individuals who were experienced in their use. Although some risk of fire and bodily harm would exist from the use of pyrotechnics, lasers, and propane cannons, when used appropriately and in consideration of those risks, those methods 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 MDNR. Those lethal methods available under the proposed action alternative or similar products would also be available under the other alternatives. Although the avicide DRC-1339 would be 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 conduct activities would be knowledgeable in the use of methods, wildlife species responsible for causing damage or threats, and WS' directives. That knowledge would be incorporated into the decision-making process inherent with the WS' Decision Model that would be applied when addressing threats and damage caused by birds. Prior to and during the utilization of methods, WS' employees would consider risks to human safety based on location and method. Risks to human safety from the use of methods would likely be greater in urban areas when compared to rural areas that were less densely populated. Consideration would also be given to the location where damage management activities would be conducted based on property ownership. If locations where methods would be employed occurred on private property in rural areas where access to the property was controlled and monitored, the risks to human safety from the use of methods would likely be less. If damage management activities occurred at or near public use areas, then risks of the public encountering damage management methods and the corresponding risk to human safety would increase. Activities would generally be conducted when human activity was minimal (*e.g.*, early mornings, at night) or in areas where human activities was minimal (*e.g.*, in areas closed to the public).

The use of live-capture traps has also been identified as a potential issue. Traps would typically be set in situations where human activity was minimal to ensure public safety. Traps rarely cause serious injury and would only be triggered through direct activation of the device. Live-capture traps available for birds are typically walk-in style traps, such as box/cage traps, nest traps, or decoy traps, where birds enter but are unable to exit. Other types of live traps include Bal-Chatri traps that utilize small monofilament nooses to ensnare the talons of raptors, pole traps, padded leg hold traps, Dho-gaza traps, and mist nets. Human safety concerns associated with live traps used to capture birds require direct contact to cause bodily harm. Risks to human safety would be minimal if people left live-traps undisturbed.

Other live-capture devices, such as net guns, net launchers, mist nets, and bow 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 can 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 were 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 were considered before the use of firearms was deemed appropriate. All methods, including firearms, must be agreed upon with the cooperator to ensure the safe use of methods.

All WS' personnel who handle and administer 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 lethally removed 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 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 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.

Risks to human safety from the use of avicides could occur 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 Maryland 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 would not be used or would be 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 were determined, treated baits would be placed in feeding stations or would be 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 would be monitored for non-target activity and to ensure the safety of the public. After each baiting session, all uneaten bait would be retrieved. Through prebaiting, target birds can be acclimated to feed at certain locations at certain times. By acclimating birds to a feeding schedule, baiting could occur at specific times to ensure bait placed would be quickly consumed by target bird species, especially when large flocks of target species were present. The acclimation period would allow treated bait to be placed at a location only when target birds were conditioned to be present at the site, which provides a higher likelihood that treated bait would be consumed by the target species making 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 had been consumed by the target species or if the bait was removed by WS, then treated bait would no longer be 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 (*i.e.*, 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).

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 within 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 (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 (*Quiscalus major*) 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 $\leq$ 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 were residues 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. 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 would be administered to target wildlife through consumption of treated bait. Therefore, the current concern, outside of transport and storage, would be 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 were followed. The use pattern of nicarbazin would also ensure threats to public safety were minimal. The label requires an acclimation period before placing treated bait, which assists with identifying risks, requires the presence of the applicator at the location until all bait was 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 (see 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 were 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.

The recommendation by WS that birds be harvested during the regulated hunting season, which is established by the MDNR 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 MDNR 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.

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 would be required to 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 would be the potential for human consumption of meat from waterfowl that have been immobilized using alpha chloralose or have consumed nicarbazin. Since waterfowl would be 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 would be 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 was 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 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 would be 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 was requested to immobilize waterfowl or use nicarbazin during a period when harvest of waterfowl was 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 would be established by the MDNR 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 MDNR 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 2006 through FY 2012. The risks to human safety from the use of non-lethal and lethal methods, when used appropriately and by trained personnel, would be 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 alleviate damage. WS would only provide technical assistance to those people requesting assistance with bird damage and threats. The only methods that would not be available under this alternative would be alpha chloralose and DRC-1339. 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. 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.

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 effects 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 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 MDNR, 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 MDNR 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 can 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 were 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 were employed according to recommendations and as demonstrated by WS, the potential risks to human safety would be similar to the proposed action. If methods were 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.

The cooperator requesting assistance would also be 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 involvement by WS 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 MDNR. 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 would generally be regarded as posing minimal risks to human safety. Habitat modification and harassment methods would also generally be

regarded as posing minimal risks to human safety. Although, some risks to safety would likely occur from the use of pyrotechnics, propane cannons, and exclusion devices, those risks would be minimal when those methods were 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 would be shooting and nest destruction. Under this alternative, shooting and nest destruction would be available to those persons experiencing damage or threats of damage when required and permitted by the USFWS and/or the MDNR. Firearms, when handled appropriately and with consideration for safety, pose minimal risks to human safety.

Similar to the technical assistance only alternative, DRC-1339 and alpha chloralose would not be available under this alternative to those people experiencing damage or threats from birds. Chemical methods that would be available to the 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 alleviate 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 people 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 alleviate damage and threats. In some instances where birds were dispersed or removed, the ability of interested persons to observe and enjoy those birds would likely temporarily decline.

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

The use of lethal methods could 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 would be 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 remain if a reasonable effort were made to locate birds outside the area in which damage management activities occurred. Those birds removed by WS would be those birds that could be removed by the person experiencing damage in the absence of assistance by WS.

Activities would only be conducted on properties where a request for assistance was received and activities would only be conducted after an agreement for such services had been agreed upon by the

requester. 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 by other entities, WS' involvement in removing those birds would not likely be additive to the number of birds that could be taken in the absence of WS' involvement. Birds could be removed by other entities with a depredation permit issued by the USFWS and the MDNR, under depredation/control orders, without the need for a permit (non-native species), or during the regulated hunting seasons.

WS' take of birds from FY 2006 through FY 2012 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 would no longer be present for viewing or enjoying, those birds would likely be taken by the property owner or manager if WS were not involved in the action. Given the limited take proposed by WS under this alternative, when compared to the known sources of mortality of birds and their population information, damage management activities conducted by WS 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 would likely be low.

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

If those people 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 could result in localized reductions in the presence of birds at the location where damage was occurring. The presence of birds where damage was occurring could be reduced where damage management activities were conducted under any of the alternatives. Even the recommendation of non-lethal methods would likely result in the dispersal of birds from the area if those non-lethal methods recommended by WS were employed by those people 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 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 has been requested and those persons would likely 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 would likely 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 were dispersed or removed by those people 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 were not as diligent in employing those methods as WS would be if conducting an operational program. If those people experiencing damage abandoned the use of those methods then birds would likely remain in the area and available for viewing and enjoying for

those people interested in doing so. Similar to the other alternatives, the geographical area in which damage management activities occurs would not be 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 people 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 was taken or if activities were not permitted by the USFWS and the MDNR, then no impact on the aesthetic value of birds would occur under this alternative.

Birds could continue to be dispersed and lethally taken by other entities under this alternative. Lethal take would continue to occur when permitted by the USFWS and the MDNR through the issuance of depredation permits. Take could also occur during the regulated harvest season, pursuant to depredation/control orders, and in the case of some species, take could occur any time without the need for a depredation permit.

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 MDNR 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, depredation permits, and under the depredation/control orders would be regulated and adjusted by the USFWS and the MDNR.

Those people experiencing damage or threats would continue to use those methods they feel appropriate to alleviate bird damage or threats, including lethal take. Therefore, WS' involvement in bird damage management would not be additive to the birds that could be lethally removed 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

Humaneness and animal welfare concerns associated with methods available for use to manage bird damage have been identified as an issue. As described previously, most of those methods available for use to manage bird damage would be available under any of the alternatives, when required and permitted by the USFWS and the MDNR. The humaneness and animal welfare concerns of methods available for use in Maryland, 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 that 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 drugs, 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 alleviate 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 would be to use methods as humanely as possible to alleviate 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 alleviate requests for assistance.

