ENVIRONMENTAL ASSESSMENT

REDUCING BIRD DAMAGE

IN THE COMMONWEALTH OF MASSACHUSETTS

In cooperation with:

United States Department of Interior
United States Fish and Wildlife Service
Migratory Bird Program
Region 5

Prepared by:

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
WILDLIFE SERVICES

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ACRONYMS

APHIS	Animal and Plant Health Inspection Service
AQDO	Aquaculture Depredation Order
AVMA	American Veterinary Medical Association
BBS	Breeding Bird Survey
BCR	Bird Conservation Region
BDM	Bird Damage Management
CBC	Christmas Bird Count
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
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
FONSI	Finding of No Significant Impact
FR	Federal Register
FY	Fiscal Year
MBTA	Migratory Bird Treaty Act
MDAR	Massachusetts Department of Agriculture Resources
MDFG	Massachusetts Department of Fish and Game
MDFW	Massachusetts Division of Fisheries and Wildlife
MDPH	Massachusetts Department of Public Health
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
PRDO	Public Resource 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
USDI	U.S. Department of Interior
USFWS	U.S. Fish and Wildlife Service
WCA	Waterbird Conservation for the Americas
WS	Wildlife Services

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

Across the United States, wildlife habitat has been substantially changed as human populations expand and land is used for human needs. These human uses and needs often compete with the needs of wildlife which increases the potential for conflicting human/wildlife interactions. This Environmental Assessment (EA) evaluates the potential environmental effects of alternatives for WS involvement in bird damage management (BDM) in Massachusetts.

Wildlife damage management (WDM) is the science of reducing damage or other problems associated with wildlife, and are recognized as an integral part of wildlife management (The Wildlife Society 2010). The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) program is the federal agency authorized to protect American resources from damage associated with wildlife (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)). Human/wildlife conflict issues are complicated by the wide range of public responses to wildlife and wildlife damage. What may be unacceptable damage to one person may be a normal cost of living with nature to someone else. An individual person will have a unique definition of damage. However, the use of the term "damage" will consistently be used to describe situations where the individual person has determined the losses associated with wildlife is actual damage requiring assistance (i.e., has reached an individual threshold).

WS' activities are conducted to prevent or reduce wildlife damage to agricultural crops and livestock, private and public property and lands, industrial and natural resources, and threats to public health and safety on private and public lands in cooperation with federal, state and local agencies, tribes, private organizations, and individuals. The WS program uses an integrated wildlife damage management (IWDM) approach (WS Directive 2.105[1]) in which a combination of methods may be used or recommended to reduce wildlife damage. These methods may include non-lethal techniques like alteration of cultural practices, habitat management, repellents, frightening devices, and physical exclusion to prevent or reduce damage. The reduction of wildlife damage may also require removal of individual animals, reducing the local animal populations through lethal means. In some instances, the goal may be to eradicate an invasive species. Program activities are not based on punishing offending animals but are conducted to reduce damage and risks to human and livestock health and safety, and are used as part of the WS Decision Model (Slate et al. 1992).

WS is a cooperatively funded, service-oriented program that receives requests for assistance with wildlife damage management from private and public entities, including tribes and other governmental agencies. As requested, WS cooperates with land and wildlife management agencies to reduce wildlife damage effectively and efficiently in accordance with applicable federal, state, and local laws and Memoranda of Understanding (MOUs) between WS and other agencies.

WS chose to prepare this EA to facilitate planning, interagency coordination and the streamlining of program management, and to clearly communicate with the public the analysis of individual and cumulative impacts. In addition, this EA has been prepared to evaluate and determine if there are any potentially significant or cumulative impacts from the proposed damage management program.

[1]The WS Policy Manual (http://www.aphis.usda.gov/wildlifedamage) provides guidance for WS personnel to conduct wildlife damage management activities through Program Directives. WS Directives referenced in this EA can be found in the manual but will not be referenced in the Literature Cited Appendix.

1.2 PURPOSE

The purpose of this EA is to evaluate cumulatively the individual projects conducted by WS and the U.S. Fish and Wildlife Service (USFWS) in Massachusetts to manage damage and threats to agricultural resources, property, natural resources, and threats to humans associated with the bird species listed in Appendix C. Of the species listed in Appendix C, European starlings, herring gulls, Canada geese, American crows, house sparrows, mallards, ring-billed gulls, common grackles, great black-backed gulls, mourning doves, barn swallows, American robins, rock pigeons, tree swallows, snow buntings, American black ducks, wild turkeys, turkey vultures, brown-headed cowbirds, red-winged blackbirds, horned larks, bank swallows, double-crested cormorants, and red-tailed hawks are responsible for the majority of the requests for operational assistance to reduce damage to resources and to reduce threats to human safety.

Requests for assistance with other species listed in Appendix C occur regularly but at lower levels; have occurred in the past; or have the potential to occur due to increasing populations or the nature of damage caused by some species. These conflicts are common to rare and usually are confined to ten or fewer incidences annually. These species are included in this analysis due to the possibility of requests to manage damage and threats caused by these species in the future, especially in airport environments.

This EA will evaluate the need for action to manage damage associated with birds in the Commonwealth, the potential issues associated with bird damage management, and the environmental consequences of conducting different alternatives to address the need for action and the identified issues. The USFWS, the Massachusetts Division of Fisheries and Wildlife (MDFW), the Massachusetts Department of Agricultural Resources (MDAR), and the Massachusetts Department of Public Health (MDPH) will be consulted on the development of this EA when applicable. To assist with the identification of additional issues and alternatives to managing damage associated with birds; this EA will be made available to the public for review and comment prior to the issuance of a Decision[2].

WS and the USFWS previously developed EA's that addressed WS' activities to manage damage associated with wildlife, including birds, at airports; rock doves (pigeons), European starlings, and house sparrows; gulls (laughing, ring-billed, herring and great black-backed gulls); Canada geese; and T&E bird nest predators including American and fish crows in the Commonwealth (USDA 2002; USDA 2007; USDA 2010; USDA 2011a; USDA 2011b; USDA 2011c). Based on the analyses in all of these EAs, Decisions and Findings of No Significant Impact (FONSI) were signed selecting the proposed action alternative for each of them. The proposed action alternative in all these EAs implemented a damage management program using a variety of methods in an integrated approach (USDA 2002; USDA 2007; USDA 2010; USDA 2011a; USDA 2011b; USDA 2011c). Changes in the need for action and the affected environment have prompted WS and the USFWS to initiate this new analysis to address comprehensive bird damage in the state. This EA will address more recently identified changes and will assess the potential environmental impacts of program alternatives based on a new need for action and a need to address damage and threats of damage associated with additional species of birds.

1.3 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 humans and wildlife that lead to requests for assistance to reduce damage to resources and to reduce threats to human safety.

[2]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 after public involvement, a decision will be made to either publish a Notice of Intent to prepare an Environmental Impact Statement or a Finding of No Significant Impact will be noticed to the public in accordance to NEPA and the Council of Environmental Quality regulations.

Both sociological and biological carrying capacities must be applied when resolving wildlife damage problems. The wildlife acceptance capacity, or sociological/cultural carrying capacity, is the limit of human tolerance for wildlife or the maximum number of a given species that can coexist compatibly with local human populations. Biological carrying capacity is the ability of a defined area to support a healthy population of wildlife species 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. While the habitat might have a biological carrying capacity to support higher populations of wildlife, in many cases, the wildlife acceptance capacity is lower or has been met. Once the wildlife acceptance capacity is met or exceeded, people begin to implement population or damage management to alleviate damage or address threats to human health and safety.

The alleviation of damage or other problems caused by or related to the behavior of wildlife is termed wildlife damage management and is recognized as an integral component of wildlife management (The Wildlife Society 2010). The imminent threat, real or perceived, of damage or loss of resources is often sufficient for individual actions to be initiated and the need for damage management is derived from specific threats to resources. These species are simply utilizing areas (e.g. reproducing, walking, foraging, defecating) where their habitat and life history requirements are being met. 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. 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). The term "*damage*" is most often defined as economic losses to resources or threats to human safety, but the term could also include a loss in aesthetic value and other situations where the actions of wildlife are no longer tolerable to an individual person.

Wildlife management is often based on balancing wildlife populations and human perceptions, in a struggle to preserve rare species, regulate species populations, oversee consumptive uses of wildlife, and conserve the environment that provides habitat for wildlife. Increasingly, cities, towns, parks, airports, and private properties have become sites of some of the greatest challenges for wildlife management (Adams et al. 2006).

Birds are generally regarded as providing ecological, educational, economic, recreational, and aesthetic benefits (Decker and Goff 1987), and there is enjoyment in knowing wildlife exists and contributes to natural ecosystems (Decker and Goff 1987). Birds add an aesthetic component to the environment, sometimes provide opportunities for recreational hunting, and provide people with valued close contact with nature. Many people, even those people experiencing damage, consider those species of birds addressed in this EA to be a charismatic and valuable component of their environment; however, tolerance differs among individuals. Because of their prolific nature, site tenacity, longevity, size, and tolerance of human activity, many bird species are often associated with situations where damage or threats can occur. For example, free-ranging waterfowl are extremely adaptable and may use the resources provided by humans in urban landscapes for nesting, rearing young, molting, feeding, and loafing.

Birds are difficult to manage because they are highly mobile and cannot be permanently excluded from large areas. It is rarely desirable or possible to remove or disperse all problem birds from an area, but with a proper management scheme, the number of birds and associated problems may be reduced to a level that can be tolerated. Additionally, management of bird-related problems often exceeds the capabilities of individual people to reduce damage to tolerable levels. Problem situations associated with

birds typically involve, but are not limited to, unacceptable accumulations of feces in public-use areas, damage to agricultural and natural resources, and unacceptable safety hazards (e.g., aircraft striking birds). Those problems frequently occur on private properties, natural/habitat restoration sites, corporate and industrial sites, airports, in residential communities, apartment/condominium complexes, municipal parks, schools, hospitals, office complexes, roadways, and other areas.

The need for action to manage damage and threats associated with birds arises from requests for assistance[3] received by WS and the USFWS to reduce and prevent damage associated with birds from occurring to four major categories (USDA 2002, USDA 2004, USFWS 2003, USFWS 2009a). Those four major categories include agricultural resources, natural resources, property, and threats to human safety. WS and the USFWS have identified those bird species most likely to be responsible for causing damage to those four categories based on previous requests for assistance and assessments of the threat of bird strike hazards at airports. Table 1.1 lists WS' technical assistance projects involving bird damage or threats of bird damage to those four major resource types in Massachusetts from the federal fiscal year[4] (FY) 2010 through FY 2014. Table 1.1 does not include projects where direct operational assistance was conducted by WS.

Technical assistance has been provided by WS to those persons requesting assistance with resolving damage or the threat of damage by providing information and recommendations on methods and techniques to reduce damage 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 are caused by birds in Massachusetts. From FY 2010 through FY 2014, WSconducted 1,724 technical assistance projects that addressed damage and threats of damage associated with those bird species addressed in this assessment. Many of the projects involved multiple resources and multiple species.

Table 1.2 lists the number of technical assistance projects involving bird damage or threats of bird damage by the four major resource types in Massachusetts from the federal fiscal year (FY) 2010 through FY 2014. Many of the bird species addressed in this EA can cause damage to or pose threats to a variety of resources. Most requests for assistance received by WS are related to threats associated with those bird species at or near airports.

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) species especially during the fall and spring migration periods. Although damage and threats can occur throughout the year, damage or the threat of damage is highest during those periods when birds are concentrated into large flocks such as migration periods and during winter months when food sources are limited. For some bird species, high concentrations of birds can be found during the breeding season where suitable nesting habitat exists, such as swallows, 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 also increases the risk that a catastrophic failure of the aircraft might occur, especially if multiple birds are ingested into aircraft engines.

[3]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 will allow to be used on property they own and/or manage.

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

Table 1.1 – Technical assistance projects conducted by WS in Massachusetts, FY 2010 - FY 2014

Species	Projects	Species	Projects
Blackbirds, Redwinged	29	Bobolinks	1
Buntings, Snow	21	Cardinal, Northern	9
Cormorants, Double-crested	20	Cowbirds, Brown-headed	26
Crows, American	105	Crows, Fish	1
Doves, Mouring	27	Dowitchers, Short-billed	11
Ducks, American Black	29	Ducks, Bufflehead	11
Ducks, Common Eider	14	Ducks, Feral	1
Ducks, Gadwall	11	Ducks, Common Goldeneye	11
Ducks, Mallard	33	Ducks, Common Merganser	12
Ducks, Hooded Merganser	11	Ducks, Red-breasted Merganser	9
Ducks, Greater Scaup	9	Ducks, Lesser Scaup	11
Ducks, Black Scoter	1	Ducks, Surf Scoter	9
Ducks, White-winged Scoter	9	Ducks, Green-winged Teal	11
Ducks, Wood	4	Eagle, Bald	2
Egrets, Cattle	11	Egrets, Great	12
Egrets, Snowy	16	Falcons, American Kestrel	27
Falcons, Peregrine	16	Finches, House	1
Flickers, Northern	1	Geese, Atlantic Brant	16
Geese, Canada	191	Geese, Snow	1
Grackles, Common	12	Grouse, Ruffed	1
Gulls, Great Black-backed	121	Gulls, Lesser Black-backed	1
Gulls, Herring	132	Gulls, Laughing	17
Gulls, Ring-billed	67	Hawks, Northern Harrier	12
Hawks, Harris	1	Hawks, Red-tailed	41
Hawks, Rough-legged	1	Herons, Great Blue	19
Herons, Black-crowned Night	13	Hummingbirds, Ruby-throated	1
Jays, Blue	9	Killdeers	28
Kingbirds, Eastern	3	Larks, Horned	31
Meadowlarks, Eastern	25	Mockingbirds, Northern	1
Ospreys	41	Owls, Barred	2
Owls, Great Horned	3	Owls, Short-eared	9
Owls, Snowy	18	Phoebes, Eastern	2
Pigeons, Rock (Feral)	48	Plovers, Black-bellied	19
Plovers, Semipalmated	12	Ravens, Common	1
Robins, American	12	Sandpipers, Least	11
Sandpipers, Semipalmated	11	Sparrows, House (English)	28
Sparrows, Savannah	2	Starlings, European	64
Swallows, Bank	6	Swallows, Barn	20
Swallows, Cliff	6	Swallows, Tree	8
Swans, Mute	21	Swifts, Chimney	2
Turkeys, Wild	16	Turnstones, Ruddy	2
Vultures, Black	7	Vultures, Turkey	22
Waxwings, Cedar	1	Whimbrels	2
Woodpeckers, Downy	23	Woodpeckers, Hairy	26
Woodpeckers, Pileated	1	Yellowlegs, Lesser	2
		Total	1,724

Table 1.2 – Birds species addressed by WS in Massachusetts and the resource types damaged

Species	Resource*				Species	Resource			
	A	N	P	H		A	N	P	H
Bitterns, American			X	X	Blackbirds, Red-winged			X	X
Bluebirds, Eastern			X		Bobolinks			X	
Buntings, Snow			X	X	Cardinals, Northern	X		X	
Catbirds, Gray	X		X		Chicadee, Black-capped			X	
Coots, American		X			Cormorants, Double-crested		X	X	X
Cowbirds, Brown-headed	X	X	X	X	Crows, American	X	X	X	X
Crows, Fish			X		Doves, Mouring			X	X
Dowitchers, Short-billed			X	X	Ducks, American Black	X	X	X	X
Ducks, Bufflehead			X	X	Ducks, Common Eider		X	X	X
Ducks, Feral				X	Ducks, Long-tailed			X	X
Ducks, Mallard	X	X	X	X	Ducks, Common Merganser			X	X
Ducks, Hooded Merganser			X	X	Ducks, Red-breasted Merganser			X	X
Ducks, Ring-necked			X		Ducks, Ruddy			X	X
Ducks, Lesser Scaup			X	X	Ducks, Black Scoter			X	X
Ducks, Surf Scoter			X	X	Ducks, White-winged Scoter			X	X
Ducks, Blue-winged Teal			X		Ducks, Green-winged Teal			X	X
Ducks, American Wigeon			X		Ducks, Wood			X	X
Eagle, Bald			X	X	Egrets, Cattle			X	
Egrets, Great			X	X	Egrets, Snowy			X	
Falcons, American Kestrel			X	X	Falcons, Peregrine			X	X
Falcons, Merlin			X		Finches, Purple			X	
Flickers, Northern			X		Gannets, Northern			X	X
Geese, Atlantic Brant			X	X	Geese, Canada	X	X	X	X
Geese, Feral			X		Goldfinches, American			X	
Grackles, Common	X	X	X	X	Grebes, Pied-billed			X	X
Grouse, Ruffed			X		Gulls, Great Black-backed	X	X	X	X
Gulls, Herring	X	X	X	X	Gulls, Lauging		X	X	X
Gulls, Ring-billed	X	X	X	X	Hawks, Cooper's	X		X	
Hawks, Northern Harrier		X	X	X	Hawks, Red-shouldered			X	
Hawks, Red-tailed	X	X	X	X	Hawks, Rough-legged			X	
Herons, Great Blue	X	X	X	X	Herons, Green			X	X
Herons, Black-crowned Night				X	Jays, Blue			X	
Killdeers			X	X	Kingfishers, Belted			X	X
Larks, Horned			X	X	Loons, Common				X
Meadowlarks, Eastern			X		Mockingbirds, Northern			X	X
Murre, Common		X			Ospreys			X	X
Owls, Barred		X	X	X	Owls, Great Horned	X	X	X	X
Owls, Short-eared		X	X	X	Owls, Snowy			X	X
Parakeets, Monk			X		Parakeets, Budgigar			X	
Pheasants, Ring-necked			X		Pigeons, Rock (Feral)	X	X	X	X
Plovers, Black-bellied			X	X	Plovers, Semipalmated			X	X
Ravens, Common		X	X		Robins, American			X	X
Sandpipers, Least				X	Sandpipers, Semipalmated			X	X
Sandpipers, Upland			X		Shrikes, Northern			X	

Species	Resource*				Species	Resource			
	A	N	P	H		A	N	P	H
Sparrows, House (English)	X	X	X	X	Sparrows, Savanah			X	X
Sparrows, Song			X		Starlings, European	X	X	X	X
Sparrows, White-throated			X		Swallows, Bank			X	
Swallows, Barn			X	X	Swallows, Cliff			X	
Swallows, Tree			X	X	Swans, Mute		X	X	X
Swifts, Chimney			X		Terns, Common			X	X
Terns, Least				X	Turkeys, Wild		X	X	X
Turnstones, Ruddy				X	Vultures, Black			X	
Vultures, Turkey		X	X	X	Warbler, Blackpoll			X	
Waxwings, Cedar			X		Woodcock, American			X	
Whimbrels			X		Woodpeckers, Downy			X	
Woodpeckers, Hairy			X		Woodpeckers, Pileated			X	
Yellowlegs, Greater			X		Yellowlegs, Lesser			X	X

*A=Agriculture, N =Natural Resources, P=Property, H=Human Safety

During requests for assistance received by WS, cooperators often report or WS verifies through site visits, damage associated with various species of birds. Between FY 2010 and FY 2014, bird damage has been reported to WS or has been verified to exceed $4,144,150 (see Table 1.3). Damages have been reported or verified as occurring primarily to property and agricultural resources. The majority of damage that occurred was by Canada geese. However herring gulls, great black-backed gulls, and ring-billed gulls also greatly contributed to the bird damage reported to or verified by WS.