Some methods have been stereotyped as "*humane*" or "*inhumane*". However, many "*humane*" methods can be inhumane if not used appropriately. For instance, 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 would be to address requests for assistance using methods in the most humane way possible that minimizes the stress and pain to the animal. Overall, the use of resource management methods, harassment methods, and exclusion devices are regarded as humane when used appropriately. Although some concern arises from the use of live-capture methods, the stress of animals is likely temporary.

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

If birds were to be live-captured by WS, WS' personnel would be present on-site during capture events or methods would be checked at least once every 24 hours to ensure birds captured were addressed timely 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 alleviate or prevent bird damage and threats, when requested. Lethal methods would include shooting, DRC-1339, the recommendation that birds be harvested during the regulated hunting seasons, and euthanasia after birds were live-

captured. WS' use of euthanasia methods under the proposed action would follow those required by WS' directives (see WS Directive 2.430, WS Directive 2.505).

The euthanasia methods being considered for use under the proposed action for live-captured birds would be cervical dislocation and carbon dioxide. The AVMA guidelines on euthanasia list cervical dislocation, carbon dioxide, and gunshot as conditionally acceptable methods of euthanasia for free-ranging birds, which can lead to a humane death (AVMA 2013). The use of cervical dislocation, carbon dioxide, or gunshot for euthanasia would occur after the animal had been live-captured and away from public view. Although the AVMA guidelines list cervical dislocation and gunshot as conditionally acceptable methods of euthanasia for free-ranging wildlife, there is greater potential those methods may not consistently produce a humane death (AVMA 2013). WS' personnel that employ methods to euthanize live-captured birds would be trained in the proper use of those methods to ensure a timely and quick death.

Although the mode of action 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. DRC-1339 to manage damage caused by certain species of birds would only be available for use by WS' personnel. A similar product containing the same active ingredient could commercially be available as a restricted use pesticide for use to manage damage associated with blackbirds and starlings; however, the product is not currently registered for use in Maryland.

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

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

outbreaks of coccidiosis with no apparent ill effects to chickens. Based on current information, the use of nicarbazin would generally be considered humane based on current research.

Alpha chloralose could be used by WS as a sedative to live-capture geese and other waterfowl. Although overdosing waterfowl with alpha chloralose can cause death, WS would employ alpha chloralose as a non-lethal method only. When using alpha chloralose, WS' personnel would be present on site to retrieve birds that become sedated. Some concern occurs that waterfowl may drown if sedation occurs while they are loafing on water. WS would ensure that a boat and/or a canoe were available for quick retrieval of birds that become sedated while in the water.

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 and alpha chloralose could be used under any of the alternatives by those people experiencing damage regardless of WS' direct involvement. Therefore, the issue of humaneness associated with methods would be similar across any of the alternatives 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 issue of humaneness of methods under this alternative is likely to be perceived as similar to humaneness issues discussed under the proposed action. This perceived similarity is derived from WS' recommendation of methods that some consider inhumane. WS would not directly be involved with 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 alleviate the damage or threat could lead to incidents with a greater probability of being perceived as inhumane. In those situations, the pain and suffering are likely to be regarded as greater than those discussed in the proposed action alternative.

Those people requesting assistance would be directly responsible for the use and placement of methods and if monitoring or checking of those methods does not occur in a timely manner, captured wildlife could experience suffering and if not addressed timely, could experience distress. The amount of time an animal is restrained under the proposed action would be shorter compared to a technical assistance alternative if those requesters implementing methods are not as diligent or timely in checking methods. Similar to Alternative 3, it can be difficult to evaluate the behavior of individual people and determining

what may occur under given circumstances. Therefore, only the availability of WS' assistance can be evaluated under this alternative 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, WS would not be involved with any aspect of bird damage management in the State. Those people experiencing damage or threats associated with birds could use those methods legally available and permitted by the USFWS, the MDNR, 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 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 humane could be employed in inhumane ways. Methods could be employed inhumanely by those people inexperienced in the use of those methods or if those people were not as diligent in attending to those methods.

The efficacy and therefore, the humaneness of methods would be based on the skill and knowledge of the person employing those methods. A lack of understanding of the target species or methods used could lead to an increase in situations perceived as being inhumane to wildlife despite the method used. Despite the lack of involvement by WS under this alternative, those methods perceived as inhumane by certain individuals and groups would still be available to the public to use to alleviate damage and threats caused by birds. Therefore, those methods considered inhumane would continue to be available for use under this alternative. If those people experiencing bird damage apply those methods considered humane 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 MDNR. Those species addressed in this EA that have established hunting seasons include snow geese, mallards, American coots, and mourning doves. 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 MDNR in published reports.

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

The magnitude of take addressed in the proposed action would be low when compared to population data and 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 and compared to the estimated population of those species, the potential impacts on those species' population was below the level of removal required to lower population levels. The USFWS and the MDNR 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.

WS' bird damage management activities would primarily be conducted in areas where hunting access was 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 was occurring to areas outside the damage area, which could serve to move birds from those less accessible areas to places accessible to hunters.

With oversight of bird populations by the USFWS and the MDNR, the number of birds that could be lethally removed by WS would not limit the ability of those people interested to harvest those bird species during the regulated season. All take by WS would be reported to the USFWS and the MDNR annually to ensure take by WS was incorporated into population management objectives established for bird populations. Based on the limited take proposed by WS and the oversight by the USFWS and the MDNR, WS' take of birds annually under this alternative would have no effect on the ability of those people 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 recommended the use of non-lethal methods and those non-lethal methods were employed by those persons experiencing damage, birds would likely 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 recommended 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 and the MDNR, under depredation/control 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 lethally removed under a depredation permit, under depredation/control orders, and during the regulated hunting seasons would be determined by the USFWS and/or the MDNR. Therefore, WS' recommendation of lethal methods, including hunting, under this alternative would not limit the ability of those people interested to harvest birds during the regulated season since the USFWS and the MDNR 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 MDNR would continue to regulate populations through adjustments of the allowed take during the regulated harvest season and the continued use of depredation/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 alleviate 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 alleviate 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 alleviate bird damage. WS would continue to provide both technical assistance and direct operational assistance to those people requesting assistance. WS would only provide assistance after a request had been received and a cooperative service agreement or other comparable document had been signed by WS and the requesting entity. The document signed between WS and the requesting entity would indicate those methods agreed upon to address birds causing damage. 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 would employ only those methods as agreed upon by the requestor after available methods were discussed.

A common issue raised is the use of lethal methods are ineffective because additional birds would likely return to the area, either after removal occurred or the following year when birds returned to the area to nest, 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 were no longer used. The common factor when employing any method is that birds would return if suitable habitat continued to exist at the location where damage was occurring and bird densities were 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 would often be 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 would be 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 can be divided into short-term redistribution approaches and long-term population/habitat management approaches (*e.g.*, see Cooper and Keefe 1997). Short-term approaches focus on redistribution and dispersal 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 could be 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 is often a short-term solution that moves birds to other areas where damages or threats could occur (*e.g.*, see Smith et al. 1999, Gorenzel et al. 2000, Gorenzel et al. 2002, Avery et al. 2008, Chipman et al. 2008). For example, 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. For example, 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).

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. For example, 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. Cooper and Keefe (1997) found that fencing and harassment with dogs were the only effective short-term approaches to reducing goose damage but likely redistribute the problem elsewhere.