Table 1.3 only reflects damage that has been reported to or verified by WS based on requests received for assistance. Assigned monetary damage to natural resources can be difficult especially when factoring in the lost aesthetic value when natural resources are damaged by birds. Similarly, placing a monetary value on threats to human safety can be difficult. Monetary damage reported in Table 1.3 reflects damage that has occurred and that has been reported to WS, but is not reflective of all bird damage occurring in the state since not all bird damage or threats are reported to WS. Information regarding bird damage to agricultural resources, property, natural resources, and threats to human safety are discussed in the following subsections of the EA.

Need to Resolve Bird Damage to Agricultural Resources

A variety of bird species can cause damage to agricultural resources. Damage and threats of damage to agricultural resources is often associated with bird species that exhibit flocking behaviors (e.g., European starlings, red-winged blackbirds) or colonial nesting behavior (e.g., pigeons, cormorants). 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. As shown in Table 1.2, many of the bird species addressed have been identified as causing or posing threats to agricultural resources.

According to the National Agricultural Statistics Service (NASS), there were approximately 523,517 acres devoted to agricultural production in Massachusetts during 2012 with a market value of agricultural products sold estimated at $492,211,000 in 2012 (NASS 2014). The top two farm commodity categories for cash receipts were nursery, greenhouse, floriculture, and sod valued at $144,188,000 and and fruits, tree nuts, and berries valued at $125,585,000, which together accounted for over 54.8% of the cash receipts. The most recently reported livestock inventory in Massachusetts included 35,703 head of cattle, 20,377 horses and ponies, 180,730 chickens (layers, pullets, broilers, and roosters), and 21,867 other

poultry (ducks, geese, pheasants, etc.) (NASS 2014a). Aquaculture sales were valued at $18,065,000 in Massachusetts in 2013 (NASS 2014b).

Table 1.3 – Reported or WS verified monetary damage by resource caused by birds in Massachusetts from FY 2010 to FY 2014

Fiscal Year	Resource Type			Total
	Agriculture	Natural Resources	Property	
2010	$270,570.00	$9,375.00	$248,027.00	$527,972.00
2011	$234,493.00	$61,504.00	$717,945.00	$1,013,942.00
2012	$250,217.00	$17,400.00	$500,690.00	$768,307.00
2013	$318,540.00	$208,270.00	$425,366.00	$952,176.00
2014	$236,603.00	$142,200.00	$502,950.00	$881,753.00
Total	$1,310,423.00	$438,749.00	$2,394,978.00	**$4,144,150.00**

A variety of bird species can cause damage to agricultural resources (USFWS 2003, USFWS 2009a). Damage and threats of damage to agricultural resources is often associated with bird species that exhibit flocking behaviors (e.g., red-winged blackbirds, European starlings) or colonial nesting behavior (e.g., swallows, gulls). 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, and predation. As shown in Table 1.2, many of the bird species addressed have been identified as causing or posing threats to agricultural resources.

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 injury 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. The principal aquaculture products propagated at facilities in Massachusetts are mollusks, food fish, trout, other aquaculture products, and sport or game fish (NASS 2014b). Of those birds shown in Table 1.2 associated with damage to agriculture, of primary concern to aquaculture facilities are gulls, osprey, herons, egrets, and to a lesser extent mergansers, mallard and American black ducks, kingfishers, double-crested cormorants, crows, bald eagles, red-tailed hawks, and common grackles.

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 predatory 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.

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

In addition to herons, other bird species have 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 mallards, egrets, kingfishers, osprey, red-tailed hawks, Northern harriers, owls, gulls, terns, American crows, mergansers, common grackles, and brown-headed cowbirds (Parkhurst et al. 1987).

Damage and Threats to Livestock Operations

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

Although damage and disease threats to livestock operations can occur throughout the year, damage is highest during those periods when birds are concentrated into large flocks such as migration periods and during winter months when food sources are limited. For some bird species, high concentrations of birds can be found during the breeding season where suitable nesting habitat exists, such as barn swallows. Of primary concern to livestock operations are European starlings, pigeons, house sparrows, crows, grackles, red-winged blackbirds, cowbirds, and to a lesser extent barn swallows. The flocking behavior of those species either from feeding, 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). 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 birds, is believed to reduce milk yields, weight gains, and is economically critical (Feare 1984). Glahn and Otis (1986) reported that starling damage was also associated with proximity to roosts, snow, and freezing temperatures and the number of livestock on feed.

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. In addition, large concentrations of birds feeding, roosting, and/or loafing at livestock operations increase risks of disease transmission from fecal matter being deposited in areas where livestock feed, water, and are housed. Birds feeding in open troughs on

livestock feed 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. A number of diseases that could affect livestock have been associated with rock pigeons, European starlings, and house sparrows and are described in Table 1.4 (Weber 1979).

Table 1.4 – Diseases of livestock that have been linked to feral domestic pigeons, European starlings, blackbirds, and/or English sparrows. Information from Weber 1979.

Disease	Livestock affected	Symptoms	Comments
Bacterial:			
Erysipeloid	cattle, swine, horses, sheep, goats, chickens, turkeys, ducks	pigs - arthritis, skin lesions, necrosis, septicemia Sheep - lameness	serious hazard for the swine industry, rejection of swine meat at slaughter due to speticemia, also affects dogs
Salmonellosis	all domestic animals	abortions in mature cattle, mortality in calves, decrease in milk production in dairy cattle Colitis in pigs,	over 1700 serotypes
Pasteurellosis	cattle, swine, horses, rabbits, chickens, turkey	chickens and turkeys die suddenly without illness pneumonia, bovine mastitis, abortions in swine, septicemia, abscesses	also affects cats and dogs
Avian tuberculosis	chickens, turkeys, swine, cattle, horses, sheep	emaciation, decrease in egg production, and death in poultry. Mastitis in cattle	also affects cats and dogs
Streptococcosis	cattle, swine, sheep, horses, chickens, turkeys, geese, ducks, rabbits	emaciation and death in poultry, mastitis in cattle, abscesses and inflammation of the heart , and death in swine	feral pigeons are susceptible and aid in transmission
yersinosis	cattle, sheep, goats, horses, turkeys, chickens, ducks	abortion in sheep and cattle	also affects dogs and cats
vibriosis	cattle and sheep	in cattle, often a cause of infertility or early embryonic death. In sheep, the only known cause of infectious abortion in late pregnancy	of great economic importance
Listeriosis	chickens, ducks, geese, cattle, horses, swine, sheep, goat	in cattle, sheep, and goats, difficulty swallowing, nasal discharge, paralysis of throat and facial muscles	Also affects cats and dogs
Viral:			
meningitis	cattle, sheep, swine, poultry	inflammation of the brain, newborn calves unable to suckle	associated with listeriosis, salmonellosis, cryptococcosis
Encephalitis (7 forms)	horses, turkeys, ducks	drowsiness, inflammation of the brain	mosquitos serve as vectors
Mycotic (fungal):			
aspergillosis	cattle, chickens, turkeys, and ducks	abortions in cattle	common in turkey poults
Blastomycosis	weight loss, fever, cough, bloody sputum and chest pains.	rarely	affects horses, dogs, and cats

Disease	Livestock affected	Symptoms	Comments
candidiasis	cattle, swine, sheep, horses, chickens, turkeys	In cattle, mastitis, diarrhea, vaginal discharge, and aborted fetuses	causes unsatisfactory growth in chickens
Cryptococcosis	cattle, swine, horses	chronic mastitis in cattle, decreased milk flow and appetite loss	Also affects dogs and cats
histoplasmosis	horses cattle and swine	(in dogs) chronic cough, loss of appetite, weakness, depression, diarrhea, extreme weight loss	also affects dogs; actively grows and multiplies in soil and remains active long after birds have departed
Coccidiosis	poultry, cattle, and sheep	bloody diarrhea in chickens, dehydration, retardation of growth	almost always present in English sparrows; also found in pigeons and European starlings
Protozoal:			
American trypanosomiasis	infection of mucous membranes of eyes or nose, swelling	possible death in 2-4 weeks	caused by the conenose bug found on pigeons
toxoplasmosis	cattle, swine, horses, sheep, chickens, turkeys	In cattle, muscular tremors, coughing, sneezing, nasal discharge, frothing at the mouth, prostration and abortion	Also affects dogs and cats
Rickettsial/Chlamydial:			
chlamydiosis	cattle, horses, swine, sheep, goats, chickens, turkeys, ducks, geese	In cattle, abortion, arthritis, conjunctivitis, enteritis	also affects dogs and cats and many wild birds and mammals
Q fever	affects cattle, sheep, goats, and poultry	may cause abortions in sheep and goats	can be transmitted by infected ticks

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.

Williams et al. (1977) and Johnston et al. (1979) reported that gulls can transmit salmonella to livestock through droppings and contaminated drinking water. 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.

Waterfowl, including mallards, Canada geese, snow geese, feral geese and ducks, are also a concern to livestock producers. Waterfowl droppings in and around livestock ponds can affect water quality and are a source of a number of different types of bacteria, creating concerns about potential disease interactions between waterfowl and livestock. 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 coliforms/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.

Wild and domestic waterfowl are the acknowledged natural reservoirs for a variety of avian influenza viruses (Davidson and Nettles 1997). Avian influenza circulates among those birds without clinical signs

and is not an important mortality factor in wild waterfowl (Davidson and Nettles 1997). However, the potential for avian influenza to produce devastating disease in domestic poultry makes its occurrence in waterfowl an important issue (Davidson and Nettles 1997, USDA 2005).

Certain bird species are also known to prey upon livestock, which can result in economic losses to livestock producers. Vultures are known to prey upon newly born calves and harass adult cattle, especially during the birthing process. The NASS reported livestock owners lost 11,900 head of cattle and calves from vultures in the United States during 2010 valued at $4.6 million (NASS 2011). Vulture predation on livestock is distinctive. Black vultures have killed pigs by pulling 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. While both turkey vultures and black vultures have been documented harassing expectant cattle, WS in Massachusetts has not documented any livestock predation by vultures from FY 2010 to FY 2014. Bald and golden eagles have also been documented depredating calves, lambs, and kid goats (O'Gara 1994).

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

Damage to Agricultural Crops

Bird damage to agricultural crops occurs primarily from the consumption of sprouting crops (*i.e.*, loss of the crop and revenue), but also consists of trampling of emerging crops by waterfowl, damage to fruits associated with feeding, and fecal contamination. In 2012, the sale of fruits, tree nuts, and berries along with vegetables, melons, and potatoes accounted for 42.0% and nursery, greenhouse, floriculture and sod accounted for 29.3% of the market value of the agricultural products sold in Massachusetts. Other crop commodities harvested in 2012 include corn, forage, maple syrup, tobacco and soybeans (NASS 2014). Damage to agricultural field crops, as reported to WS, occurs primarily from Canada geese, American crows, European starlings, red-winged blackbirds, common grackles, brown-headed cowbirds, mallards, American black ducks, wild turkeys, and mute swans.

Waterfowl can graze and trample a variety of crops, including corn, soybeans, rye, and oats (Cleary 1994). For example, a single intense grazing event by Canada geese in fall, winter, or spring can reduce the yield of winter wheat by 16 to 30% (Fledger et al. 1987), and reduce growth of rye plants by more than 40% (Conover 1988). However, some research has reported that grazing by geese during the winter may increase rye or wheat seed yields (Clark and Jarvis 1978, Allen et al. 1985). Associated costs with agricultural damage involving waterfowl include costs to replant grazed crops (e.g., soybeans, corn, cranberries), implement non-lethal wildlife management practices, purchase replacement hay, and decreased yields.

Bird damage to sweet corn can also result in economic losses to producers with damage often amplified since damage to sweet corn caused by birds makes the ear of corn unmarketable since damage is unsightly to the consumer (Besser 1985). Large flocks of red-winged blackbird are responsible for most of the damage reported to sweet corn with damage also occurring from grackles 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, which the birds puncture to ingest the contents. Once punctured, the area of the ear damage often discolors and is susceptible to disease introduction into the ear (Besser 1985). Damage usually begins at the tip of the ear as the husk is ripped and pulled back but can occur anywhere on the ear (Besser 1985).

Damage can also occur to sprouting corn as birds pull out the sprout or dig the sprout up to feed on the seed kernel (Besser 1985). Damage to sprouting corn occurs primarily from grackles and crows but red-winged blackbirds and common ravens are known to cause damage to sprouting corn (Mott and Stone 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 (Mott and Stone 1973, Rogers and Linehan 1977). Rogers and Linehan (1977) found grackles damaged two corn sprouts per minute on average when present at a field planted near a breeding colony.

Fruit and nut crops can be damaged by crows, robins, starlings, red-winged blackbirds, grackles, cowbirds, and American crows. WS has received requests for assistance to alleviate damage to fruit crops associated with starlings, Northern cardinals, gray catbirds, house finches, American gold finches, rose-breasted grosbeaks, blue jays, Northern mockingbirds, cedar waxwings, and American robins. Red-winged blackbirds, cowbirds, woodpeckers, and crows are also known to cause damage to blueberries (Besser 1985). Damage to blueberries typically occurs from birds plucking and consuming the berry (Besser 1985).

Damage to apples occurs from beak punctures which makes the apples unmarketable (Besser 1985). Crows and robins 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). Common ravens have been observed feeding on and damaging potatoes. Ravens dug unharvested potatoes and pecked holes in them making them useless for production of potato chips.

Need to Resolve Threats that Birds Pose to Human Safety

Several bird species listed in Table 1.2 can be closely associated with human habitation and often exhibit gregarious roosting behavior, such as vultures, waterfowl, gulls, crows, swallows, grackles, cowbirds, and red-winged blackbirds. The close association of those bird species with human activity can pose threats to human safety from disease transmission, threaten the safety of air passengers if birds are struck by aircraft, excessive droppings can be aesthetically displeasing, and aggressive behavior, primarily from waterfowl, can pose risks to human safety.

Threat of Disease Transmission

Birds can play an important role in the transmission of zoonotic diseases (i.e., animal diseases transmissible to humans) where humans may encounter fecal droppings of those birds. As many as 65 different diseases transmittable to humans or domestic animals have been associated with pigeons, European starlings, and house sparrows; the more common zoonotic diseases affecting humans are described in Table 1.5 (Weber 1979). Few studies are available on the occurrence and transmission of zoonotic diseases in wild birds. 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. The presence of disease causing organisms in bird feces is a result of the pathogens being present in the environment in which birds live. Birds likely acquire disease-causing organisms through ingestion of pathogens that originated in the environment. Disease-causing organisms do not originate with birds (i.e., birds do not produce disease-causing organisms), but those birds can act as reservoirs for disease causing organisms that are of concern to human safety.

Of concern, is the ability of birds to obtain disease causing organisms and transporting those organisms to other areas, especially to areas with a high amount of human activity. Human exposure to fecal droppings through contact or through the disturbance of accumulations of fecal droppings where disease organisms

are known to occur increases the likelihood of disease transmission. Birds can be closely associated with human habitation where interaction with birds or fecal droppings can occur. Many bird species often exhibit gregarious behavior, which can lead to accumulations of fecal droppings in areas where those species forage or loaf. Accumulations of feces 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 found in areas where humans may be exposed.

Table 1.5 - Diseases transmissible to humans that are associated with feral domestic pigeons, European starlings, And English sparrows. Information from Weber (1979)

Disease	Human Symptoms	Potential for Human Fatality
Bacterial:		
erysipeloid	skin eruption with pain, itching; headaches, chills, joint pain, prostration, fever, vomiting	sometimes - particularly to young children, old or infirm people
salmonellosis	gastroenteritis, septicaemia, persistent infection	possible, especially in individuals weakened by other disease or old age
Pasteurellosis	respiratory infection, nasal discharge, conjunctivitis, bronchitis, pneumonia, appendicitis, urinary bladder inflammation, abscessed wound infections	Rarely
Listeriosis	conjunctivitis, skin infections, meningitis in newborns, abortions, premature delivery, stillbirth	sometimes - particularly with newborns
Viral:		
meningitis	inflammation of membranes covering the brain , dizziness, and nervous movements	possible — can also result as a secondary infection with listeriosis, salmonellosis, cryptococcosis
encephalitis (7 forms)	headache, fever, stiff neck, vomiting, nausea, drowsiness, disorientation	mortality rate for eastern equine encephalomyelitis may be around 60%
Mycotic (fungal):		
aspergillosis	affects lungs and broken skin, toxins poison blood, nerves, and body cells	Not usually
blastomycosis	weight loss, fever, cough, bloody sputum and chest pains.	Rarely
candidiasis	infection of skin, fingernails, mouth, respiratory system, intestines, and urogenital tract	Rarely
cryptococcosis	lung infection, cough, chest pain, weight loss, fever or dizziness, also causes meningitis	possible especially with meningitis
histoplasmosis	pulmonary or respiratory disease. May affect vision	possible, especially in infants and young children or if disease disseminates to the blood and bone marrow
Protozoal:		
American trypanosomiasis	infection of mucous membranes of eyes or nose, swelling	possible death in 2-4 weeks
toxoplasmosis	inflammation of the retina, headaches, fever, drowsiness, pneumonia, strabismus, blindness, hydrocephalus, epilepsy, and deafness	Possible
Rickettsial /Chlamydial:		
chlamydiosis	pneumonia, flu-like respiratory infection, high fever, chills, loss of appetite, cough, severe headaches, generalized aches and pains, vomiting, diarrhea, hepatitis, insomnia, restlessness, low pulse rate	occasionally, restricted to old, weak or those with concurrent diseases
Q fever	sudden pneumonitis, chills, fever, weakness, severe sweating, chest pain, severe headaches and sore eyes	possible

Public health officials and residents near areas where fecal droppings accumulate express concerns for human health related to the potential for disease transmission. Fecal droppings that accumulate from large communal bird roosts can facilitate the growth of disease organisms, which grow in soils enriched

by bird excrement, such as the fungus *Histoplasma capsulatum*, which causes the disease histoplasmosis in humans (Weeks and Stickley 1984). The disturbance of soil or fecal droppings under bird roosts where fecal droppings have accumulated can cause *H. capsulatum* to become airborne. Once airborne, the fungus could be inhaled by people in the area.

Ornithosis (*Chlamydia psittaci*) is another respiratory disease that can be contracted by humans, livestock, and pets that can be associated with accumulations of bird droppings. Pigeons are most commonly associated with the spread of Ornithosis to humans. Ornithosis is a virus that is spread through infected bird droppings when viral particles become airborne after infected bird droppings are disturbed. In most cases in which human health concerns are a major reason for requesting assistance, no actual cases of bird transmission of disease to humans have been proven to occur. Thus, the primary reason for requesting assistance is the risk of disease transmission.

Waterfowl may affect human health through the distribution and incubation of various pathogens and through nutrient loading in water supplies. Avian botulism is produced by the bacteria *Clostridium botulinum* type C, which occurs naturally in wild bird populations across North America. Ducks are most often affected by this disease. Avian botulism is the most common disease of waterfowl. Salmonella (*Salmonella* spp.) may be contracted by humans by handling materials soiled with bird feces (Stroud and Friend 1987). Salmonella causes gastrointestinal illness, including diarrhea.

Chlamydia psittaci, which can be present in diarrhetic feces of infected waterfowl, can be transmitted if it becomes airborne (Locke 1987). Severe cases of chlamydiosis have occurred among wildlife biologists and others handling snow geese, ducks, and other birds (Wobeser and Brand 1982). Chlamydiosis can be fatal to humans if not treated with antibiotics. Waterfowl, herons, and rock pigeons are the most commonly infected wild birds in North America (Locke 1987).

Escherichia 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). Probably the best-known serological type of *E. coli* 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 temporarily closed which can adversely affect the enjoyment of the area by the public, even though the serological type of the *E. coli* is unknown. Unfortunately, linking the elevated bacterial counts to 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 Canada geese and gulls roosting at the reservoir.

Research has shown that gulls carry various species of bacteria such as *Bacillus* spp., *Clostridium* spp., *Campylobacter* spp., *Escherichia coli*, *Listeria* spp., and *Salmonella* spp. (MacDonald and Brown 1974, Fenlon 1981, Butterfield et al. 1983, Monaghan et al. 1985, Norton 1986, Vauk-Hentzelt et al. 1987, Quessey and Messier 1992). Transmission of bacteria from gulls to humans is difficult to document; however, 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.

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

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

Threat of Aircraft Striking Wildlife at Airports and Military Installations

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). In several instances, wildlife-aircraft collisions in the United States have resulted in human fatalities. The risk that birds pose to aircraft is well documented with the worst case reported in Boston in 1960 when 62 people were killed in the crash of an airliner that collided with a flock of European starlings (Terres 1980). From 1990 through 2013, 1,992 birds have been reported as struck by aircraft in Massachusetts (FAA 2014).

When birds enter or exit a roost in large flight lines at or near airports or when present in large flocks foraging on or near an airport, those bird species represent a safety threat to aviation. 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 2014, 151,267 bird strikes were reported to the Federal Aviation Administration (FAA) in the United States (Dolbeer et al. 2015). Of these, 2,162 reported bird strikes occurred in Massachusetts (Embry Riddle Aeronautical University 2015). This comprises 96.9% of the total wildlife strikes reported. The number of actual bird strikes is likely to be much greater since an estimated 80% of civil bird strikes may go unreported (Linnell et al. 1999, Cleary et al. 2005, Wright and Dolbeer 2005).

Between 2004 and 2008, Dolbeer (2009) estimated that 39% of aircraft strikes were reported to the FAA. Generally, bird collisions occur when aircraft are near the ground during take-off and approach to the runway. From 1990 through 2014, for commercial and general aviation aircraft, approximately 71% and 73% of bird strikes, respectively, occurred at or below 500 feet above ground level. Additionally, approximately 92% of commercial aircraft strikes occurred at or less than 3,500 feet above ground level (Dolbeer et al. 2015).

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 2012, gulls comprised 15% 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. 2013). Between 2010 and 2014, strikes with seven red-tailed hawks, ten ospreys, 20 snowy owls, and 60 American kestrels have occurred at Massachusetts airports (Embry Riddle Aeronautical University 2015).

Birds being struck by aircraft can cause substantial damage. Bird strikes can cause catastrophic failure of aircraft systems (e.g., ingesting birds into engines) which can cause the plane to become uncontrollable which can lead to crashes. Since 1988, more than 229 people worldwide have died in aircraft that have crashed after striking wildlife (Dolbeer et al. 2013). During the 25 year period between 1990 and 2014, twelve wildlife strikes involving commercial or private aircraft have resulted in the deaths of 26 people in the United States (Dolbeer et al. 2015). Of these, 25 fatalities involved strikes with birds. Eight fatalities occurred after striking birds that were not identified, eight occurred after strikes involving red-tailed hawks, five after strikes with American white pelicans, two after strikes with Canada geese, and one each with brown pelicans and turkey vultures (Dolbeer et al. 2015). Between 1990 and 2014, 44 strikes involving birds have resulted in injuries to 240 people involved in 186 strikes (Dolbeer et al. 2013).

Reports were received of 198 bird strikes that resulted in 352 human injuries (Dolbeer et al. 2015). Raptors (eagles, hawks, falcons, vultures, owls, and ospreys; 54 strikes, 78 humans injured), waterfowl (ducks and geese; 53 strikes, 159 humans injured), and unidentified birds (44 strikes, 53 humans injured) caused 151 (76.3%) of the 198 strikes resulting in injuries. Canada geese caused 117 (33.2%) of the 352 injuries caused by strikes with birds (Dolbeer et al. 2015).

From 1990 to 2014 at least 87 flights at Massachusetts airports took precautionary landings after a bird strike, at least twelve flights required an engine shutdown and at least 59 pilots aborted take-off to ensure the aircraft was not damaged and safe to fly.

Additional Human Safety Concerns Associated with Birds

As people are increasingly living with wildlife, the lack of harassing and threatening behavior by people toward many species of wildlife, especially around urban areas, has led to a decline in the fear wildlife have toward humans. When wildlife species begin to habituate to the presence of people and human activity, a loss of apprehension occurs that can lead those species to exhibit threatening behavior toward people. This threatening behavior continues to increase as human populations expand and the populations of those species that adapt to human activity increase (Lowry et al. 2013). Threatening behavior can be in the form of aggressive posturing, a general lack of apprehension toward people, or abnormal behavior. Although birds attacking people occurs rarely, aggressive behavior by birds does occur, especially during nest building and the rearing of eggs and chicks. Raptors, mockingbirds, and gulls can aggressively defend their nests, nesting areas, and young, and may swoop and strike pets, children, and adults.

In addition to raptors, mockingbirds, and gulls, other waterfowl, particularly Canada geese and mute swans, 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. Feral waterfowl often nest in high densities in areas used by humans for recreational purposes such as office parks, industrial areas, parks, beaches, and sports fields (VerCauteren and Marks 2004). If people unknowingly approach waterfowl or their nests at those locations, injuries could occur if waterfowl react aggressively to the presence of those people or pets. Additionally, slipping hazards can be created by the buildup of feces from birds on docks, walkways, and other foot traffic areas. To avoid those conditions, regular cleanup is often required to alleviate threats of slipping on fecal matter, which can be economically burdensome.

Need to Resolve Bird Damage Occurring to Property

Strikes with small birds, such as sparrows, swallows, and swifts can cause substantial damage requiring costly repairs and aircraft downtime, and even smaller birds such as wrens and warblers can cause minor damage (Dolbeer et al. 2015).

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 activities.

One example of direct damage to property occurs when vultures damage asphalt and cedar roofing shingles, pull out latex caulking or rubber gaskets around windows and peck vinyl seat covers from boats, patio furniture, and ATV seats. Accumulations of fecal droppings can cause damage to buildings and statues. Woodpeckers also cause direct damage to property through excavating holes in buildings either to delineate nesting territories, for nesting purposes or to locate food, which can remove insulation and allows water and other wildlife to enter the building. Direct damage can result from birds that act aggressively toward their reflection in mirrors and windows, which can scratch paint and siding. On flat rooftops, accumulated nesting material from gull nest colonies can wash into rooftop drains during heavy rains creating clogs that result in rooftop flooding which can result in leaks or roof collapse.

Birds frequently damage structures on private property and 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. Droppings from gulls roosting on automobiles cause additional damage because sand and shell fragments in the fecal material acts as an abrasive when trampled by the gulls removing protective finishes and even paint.

Electrical utility companies frequently have problems with birds and bird droppings. Crows roosting and gulls nesting in electrical substations have resulted in largescale outages and significant property damage when birds short out and destroy transformers. Similarly ospreys and other raptors nesting on transmission poles have caused power outages shorting out transformers with nesting material or their bodies. Outages and pole fires have also occurred due to nesting monk parakeets in neighboring Connecticut. Piliated woodpeckers nesting in wooden utility poles can damage the structural integrity of the poles resulting in collapse during inclement weather. These incidents have resulted in hundreds of thousands of dollars of equipement damage and outage time for power companies.

Nesting osprey and red-tailed hawks and roosting black vultures and turkey vultures can cause damage to cell phone and radio towers by nesting or roosting on critical tower infrastructure and can also interfere with required maintenance and repairs.

Mourning doves, American kestrels, killdeer, European starlings, and barn swallows were the bird species most frequently struck by aircraft in the United States from 1990 to 2014. Among the other 30 most most

struck species, the turkey vultures resulted in damage in 50.6% of strikes, Canada geese in 49.6% of strikes, mallards in 23.1% of strikes, ospreys in 21.9% of strikes, and great blue herons in 20.9% of strikes (Dolbeer et al. 2015).

From 1990 to 2014, 10,107 gull strikes caused $57,053,422 in damages; 1,254 pigeon and doves strikes caused $21,737,259 in damages; 5,470 hawk, eagle, and vulture strikes caused $104,181,129 in damages; and 4,675 waterfowl strikes caused $233,983,442 in damages. In total, 151,267 aircraft strikes involving birds have resulted in $643,517,150 in reported damages to civil aircraft in the United States during this period (Dolbeer et al. 2015).

Damage to property associated with large concentrations of roosting birds occurs primarily from accumulations of droppings and feather debris. 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 recurring presence of fecal droppings under bird roosts can lead to repeated cleaning costs for property owners.

Waterfowl may cause damage to aircraft, landscaping, piers, yards, boats, beaches, shorelines, parks, golf courses, driveways, athletic fields, ponds, lakes, rafts, porches, patios, gardens, footpaths, swimming pools, play grounds, school grounds, and cemeteries. Property damage most often involves waterfowl fecal matter that contaminates landscaping and walkways, often at golf courses and water front property. Fecal droppings and the overgrazing of vegetation can be aesthetically displeasing. Businesses may be concerned about the negative aesthetic appearance of their property caused by excessive droppings and excessive grazing, and are sensitive to comments by clients and guests. Costs associated with property damage include labor and disinfectants to clean and sanitize fecal droppings, implementation of non-lethal wildlife management methods, loss of property use, loss of aesthetic value of flowers, gardens, and lawns consumed by geese, loss of customers or visitors irritated by walking in fecal droppings, repair of golf greens, and replacing grazed turf.

The attraction of landfills as a food source for gulls has been well-documented (Mudge and Fern 1982, Patton 1988, Belant et al. 1995*a*, Belant et al. 1995*b*, Gabrey 1997, Belant et al. 1998). Large numbers of gulls are attracted to landfills as feeding and loafing areas throughout North America. In the northeastern United States, landfills often serve as foraging and loafing areas for gulls throughout the year, while attracting larger populations of gulls during migration periods (Bruleigh et al. 1998). Landfills have even been suggested as contributing to the increase in gull populations (Verbeek 1977, Patton 1988, Belant and Dolbeer 1993*a*, Belant and Dolbeer 1993*b*, Belant et al. 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 the deposition of garbage on surrounding industrial and residential areas which creates a nuisance, as well as increases the risks of disease transmission. Other species are also commonly attracted to landfills, including European starlings, rock pigeons, house sparrows, American crows, turkey vultures, and black vultures.

Damage to property by birds, reported to or verified by WS in Massachusetts, has totaled $2,394,978 between FY 2010 and FY 2014, which is an average of $478,995 per year. In most situations, requests for assistance received by WS are associated with the accumulation of fecal droppings in areas where birds roost, loaf, and feed.

Need to Resolve Bird Damage Occurring to Natural Resources

Birds can also negatively affect natural resources through habitat degradation, competition with other

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

Habitat degradation in Massachusetts occurs primarily in areas where colonial waterbirds nest, where waterfowl trample vegetation and feed on new plantings at wetland restoration sites, or where the gregarious roosting behavior of birds occurs. The degradation of habitat occurs from the continuous accumulation of fecal droppings that occurs under nesting colonies of birds or under areas where birds consistently roost. Overtime, the accumulation of fecal droppings under areas where colonial waterbirds nest can lead to the loss of vegetation due to the ammonium nitrogen found in the fecal droppings of birds. The combined activities of stripping leaves and branches for nesting material, the weight of nests of many colonial waterbirds breaking branches, and the accumulation of feces under areas where roosting and nesting occurs can lead to the death of surrounding vegetation within three to ten years of areas being occupied by colonial waterbirds (Lewis 1929, Lemmon et al. 1994, Weseloh and Ewins 1994, Weseloh and Collier 1995, Bédard et al. 1995, Weseloh et al. 1995, Korfanty et al. 1999, Hebert et al. 2005).

Some species listed as threatened and endangered under the Endangered Species Act of 1973 (ESA) are preyed upon or otherwise adversely affected by certain bird species. Concentrations of gulls often impact the productivity and survivorship of rare or endangered colonial species such as terns (U.S. Department of the Interior [USDI] 1996) and prey upon the eggs and chicks of colonial waterbirds. Colonial nesting gull species are also known to compete with other bird species, such as terns and plovers, for nest sites. Similarly, Cooper's hawks, Northern harriers, peregrine falcons, great horned owls, short-eared owls, black-crowned night herons, ruddy turnstones, common grackles, American and fish crows have all been reported preying on terns and piping plovers in Massachusetts.

Damage to natural resources by birds, reported to or verified by WS in Massachusetts, has totaled $438,749 between FY 2010 and FY 2014, which is an average of $87,749 per year. In most situations, requests for assistance received by WS are associated with the bird contamination or damage to watersheds used for drinking water and predation of T&E species.