Long-term solutions to resolving bird damage often require management of the population (*e.g.*, see Smith et al. 1999) and identifying the habitat characteristics that attract birds to a particular location (Gorenzel and Salmon 1995). For example, hunting, goose removal, and egg destruction were identified as long-term solutions to resolving goose damage over larger geographical areas by reducing goose populations (Cooper and Keefe 1997). Boyd and Hall (1987) showed that a 25% reduction in a local

crow roost resulted in reduced hazards to a nearby airport. Cooper (1991) reported 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 reduced goose-aircraft collisions at Minneapolis-St. Paul International Airport. An integrated approach to resolving bird damage is likely the most effective (*e.g.*, see Smith et al. 1999). 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. Translocating geese to areas where they can be hunted has been found to be an effective method to reduce conflicts with geese at problem sites. Hall and Groniger (2002) found that translocated geese were subject to higher hunting mortality by about 8% than non-relocated geese and that hunting as a management tool reduced the population of geese at Truckee Meadows in Nevada from about 2,000 to 400 geese. Holevinski et al. (2006) found that more translocated adult geese (23.8%) and juvenile geese (22.0%) in New York were harvested than control geese when translocated to an area open to hunting; and that only seven of 177 translocated geese returned to the original capture site. Recent research at an airport in the United Kingdom found that through the capture of approximately 287 geese each year over a period of three years, combined with the oiling of 2,980 eggs and hazing geese from problem roost sites, reduced goose movements over the airfield by 63% (Baxter and Robinson 2007).

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 to manage localized damage is not intended as a way to manage bird populations 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 can be effective despite birds returning the following year.

As stated 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 alleviate 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). For example, 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 evaluate effectively 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 using the WS Decision Model. Once employed, methods would be further evaluated for effectiveness based on a continuous evaluation of activities by WS. Therefore, the effectiveness of methods would be 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.

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 assistance under this alternative, entities requesting assistance could 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. However, in most instances, those 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 (*e.g.*, see 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 conduct the actions efficiently and effectively.

Under this alternative, most of the methods described in Appendix B would be recommended and/or demonstrated, except for alpha chloralose and DRC-1339. WS would recommend methods using the WS Decision Model based on information provided by those people 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 alleviate bird damage are reasonably anticipated to be effective in resolving damage occurring. Under this alternative, those people requesting assistance would be provided information on bird behavior to ensure methods were applied when the use of those methods would likely 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, except alpha chloralose and DRC-1339. If methods were 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 people requesting assistance. However, if methods are employed that are not recommended or if those methods are employed incorrectly by those people 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 people 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 and alpha chloralose, which are restricted to use by WS only. WS would not be directly involved with application of any methods to alleviate 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 and the MDNR. Nest destruction and egg oiling/addling would continue to occur under this alternative when permitted by the USFWS and the MDNR. 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, mute swans, rock pigeons, 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 damage management activities at adjacent sites within the same period. In addition, commercial pest control companies may conduct damage management activities in the same area. The potential cumulative impacts analyzed below could occur because of WS' damage management program activities over time or because 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 MDNR, activities of each agency and the take of birds would be available. 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 through vehicle strikes, aircraft strikes, and illegal take
- 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). 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 populations, the USFWS and the MDNR could adjust take levels, including the take by WS, to ensure population objectives for bird species were achieved. Consultation

and reporting of take by WS would ensure the USFWS and the MDNR considered any activities conducted by WS.

WS' take of birds in Maryland from FY 2006 through FY 2012 was of a low magnitude when compared to the total known take and when compared to available population information. The USFWS and the MDNR considers all known take when determining population objectives for birds and could adjust the number of birds that could be taken during the regulated hunting 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 and the MDNR. Any bird population declines or increases induced through the regulation of take would be the collective objective for bird populations established by the USFWS and the MDNR. Therefore, the cumulative take of birds annually or over time by WS would occur at the desire of the USFWS and the MDNR as part of management objectives for birds in the State. No cumulative effects on target bird species would be expected from WS' damage management activities based on the following considerations:

Historical outcomes of WS' damage management activities on wildlife

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

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 often 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 dispersal methods would generally be 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 affect 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. Most methods described in Appendix B are methods that would be employed to confine or restrain target bird species that would be subsequently euthanized using humane methods. 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 affect non-target species.

Chemical methods available for use under the proposed action would be taste repellents, nicarbazin, alpha chloralose, and DRC-1339, which are described in Appendix B. Except for repellents that would be applied directly to the affected resource, all chemical methods would be employed using baits that would be highly attractive to target species and would be used in areas where exposure to non-targets would be 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 would be 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 effects 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 were observed feeding on the pre-bait, the plots would be abandoned and no baiting would occur at those locations. Once sites were baited, sites would be monitored daily to observe for non-target feeding activity. If non-targets were observed feeding on bait, those sites would be 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 MDA 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 would be 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 were registered for use by the EPA in accordance to the FIFRA and were applied according to label requirements, no adverse effects to non-targets would be 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 Maryland, other bird repellents registered contain the active ingredient anthraquinone, which is a naturally occurring plant extract. Characteristics of those chemicals and potential use patterns indicate that no significant cumulative impacts related to environmental fate are expected from their use by WS in Maryland 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 any non-targets to be released if captured. Therefore, the use of those methods would not affect non-target species.

The methods described in Appendix B have a high level of selectivity and can be employed using SOPs to ensure minimal effects to non-targets species. Non-targets were not taken by WS during activities to alleviate bird damage from FY 2006 through FY 2012. Based on the methods available to alleviate 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 of non-targets under the proposed action would not cumulatively affect non-target species. WS has reviewed the T&E species listed by the MDNR, the USFWS, and the National Marine Fisheries Services and has determined that 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 would be used after careful consideration of the safety of those people employing methods and to the public. Capture methods would be employed where human activity was 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 would be agreed upon by the requesting entities, which would be 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 would also ensure the safety of the public from those methods used to capture or take wildlife. 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 affect human safety.

Repellents 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 with the MDA. 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 were 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 Maryland. 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 would be placed on platforms or other hard surfaces where they would seldom be exposed to 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 (EPA 1995). Additionally, the relatively small quantity of DRC-1339 that could potentially be used in bird damage management programs in Maryland, 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 damage management activities would not be expected to increase to a level that 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 Maryland.

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 would be required to attend training courses on the proper use of alpha chloralose and employees using alpha chloralose must be certified in the application of alpha chloralose. Training would ensure proper care and handling occurred, ensure that proper doses were administered, and 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 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. Carbon dioxide is considered a moderately rapid form of euthanasia (AVMA 2013). 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 2006 through FY 2012. No cumulative effects from the use of those methods discussed in Appendix B would be expected given the use patterns of those methods for resolving bird damage in the State. For these reasons, WS concludes that the use of methods would not create an environmental health or safety risk to children from implementing the proposed action. It is not anticipated that the proposed action or the other alternatives would result in any adverse or disproportionate environmental impacts to minorities and persons or populations of low-income people.

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 droppings 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 MDNR 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 the MDNR. Since those people seeking assistance could remove birds from areas where damage was occurring with or without a permit from the USFWS and the MDNR, WS' involvement would have no effect of the aesthetic value of birds in the area where damage was occurring. 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 would not be 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 to ensure SOPs were 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 the proposed annual take by WS on the populations of target species was low when compared to the total take of birds and when compared to the estimated statewide populations of those species. Since all take of birds is regulated by the USFWS and the MDNR, 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 of the known annual take that occurs during the harvest seasons.

With oversight of bird take, the USFWS and the MDNR 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 MDNR 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 the practitioner diagnoses 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 (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 were unsuccessful, but that periodic management may be necessary.

Correlated with the effectiveness of methods at reducing or alleviating damage or threats would be 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 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. In addition, it is rarely possible to prove conclusively birds were 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 alleviate 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. 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 receive the greatest application. As part of an integrated approach, evaluation of methods would continually occur to allow for those methods that were most effective at resolving damage or threats to be employed under similar circumstance where birds were causing damage or posed a threat. Additionally, management operations could be constrained by cooperator funding and/or objectives and needs. The cost effectiveness of methods and the effectiveness of methods are linked. The issue of cost effectiveness as it relates to the effectiveness of methods was discussed as an issue in Chapter 2 of this EA.

As stated in this EA, WS would only provide 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 and translocating 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 would be 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 animal damage was also addressed in Chapter 1 of this EA.

CHAPTER 5 - LIST OF PREPARERS AND PERSONS CONSULTED

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APPENDIX A
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APPENDIX B

METHODS AVAILABLE FOR ALLEVIATING OR PREVENTING BIRD DAMAGE IN MARYLAND

The most effective approach to resolving wildlife damage problems would be to integrate the use of several methods, either simultaneously or sequentially. An adaptive plan would integrate and apply practical methods of prevention and reduce damage by birds while minimizing harmful effects of damage reduction measures on people, other species, and the environment. An adaptive plan may incorporate resource management, physical exclusion and deterrents, and population management, or any combination of these, depending on the characteristics of specific damage problems.

In selecting damage management techniques for specific damage situations, consideration would be given to the responsible species and the magnitude, geographic extent, duration and frequency, and likelihood of bird damage. Consideration would also be given to the status of target and potential non-target species, local environmental conditions and impacts, social and legal aspects, and relative costs of damage reduction options. The cost of damage reduction may sometimes be a secondary concern because of the overriding environmental, legal, and animal welfare considerations. Those factors would be evaluated in formulating damage management strategies that incorporate the application of one or more techniques.

A variety of methods would potentially be available to the WS program in Maryland relative to the management or reduction of damage from birds. Various federal, state, and local statutes and regulations and WS directives would govern WS' use of damage management methods. WS would develop and recommend or implement strategies based on resource management, physical exclusion, and wildlife management approaches. Within each approach there may be available a number of specific methods or techniques. The following methods could be recommended or used by the WS program in Maryland. Many of the methods described would also be available to other entities in the absence of any involvement by WS.

NON-LETHAL WILDLIFE DAMAGE MANAGEMENT METHODS

Non-lethal methods consist primarily of tools or devices used to disperse or capture a particular animal or a local population of wildlife to alleviate damage and conflicts. Most of the non-lethal methods available to WS would also be available to other entities within the State and could be employed by those entities to alleviate bird damage.

Habitat alteration can be the planting of vegetation unpalatable to wildlife or altering the physical habitat (Conover and Kania 1991, Conover 1992). Conover (1991) found that even hungry Canada geese refused to eat some ground covers such as common periwinkle (*Vinca minor*), English ivy (*Hedera helix*) and Japanese pachysandra (*Pachysandra terminalis*). Planting less preferred plants or grasses to discourage geese from a specific area could work more effectively if good alternative feeding sites are nearby (Conover 1985). However, the manipulation of turf grass varieties in urban/suburban, heavy use situations such as parks, athletic fields, and golf courses is often not feasible. Varieties of turf grass that grow well and can withstand regular mowing and regular/heavy human use include Kentucky blue grass, red fescue, perennial bent grass, perennial rye grass, and white clover. All of these grasses are appealing to most waterfowl. The turf grass varieties that are not appealing to geese, such as tall fescue, orchard grass, and timothy, do not withstand regular mowing and/or regular/heavy human use.

Fences, hedges, shrubs, boulders, and other structures can be placed at shorelines to impede waterfowl movements. Restricting a bird's ability to move between water and land would deter them from an area, especially during molts (Gosser et al. 1997). However, people are often reluctant to make appropriate

landscape modifications to discourage waterfowl activity (Breault and McKelvey 1991, Conover and Kania 1991). Unfortunately, both humans and geese appear to find lawn areas near water attractive (Addison and Amernic 1983), and conflicts between humans and geese would likely continue wherever this interface occurs.

Habitat modification can be an integral part of bird damage management. Wildlife production and/or presence are often 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 would be responsible for implementing habitat modifications, and WS would only provide advice on the type of modifications that would provide the best chance of achieving the desired effect. Habitat management would most often be a primary component of 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. For example, habitat management would often be necessary to minimize damage caused by crows, blackbirds, and starlings that form large roosts during late autumn and winter. Bird activity can be greatly reduced at roost sites by removing all the trees, selectively thinning trees, or pruning trees. Habitat modification would be available to all entities.

Supplemental Feeding and Lure crops are food resources planted or provided to attract wildlife away from more valuable resources (*e.g.*, crops). Food is provided so that the animals causing damage would consume it rather than the resource being protected. In feeding programs, target wildlife would be offered an alternative food source with a higher appeal with the intention of luring them from feeding on affected resources. This method can be ineffective if other food sources are available. For example, lure crops would largely be ineffective for geese since food resources (turf) are readily available. For lure crops to be effective, the ability to keep birds from surrounding fields would be necessary, and the number of alternative feeding sites must be minimal (Fairaizl and Pfeifer 1988). Additionally, lure crops reduce damage for only a short time (Fairaizl and Pfeifer 1988) and damage by birds is generally continuous. The resource owner would be limited in implementing this method contingent upon ownership of or other ability to manage the property and the property of others. Supplemental feeding and the planting of lure crops would be available to other entities within the State.

Modifying Human Behavior would be methods recommended by WS when providing technical assistance. Recommendations would include modifying the behavior of people that may be attracting or contributing to damage being caused by birds. For example, artificial feeding of waterfowl by people can attract and sustain more birds in an area than could normally be supported by natural food supplies. This unnatural food source can result in an increase in damage caused by waterfowl. Recommendations may include altering planting dates so that crops are less vulnerable to damage when birds may be present. Modifying human behavior could include recommending people plant crops that are less attractive or less vulnerable to damage. 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, removal of spilled grain or standing water, and use of bird proof feeders (Johnson and Glahn 1994). Those recommendations made by WS would be available for implementation by other entities.

Alter Aircraft Flight Patterns could occur in cases where the presence of birds at or near airports results in threats to human safety, and when such problems cannot be resolved by other means, the alteration of aircraft flight patterns or schedules may be recommended. However, altering operations at airports to decrease the potential for bird strike hazards would generally not be feasible unless an emergency exists.

Otherwise, the expense of interrupted flights and the limitations of existing facilities generally make this practice prohibitive.

Removal of Domestic Waterfowl could be recommended or implemented by WS and other entities to alleviate damage. Flocks of urban/suburban domestic waterfowl are known to act as decoys and attract other migrating waterfowl (Crisley et al. 1968, Woronecki 1992). Avery (1994) reported that birds learn to locate food resources by watching the behavior of other birds. The removal of domestic waterfowl from water bodies removes birds that act as decoys in attracting other waterfowl. Domestic waterfowl could also carry diseases, which can threaten wild populations. Property or resource owners may be reluctant to remove some or all decoy birds because of the enjoyment of their presence.

Electric Fencing could be recommended or implemented by WS and others to alleviate damage caused by waterfowl. The application of electrified fencing would generally be limited to rural settings, due to the possibility/likelihood of interaction with people and pets. Limits of this application arise where there are multiple landowners along the wetland, pond, or lake, the size of the area, and its proximity to bodies of water used by waterfowl. Perceptions from Minnesota on the effectiveness of electric fences were high (Cooper and Keefe 1997). While electric fencing may be effective in repelling waterfowl in some urban settings, its use is often prohibited in many municipalities for human safety reasons. Problems that typically reduce the effectiveness of electric fences include vegetation on fence, flight capable birds, fencing knocked down by other animals (*e.g.*, white-tailed deer and dogs), and poor power. Electric fencing would generally be available to all entities.

Barrier Fencing could also be recommended or implemented by WS and others. The construction or placement of physical barriers has limited application for birds and would primarily be recommended or employed to alleviate waterfowl damage. Barriers can be temporary or permanent structures. Lawn furniture/ornaments, vehicles, boats, snow fencing, plastic hazard fencing, metal wire fencing, and multiple strand fencing have all been used to limit the movement of waterfowl. The application of this method would be limited to areas that could be completely enclosed and do not allow waterfowl to land inside enclosures. Similar to most abatement techniques, this method has been most effective when dealing with small numbers of breeding geese and their flightless young along wetlands and/or waterways. Unfortunately, there have been situations where barrier fencing designed to inhibit goose nesting has entrapped young and resulted in starvation (Cooper 1998). The preference for geese to walk or swim, rather than fly, during this time period contributes to the success of barrier fences. Birds that are capable of full or partial flight render this method useless, except for enclosed areas small enough to prevent landing. Exclusion adequate to stop bird movements can also restrict movements of livestock, people, and other wildlife (Fuller-Perrine and Tobin 1993). Barrier fencing would generally be available to all entities.