1.4 DECISIONS TO BE MADE

Based on agency relationships, MOUs, and legislative authorities, WS is the lead agency for this EA, and therefore, responsible for the scope, content, and decisions made. Management of migratory birds is the responsibility of the USFWS. As the authority for the overall management of migratory 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 MDFW is responsible for managing wildlife in Massachusetts, including birds and has authority for the overall management of birds not considered migratory under the MBTA within the Commonwealth. The MDFW establishes and enforces regulated hunting seasons, including the establishment of seasons that allow the take of some of the bird species addressed in this assessment.

For migratory birds, the MDFW can establish hunting seasons for those species under frameworks determined by the USFWS. WS' activities to reduce and/or prevent bird damage would be coordinated with the USFWS and the MDFW, which ensure WS' actions are incorporated into population objectives established by those agencies. 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/or the MDFW; therefore, the take of

those bird species by WS to alleviate damage or reduce threats of damage would only occur at the discretion of those agencies. In addition, WS' annual take of birds to alleviate damage or threats of damage would only occur at levels authorized by those agencies as specified in depredation permits.

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

- How can WS best respond to the need to reduce bird damage in Massachusetts?
- Do the alternatives have significant impacts meriting an Environmental Impact Statement (EIS)?

1.5 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Actions Analyzed

This EA evaluates the need for bird damage management to reduce threats to human safety and to resolve damage to property, natural resources, and agricultural resources on federal, state, tribal, municipal, and private land within the Commonwealth of Massachusetts, wherever such management is requested by a cooperator. This EA discusses the issues associated with conducting damage management activities to meet the need for action and evaluates different alternatives to meet that need while addressing those issues.

The methods available for use under the alternatives evaluated are provided in Appendix B. The alternatives and Appendix B also discuss how methods would be employed to manage damage and threats associated with birds. Therefore, the actions evaluated in this EA are the use of those methods available under the alternatives 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) and/or when permitted by the MDFW in compliance with Massachusetts statutes and codes.

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 U.S.C 703-711). A list of bird species protected under the MBTA can be found in 50 CFR 10.13.

The MBTA does allow for the lethal take of those bird species listed in 50 CFR 10.13 when depredation occurs through the issuance of depredation permits or the establishment of depredation orders. Under authorities in the MBTA, the USFWS is the federal agency responsible for the issuance of depredation permits or the establishment of depredation orders for the take of those protected bird species when damage or threats of damage are occurring. Information regarding migratory bird permits can be found in 50 CFR 13 and 50 CFR 21.

The USFWS is a cooperating agency on this EA to analyze cumulative take of those bird species addressed in this EA from the issuance of depredation permits to entities within the state and to ensure compliance with the NEPA. The USFWS has jurisdiction over the management of migratory birds and has specialized expertise in identifying and quantifying potential adverse effects to the human environment from activities to manage bird damage.

Native American Lands and Tribes

The WS program in Massachusetts would only conduct damage management activities on tribal lands when requested by a Native American Tribe. Activities would only be conducted after a MOU or cooperative service agreement had been signed between WS and the Tribe requesting assistance.

Therefore, the Tribe would determine when WS' assistance is required and what activities would be allowed. Because Tribal officials would be responsible for requesting assistance from WS and determining what methods would be available to alleviate damage, no conflict with traditional cultural properties or beliefs would be anticipated. Those methods available to alleviate damage associated with birds on federal, state, county, municipal, and private properties under the alternatives analyzed in this EA would be available for use to alleviate damage on Tribal properties when the use of those methods has been approved by the Tribe requesting WS' assistance. Therefore, the activities and methods addressed under the alternatives would include those methods that could be employed on Native American lands, when requested and agreed upon between the Tribe and WS.

Federal, State, County, City, and Private Lands

Under two of the alternatives, WS could continue to provide bird damage management activities on federal, state, county, municipal, and private land in Massachusetts when a request is received for such services by the appropriate resource owner or manager. In those cases where a federal agency requests WS' assistance with managing damage caused by birds, the requesting agency would be responsible for analyzing those activities in accordance with the NEPA. However, this EA 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.

Site Specificity

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

Many of the bird species addressed in this EA can be found statewide and throughout the year; therefore, damage or threats of damage can occur wherever those birds occur. Planning for the management of bird damage must be viewed as being conceptually similar to other 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 and 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 to manage damage associated with birds is often unique to the individual; therefore, predicting where and when such a request for assistance would be received by WS is difficult. This EA emphasizes major issues as those issues relate to specific areas whenever possible; however, many issues apply wherever bird damage 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 Massachusetts. The standard WS Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS (see Chapter 3 for a description of the WS Decision Model and

its application). Decisions made using the model would be in accordance with WS' directives[5] 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 Massachusetts. In this way, WS believes it meets the intent of the NEPA with regard to site-specific analysis and that this is the only practical way for WS to comply with the NEPA and still be able to accomplish the program's mission.

Summary of Public Involvement

Issues and alternatives related to bird damage management as conducted by WS in Massachusetts were initially developed by WS in consultation with the USFWS and the MDFW. Issues were defined and preliminary alternatives were identified through the scoping process. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS' NEPA implementing regulations, this document will be noticed to the public through legal notices published in local print media, through the APHIS stakeholder registry to those who have an interest in the reduction of threats and damage associated with birds, and by posting the EA on the APHIS website.

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

1.6 RELATIONSHIP OF THIS DOCUMENT TO OTHER ENVIRONMENTAL DOCUMENTS

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

Proposal to Permit Take as Provided under the Bald and Golden Eagle Protection Act - Final Environmental Assessment: Developed by the USFWS, this EA evaluated the issues and alternatives associated with the promulgation of new regulations to authorize the "take" of bald eagles and golden eagles as defined under the Bald and Golden Eagle Protection Act. The preferred alternative in the EA evaluated the authorization of disturbance take of eagles, the removal of eagle nests where necessary to reduce threats to human safety, and the issuance of permits authorizing the lethal take of eagles in limited circumstances, including authorizing take that is associated with, but is not the purpose of, an action (USFWS 2009). A Decision and Finding of No Significant Impact (FONSI) was made for the preferred alternative in the EA. The selected alternative in the EA established new permit regulations for the "take" of eagles (see 50 CFR 22.26) and a provision to authorize the removal of eagle nests (see 50 CFR 22.27). The USFWS published a Final Rule on September 11, 2009 (74 FR 46836-46879).

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

[5]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.

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).

Resident Canada Goose Management - Final Environmental Impact Statement: The USFWS has issued a FEIS on the management of resident Canada geese (USFWS 2005). Pertinent and current information available in the FEIS has been incorporated by reference into this Decision/FONSI. The FEIS may be obtained by contacting the Division of Migratory Bird Management, U.S. Fish and Wildlife Service, 4401 North Fairfax Drive, MBSP-4107, Arlington, Virginia 22203 or by downloading it from the USFWS website at http://www.fws.gov/migratorybirds/issues/cangeese/finaleis.htm.

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

Waterbird Conservation Plan: 2006-2010, Mid-Atlantic/New England/Maritimes Region: Waterbird Conservation for the Americas (WCA), Waterbird Conservation Plan for the Mid-Atlantic/New England/ Maritimes Region (MANEM) developed a regional waterbird conservation plan for the region of the United States and Canada (WCA 2007). 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 (WCA 2007). Information in the Plan on waterbirds and their habitats provide a regional perspective for local conservation action.

***WS' Environmental Assessments*:** WS has previously developed EAs that analyzed the need for action to manage damage associated with wildlife, including bird species, at airports (USDA 2002) and the supplement to the EA (USDA 2011a). WS has also prepared separate EAs to evaluate the need to manage damage associated with rock doves (pigeons), European starlings, and house sparrows (USDA 2007), herring, ring-billed, great black-backed and laughing gulls (USDA 2010), Canada geese (USDA 2011b), and nest predators of T&E bird species, including American and fish crows (USDA 2011c). Those EAs identified the issues associated with managing damage associated with birds and analyzed alternative approaches to meet the specific need identified in those EAs while addressing the identified issues.

Since activities conducted under the previous EAs will be re-evaluated under this EA to address the new need for action and the associated affected environment, the previous EAs that addressed birds will be superseded by this analysis and the outcome of the Decision issued.

1.7 AUTHORITY OF FEDERAL AND STATE AGENCIES

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

WS' Legislative Authority
The primary statutory authorities for 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 wildlife. WS' directives define program objectives and guide WS' activities to manage wildlife damage management.

USFWS' Authority
The USFWS mission is to conserve, protect, and enhance fish and wildlife along with 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. The USFWS also manages lands under the National Wildlife Refuge System.

The USFWS is responsible for managing and regulating take of bird species that are listed as migratory under the MBTA and those that are listed as T&E 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 orders that allow for the take of those migratory birds addressed in those orders 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 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 repellents for dispersing birds and avicides available for use to lethally take birds.

United States Food and Drug Administration (FDA)
The FDA is responsible for protecting the 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.

U.S. Army Corps of Engineers (USACE)
The USACE is a cooperating agency with WS to help resolve wildlife damage management in Massachusetts. The mission of the USACE is to deliver vital public and military engineering services and partnering in peace and war, to strengthen our Nation's security, energize the economy, and reduce risks from disasters.

Massachusetts Department of Fish and Game (MDFG)
The MDFG was established under Massachusetts General Law (MGL) Part 1, Title XIX, Chapter 131 and is within the Executive Office of Environmental Affairs. Chapter 131 also provides the MDFG authority to manage fish and wildlife in the Commonwealth. This authority is exercised through the MDFW.

Massachusetts Division of Fisheries and Wildlife (MDFW)
Established under MGL Part 1, Title XIX, Chapter 131, Section 1A, the MDFW was created under the MDFG. It is under the supervision of the Fisheries and Wildlife Board which appoints the Director of Fisheries and Wildlife. The Director, subject to the approval of the Fisheries and Wildlife Board, may appoint an assistant director and may employ such experts, clerks and other employees necessary for the Division's operations. The director, under control of the board, directs and supervises all matters relative to the division and its employees, carries out the policies of the board. The director also has the power, notwithstanding any other provisions of Chapter 131, but subject to federal law, rules and regulations, to take or in writing authorize other persons to take and possess mammals at any time or in any manner for purposes of observation, research, control or management. At the director's discretion, fees for permits or licenses may be excused to persons so authorized from any licensing provision of Chapter 131.

The Natural Heritage and Endangered Species Program (NHESP) within the MDFW is responsible for the conservation and protection of the biodiversity in Massachusetts. The NHESP is primarily responsible for the management of the approximately 176 species of vertebrate and invertebrate animals and 259 species of native plants and their habitats that are officially listed as Endangered, Threatened or of Special Concern under the Massachusetts Endangered Species Act.

Massachusetts Department of Agricultural Resources (MDAR)
The MDAR mission is to ensure the long-term viability of agriculture in Massachusetts. Through its four divisions – Agricultural Conservation and Technical Assistance, Agricultural Markets, Animal Health, and Crop and Pest Services, the MDAR strives to support, regulate and enhance the rich diversity of the Commonwealth's agricultural community to promote economically and environmentally sound food safety and animal health measures, and fulfill agriculture's role in energy conservation and production.

> **Division of Animal Health**
> The Division of Animal Health is responsible for monitoring and maintaining the health and safety of the Commonwealth's domestic animals. This is accomplished through inspections, licensing, awareness and education to help ensure the general welfare of companion and food-producing animals across the state.
>
> The Division of Animal Health works with the Massachusetts Department of Public Health, non-governmental organizations, local veterinarians, local health departments, municipal animal inspectors, and animal control officers to mount a rapid response when problematic situations develop. Mounting a rapid response ensures the fewest number of animals and animal owners are affected.

Division of Regulatory and Consumer Services, Pesticide Bureau
The Pesticide Bureau carries out the day to day responsibilities of regulating pesticides in the Commonwealth of Massachusetts. The Bureau also acts as support staff for the Pesticide Board and subcommittee. The major functions of the Bureau are broken down into specific programs. The Pesticide Bureau is responsible for enforcing all pesticide regulations and laws, both Commonwealth and federal. The Bureau is responsible for carrying out provisions of the Massachusetts Pesticide Control Act. Through cooperative agreements with the EPA, the department also implements provisions of the FIFRA.

Massachusetts Department of Public Health (MDPH)
The mission of the Massachusetts Department of Public Health is to prevent illness, injury, and premature death, to assure access to high quality public health and health care services, and to promote wellness and health equity for all people in the Commonwealth. Massachusetts ranks among the healthiest of states according to comparative analyses, but faces numerous challenges, including infectious disease.

The MDPH provides programs to address specific diseases and conditions and offer services to address the needs of vulnerable populations. It also develops implements, promotes, and enforces policies to assure that the conditions under which people live are most conducive to health and enable people to make healthy choices for themselves and their families.

Massachusetts Department of Transportation (MassDOT), Aeronautics Division
The mission of the Massachusetts Department of Transportation is to deliver excellent customer service to people who travel in the Commonwealth, and provide the United State's safest and most reliable transportation system in a way that strengthens the economy and quality of life with a focus on customer service and safety. The MassDOT Aeronautics Division currently has a MOU with WS, which establishes a cooperative relationship between the two agencies and outlines the roles and responsibilities for resolving wildlife damage at and around airports in Massachusetts.

University of Massachusetts Cooperative Extension Service (UMASS Extension)
The UMASS Extension currently has a MOU with WS, which establishes a cooperative relationship between the two agencies and outlines the roles and responsibilities for resolving wildlife damage in Massachusetts. The UMASS Extension develops and teaches the best practices for sustainable agriculture, responsible use of renewable resources, and stewardship of natural resources as well as provides programs and services to help improve communities, workforce, and the economy of the people of Massachusetts. Per the MOU, UMASS Extension provides educational, outreach, and extension assistance to all Massachusetts residents on wildlife damage management issues.

1.8 COMPLIANCE WITH LAWS AND STATUTES

Several laws or statutes authorize, regulate, or otherwise would affect WS' activities under the alternatives. 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 (NEPA)
All federal actions are subject to the NEPA (Public Law 9-190, 42 USC 4321 et seq.). WS follows CEQ regulations implementing the NEPA (40 CFR 1500 et seq.), 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 NEPA procedures, as published in the Federal Register (44 CFR 50381-50384), provide guidance to the APHIS regarding the NEPA process.

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

Migratory Bird Treaty Act of 1918 (16 USC 703-711; 40 Stat. 755), as amended
The MBTA makes it unlawful to pursue, hunt, take, capture, kill, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or their parts, nests, or eggs (16 USC 703-711). A list of bird species protected under the MBTA can be found in 50 CFR 10.13.
The MBTA also provides the USFWS regulatory authority to protect families of migratory birds. The law prohibits any "*take*" of migratory bird species by any entities, except as permitted by the USFWS. Under permitting guidelines in the Act, the USFWS may issue depredation permits to requesters experiencing damage caused by bird species protected under the Act. Information regarding migratory bird permits can be found in 50 CFR 13 and 50 CFR 21. All actions analyzed in this EA would be conducted in compliance 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). Free-ranging or feral domestic waterfowl, mute swans, ring-necked pheasants, wild turkeys, monk parakeets, rock pigeons, European starlings, and house sparrows are not protected from take under the MBTA. A permit from the USFWS to take those species is not required. However, a permit from the MDFW may be required to take those species.

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

Depredation Order for Blackbirds, Cowbirds, Grackles, Crows, and Magpies (50 CFR 21.43)
Pursuant to the MBTA under 50 CFR 21.43, a depredation permit is not required to lethally take blackbirds when those species are found committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance (Sobeck 2010). Those bird species that can be lethally taken under the blackbird depredation order that are addressed in the assessment include American crows, fish crows, red-winged blackbirds, common grackles, boat-tailed grackles, and brown-headed cowbirds.

Control Order for Muscovy Ducks (50 CFR 21.54)
Muscovy ducks are native to South America, Central America, and Mexico with a small naturally occurring population in southern Texas. Muscovy ducks have also been domesticated and have been sold and kept for food and as pets in the United States. In many states, Muscovy ducks have been released or escaped captivity and have formed feral populations, especially in urban areas, that are non-migratory.

The USFWS has issued a Final Rule on the status of the Muscovy duck in the United States (75 FR 9316-9322). Since naturally occurring populations of Muscovy ducks are known to inhabit parts of south Texas, the USFWS has included the Muscovy duck 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).

Bald and Golden Eagle Protection Act (16 USC 668)
Populations of bald eagles showed periods of steep declines in the lower United States during the early 1900s attributed to the loss of nesting habitat, hunting, poisoning, and pesticide contamination. To curtail declining trends in bald eagles, Congress passed the Bald Eagle Protection Act (16 USC 668) in 1940 prohibiting the take or possession of bald eagles or their parts. The Bald Eagle Protection Act was amended in 1962 to include the golden eagle and is now referred to as the Bald and Golden Eagle Protection Act. Certain populations of bald eagles were listed as *"endangered"* under the Endangered Species Preservation Act of 1966, which was extended when the modern Endangered Species Act (ESA) was passed in 1973. The *"endangered"* status was extended to all populations of bald eagles in the lower 48 States, except populations of bald eagles in Minnesota, Wisconsin, Michigan, Washington, and Oregon, which were listed as *"threatened"* in 1978. As recovery goals for bald eagle populations began to be reached in 1995, all populations of eagles in the lower 48 States were reclassified as *"threatened"*. In 1999, the recovery goals for populations of eagles had been reached or exceeded and the eagle was proposed for removal from the ESA. The bald eagle was officially de-listed from the ESA on June 28, 2007 with the exception of the Sonora Desert bald eagle population. Although officially removed from the protection of the ESA across most of its range, the bald eagle is still afforded protection under the Bald and Golden Eagle Protection Act.