Surface Coverings could be recommended or employed by WS and others to discourage birds from using areas, primarily waterfowl. For example, plastic balls approximately five inches in diameter can be used to cover the surface of a pond and prevent access by waterfowl. A "*ball blanket*" renders a pond unusable for boating, swimming, fishing, and other recreational activities. This method can be very expensive depending on the area covered.

Overhead wire grids consist of wire (*e.g.*, fishing line) grid that is stretched taught over a resource to prevent access by birds. The birds apparently fear colliding with the wires and thus avoid flying into areas where the method has been employed. Johnson (1994) found that wire grids could deter crow use of specific areas where they are causing a nuisance. Waterfowl may be excluded from ponds using overhead wire grids (Fairaizl 1992, Lowney 1993) and are most applicable on ponds of two acres or less. Exclusion may be impractical in most settings (*e.g.*, commercial agriculture); however, wire grids could be practical in small areas (*e.g.*, personal gardens) or for high-value crops (*e.g.*, grapes) (Johnson 1994).

A few people would find exclusionary devices such as wire grids unsightly, trashy, and a lowering of the aesthetic value of the neighborhood when used over personal gardens. Wire grids generally render an area unusable by people. The cost of constructing and maintaining wire grids could be burdensome for some people.

Visual scaring techniques such as Mylar tape (highly reflective surface produces flashes of light that startles birds), eyespot 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). Reflective tape has been used successfully to repel some birds from crops when spaced at three to five meter intervals (Bruggers et al. 1986, Dolbeer et al. 1986). Mylar flagging has been reported effective at reducing migrant Canada goose damage to crops (Heinrich and Craven 1990). Other studies have shown reflective tape ineffective (Bruggers et al. 1986, Dolbeer et al. 1986, Tobin et al. 1988, Conover and Dolbeer 1989). 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. Visual scaring techniques can be impractical in many locations and has met with some concerns due to the negative aesthetic appearance presented on the properties where those methods are used.

Dogs can be effective at harassing waterfowl and keeping them off turf and beaches (Conover and Chasko 1985, Castelli and Sleggs 2000). Around water, this technique appears most effective when the body of water to be patrolled is less than two acres in size (Swift 1998). Although dogs can be effective in keeping waterfowl off individual properties, they do not contribute to a solution for the larger problem of overabundant goose populations (Castelli and Sleggs 2000). Swift (1998) and numerous individuals in New Jersey have reported that when harassment with dogs ceases, the number of geese returns to pre-treatment numbers. WS has recommended and encouraged the use of dogs where appropriate.

Scarecrows and Effigies often depict predator animals (*e.g*., alligators, owls), people, or mimic distressed target species (*e.g*., dead geese, dead vultures) and they are intended to elicit a flight response from target birds, which disperses those birds from the area. Avery et al. (2002) and Seamans (2004) found that the use of vulture effigies were an effective non-lethal method to disperse roosting vultures. Avery et al. (2008) found that effigies could be effective as dispersing crows. However, Conover and Chasko (1985) found an integrated approach (using swan and predator effigies, distress calls and non-lethal chemical repellents) to be ineffective at scaring or repelling nuisance waterfowl. While Heinrich and Craven (1990) reported that using scarecrows reduced migrant Canada goose use of agricultural fields in rural areas, their effectiveness in scaring geese from urban/suburban areas was severely limited because geese were not afraid of humans as a result of nearly constant contact with people. In general, scarecrows would be most effective when they were moved frequently, alternated with other methods, and were well maintained. However, scarecrows tend to lose effectiveness over time and become less effective as populations increase (Smith et al. 1999). In general, those methods would be available to all entities.

Alarm or Distress Calls are electronic devices that mimic the sounds exhibited when target species are in distress, which is intended to cause a flight response and disperse target animals from the area. Alarm calls are given by birds when they detect predators while distress calls are given by birds when they are captured by a predator (Conover 2002). When other birds hear these calls, they know a predator is present or a bird has been captured (Conover 2002). Recordings of both calls have been broadcast in an attempt to scare birds from areas where they are unwanted. Recordings have been effective in scaring starlings from airports and vineyards, gulls from airports and landfills, finches from grain fields, and herons from aquaculture facilities and American crows from roosts (Conover 2002). Aguilera et al. (1991) found distress calls ineffective in causing migratory and resident geese to abandon a pond.

However, the effectiveness of alarm or distress calls can be reduced as birds become accustomed to the sounds and learn to ignore them. Because alarm or distress calls are given when a bird is being held by a predator or when a predator is present, birds should expect to see a predator when they hear these calls. If they do not, they may become accustomed to alarm or distress calls more quickly. In generally, birds tend to habituate to hazing techniques (Zucchi and Bergman 1975, Summers 1985, Aubin 1990). For this reason, scarecrows or effigies should be paired with alarm or distress calls (Conover 2002), pyrotechnics (Mott and Timbrook 1988), or other methods realize maximum effectiveness. In some situations, the level of volume required for this method to be effective may disturbing to residents or be prohibited by local noise ordinances. Although, Mott and Timbrook (1988) reported distress calls as effective at repelling resident geese 100 meters from the distress unit, the birds would return shortly after the calls stopped. The repellency effect was enhanced when pyrotechnics were used with the distress calls. In some situations, the level of volume required for this method to be effective in urban/suburban areas would be prohibited by local noise ordinances. A similar device, which electronically generates sound, has proven ineffective at repelling migrant waterfowl (Heinrich and Craven 1990).

Birds hazed from one area where they are causing damage frequently move to another area where they cause damage (Brough 1969, Conover 1984, Summers 1985, Swift 1998). Smith et al. (1999) noted that others have reported similar results, stating "*biologists are finding that some techniques (e.g., habitat modifications or scare devices) that were effective for low to moderate population levels tend to fail as flock sizes increase and waterfowl become more accustomed to human activity*". Whitford (2003) used a combination of noise harassment, dogs, nest displacement, and visual harassment to chase geese from an urban park during the nesting season. Birds responded by dispersing and continued harassment with alarm calls prevented recolonization of the site during the nesting season.

Lasers and Lights are avian damage management methods that have evaluated for a number of species (Glahn et al. 2000*b*, Blackwell et al. 2002). For best results and to disperse numerous birds from a roost, a 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).

Research on this potential tool has been conducted in a replicated format only for double-crested cormorants (Glahn et al. 2000*b*). Moving the laser light through the tree branches rather than touching birds with the laser light elicited an avoidance response from cormorants (Glahn et al. 2000*b*). During pen trials with lasers, the cormorants were inconsistent in their response with some birds showing no response to the laser (Glahn et al. 2000*b*). The lack of overt response by cormorants to lasers is not clearly understood, but suggests laser light is not a highly aversive agent (Glahn et al. 2000*b*). Blackwell et al. (2002) tested lasers on several bird species and observed varied results among species. Lasers were ineffective at dispersing starlings and cowbirds (Blackwell et al. 2002). Lasers were found to be only moderately effective for harassing geese, with significant reduction in night roosting, but little to no reduction in diurnal activity at the site pre- and post-use (Sherman 2003). Similar to the use of lasers, application of spotlights to haze birds from night roosts has proven to be a moderately effective method. It is a method that can be incorporated with other methods in integrated management plans (VerCauteren et al. 2003).