Under the Bald and Golden Eagle Protection Act (16 USC 668-668c), the take of bald eagles is prohibited without a permit from the USFWS. Under the Act, the definition of "*take*" includes actions that "*pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, or disturb*" eagles. The regulations authorize the USFWS to issue permits for the take of bald eagles and golden eagles on a limited basis (see 74 FR 46836-46837, 50 CFR 22.26, 50 CFR 22.27). As necessary, WS would apply for the appropriate permits as required by the Bald and Golden Eagle Protection Act.

Endangered Species Act (ESA)
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)).

As part of the development of this EA, WS has also consulted with the USFWS concerning T&E species in Massachusetts in regards to proposed bird damage management activities, which will be discussed in Chapter 4 of this EA.

National Historic Preservation Act (NHPA) of 1966, as amended
The NHPA and its implementing regulations (36 CFR 800) require federal agencies to initiate the Section 106 process if an agency determines that the agency's actions are undertakings as defined in Sec. 800.16(y) and, if so, whether it is a type of activity that has the potential to cause effects on historic properties. If the undertaking is a type of activity that does not have the potential to cause effects on historic properties, assuming such historic properties were present, the agency official has no further

obligations under Section 106. None of the bird damage management methods described in this EA that might be used under the alternatives causes major ground disturbance, any physical destruction or damage to property, any alterations of property, wildlife habitat, or landscapes, nor involves the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. Therefore, the methods that could be used by WS under the proposed action are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, the site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

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

Environmental Justice - 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. Environmental justice is a priority within APHIS and WS. Executive Order 12898 requires federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies, and activities on minorities and persons or populations of low income. APHIS implements Executive Order 12898 principally through its compliance with the NEPA. All WS' activities are evaluated for their impact on the human environment and compliance with Executive Order 12898. WS' personnel use only legal, effective, and environmentally safe wildlife damage management methods, tools, and approaches. It is not anticipated that the use of methods would result in any adverse or disproportionate environmental impacts to minorities and persons or populations of low income.
Protection of Children - Executive Order 13045

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

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

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

The Native American Graves and Repatriation Act of 1990
The Native American Graves Protection and Repatriation Act requires federal agencies to notify the Secretary of the Department that manages the federal lands upon the discovery of Native American cultural items on federal or tribal lands. Federal projects would discontinue until a reasonable effort has been made to protect the items and the proper authority has been notified.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
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 employed and/or recommended by the WS' program in Massachusetts pursuant to the alternatives would be registered with the EPA and MDAR, when applicable. All chemical methods would be employed by WS pursuant to label requirements when providing direct operational assistance under the alternatives. In addition, WS would recommend that all label requirements be adhered to when recommending the using of chemical methods while conducting technical assistance projects under the alternatives.

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

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.

Inland Fisheries and Game and Other Natural Resources (MGL c.131 and Regulations 310 CMR 10.00 and 321 CMR 2.00 and 3.00)
This law establishes the Massachusetts Department of Fish and Game and under it the Division of Fisheries and Wildlife. It also provides for the Fisheries and Wildlife Board and the Director of the Division of Fisheries and Wildlife and designates their responsibilities and powers. Regulations established pursuant to this statute regulate trapping, hunting, problem animal management, wetlands protection and manipulation or removal of beaver dams.

Powers of Inland Fisheries and Game Director (MGL c.131, s.4 p.2)
MGL c.131, Section 4, paragraph 2 provides the Director of the Inland Fisheries and Game authority to take or authorize other persons in writing to take mammals and other animals at any time or in any manner for purposes of control or management. This paragraph reads as follows:

"Notwithstanding any other provisions of this chapter, but subject to federal law, rules and regulations, take or in writing authorize other persons to take and possess fish, fish spawn, birds, the nest or eggs thereof, mammals, reptiles or amphibians at any time or in any manner for purposes of observation, research, control or management for which a fee shall be charged, the amount of which shall be determined annually by the commissioner of administration under the provision of section three B of chapter seven, and, in the director's discretion, excuse certain persons so authorized from any licensing provision of this chapter and he may, subject to federal law, rules and regulations, regulate the trapping and taking of raptors for the purpose of falconry in accordance with rules and regulations established under the provisions of section five."

Problem Animal Control Regulations 321 CMR 2.14
"The purpose of 321 CMR 2.14 is to control problem animals. In accordance with MGL c.131, s.4, problem animal control agents may harass, take, and destroy, or may release or liberate as stipulated in 321 CMR 2.14 (20), such problem animals as are set forth in 321 CMR 2.14 (20). Problem animal control agents may also disturb, remove, or destroy dens, lodges, burrows, or nests of such problem animals on property of such persons as who have engaged the services of the problem animal control agent. Nothing in 321 CMR 2.14 shall allow or be construed to allow the propagation of wildlife contrary to 321 CMR 2.12 or the rehabilitation of wildlife contrary to 321 CMR 2.13. Problem Animals means non-domesticated reptiles, birds, and mammals the actions of which have or are endangering the life and health of humans or domestic animals; damaging the property of a person except grass or other natural vegetation growing without cultivation and which is not harvested or otherwise put to material use by the owner or tenant thereof; obstructing the reasonable and comfortable use of property by the owner or tenant thereof and which cannot be abated in another fashion; or otherwise producing such material annoyance, inconvenience, and discomfort that can reasonably be presumed to result in damage or hurt to persons or their property. A problem animal control permit shall authorize the permittee to control problem animals of the following species or groups of species: snapping turtle, starling, pigeon (rock dove), house (English) sparrow, opossum, moles, bats except those species listed in 321 CMR 10.60, cottontail rabbits, European rabbit, chipmunk, gray squirrel, red squirrel, flying squirrels, woodchuck, muskrat, rats, mice, and voles except those species listed in 321 CMR 10.90, porcupine, raccoon, short-tailed weasels, long-tailed weasels, red fox, gray fox, coyote, and striped skunk. The Director may authorize individual permittees to control problem animals of other species or groups of species at such times and in such locations as he shall determine. Other allowable methods include shooting with a firearm when done in accordance with provisions of M.G.L. c. 131, c. 140, and c. 269; hand nets or noose poles; fumigant cartridges for the control of woodchucks; and anticoagulant rodenticides for the control

of rats, mice and voles when not in conflict with M.G.L. c. 131, § 43, or c. 270, § 3A. Dogs may be used to track or locate problem animals. The Director may authorize the chemical restraint of certain problem animals by employees of a municipal entity, provided that such persons satisfy the Director as to their training and experience in such chemical restraint and provided that such persons are otherwise authorized in accordance with M.G.L. c. 94C and applicable federal law."

Killing of Game by Owner or Tenant of Land; Reports MGL c.131, s.37
Under MGL c.131, Section 37 *"an owner or tenant of land or, if authorized by such owner or tenant, any member of his immediate family or his employee, as defined pursuant to section one of chapter sixty-two B, may, upon such land:*

(1) Kill or attempt to kill, by means other than poisoning or trapping, any wild bird damaging his property, including domesticated animals, poultry and game on game-rearing farms or preserves, provided that such killing is not contrary to any federal law, rule or regulation.
(2) Hunt or take by other means, except by poison or snare, any mammal which he finds damaging his property except grass growing on uncultivated land.

No such owner or tenant shall authorize any person, other than a member of his immediate family or a person permanently employed by him, to place traps for the protection of said property other than during the open season, unless such owner or tenant has first obtained from the director a permit authorizing him so to do, which permit the director is hereby authorized to issue in his discretion, unless such authorized person holds a trapping license. All deer so killed shall be turned over to any environmental police officer and shall be disposed of by the director of law enforcement.

The following written reports shall be sent to the director by such owner or tenant acting under authority of this section:—(a) upon the taking of pheasant, ruffed grouse, hares or rabbits, or the wounding or killing of a deer, a report stating the time and place, kind and number of birds or mammals so taken, wounded or killed, within twenty-four hours of such taking, wounding or killing; (b) upon the taking of any other birds or mammals, a report on or before January thirty-first of each year, stating the number and kinds of birds or mammals taken under authority of this section during the previous year. This section shall not be construed to limit any other provisions of this chapter."

Massachusetts Endangered Species Act (MESA) (MGL c.131A and regulations 321 CMR 10.00)
The Massachusetts Endangered Species Act (M.G.L c.131A and regulations 321 CMR 10.00) protect rare species and their habitats by prohibiting the "Take" of any plant or animal species listed as Endangered, Threatened, or Special Concern by the MDFW. "Take" is defined as, *"in references to animals to harass, harm, pursue, hunt, shoot, hound, kill, trap, capture, collect, process, disrupt the nesting, breeding, feeding or migratory activity or attempt to engage in any such conduct, or to assist such conduct, and in reference to plants, means to collect, pick, kill, transplant, cut or process or attempt to engage or to assist in any such conduct. Disruption of nesting, breeding, feeding or migratory activity may result from, but is not limited to, the modification, degradation or destruction of Habitat."* Permits for taking rare species for scientific, educational, conservation, or management purposes can be granted by the MDFW.

Massachusetts Pesticide Control Act (MGL c.132B)
The purpose of the Massachusetts Pesticide Control Act is "*...to conform the laws of the commonwealth to the* [FIFRA], *Public Law 92-516, as amended,...and to establish a regulatory process in the commonwealth"*. The Act provides "*...exclusive authority in regulating the labeling, distribution, sale, storage, transportation, use and application, and disposal of pesticides in the commonwealth..."*.

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES

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

2.1 AFFECTED ENVIRONMENT

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

Upon receiving a request for assistance, the proposed action alternative or those actions described in the other alternatives could be conducted on private, federal, state, tribal, and municipal lands in Massachusetts 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 Massachusetts that are currently being conducted under a MOU or cooperative service agreement with WS where activities have been and currently are being conducted. This EA also addresses the impacts of bird damage management where additional agreements may be signed in the future.

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

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

associated with resident wildlife species managed by the state natural resources agency, invasive species, or unprotected wildlife species.

Most native wildlife species are protected under state or federal law. For some bird species, take during the hunting season is regulated pursuant to the MBTA by the USFWS through the issuance of frameworks, that include the allowable length of hunting seasons, methods of take, and allowed take which are implemented by the MDFW. Under the blackbird depredation order (50 CFR 21.43), blackbirds can be taken by any entity without a depredation permit when those species identified in the order are found committing or about to commit damage or posing a human safety threat. In addition, Muscovy ducks can also be removed in Massachusetts pursuant to a control order without the need for a permit. Pursuant to the MBTA, the USFWS can issue depredation permits to those entities experiencing damage associated with birds, when deemed appropriate. Free-ranging or feral domestic waterfowl, European starlings, rock pigeons, mute swans, ring-necked pheasants, wild turkeys, monk parakeets, and house sparrows are not protected from take under the MBTA and can be addressed without the need for a depredation permit from the USFWS. However, pheasants, turkeys, and mute swans are protected under Massachusetts state law and the lethal take of those species requires a permit or authorization from the MDFW.

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 to alleviate bird damage, the action is not subject to compliance with the NEPA due to the lack of federal involvement[6] in the action. Under such circumstances, the environmental baseline or status quo must be viewed as an environment that includes those resources as they are managed or impacted by non-federal entities in the absence of the federal action being proposed. Therefore, in those situations in which a non-federal entity has decided that a management action directed towards birds should occur and even the particular methods that would be used, WS' involvement in the action would not affect the environmental status quo. WS' involvement would not change the environmental status quo if the requestor had conducted the action in the absence of WS' involvement in the action. Since the lethal take of birds can occur either without a permit if those species are non-native, during hunting seasons, under depredation orders, under control orders, or through the issuance of depredation permits by the USFWS and/or MDFW and since most methods for resolving damage are available to both WS and to other entities, WS' decision-making ability is restricted to one of three alternatives. WS can either provide technical assistance with managing damage with no direct involvement, take the action using the specific methods as decided upon by the non-federal entity, or take no action at which point the non-federal entity could take the action anyway either without a permit, during the hunting season, under depredation orders, under control orders, or through the issuance of a depredation permit by the USFWS and/or MDFW. 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.

In some situations, however, certain aspects of the human environment may actually benefit more from WS' involvement than from a decision not to assist. For example, if a cooperator believes WS has greater expertise to manage damage when compared to other entities, WS' management activities may have less of an impact on target and non-target species than if the non-federal entity conducted the action alone. The concern arises from those persons experiencing damage using methods that have no prior experience with managing damage or threats associated with birds. The lack of experience in bird behavior and damage management methods could lead to the continuation of damage, which could threaten human safety or could lead to the use of inappropriate methods in an attempt to resolve damage. WS' personnel are trained in the use of methods, which increases the likelihood that damage management methods are

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

employed appropriately, which can increase effectiveness, humaneness, minimizes non-target take, and reduces threats to human safety from those methods. 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. Issues related to managing damage associated with birds in Massachusetts were developed by WS in consultation with the USFWS and the MDFW. The 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 is the potential impact of management actions on the populations of target species. Methods available to resolve damage or threats to human safety are categorized into non-lethal and lethal methods. Non-lethal methods 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 result in local population reductions in the area where damage or threats were occurring. The number of target species that could be removed from the 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. Under certain alternatives, both non-lethal and lethal methods could be recommended, as governed by federal, state, and local laws and regulations.

The analysis for magnitude of impact on the populations of those species addressed in the EA would be based on a measure of the number of individuals killed from each species in relation to that species' abundance. Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations would be based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations would be based on population trends and harvest trend data, when available. Take would be monitored by comparing the number killed with overall populations or trends in the population. All lethal take of birds by WS would occur at the requests of a cooperator seeking assistance and only after the take of those birds species has been permitted by the USFWS pursuant to the MBTA, when required.

Information on bird populations and trends are often derived from several sources including the Breeding Bird Survey (BBS), the Christmas Bird Count (CBC), and 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 (BBS)

Bird populations can be monitored by using trend data derived from data collected during the BBS. Under established guidelines, observers count birds at established survey points for a set duration along a pre-determined route, usually along a road. Surveys were started in 1966 and are conducted in June, which is generally considered as the period of time when those birds present at a location are likely breeding in the immediate area. The BBS is conducted annually in the United States, across a large

geographical area, under standardized survey guidelines. The BBS is a large-scale inventory of North American birds coordinated by the United States Geological Survey, Patuxent Wildlife Research Center (Sauer et al. 2014). The BBS is a combined set of over 3,700 roadside survey routes primarily covering the continental United States and southern Canada. The primary objective of the BBS has been to generate an estimate of population change for all breeding birds. Populations of birds tend to fluctuate, especially locally, because of variable local habitat and climatic conditions. Trends can be determined using different population equations and tested to identify whether it is statistically significant.

Current estimates of population trends from BBS data are derived from hierarchical model analysis (Link and Sauer 2002, Sauer and Link 2011) and are dependent upon a variety of assumptions (Link and Sauer 1998). The statistical significance of a trend for a given species is also determined using BBS data (Sauer et al. 2014).

Christmas Bird Count (CBC)

The CBC is conducted in December and early January annually by numerous volunteers under the guidance of the National Audubon Society (NAS). The CBC reflects the number of birds frequenting a location during the winter months. Participants count the number of birds observed within a 15-mile diameter circle around a central point (177 mi^2). The CBC data does not provide a population estimate, but the count can be used as an indicator of trends in the population of a particular bird species over time. Researchers have found that population trends reflected in CBC data tend to correlate well with those from censuses taken by more stringent means (NAS 2010).

Partners in Flight Landbird Population Estimate

The BBS data are intended for use in monitoring bird population trends, but it is also possible to use BBS data to develop a general estimate of the size of bird populations. Using relative abundances derived from the BBS, Rich et al. (2004) extrapolated population estimates for many bird species in North America as part of the Partners in Flight Landbird Population Estimate database. The Partners in Flight system involves extrapolating the number of birds in the 50 quarter-mile circles (total area/route = 10 mi^2) survey conducted during the BBS to an area of interest. The model used by Rich et al. (2004) makes assumptions on the detectability of birds, which can vary for each species. Some species of birds that are more conspicuous (visual and auditory) are more likely to be detected during bird surveys when compared to bird species that are more secretive and do not vocalize often. Information on the detectability of a species is combined to create a detectability factor, which may be combined with relative abundance data from the BBS to yield a population estimate (Rich et al. 2004). The Partners in Flight Science Committee (2013) updated the database recently to reflect more current population estimates.

Bird Conservation Regions

Bird Conservation Regions are areas in North America that are characterized by distinct ecological habitats that have similar bird communities and resource management issues. The Commonwealth of Massachusetts lies within the Atlantic Northern Forest (Bird Conservation Region 14) and the New England/Mid-Atlantic Coast (Bird Conservation Region 30) regions. The majority of the state lies within the New England/Mid-Atlantic Coast region.

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.

Annual Harvest Estimates

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 by the MDFW. Those species addressed in this EA that have established hunting seasons include snow geese, Canada geese, Atlantic brant, wood ducks, gadwall, Eurasian wigeons, American wigeons, American black ducks, mallards, ring-necked ducks, green-winged teal, blue-winged teal, common eiders, white-winged scoters, hooded mergansers, common mergansers, red-breasted mergansers, ring-necked pheasants, wild turkeys, American woodcocks, American crows, and fish crows.

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

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

A common issue when addressing damage caused by wildlife are the potential impacts of management actions on non-target species, including threatened and endangered species. Methods available to resolve damage or threats of damage can be categorized as lethal and non-lethal. Non-lethal methods disperse or otherwise make an area where damage is occurring unattractive to the species (target species) causing the damage, thereby reducing the presence of those species in the area. However, non-lethal methods also have the potential to inadvertently disperse non-target wildlife. Lethal methods remove individuals of the species (target species) causing the damage, thereby reducing the presence of those species in the area and the local population. However, lethal methods also have the potential to inadvertently capture, kill, or otherwise impact non-target wildlife.

The Endangered Species Act (ESA) makes it illegal for any person to ‘take’ any listed endangered or threatened species or their critical habitat. The ESA defines take as, "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 USC 1531-1544). Critical habitat is a specific geographic area or areas that are essential for the conservation of a threatened or endangered species. The Act requires that federal agencies conduct their activities in a way to conserve species. It also requires that federal agencies consult with the appropriate implementing agency (either the USFWS or the National Marine Fisheries Service) prior to undertaking any action that may take listed endangered or threatened species or their critical habitat pursuant to Section 7(a)(2) of the ESA.

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. Risks can occur to persons employing methods and to persons coming into contact with methods. Risks can be inherent to the method itself or related to the misuse of the method.

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 lethally take birds. DRC-1339 and Avitrol are the only avicides currently being considered for use to manage damage in this assessment. In Massachusetts, DRC-1339 is registered for use by WS for management of damage associated with feral pigeons, red-winged blackbirds, brown-headed cowbirds, common grackles, European starlings, crows, and gulls.

Several avian repellents are commercially available to disperse birds from an area or discourage birds from feeding on desired resources. Avitrol is an avian repellent available for use to manage damage associated with several bird species. For those species addressed in this assessment, Avitrol is available to manage damage associated with feral pigeons, red-winged blackbirds, common grackles, brown-headed cowbirds, European starlings, house sparrows, and crows.

Other repellents are also available with the most common ingredients being polybutene, anthraquinone, and methyl anthranilate. An additional repellent considered for use in this assessment is Mesurol. It is currently being registered for use in Massachusetts. Mesurol is intended for use to discourage crows from predating on eggs of T&E species. In addition, alpha-chloralose, 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 fully reversible with a full recovery of sedated animals occurring.

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 are also discussed in detail in Appendix B. Many of the non-chemical methods are only 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, anti-perching devices, electronic distress calls).

The primary safety risk of most non-chemical methods occurs directly to the applicator or those persons assisting the applicator. However, risks to others do exist when employing non-chemical methods, such as when using firearms, cannon nets, or pyrotechnics. Most of the non-chemical methods available to address bird damage in Massachusetts 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.

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 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, large percentages of households have indoor or outdoor pets. However, some people may consider individual wild animals and birds as "*pets*" or exhibit affection toward those animals, especially people who enjoy viewing wildlife. Therefore, the public reaction is variable and mixed to wildlife damage management because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between humans and wildlife.

Wildlife populations provide a wide range of social and economic benefits (Decker and Goff 1987). 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. Direct benefits may be derived from direct consumptive use (e.g., using parts of or the entire animal) or non-consumptive use (e.g., viewing or photographing 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. The effects on the aesthetic value of birds from implementation of the identified alternatives, including the proposed action, are analyzed in Chapter 4.

2.3 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

Additional issues were identified by WS and the USFWS during the scoping process of this EA. Those issues were considered by WS and the USFWS; however, those issues will not be analyzed in detail 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 Commonwealth of Massachusetts would not meet the NEPA requirements for site specificity. Wildlife damage management falls within the category of federal or other regulatory agency actions in which the exact timing or location of individual activities cannot usually be predicted well enough ahead of time to accurately describe such locations or times in an EA or EIS. Although WS can predict some of the possible locations or types of situations and sites where some kinds of wildlife damage would occur, the program cannot predict the specific locations or times at which affected resource owners would determine a damage problem has become intolerable to the point that they request assistance from WS. In addition, the WS program would not be able to prevent such damage in all areas where it might occur without resorting to destruction of wild animal populations over

broad areas at a much more intensive level than would be desired by most people, including WS and other agencies. Such broad scale population management would also be impractical or impossible to achieve within WS' policies and professional philosophies.

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

In terms of considering cumulative effects, one EA analyzing impacts for the entire state would provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. If a determination were made through this EA that the proposed action or the other alternatives might have a significant impact on the quality of the human environment, then an EIS would be prepared. Based on previous requests for assistance, the WS program in Massachusetts 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. 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 of Massachusetts and would only target those birds identified as causing damage or posing a threat. Therefore, damage management activities conducted pursuant to any of the alternatives would not adversely affect biodiversity.

Humaneness of Methods to be Employed

Humaneness, in part, is a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife, is an important and very complex concept that can be interpreted in a variety of ways.Pain obviously occurs in animals, but assessing pain experienced by animals can be challenging (AVMA 2013, CDFG 1991). The AVMA defines pain as being, "that sensation (perception) that results from nerve impulses reaching the cerebral cortex via ascending neural pathways" (AVMA 2013). The key component of this definition is the perception of pain. The AVMA (2013) notes that "pain" should not be used for stimuli, receptors, reflexes, or pathways because these factors may be active without pain perception. For pain to be experienced, the cerebral cortex and subcortical structures must be functional. If the cerebral cortex is nonfunctional because of hypoxia, depression by drugs, electric shock, or concussion, pain is not experienced.

The AVMA states "... euthanasia is the act of inducing humane death in an animal" and that "...that if an animal's life is to be taken, it is done with the highest degree of respect, and with an emphasis on making the death as painless and distress free as possible" (AVMA 2013). Additionally, euthanasia methods should minimize any stress and anxiety experienced by the animal prior to unconsciousness." AVMA (2013) notes, "While recommendations are made, it is important for those utilizing these recommendations to understand that, in some instances, agents and methods of euthanasia identified as appropriate for a particular species may not be available or may become less than an ideal choice due to differences in circumstances. Conversely, when settings are atypical, methods normally not considered

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

WS euthanizes animals by methods recommended by the AVMA (2013) or the recommendations of a veterinarian, even though the AVMA euthanasia methods were developed principally for companion animals and slaughter of food animals, and not for free-ranging wildlife. Due to the status quo definition, animals will be removed from the environment even with the absence of WS operations. Therefore, WS' professional involvement would ensure that most humane methods are utilized.

WS and the National Wildlife Research Center (NWRC) are striving to bring additional non-lethal damage management alternatives into practical use and to improve the selectivity and humaneness of management devices. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in situations when non-lethal damage management methods are not practical or effective. WS supports the most humane, selective, and effective damage management techniques, and would continue to incorporate advances into program activities.

A Loss Threshold Should be Established before Allowing Lethal Methods

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

Bird Damage Management should not occur at Taxpayer Expense

An issue previously 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 damage management activities would be derived from federal appropriations and through cooperative funding. Activities conducted 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 Massachusetts. The remainder of the WS program is entirely fee-based. Technical assistance is provided to requesters as part of the federally funded activities, but all direct assistance in which WS' employees perform damage management activities is funded through cooperative service agreements between the requester and WS.

Cost Effectiveness of Management Methods

The CEQ does not require a formal, monetized cost benefit analysis to comply with the NEPA. Consideration of this issue is not essential to making a reasoned choice among the alternatives being considered. However, the methods determined to be most effective to reduce damage and threats to

human safety caused by birds and that prove to be the most cost effective would receive the greatest application. As part of an integrated approach, evaluation of methods would continually occur to allow for those methods that are most effective at resolving damage or threats to be employed under similar circumstances where birds are causing damage or pose 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.

Bird Damage should be Managed by Problem Animal Control (PAC) Agents
Private nuisance wildlife control agents known in Massachusetts as problem animal control or PAC agents could be contacted to reduce bird damage for property owners when deemed appropriate by the resource owner. Some property owners would prefer to use a PAC agent because the PAC agent is located in closer proximity and thus could provide the service at less expense, or because they prefer to use a private business rather than a government agency. However, some property owners would prefer to enter into an agreement with a government agency. In particular, large industrial businesses, and cities and towns may prefer to use WS because of security and safety issues. The relationship between WS and private industry is addressed in WS directive 3.101.

Effects from the Use of Lead Ammunition in Firearms
Questions have arisen about the deposition of lead into the environment from ammunition used in firearms to lethally take birds. As described in Appendix B, the lethal removal of birds with firearms by WS to alleviate damage or threats would occur using a rifle or shotgun. To address lead exposure from the use of shotguns, the standard conditions of depredation permits issued by the USFWS pursuant to the MBTA for the lethal take of birds requires the use of non-toxic shot.

The take of birds by WS would occur primarily from the use of shotguns. However, the use of rifles could be employed to lethally take some species. 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.

Research by Craig et al. (1999), Laidlaw et al. (2005), and Stansley et al. (1992) suggests that, given the very low amount of lead being deposited and the concentrations that would occur from WS' activities to reduce bird damage using rifles, as well as most other forms of dry land small game hunting in general, lead contamination of water from such sources would be minimal to nonexistent.

Since the take of birds can occur during regulated hunting seasons, through the issuance of depredation permits, under depredation orders without the need to obtain a depredation permit, or are considered non-native with no depredation permit required for take, WS' assistance with removing birds would not be additive to the environmental status quo. 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. Based on current information, the risks associated with lead bullets that could be deposited into the environment from WS' activities due to misses, the bullet passing through the carcass, or from bird carcasses that may be irretrievable would be below any level that would pose any risk from exposure or significant contamination of water.

Effects on Human Health from Consumption of Waterfowl
Of concern under this issue is the consumption of waterfowl meat donated to charitable organizations after being lethally taken by WS. Of recent concern is the potential for lead bullet fragments to be present in meat that has been processed for human consumption. In addition, the potential for the spreading of

zoonotic diseases or other contaminants in waterfowl processed and donated for human consumption is a concern.

In order to address potential health concerns associated with consuming waterfowl, waterfowl donated for human consumption may be tested for exposure to substances such as organophosphate and carbamate insecticides, lead, mercury, arsenic, organochlorines, and organic chemicals prior to distribution. The entity selecting the capture/euthanize (and donation for charitable consumption) program would be responsible for all costs associated with legal and appropriate donation for human consumption. Poultry processing facilities utilized for this process would be in compliance with existing USDA regulations pertaining to the processing and handling of fowl (e.g., turkeys, chickens).

Waterfowl immobilized using alpha chloralose would not be donated for human consumption with disposal of carcasses occurring by deep burial or incineration. Waterfowl taken by any method for disease sampling or in an area where zoonotic diseases of concern are known to be prevalent and of concern to human health after consuming processed waterfowl meat would not be donated for consumption and would be disposed of by deep burial or incineration.

WS' activities to alleviate damage or threats associated with waterfowl would only occur after receiving a request for direct operational assistance. Therefore, the decision to process waterfowl for human consumption that were taken by WS would be the sole responsibility of the entity requesting assistance. WS would not process and/or donate processed waterfowl meat to charitable organizations and would not be involved with the processing and/or donation of the meat to charitable organizations.

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 continuing conflict can develop when habitat alteration is used to disperse a bird roost. This concern is heightened in large metropolitan areas where the likelihood of birds dispersed from a roost, finding a new roost location, and not coming into conflict is very low. WS has minimized the impact of dispersing bird roosts in urban/suburban areas by evaluating a management option to depopulate the bird roost that is creating the conflict problem.

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

Global Climate Change/Greenhouse Gas Emissions

The WS program activities that may result from the alternatives would have a negligible effect on atmospheric conditions including the global climate. Meaningful direct or indirect emissions of greenhouse gases would not occur as a result of the proposed action. The proposed action would meet

requirements of applicable federal laws, regulations, and Executive Orders including the Clean Air Act and Executive Order 13514.

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 Massachusetts 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:

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

The proposed action/no action alternative would continue the current implementation of an adaptive integrated approach utilizing non-lethal and lethal techniques, as deemed appropriate using the WS Decision Model, to reduce damage and threats caused by birds. A major goal of the program would be to resolve and prevent bird damages and to reduce threats to human safety. To meet this goal, WS, in cooperation with the USFWS and in consultation with the MDFW, would continue to respond to requests for assistance with, at a minimum, technical assistance, or when funding is available, operational damage management. Funding could occur through federal appropriations or from cooperative funding.

The adaptive approach to managing damage associated with birds would integrate the use of the most practical and effective methods to resolve a request for damage management as determined by site-specific evaluation to reduce damage or threats to human safety for each request after applying the WS Decision Model. City/town managers, agricultural producers, property owners, and others requesting assistance would be provided information regarding the use of appropriate non-lethal and lethal techniques. WS would work with those persons experiencing bird damage in addressing those birds responsible for causing damage as expeditiously as possible. To be most effective, damage management activities should begin as soon as birds begin to cause damage. Bird damage that has been ongoing can be difficult to resolve using available methods since birds are conditioned to feed, roost, loaf, and are familiar with a particular location. Subsequently, making that area unattractive using available methods can be difficult to achieve once damage has been ongoing. The USFWS could continue to issue depredation permits to WS and to those entities experiencing bird damage when requested by the entity and when deemed appropriate by the USFWS for those species that require a permit.

Under this alternative, WS could respond to requests for assistance by: 1) taking no action, if warranted, 2) providing only technical assistance to property owners or managers on actions they could take to reduce damages caused by birds, or 3) providing technical assistance and direct operational assistance to a property owner or manager experiencing damage. The take of birds 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 is required. When applying for a depredation permit, the requesting entity submits 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.

Property owners or managers may choose to implement WS' recommendations on their own (i.e., technical assistance), use contractual services of private businesses, use volunteer services of private organizations, use the services of WS (i.e., direct operational assistance), or take no action.

The property owner or manager may choose to apply for their own depredation permit from the USFWS to lethally take birds, as required by the implementing regulations of the MBTA for depredation control (see 50 CFR 21.41). The USFWS requires non-lethal methods be used and shown ineffective or impractical before the USFWS will issue a depredation permit. In this situation, WS could evaluate the damage and complete a Migratory Bird Damage Report, which would include information on the extent of the damages, the number of birds present, and a recommendation for the number of birds that should be taken to best alleviate the damages.

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

In anticipation of damage management activities, WS would annually submit an application for a depredation permit to the USFWS estimating the maximum number of birds that could be lethally taken to alleviate damage in Massachusetts through direct operational assistance projects. The number of birds anticipated to be lethally taken by WS would be based on previous requests for assistance received to manage damage associated with those species of birds. In addition, WS could be listed as subpermittees under depredation permits issued to other entities.

Non-lethal methods include, but are not 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 taste repellents (see Appendix B for a complete list and description of potential methods). Lethal methods considered by WS include live-capture followed by euthanasia, DRC-1339, the recommendation of take during hunting seasons, and firearms. WS would employ cervical dislocation, shot to the head, or carbon dioxide to euthanize target birds once those birds were live-captured using other methods. Carbon dioxide is an acceptable form of euthanasia for birds while cervical dislocation is a conditionally acceptable[7] method of euthanasia (AVMA 2013). The use of firearms could also be used to euthanize birds live-captured; however, the use of firearms for euthanasia is considered a conditionally acceptable method for wildlife (AVMA 2013).

Lethal and non-lethal methods are intended to be short-term attempts at reducing damage occurring at the time those methods are employed. Long-term solutions to managing bird damage would include limited

[7]The AVMA (2013) defines conditional acceptable as "...[methods] *that by the nature of the technique or because of greater potential for operator error or safety hazards might not consistently produce humane death or are methods not well documented in the scientific literature".*

habitat manipulations and changes in cultural practices that are addressed further below and in Appendix B.

Integrated Wildlife Damage Management (IWDM)

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

Technical Assistance Recommendations

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

Operational Damage Management Assistance

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

Educational Efforts

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

Research and Development

The National Wildlife Research Center (NWRC) functions as the research arm of WS by providing scientific information and development of methods for wildlife damage management that are effective and environmentally responsible. Research biologists with the NWRC work closely with wildlife managers, researchers, and others to develop and evaluate damage management techniques. For example, research biologists from the NWRC were involved with developing and evaluating mesurol for reducing

crow predation on eggs. NWRC biologists have authored hundreds of scientific publications and reports, and are respected worldwide for their expertise in wildlife damage management.

WS' Decision Making Procedures

WS' personnel use a thought process for evaluating and responding to damage complaints that is depicted by the WS Decision Model (WS Directive 2.201) and described by Slate et al. (1992) as seen in Figure 3.1. WS' personnel are frequently contacted after requesters have tried or considered non-lethal methods and found them to be impractical, too costly, or inadequate for effectively reducing damage. WS' personnel assess the problem and then evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic, and social considerations. Following this evaluation, methods deemed practical for the situation would be incorporated into a damage management strategy. After this strategy had been implemented, monitoring would be conducted and evaluation would continue to assess the effectiveness of the strategy. If the strategy were effective, no further management would be needed. In terms of the WS Decision Model, most efforts to manage damage consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The WS Decision Model is not a written documented process, but a mental problem-solving process common to most, if not all, professions, including WS.