Pyrotechnics (screamer shells, bird bombs, and 12-gauge cracker shells) have been used to repel many species of birds (Booth 1994). Aguilera et al. (1991) found 15 mm screamer shells effective at reducing resident and migrant Canada geese use of areas in Colorado. However, Mott and Timbrook (1988) and Aguilera et al. (1991) doubted the efficacy of harassment and believed that moving the geese simply

redistributed the problem to other locations. These devices are sometimes effective but usually only for a short period 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 because of pyrotechnics and propane cannon use.

Fairaizl (1992) and Conomy et al. (1998) found the effectiveness of pyrotechnics highly variable among different flocks of waterfowl. Some flocks in urban areas required continuous harassment throughout the day with frequent discharges of pyrotechnics. The waterfowl usually returned within hours. In another example, a minority of resident Canada goose flocks in Virginia showed no response to pyrotechnics (Fairaizl 1992). Some flocks of Canada geese in Virginia showed a quick response to pyrotechnics during winter months, suggesting migrant geese made up some or all of the flock (Fairaizl 1992). In another example, Shultz et al. (1988) reported fidelity of resident Canada geese to feeding and loafing areas is strong, even when heavy hunting pressure is ongoing. Mott and Timbrook (1988) concluded that the efficacy of harassment with pyrotechnics was partially dependent on availability of alternative loafing and feeding areas. Although one of the more effective methods of frightening geese away, more often than not pyrotechnics simply move geese to other areas. There are also safety and legal implications regarding their use. Discharge of pyrotechnics is inappropriate and prohibited in some urban/suburban areas. Pyrotechnic projectiles can start fires, ricochet off buildings, pose traffic hazards, trigger dogs to bark incessantly, and annoy and possibly injure people. Use of pyrotechnics in certain municipalities would be constrained by local firearm discharge and noise ordinances.

Paintballs and recreational paintball equipment may be used to supplement other harassment methods. Paintballs consist of a gelatin shell filled with a non-toxic glycol and water-based coloring that rapidly dissipates and is not harmful to the environment. A paintball marker (or gun) uses compressed CO_2 to propel paintballs an average of 280 feet per second, though they are not very accurate. The discharge of the paintball marker combined with the sound of paintballs hitting the ground or splashing in water may be effective in dispersing birds, especially when combined with other harassment techniques. Though paintballs break easily and velocity rapidly decreases with distance, firing at close range is discouraged to avoid harming birds. As with pyrotechnics, use of paintballs may be restricted in some areas by local ordinances.

Propane Cannons produce a noise that is intended to represent a firearm discharge. Cannons are attached to a propane tank and regulated to discharge at certain intervals. Propane cannons are generally inappropriate for urban/suburban areas due to the repeated loud explosions, which many people would consider a serious and unacceptable nuisance and potential health threat (hearing damage). Although a propane cannon can be an effective dispersal tool for birds in agricultural settings, resident waterfowl in urban areas are more tolerant of noise and habituate to propane cannons relatively quickly.

Avitrol is a chemical frightening agent (repellent) that can be effective in a single dose when mixed with untreated baits, normally in a 1:9 ratio. However, birds consuming treated baits are generally killed (Johnson and Glahn 1994). Prebaiting is usually necessary to achieve effective bait acceptance by the target species. This chemical has been 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, the affected bird begins to broadcast distress vocalizations and display abnormal flying behavior; thereby, frightening the remaining birds away.

Avitrol is a restricted use pesticide that can only be sold to certified applicators and has been available in several bait formulations where only a small portion of the individual grains carries 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 gastrointestinal tract of affected or dead birds (Schafer, Jr. 1981, Holler and Shafer, Jr. 1982).

Methyl anthranilate has been used as an artificial grape flavoring in foods and soft drinks for human consumption. Methyl anthranilate could be used or recommended by WS as a bird repellent and would be available for use by other entities. Methyl anthranilate has been shown to be a promising repellent for many bird species, including waterfowl (Dolbeer et al. 1993*b*). Cummings et al. (1995) found the effectiveness of methyl anthranilate declined significantly after 7 days. Belant et al. (1996) found methyl anthranilate ineffective as a bird grazing repellent, even when applied at triple the recommended label rate. Methyl anthranilate has also been investigated 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[20]), nontoxic to rats in an inhalation study (LC_{50} > 2.8 mg/L[21]), 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 (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 methyl anthranilate are generally considered expensive. A potentially more cost effective method of methyl anthranilate 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 three to five times after the initial treatment before the birds abandon a treatment site.

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 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 have shown bird repellent capabilities. Anthraquinone is a naturally occurring chemical found in many plant species and in some invertebrates as a natural predator defense mechanism. Anthraquinone has shown effectiveness in protecting rice seed from red-winged blackbirds

[20] 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.

[21] 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.

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 (mothballs) was found to be ineffective in repelling European starlings (Dolbeer et al. 1988).

Live traps generally allow target bird species to enter inside the trap but prevent them from exiting the trap. Bird live-captured in traps could be translocated or euthanized. Live traps include:

Bow nets are normally used for raptors but may also be used for European starlings, shorebirds, and other species using visual bait and/or conspecific decoys. Bow nets are remotely triggered from a nearby observation site. Once the net is triggered, the net envelopes the target birds inside the net similar to a suitcase when closed.

Box/cage traps come in a variety of styles to live-capture birds. A visual attractant or bait is generally placed inside the trap to attract target bird species. Target bird species enter the trap to through one-way doors to access the bait or attractant but are then unable to exit.

Decoy traps are similar in design to the Australian Crow Trap as reported by McCracken (1972) and Johnson and Glahn (1994) or typical pigeon traps. 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 the trap through one-way doors and are unable to exit. Active decoy traps are monitored daily, every other day, or as appropriate if food, water, and shelter are provided, to remove and euthanize excess birds and to replenish bait and water.

Drop nets could be suspended over a pre-baited site and manually or remotely triggered to drop on target animals or manually dropped on target birds from a high site such as a bridge or rooftop. Decoys may also be used to enhance the effectiveness of drop nets.

Cannon nets are normally used for larger birds, such as geese or pigeons and use mortar projectiles or compressed air to propel a net up and over birds that have been baited to a particular site.

Foothold traps could be employed to live-captures birds, primarily raptors. Johnson (1994) found that trapping with modified foothold traps could be effective in areas where a small resident crow population is present. No. 0 or 1 foothold traps with padded jaws were used to trap individual birds in areas habitually used by crows. Foothold traps could also be used atop poles to capture raptors. Pole traps are designed to live-capture raptors as they land atop a pole to perch. When landing atop the pole, raptors are captured in modified foothold traps. Traps are attached to a guide wire that runs from the trap down the pole to the ground. Once live-captured by the foothold traps, the trap and raptor slide down the guide water to the ground for handling. Traps would be monitored a minimum of twice each day to ensure raptors captured were addressed timely.

Nest box traps 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) and operate similar to other live-capture traps. Nest box traps allow birds to enter but not exit.

Nest/walk-in traps are similar to box or decoy traps. They are placed over an active nest or baited with food and allow the target bird to pass through a funnel, one-way, or drop down door that

confines the target. Nest and walk-in traps are effective in capturing ground nesting birds such as cormorants, ducks, geese, and ground feeding birds such as rock pigeons and mourning doves.

Mist nets are more commonly used for capturing small-sized birds but can be used to capture larger birds, such as ducks and smaller raptors. It was introduced into 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 the bird species that could be caught and overlapping pockets in the net cause birds to entangle themselves when they fly into the net. Decoys and electronic calls may also be used to enhance the effectiveness of mist nets.

Net guns/launchers are normally used for flocking birds such as waterfowl and European starlings. They use a firearm blank or compressed air to propel a weighted net up and over birds, which have been baited to a particular site or birds that do not avoid people. Net guns are manually discharged while net launchers are remotely discharged from a nearby observation site.

Raptor traps are varied in form and function and includes but is not limited to Bal-chatri, Dho Gaza traps, Phai hoop traps, and Swedish goshawk traps. These traps could be used specifically to live-trap raptors.

Corral traps could be used to live-capture birds, primarily geese and other waterfowl. Corral traps can be effectively used to live capture waterfowl. Waterfowl can be slowly guided into corral-traps.