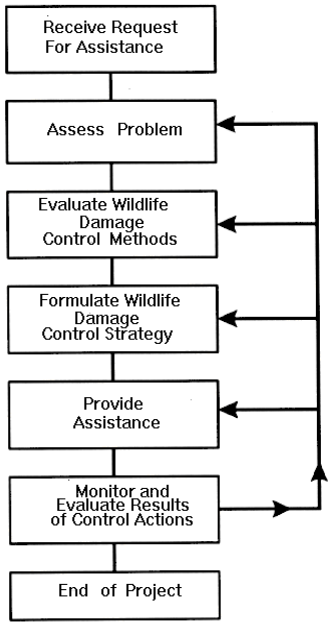


Figure 3.1 WS Decision Model as presented by Slate et al. (1992) for developing a strategy to respond to a request for assistance with human-wildlife conflicts.

Community-based Decision Making

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

By involving decision-makers in the process, damage management actions can be presented to allow decisions to involve those individuals that the decision-maker(s) represents. 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 on activities to be made based on local input.

Alternative 2 - Bird Damage Management by WS using only Non-lethal Methods

Under this alternative, WS would be restricted to only using or recommending non-lethal methods to resolve damage caused by birds in Massachusetts (Appendix B). Lethal methods could continue to be

used under this alternative by those persons experiencing damage without involvement by WS. In situations where non-lethal methods were impractical or ineffective to alleviate damage, WS could refer requests for information regarding lethal methods to the the state, local animal control agencies, or private businesses or organizations. Property owners or managers may choose to implement WS' non-lethal recommendations on their own or with the assistance of WS, implement lethal methods on their own, or request assistance (non-lethal or lethal) from a private or public entity other than WS.

The property owner or manager may choose to apply for their own depredation permit from the USFWS to lethally take birds. The USFWS could continue to issue depredation permits to those entities when requested by the entity and when deemed appropriate by the USFWS for those species that require a permit. Permitting procedures would be followed as described under Alternative 1.

Most methods discussed in Appendix B that are available for use to manage bird damage would be available to all entities. The only methods currently available that would not be available for use by those persons experiencing bird damage is the avicide DRC-1339, the immobilizing drug alpha-chloralose, and the repellent mesurol, which can only be used by WS.

Alternative 3 – No Bird Damage Management Conducted by WS

This alternative precludes 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. All requests for assistance received by WS to resolve damage caused by birds would be referred to the USFWS, the MDFW, and/or private entities. This alternative would not deny other federal, state, and/or local agencies, including private entities from conducting damage management activities directed at alleviating damage and threats associated with birds. Many of the methods listed in Appendix B would be available for use by other agencies and private entities, unless otherwise noted in the Appendix, to manage damage and threats associated with birds.

Under this alternative, property owners/managers may have difficulty obtaining permits to use lethal 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 are to be issued. If the information were provided to the USFWS, following the agency's review of a complete application package for a depredation permit from a property owner or manager to lethally take birds, the permit issuance procedures would follow that described in Alternative 1.

Despite no involvement by WS in resolving damage and threats associated with birds, those persons experiencing damage caused by birds could continue to resolve damage by employing those methods legally available since the take of birds could occur either through the issuance of depredation permits by the USFWS; take during the hunting seasons, and blackbirds could be taken at any time when found committing or about to commit damage or posing a human safety threat under a depredation order; Muscovy ducks could be taken under the control order, and non-native bird species could be taken without the need for a depredation permit issued by the USFWS. All methods described in Appendix B would be available for use by those persons experiencing damage or threats except for the use of alpha-chloralose for waterfowl, DRC-1339 for blackbirds and gulls, along with mesurol for crows (when registered by the state), which can only be used by WS.

3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

In addition to those alternatives analyzed in detail, several alternatives were identified by WS and the

USFWS; however, those alternatives will not receive detailed analyses in this EA for the reasons provided. Those alternatives considered, but not analyzed in detail include:

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

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

Use of Lethal Methods Only by WS
This alternative would require the use of lethal methods only to reduce threats and damage associated with birds. However, non-lethal methods can be effective in preventing damage in certain instances. Under WS Directive 2.101, WS must consider the use of non-lethal methods before lethal methods. Therefore, this alternative was not considered in detail.

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

The translocation of birds, that have caused 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 blackbird roosts); therefore, translocation would be unrealistic. Translocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of the stress to the translocated animal, poor survival rates, and the difficulties that translocated wildlife have with adapting to new locations or habitats (Nielsen 1988).

Technical Assistance Only
This alternative would restrict WS to only providing technical assistance (advice) on BDM. Producers, property owners, agency personnel, or others could obtain permits from the USFWS and/or the MDFW as needed and could conduct bird damage management using any of the legally available non-lethal and lethal techniques. Technical assistance information is also readily available from entities other than WS such as the USFWS, universities, extension agents, FAA, and private individual and organizations. Environmental impacts of this alternative are likely to be similar to Alternative 3. Consequently, the agencies have determined that detailed analysis of this alternative would not contribute substantive new information to the understanding of environmental impacts of damage management alternatives and have chosen to not analyze this alternative in detail.

3.3 STANDARD OPERATING PROCEDURES FOR BIRD DAMAGE MANAGEMENT

SOPs improve the safety, selectivity, and efficacy of those methods available to resolve or prevent damage. The current WS program uses many such SOPs. Those SOPs would be incorporated into activities conducted by WS when addressing bird damage and threats.

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

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

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

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

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

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

- All personnel who use firearms would be trained according to WS' Directives.

- 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.

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

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

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

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

3.4 ADDITIONAL STANDARD OPERATING PROCEDURES SPECIFIC TO THE ISSUES

Several additional SOPs are 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 and by the USFWS and MDFW to evaluate population trends and the magnitude of WS' take of birds in the state.

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

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

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

- 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 would be addressed in a timely manner to minimize the stress of being restrained.

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

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

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

- WS will obtain confirmation that only the target bird species are consuming pre-bait through direct observations, track monitoring, and/or remote cameras before application of treated bait when conducting control operations with DRC-1339.

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

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

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

- WS has consults as required with the USFWS and the MDFW to evaluate activities to resolve bird damage and threats to ensure the protection of T&E 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).

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

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

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

- Carcasses of birds retrieved after damage management activities would be disposed of in accordance with WS Directive 2.515, including any permits required by the USFWS and MDFW.

- WS' employees who use alpha chloralose participate in approved training courses concerning immobilizing drugs.

- WS would adhere to all established withdrawal times when using immobilizing drugs for the capture of waterfowl that are agreed upon by WS, the USFWS, the MDFW, and veterinarian authorities. Although unlikely, in the event that WS is requested to immobilize waterfowl either during a period of time when harvest of waterfowl is occurring or during a time where the withdrawal period could overlap with the start of a harvest season, WS would euthanize the animal.

Issue 4 - Effects on the Aesthetic Values of Birds

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

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

- Feral domestic waterfowl, mute swans, pigeons, starlings, and house sparrows are non-native, invasive species in the state that can cause harm to native flora and fauna. Any reduction in those populations could be viewed as benefiting the aesthetic value of a more native ecosystem.

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 are not expected to be significantly impacted by any of the alternatives analyzed as none of the alternatives cause any significant ground disturbance: soils, geology, minerals, water quality/quantity, flood plains, wetlands, visual resources, air quality, prime and unique farmlands, aquatic resources, timber, historical, and range. Therefore, these resources will not be analyzed.

Indirect Effects: These are impacts caused by an action that are later in time or farther removed in distance, but are still reasonably foreseeable.

Cumulative Effects: As defined by CEQ (40 CFR 1508.7), these 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 that undertakes such other actions. Cumulative impacts may result from individually minor, but collectively significant, actions taking place over time.

Irreversible and Irretrievable Commitments of Resources: Other than minor uses of fuels for motor vehicles and other materials, there are no irreversible or irretrievable commitments of resources.

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

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 USFWS, and the MDFW.

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

Population Impact Analyses of the Alternatives

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

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

Under the proposed action, WS would continue to provide both technical assistance and direct operational assistance using methods described in Appendix B to those persons requesting assistance with managing damage and threats associated with birds. WS' lethal removal is monitored by comparing numbers of animals killed with overall state populations or trends in populations to assure the magnitude of removal is maintained below the level that would cause significant adverse impacts 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. Unless noted otherwise, the state population estimate listed for each species analyzed below was obtained from PFSC (2013). Breeding Bird Survey (BBS) population trends from 1966 to 2012 for Massachusetts and the region that the Commonwealth falls within (New England/Mid-Atlantic) are listed for each species when available (Sauer et al. 2014). The statistical significance of a trend for a given species that is determined by the

BBS data is color coded: a black percentage indicates a statistically non-significant positive or negative trend, a red percentage indicates a statistically significant negative trend, and a blue percentage indicates a statistically significant positive trend (Sauer et al. 2014).

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

Many non-lethal methods are used to excluded, harass, and disperse target wildlife from areas where damage or threats are occurring. When effective, non-lethal methods would disperse birds from the area resulting in a reduction in the presence of those birds at the site where those methods were employed. However, birds responsible for causing damage or threats are moved to other areas with minimal impact on those species' populations. Non-lethal methods are not employed over large geographical areas or applied at such intensity that essential resources (*e.g.*, food sources, habitat) would be unavailable for extended durations or over 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 bird populations in the state under any of the alternatives.

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 mammals 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.

WS may recommend birds be harvested during the regulated hunting and/or trapping 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 and trapping seasons and the allowed take during those seasons is the responsibility of the MDFW. WS does not have the authority to establish hunting or trapping seasons or to set allowed harvest numbers during those seasons. However, the harvest of those birds with hunting and/or trapping seasons would be occurring in addition to any take that could occur by WS under the alternatives or recommended by WS.

Generally, WS only conducts damage management on species whose population densities are high or concentrated and usually only after they have caused damage. The issue of the potential impacts of conducting the alternatives on the populations of those target bird species addressed in this EA is analyzed for each alternative below.

Mute Swan Biology and Population Impacts

MA population estimate: 1,046*	WS proposed removal: 100 +75 nests (and eggs)
New England/Mid-Atlantic BBS, 1966-2012: 1.81%	MA BBS, 1966-2012: 11.02%
New England/Mid-Atlantic BBS, 2002-2012: 1.64%	MA BBS, 2002-2012: 7.02%
WS removal as % of state population: 9.56%	MA CBC Trend 1966-2013: Increasing

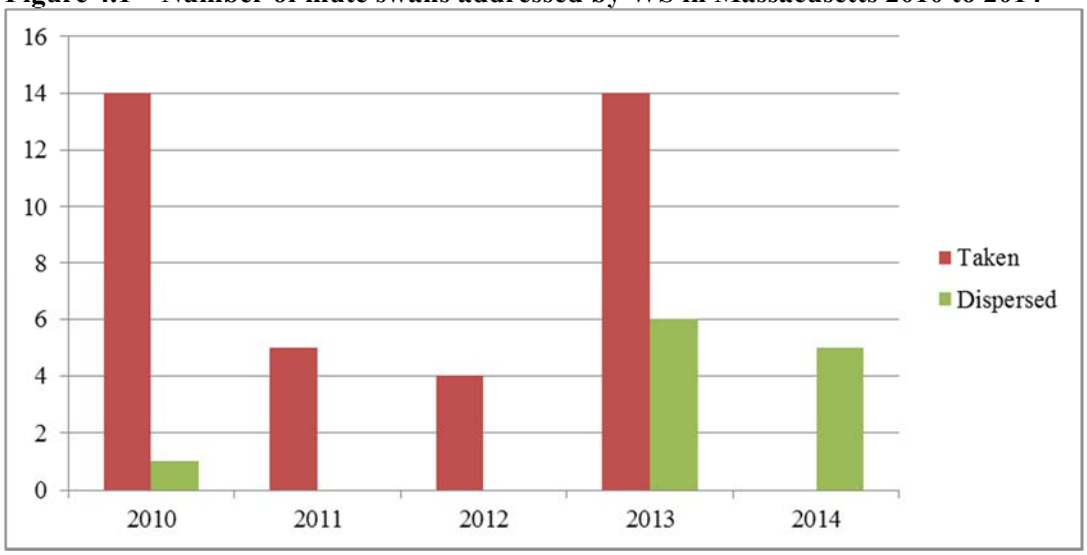
*Estimate from 2008 Mid Summer Mute Swan Survey Results (Atlantic Flyway Council 2009)

The mute swan was introduced from Europe into the United States in the late 1800's near New York City. Mute swans were first recorded in Massachusetts in 1922 (Atlantic Flyway Council 2003). Mute swan nesting territories vary in size from 1.6 to 4 ha (4 to 10 acres) and are used year-round or reoccupied each year. Small islands, narrow peninsulas, and clumps of aquatic vegetation are preferred nesting sites. Most mute swans breed at age three and remain with the same mate for life.

The mute swan lays the largest of all swan eggs, and a typical clutch of four to eight eggs takes 35 to 38 days to hatch. Half of all young mute swans can expect to survive through age seven. Mute swans are long-lived and may reach 20 to 30 years of age (CT DEEP 1999). Under the Atlantic Flyway Mute Swan Management Plan 2003-2013, Massachusetts has a target mute swan population of 500 individuals (Atlantic Flyway Council 2003).

From FY 2006 through FY 2014, a total of 46 mute swans have been lethally taken by WS to alleviate damage and 16 were non-lethally dispersed (see Figure 4.1). Mute swans are not protected federally under the MBTA because they are considered an invasive exotic species. They are, however, specifically protected from hunting under Massachusetts state regulations. The MDFW can issue permits to addle eggs and destroy mute swans (MDFW 2014*a*).

Figure 4.1 – Number of mute swans addressed by WS in Massacusetts 2010 to 2014



Because hunting swans is illegal under state law in Massachusetts (MDFW 2014*a*), MDFW is aware of any mute swans taken annually by non-WS' entities. WS would contact MDFW and obtain appropriate prior authorization before conducting any lethal control. Executive Order 13112 states that each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law; 1) reduce invasion of exotic species and associated damages, 2) monitor invasive species populations, provide for restoration of native species and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control and promote public education on invasive species.

***Direct, Indirect, and Cumulative Effects*:**

Any lethal take by WS' could be furthering the Atlantic Flyway management goal since mute swans are considered an invasive, exotic species and a target population of 500 mute swans has been set under the Atlantic Flyway Mute Swan Management Plan. This goal is to reduce the mute swan population in the

Atlantic Flyway to level that will minimize negative ecological impacts to wetland habitats and native migratory birds and to prevent further range expansion into unoccupied areas (Atlantic Flyway Council 2003). Based on the best scientific data, WS proposed removal level will have no adverse direct or indirect effects on mute swan populations. The permitting of the removal by the MDFW ensures removal by WS and by other entities occurs within allowable removal levels to achieve the desired population objectives for mute swans.

Canada Geese

MA population estimate: 37,835*	WS proposed removal: 500 +250 nests (and eggs)
New England/Mid-Atlantic BBS, 1966-2012: 8.54%	MA BBS, 1966-2012: 8.09%
New England/Mid-Atlantic BBS, 2002-2012: 8.17%	MA BBS, 2002-2012: 8.33%
WS removal as % of state population: 1.32%	MA CBC Trend 1966-2013: Increasing

*Estimate from 2014 Atlantic Flyway Breeding Waterfowl Plot Survey (Klimstra et al. 2014)

There are two types of Canada geese that inhabit Massachusetts during the year, resident and migratory. Canada geese are considered resident in the Commonwealth when nesting and/or residing on a year around basis within the Commonwealth, when nesting in the Commonwealth during the months of March, April, May, or June, or residing in the Commonwealth during the months of April, May, June, July, August (Rusch et al. 1995, Ankney 1996, USFWS 2005). Most requests for assistance received by WS occur under the criteria where geese present in the Commonwealth are considered resident.

Resident Canada Geese

The annual Atlantic Flyway Breeding Waterfowl Plot Survey population estimates for resident Canada geese in the Commonwealth from 2010 through 2014 (Klimstra et al. 2014) are shown in Table 4.1. The MDFW estimated the statewide population in 2005 at 39,500 geese based on a mark and re-sight surveys (H. Heusmann, MDFW pers. comm. 2011). In 1999, the population objective for resident Canada geese in the Commonwealth was established at 20,000 individuals (Atlantic Flyway Council 2011, USFWS 2005).

Canada geese can be harvested during regulated hunting seasons in the Commonwealth. Under frameworks developed by the USFWS, the MDFW allows Canada geese to be harvested during a September hunting season, the regular waterfowl season, and during a late Canada goose season. To manage increasing populations of resident geese across their range, the USFWS established a framework that allowed the states to implement a harvest season in September which is intended to target resident geese specifically.

The take of geese under the depredation orders that allow for the take of Canada geese once certain conditions have been met must be reported to the USFWS. Therefore, the cumulative impacts of the proposed action on resident Canada geese populations are based upon the anticipated WS' take, hunter harvest, and authorized take by other entities (e.g., agricultural producers, municipalities, homeowners associations, airports) through the issuance of depredation permits or under the depredation orders. The cumulative take of geese in Massachusetts from 2010 through 2014 is shown in Table 4.1.

With the population of geese estimated at 37,835 geese in the Commonwealth during 2014, WS' take of 354 geese in FY 2014 to alleviate damage and reduce threats would represent 0.94% of the estimated statewide breeding population. Of the total number of geese addressed by WS from FY 2010 through FY 2014, over 85.36% were addressed using non-lethal methods.