Funnel traps could be used to live-capture waterfowl. Traps are set up in shallow water and baited. Funnel traps allow waterfowl to enter the trap but prevents the ducks from exiting. Traps would be checked regularly to address live-captured waterfowl. Captured ducks can be relocated or euthanized.

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. 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.

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 that 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.

Egg addling/destruction are methods 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).

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.

Live-capture and Translocation could be accomplished using methods to live-capture some bird species for translocating and releasing those birds in other areas. WS could employ those methods in Maryland when the target animal(s) can legally be translocated or can be captured and handled with relative safety by WS' personnel.

Smith (1996) reported that groups of juvenile geese relocated from urban to rural settings could effectively eliminate these geese from urban areas, retain them at the release site, include them in the sport harvest, and expose them to higher natural mortality. Smith (1996) also reported that multiple survival models indicated that survival estimates of relocated juveniles were half of those of urban captured and released birds. The relocation of resident geese from metropolitan communities can assist in the reduction of overabundant populations (Cooper and Keefe 1997), and translocating geese has generally been accepted by the public as a method of reducing goose populations to socially acceptable levels (Fairaizl 1992, Powell et al. 2003). In areas where interest in hunting is high, the potential exists for moving nuisance geese to areas more accessible by hunters. In addition, the removal of geese posing or likely to pose a hazard to air safety at airports has been demonstrated to reduce the population of local geese and decrease the number of flights through the airport operations airspace, resulting in increased air safety at the Minneapolis-St. Paul International Airport (Cooper 1991).

Live capture and handling of birds poses an additional level of human health and safety threat if target birds are aggressive, large, or extremely sensitive to the close proximity of humans. For that reason, WS may limit this method to specific situations and certain species. In addition, moving damage-causing individuals to other locations can typically result in damage at the new location, or the translocated individuals can move from the relocation site to areas where they are unwanted. In addition, translocation can facilitate the spread of diseases from one area to another. High population densities of some animals may make this a poor wildlife management strategy for those species. Translocation would be evaluated by WS on a case-by-case basis. Translocation would only occur with the prior authorization of the USFWS and the MDNR.

Nicarbazin is an EPA registered reproductive inhibitor that can be used to reduce egg production and viability in Canada geese and rock pigeons. Nicarbazin is available to certified pesticide applicators and is not restricted to use by WS. Use of baits containing nicarbazin would allow the numbers of small to

moderate sized groups of Canada geese and rock pigeons to be controlled by reducing the hatchability of eggs laid by treated birds without requiring the location of each individual nest to be determined (as is the case for egg oiling/addling/destruction).

Nicarbazin is thought to induce infertility in birds by two main mechanisms. Nicarbazin may disrupt the membrane surrounding the egg yolk, resulting in intermixing of egg yolk and white (albumin) components, creating conditions in which the embryo cannot develop. Nicarbazin may also inhibit incorporation of cholesterol into the yolk, a step that is necessary for yolk formation; thereby, limiting energy for the developing embryo. If the yolk does not provide enough energy, the embryo will not completely form and the egg will never hatch. Nicarbazin bait must be consumed for several days to achieve blood levels that affect the hatchability of eggs that are forming. Nicarbazin is undetectable in the plasma of Canada Geese, mallards, and chickens by four to six days after consumption of nicarbazin bait has stopped. The levels of active ingredient in the blood are reduced by half within one day after bait consumption stops. If the level of active ingredient falls by approximately one-half its peak levels, no effects on egg formation can be seen. By two days after bait consumption has stopped, no effects on the egg being formed are seen. Consequently, the bait must be offered to the birds each day of the nesting period for to limit reproduction effectively.

LETHAL METHODS WILDLIFE DAMAGE MANAGEMENT METHODS

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. 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. WS' firearm use and safety would comply with WS Directive 2.615.

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 MDNR and the 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.

Cervical dislocation is sometimes used to euthanize birds that 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 considers this technique as a conditionally acceptable method of euthanasia and states that cervical dislocation when properly executed may be a humane technique for euthanasia of poultry and other small birds (AVMA 2013). Cervical dislocation is a technique that may induce rapid unconsciousness, does not chemically contaminate tissue, and is rapidly accomplished (Beaver et al. 2001).

Carbon dioxide is sometimes used to euthanize birds that are captured in live traps. Live birds are placed in a container such as a plastic 5-gallon bucket or chamber and sealed shut. Carbon dioxide 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 (AVMA 2013). Carbon dioxide 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 the gas released by dry ice. The use of carbon

dioxide by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society.

Snap traps are modified rat snap traps used to remove individual European Starlings, and other cavity using birds. The trap treadle is baited with peanut butter or other food attractants and attached near the damage area caused by the offending bird. These traps pose no imminent danger to pets or the public, and are usually located in positions inaccessible to people and most non-avian animals. They are very selective because they are usually set in the defended territory of the target birds.

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), dispersing crow roosts in urban/suburban areas (Boyd and Hall 1987), and Blanton et al. (1992) reports that DRC-1339 appears to be a very effective, selective, and safe means of urban pigeon population reduction. 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 (EPA 1995). 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 that 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. DRC-1339 has several EPA Registration Labels (56228-10, 56228-17, 56228-28, 56228-29, and 56228-30) depending on the application or species involved in the damage management project.

APPENDIX C

FEDERAL THREATENED AND ENDANGERED SPECIES IN MARYLAND

U.S. Fish & Wildlife Service

Threatened & Endangered Species System

(a) Maryland

E = Endangered Species and T = Threatened Species

Notes:
This report shows the species listed in this state according to the Federal Register listing description.
This list does not include experimental populations and similarity of appearance listings.
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 (17species)

Status	Species/Listing Name
E	Bat, Indiana (Myotis sodalis)
E	Darter, Maryland (Etheostoma sellare)
T	Plover, piping except Great Lakes watershed (Charadrius melodus)
T	Sea turtle, green except where endangered (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	Squirrel, Delmarva Peninsula fox Entire, except Sussex Co., DE (Sciurus niger cinereus)
E	Sturgeon, shortnose (Acipenser brevirostrum)
T	Tiger beetle, northeastern beach (Cicindela dorsalis dorsalis)
T	Tiger beetle, Puritan (Cicindela puritana)
T	Turtle, bog (=Muhlenberg) northern (Clemmys muhlenbergii)
E	Wedgemussel, dwarf (Alasmidonta heterodon)
E	Whale, finback (Balaenoptera physalus)
E	Whale, humpback (Megaptera novaeangliae)
E	Whale, right (Balaena glacialis (incl. australis))

Animal species listed in this state that do not occur in this state (3species)

Status	Species/Listing Name
E	Beetle, American burying (Nicrophorus americanus)
E	Puma (=cougar), eastern (Puma (=Felis) concolor couguar)
E	Wolf, gray Lower 48 States, except where delisted and where EXPN. Mexico. (Canis lupus)

Plant species listed in this state and that occur in this state (7 species)

Status	Species/Listing Name
T	Amaranth, seabeach (Amaranthus pumilus)
E	Bulrush, Northeastern (Scirpus ancistrochaetus)
E	Dropwort, Canby's (Oxypolis canbyi)
E	Gerardia, sandplain (Agalinis acuta)
E	Harperella (Ptilimnium nodosum)
T	Joint-vetch, sensitive (Aeschynomene virginica)
T	Pink, swamp (Helonias bullata)

Plant species listed in this state that do not occur in this state (3species)

Status	Species/Listing Name
E	Chaffseed, American (Schwalbea americana)
E	Coneflower, smooth (Echinacea laevigata)
T	Pogonia, small whorled (Isotria medeoloides)

APPENDIX D

MARYLAND'S ENDANGERED ANIMALS

Maryland Department of Natural Resources
Wildlife and Heritage Division

Planarians		
Hoffmaster's Cave planarian	***Macrocotyla hoffmasteri***	**Endangered**
A planarian	***Procotyla typhlops***	**Endangered**
Mollusks		
Dwarf wedge mussel	***Alasmidonta heterodon***	**Endangered**
Triangle floater	***Alasmidonta undulate***	**Endangered**
Brook floater	***Alasmidonta varicosa***	**Endangered**
Blue ridge spring snail	***Fontigens orolibas***	**Endangered**
Green floater	***Lasmigona subviridis***	**Endangered**
Crustaceans		
Franz's cave isopod	***Caecidontea franzi***	**Endangered**
Maus' isopod	***Caecidontea mausi***	**Endangered**
Dearolf's cave amphipod	***Crangonyx dearolfi***	**Endangered**
Biggers' cave amphipod	***Stygobromus biggersi***	**Endangered**
Greenbrier cave amphipod	***Stygobromus emarginatus***	**Endangered**
Shenandoah cave amphipod	***Stygobromus gracilipes***	**Endangered**
Rock creek groundwater amphipod	***Stygobromus kenki***	**Endangered**
A groundwater amphipod	***Stygobromus sextarius***	**Endangered**
Insects		
Superb jewelwing	***Caloperyx amata***	**Threatened**
Selys' sunfly	***Helocordulia selysii***	**Threatened**
White corporal	***Ladona exusta***	**Endangered**
Elfin skimmer	***Nannothemis bella***	**Endangered**
Appalachian snaketail	***Ophigomphus incuratus uncuratus***	**Endangered**
Spatterdock darner	***Rhionaeschna mutate***	**Endangered**
Treetop emerald	***Somatochlora provocans***	**Endangered**
Eastern sedge barrens planthopper	***Limotettix minuendus***	**Endangered**
Tiger beetle	***Cicindela abdominalis***	**Endangered**
Tiger beetle	***Cicindela ancocisconensis***	**Endangered**
Northeastern beach tiger beetle	***Cicindela dorsalis dorsalis***	**Endangered**
White tiger beetle	***Cicindela dorsalis media***	**Endangered**
Little white tiger beetle	***Cicindela lepida***	**Endangered**
Green-patterned tiger beetle	***Cicindela patruela***	**Endangered**
Puritan tiger beetle	***Cicindela puritana***	**Endangered**
Six-banded longhorn beetle	***Dryobius sexnotatus***	**Endangered**
Tenebrionid beetle	***Helops cisteloides***	**Endangered**
Seth forest water scavenger beetle	***Hydrochus spangleri***	**Endangered**
Tenebrionid beetle	***Schoenicus puberulus***	**Endangered**
Great purple hairstreak	***Atlides halesus***	**Threatened**
Northern metalmark	***Calephelis borealis***	**Threatened**
Frosted elfin	***Callophrys irus***	**Endangered**
Hoary elfin	***Callophrys polios***	**Endangered**
Harris' checkerspot	***Chlosyne harrisii***	**Threatened**
Easrly hairstreak	***Erora laeta***	**Endangered**
Mottled duskywing	***Ernnis martialis***	**Endangered**

Two-spotted skipper	***Euphyes bimacula***	**Endangered**
Bog copper	***Lycaena epixanthe***	**Endangered**
Compton tortoiseshell	***Nymphalis vau-album***	**Endangered**
Palamedes swallowtail	***Papilio palamedes***	**Endangered**
Chermock's mulberry wing	***Poanes Massasoit chermocki***	**Endangered**
Rare skipper	***Problema bulenta***	**Threatened**
Grizzled skipper	***Pyrgus Wyandot***	**Endangered**
Hickory hairstreak	***Satyrium caryaevorus***	**Endangered**
Edwards' hairstreak	***Satyrium edwardsii***	**Endangered**
Northern oak hairstreak	***Satyrium favonius ontario***	**Endangered**
King's hairstreak	***Satyrium kingi***	**Endangered**
Atlantis fritillary	***Speyeria atlantis***	**Threatened**
Fish		
Shortnose sturgeon	***Acipenser brevirostrum***	**Endangered**
Flier	***Centrarchus macropterus***	**Threatened**
Blackbanded sunfish	***Enneacanthus chaetodon***	**Endangered**
Maryland darter	***Etheostoma sellare***	**Endangered**
Glassy darter	***Etheostoma vitreum***	**Threatened**
American brook lamprey	***Lampetra appendix***	**Threatened**
Pearl dace	***Margariscus margarita***	**Threatened**
Comely shiner	***Notropis amoenus***	**Threatened**
Ironcolor shiner	***Notropis chalybaeus***	**Endangered**
Stonecat	***Noturus flavus***	**Endangered**
Logperch	***Percina caprodes***	**Threatened**
Stripeback darter	***Percina notogramma***	**Endangered**
Amphibians		
Eastern tiger salamander	***Ambystoma tigrinum***	**Endangered**
Green salamander	***Aneides aeneus***	**Endangered**
Eastern hellbender	***Cryptobranchus alleganiensis***	**Endangered**
Eastern narrow-mouthed toad	***Gastrophryne carolinensis***	**Endangered**
Barking treefrog	***Hyla gratiosa***	**Endangered**
Mountain chorus frog	***Pseudacris brachyphona***	**Endangered**
Reptiles		
Loggerhead sea turtle	***Caretta caretta***	**Threatened**
Green sea turtle	***Chelonian mydas***	**Threatened**
Leatherback sea turtle	***Dermochelys coriacea***	**Endangered**
Atlantic hawksbill sea turtle	***Eretmochelys imbricata***	**Endangered**
Northern coal skink	***Eumeces anthracinus***	**Endangered**
Rainbow snake	***Farancia ertrogramma***	**Endangered**
Bog turtle	***Glyptemys muhlenbergii***	**Threatened**
Northern map turtle	***Graptemys geographica***	**Endangered**
Kemp's ridley sea turtle	***Lepidochelys kempii***	**Endangered**
Mountain earthsnake	***Virginia valeriae pulchra***	**Endangered**
Birds		
Northern goshawk	***Accipiter gentilis***	**Endangered**
Henslow's sparrow	***Ammodramus henslowii***	**Threatened**
Short-eared owl	***Asio flammeus***	**Endangered**
Upland sandpiper	***Bartramia longicauda***	**Endangered**
Piping plover	***Charadrius melodus***	**Endangered**
Wilson's plover	***Charadrius wilsonia***	**Endangered**
Sedge wren	***Cistothorus platensis***	**Endangered**

Olive-sided flycatcher	***Contopus cooperi***	**Endangered**
Blackburnian warbler	***Dendroica fusca***	**Threatened**
Gull-billed tern	***Gelochelidon nilotica***	**Endangered**
Loggerhead shrike	***Lanius ludovicianus***	**Endangered**
Black rail	***Laterallus jamaicensis***	**Endangered**
Swainson's warbler	***Limnothlypis swainsonii***	**Endangered**
Mourning warbler	***Oporornis philadelphia***	**Endangered**
Black skimmer	***Rynchops niger***	**Endangered**
Least tern	***Sternula antillarum***	**Threatened**
Royal tern	***Thalasseus maximus***	**Endangered**
Bewick's wren	***Thryomanes bewickii***	**Endangered**
Mammals		
Sei whale	***Balaenoptera borealis***	**Endangered**
Blue whale	***Balaenoptera musculus***	**Endangered**
Finback whale	***Balaenoptera physalus***	**Endangered**
Black right whale	***Eubalaeana glacialis***	**Endangered**
Humpback whale	***Megaptera novaeangliae***	**Endangered**
Southern rock vole	***Microtus chrotorrhinus carolinensis***	**Endangered**
Eastern small-footed bat	***Myotis leibii***	**Endangered**
Indiana bat	***Myotis sodalist***	**Endangered**
Allegheny woodrat	***Meotoma magister***	**Endangered**
Sperm whale	***Physeter macrocephalus***	**Endangered**
Delmarva fox squirrel	***Sciurus niger cinereus***	**Endangered**
Southern water shrew	***Sorex palustris punctulatus***	**Endangered**