WS' take of nests and/or eggs would only occur when permitted by the USFWS and the MDFW through the issuance of depredation permits. Therefore, WS take would only occur at the discretion of the USFWS and MDFW after population objectives for geese are considered.

Table 4.1 Resident Canada goose population estimates and number addressed and harvested in Massachusetts from FY 2010 to FY 2014

Year	Estimated Population	Hunter Harvest	Dispersed by WS[1]	Total Lethal Take Authorized by USFWS[2]	Lethal Take under Depredation Permits		
					WS' Take[1]	Non-WS' Take[3]	Total Take by All Entities
2010	29,422	16,500	4,067	1,493	379	420	67
2011	35,708	12,553	3,238	1,337	349	390	66
2012	42,637	15,029	2,798	1,332	252	385	637
2013	38,271	10,806	1,812	1,380	252	244	496
2014	37,835	7,107	2,834	1,387	354	n/a	354
AVERAGE		**12,399**	**2,950**	**1,386**	**317**	**360**	**324**

[1]WS' take is reported by federal fiscal year
[2]Adapted from harvest reports from the USFWS
[3]Data provided by the USFWS (J. Ratcliffe, USFWS pers. comm. 2014).

Based on the 2014 resident goose population estimate in the Commonwealth of 37,835 geese, the take of 500 geese by WS would represent 1.32% of the estimated statewide population, if all 500 geese were taken during the period when geese would be considered resident geese. Therefore, even if the resident Canada goose population in the Commonwealth stabilizes at 20,000 geese, the population goal for Massachusetts established by the Atlantic Flyway Council, WS' take of up to 500 geese annually would only represent 2.5% of the estimated population.

Migratory Canada Geese

Migratory Canada geese breed in Canada and Alaska and winter in the continental United States. Breeding populations that winter in Massachusetts are typically from three breeding populations. These are the North Atlantic Population (NAP), Southern James Bay Population (SJBP), and the Atlantic Population (AP) of Canada geese. Under field conditions, distinguishing geese between population segments can be difficult. Determining whether a Canada goose present in the Commonwealth is migratory or a resident (*i.e.*, present in the Commonwealth throughout the year) can also be difficult under field conditions. Therefore, for the purposes of this analyses, those Canada geese present in the Commonwealth from September through March will be considered as migratory geese, although resident geese regularly begin nesting in March throughout the Commonwealth and nesting geese can be clearly identified as being resident.

Frameworks have been established by the USFWS and implemented by the MDFW to allow for the harvest of geese in the Commonwealth during those months when geese present in the Commonwealth could be migratory. The September season is intended to manage populations of resident geese. Although migratory geese could be present in the Commonwealth during September, the majority of geese present in the Commonwealth are likely geese that nested within the Commonwealth. This is based on band recovery data, collar observations, and radio satellite data which indicate that the September season is virtually entirely free of migratory birds (H. Heusmann, MDFW pers. comm. 2011). The September hunting season originally ended September 10, then was moved to September 15, and finally until September 25 each year due to evidence indicating that most migrant geese did not leave Canada before early October (H. Heusmann, MDFW pers. comm. 2011). Dunn and Jacobs (2000) found that from 1992 through 1999, 4.1% of the banded geese harvested in Pennsylvania during a special September season were identified as migrant geese from either the SJBP (n=24) or the AP (n=5) of Canada geese.

From FY 2010 through FY 2014, a total of 478 geese were lethally taken by WS in the Commonwealth during the period when geese present in the Commonwealth could be considered migratory (September through March) or approximately 96 geese per year. This represents 30.14% of the 1,586 geese taken by

WS during the same time period. However, based on increasing requests for assistance to manage geese, WS may be required to lethally take geese during those months when geese could be considered migratory, if deemed appropriate through the use of the WS Decision Model. WS anticipates that requests for the lethal take of geese during those months when geese are considered migratory would occur primarily at airports where geese can pose a threat to human safety and to property. However, requests could be received to reduce damage or threats to other resources. Based on an increase in the number of requests received for the lethal take of geese during those periods of time when geese present in the Commonwealth would be considered migratory, WS may take up to 200 geese during those periods when geese could be considered migratory.

All take by WS occurs through the issuance of a depredation permit issued by the USFWS which is reported annually to the USFWS. Take by other entities in the Commonwealth occurs under depredation permits or depredation orders established by the USFWS with the requirement that take be reported to the USFWS. Therefore, the permitting of the take by the USFWS and the MDFW ensures cumulative take is considered as part of management objectives for Canada geese. WS' cumulative take of up to 200 geese, that could be considered migratory, annually would have represented almost 2.82% of the number of geese harvested in the Commonwealth during the 2013-14 Canada goose seasons. According to Lindberg and Malecki (1994) resident geese were harvested proportionally more than their availability in the population while migrants were harvested proportionally less than their availability in Crawford County, Pennsylvania during 1988 and 1989.

Direct, Indirect, and Cumulative Effects:
WS' proposed removal level will have no adverse direct or indirect effects on the resident or migratory Canada goose populations. WS proposed removal level would assist in bringing the estimated resident goose population down to the population objective stated in the Atlantic Flyway Resident Population Canada Geese Management Plan. WS typically removes approximately one third of the annual goose take during the migratory period. This minimal removal is not expected to have adverse direct or indirect effects on migratory goose populations.

Additionally, the potential authorized removal from all non-WS entities combined with WS proposed removal and the annual harvest is not expected to create significant impacts to Canada goose populations. The removal of Canada geese by WS would only occur at levels authorized by the USFWS and MDFW, which ensures WS' removal and removal by all entities, including hunter harvest, would be considered to achieve the desired population management levels of Canada geese in Massachusetts. Provided that the goose population allows for an annual harvest, WS' removal could be considered of low magnitude when compared to the number of geese observed and harvested in Massachusetts annually and therefore will not hinder the ability of those interested persons to harvest geese during the hunting season.

Mallard Biology and Population Impacts

MA population estimate: 47,478*	WS proposed removal: 125 +25 nests (and eggs)
New England/Mid-Atlantic BBS, 1966-2013: 2.02%	MA BBS, 1966-2013: 2.77%
New England/Mid-Atlantic BBS, 2003-2013: 0.70%	MA BBS, 2003-2013: 3.64%
WS removal as % of state population: 0.26%	MA CBC Trend 1966-2013: Increasing

*Estimate from 2014 Atlantic Flyway Breeding Waterfowl Plot Surveys (Klimstra et al. 2014)

Mallards were brought to Massachusetts by waterfowlers who used them as live decoys or call ducks until that practice was outlawed in 1935. The liberated birds adapted readily to the lakes and ponds of Massachusetts, especially in areas where they were fed. There is some evidence that mallards also expanded their range eastward from the Midwest in response to the forest clearing and pond construction that occurred during the past 200 years. Numbers have risen steadily since 1950, with a sharper increase

after 1970 (Petersen and Meservey 2003). In Massachusetts, mallards can be found year-round throughout the state (T. Cozine Pers. Observation).

The number of mallards observed in the state during the Midwinter Waterfowl Survey conducted in 2014 was estimated at 3,301 mallards, up from 2,132 in 2013. The five year average for midwinter mallards in Massachusetts from 2011 to 2014 is 2,599 (Klimstra et al. 2014). Most mallards winter on inland sites where they are fed by people. Surveys have been conducted by the MDFW every five years since 1873. Mallards numbers at such sites peaked in 1993 at 20,110 but then declined to 9,750 by 2013 as the number of feeding sites declined due to the passing of "no feeding" ordinances and posting of "No Feeding Waterfowl" signs (Heusmann 2013).

Like other waterfowl species, mallards can be harvested during a regulated season. An estimated 4,994 mallards were harvested in the Commonwealth during the 2013 to 2014 season, and 5,054 mallards were harvested in the Commonwealth during the 2012 to 2013 season (see Table 4.2) (Raftovich et al. 2014). In addition, Raftovich et al. (2014) estimated that 61 domestic mallards were harvested in the state during the 2012 to 2013 season.

Table 4.2 – Number of mallards and domestic mallards harvested 2010 to 2014

	Hunter Harvest	
Year[1]	Mallard	Domestic Mallard
2010	8,458	0
2011	5,897	31
2012	9,861	0
2013	5,054	61
2014	4,994	0
AVERAGE	**6,853**	**18**

[1] Data reported by federal fiscal year and correlates to the prior year's hunting season, for example, 2006 correlates to the 2005 hunting season began in the fall of 2005 and ended in the winter of 2006.

Table 4.3 lists the mallard take by all entities between 2010 and 2014. From 2010 through 2014, the combined take of mallards by WS and non-WS' entities under depredation permits represented 0.48% of the total number of mallards and domestic mallards harvested in Massachusetts during the regulated hunting season from 2010 through 2014.

Direct, Indirect, and Cumulative Effects:

WS anticipates the number of airports requesting assistance with managing threats associated with mallards on or near airport property will increase. Since 2010, the average number of mallards harvested has been estimated at 6,871 mallards and domestic mallards. Based on the average take of mallards from 2010 through 2014 during the hunting season, the take of up to 125 mallards by WS would have represented 1.82% of the estimated take of mallards. If the highest level of non-WS take during this period of five mallards is included with the total anticipated annual take by WS of 125, cumulative take would represent 1.89% of the average annual harvest. If WS anticipated take of 125 mallards is combined with the maximum non-WS take from 2010 to 2014 of five and the estimated harvest during 2014, the combined estimated take of mallards of 5,124 would represent 10.79% of the estimated 2014 Massachusetts mallard population based on the Atlantic Flyway Breeding Waterfowl Plot Surveys (Raftovich et al. 2014).

Based on the known take of mallards, the take of up to 125 mallards and up to 25 nests with eggs

annually by WS to alleviate damage would not adversely affect mallard populations in Massachusetts. All take by WS would occur under a depredation permit issued by the USFWS and the MDFW for the take of those mallards which ensures the cumulative take of mallards from all known sources is considered when establishing population objectives.

Table 4.3 – Number of mallards addressed in from FY 2010 to FY 2014

Year	Dispersed by WS[1]	Total Lethal Take Authorized by USFWS[2]	Lethal Take under Depredation Permits		
			WS' Lethal Take[1]	Non-WS' Lethal Take[3]	Total Lethal Take by All Entities
2010	1,044	145	46	0	67
2011	4,652	135	76	3	66
2012	1,170	160	29	5	24
2013	966	160	22	3	21
2014	58	95	10	0	10
AVERAGE	**1,578**	**139**	**37**	**2**	**38**

[1]Data reported by federal fiscal year
[2]Does not include WS authorized take
[3]Data reported by calendar year

American Black Duck Biology and Population Impacts

MA population estimate: 21,986*
New England/Mid-Atlantic BBS, 1966-2013: -6.41%
New England/Mid-Atlantic BBS, 2003-2013: -4.41%
WS removal as % of state population: 0.23%
WS proposed removal: 50 +10 nests (and eggs)
MA BBS, 1966-2013: -6.54%
MA BBS, 2003-2013: -6.41%
MA CBC Trend 1966-2013: Decreasing

*Estimate from 2014 Midwinter Waterfowl Survey (Klimstra et al. 2014)

The American black duck is closely related to the mallard, and is among the largest of North American ducks and regularly hybridize with mallards. The American black duck can be found in just about any aquatic habitat type within its range as long as there is adequate cover present. The American black duck breeds from the upper Mississippi River to the northeastern United States, north from northern Saskatchewan to the eastern Canadian provinces. The highest breeding densities are found from northern New England to the Canadian Maritimes. American black ducks utilize a variety of habitats for breeding, such as alkaline marshes, bogs, lakes, streams, fresh, brackish and salt marshes, and estuaries. Female American black ducks produce an average of nine eggs (Ducks Unlimited 2012). American black ducks are most common in the Atlantic and Mississippi flyways, mostly along the Atlantic coast from the Maritime Provinces to Florida. Highest concentrations are found wintering between Long Island, New York and North Carolina (Ducks Unlimited 2012).

The number of American black ducks observed in the Commonwealth during the Midwinter Waterfowl Survey conducted in 2014 was estimated at 21,986 American black ducks up from 18,625 in 2013. The five year average for American black ducks in Massachusetts from 2011 to 2014 is 21,948 (Klimstra et al. 2014). The population estimate for black ducks in Massachusetts bases on Atlantic Flyway Breeding Waterfowl Plot Surveys was 12,347 during 2014, with a five year average of 6,929 black ducks (Klimstra et al. 2014).

Like other waterfowl species, American black ducks can be harvested during a regulated season. An average of 3,312 American black ducks and 191 American black duck-mallard hybrids have been harvested annually from the 2010 through 2014 seasons (see Table 4.4).

In addition to the take of American black ducks during the hunting season, an average of 15 American black ducks have been lethally taken by WS from FY 2010 through FY 2014 (Table 4.5). No American black ducks have been lethally taken under depredation permits by non-WS' entities between 2010 and 2014. From 2010 through 2014, the take of American black ducks by WS represented 0.43% of the total number of American black ducks and American black duck-mallard hybrids harvested in Massachusetts during the regulated hunting season from 2010 through 2014.

Table 4.4 – Number of American black ducks and American black duck-mallard hybrids harvested 2010 to 2014

	Hunter Harvest	
Year[1]	American Black Duck	American Black Duck-Mallard Hybrid
2010	4,520	387
2011	2,683	218
2012	4,511	157
2013	2,179	61
2014	2,669	132
AVERAGE	**3,312**	**191**

[1]Data reported by federal fiscal year and correlates to the prior year's hunting season, for example, 2010 correlates to the 2009 hunting season which began in the fall of 2005 and ended in the winter of 2006.

Table 4.5 – Number of American black ducks addressed by WS in Massachusetts from 2006 to 2014

Year[1]	Dispersed by WS	WS' Lethal Take
2010	376	26
2011	3,190	45
2012	210	2
2013	205	2
2014	26	0
AVERAGE	**801.4**	**15**

[1]Data reported by federal fiscal year

Based on the average take of American black ducks and hybrids from 2010 through 2014 during the hunting season, the take of up to 50 American black ducks by WS would have represented 1.43% of the estimated annual take of American black ducks.

Direct, Indirect, and Cumulative Effects:

WS anticipates the number of airports requesting assistance with managing threats associated with American black ducks on or near airport property will increase. If WS anticipated take of 50 American black ducks is combined with the the estimated harvest during 2014, the combined estimated take of American black ducks and hybirds of 2,851 would represent 12.97% of the estimated 2014 Massachusetts American black duck population based on the Midwinter Waterfowl Survey (Klimstra et al. 2014).

Based on the known take of American black ducks, the take of up to 50 American black ducks and up to 10 American black duck nests with eggs annually by WS to alleviate damage would not adversely affect American black duck populations in Massachusetts. All take by WS would occur under a depredation permit issued by the USFWS and the MDFW for the take of those American black ducks which ensures

the cumulative take of American black ducks from all known sources is considered when establishing population objectives.

Feral Waterfowl Biology and Population Impacts

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, 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 ducks, 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.

Domestic waterfowl have been purchased and released by property owners for their aesthetic value, but those released waterfowl may not always remain at the release sites; thereby, becoming feral. Feral waterfowl are defined as a domestic species of waterfowl that cannot be linked to a specific ownership. Examples of areas where domestic waterfowl have been released are business parks, universities, wildlife management areas, parks, military bases, residential communities, and housing developments. Many times, those birds are released with no regard or understanding of the consequences or problems they can cause to the environment or the local community.

Federal law does not protect domestic varieties of waterfowl (see 50 CFR 21), nor are domestic waterfowl specifically protected by state law in Massachusetts. Domestic waterfowl may at times cross breed with migratory waterfowl species, creating a hybrid cross breed (e.g., mallard X domestic duck, Canada goose X domestic goose). Those types of hybrid waterfowl species would be taken in accordance with definitions and regulations provided in 50 CFR 10 and 50 CFR 21.

Domestic ducks, geese, and swans are non-indigenous species considered by many wildlife biologists and ornithologists to be an undesirable component of native ecosystems in North America. Any reduction in the number of these domestic waterfowl species could be considered as benefiting other native bird species since they compete with native wildlife for resources. Domestic and feral waterfowl are almost always found near water, such as ponds, lakes, retaining pools, and waterways. Domestic and feral waterfowl generally reside in the same area year-round with little to no migration occurring. Currently, population estimates do not exist for domestic and feral waterfowl in Massachusetts.

The Muscovy ducks located in Massachusetts are from non-migratory populations that originated from domestic stock. The USFWS has recently changed the regulations governing Muscovy ducks. Because Muscovy ducks 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 Massachusetts. 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 Massachusetts. 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, which is an order to allow control of Muscovy ducks, their nests, and eggs.

From FY 2009 through FY 2014, the WS program in Massachusetts removed 19 feral geese and placed them in permanent captivity to reduce damage and threats of damage. Although no specific hunting season has been designated specifically for feral waterfowl, some domestic or feral waterfowl are taken during the annual hunting season for free-ranging waterfowl. As discussed under mallard ducks, an estimated 92 domestic mallards were harvested from 2009 to 2014.

Direct, Indirect, and Cumulative Effects:

Based on previous requests for assistance and in anticipation of additional efforts, WS could lethally remove up to 300 feral ducks or feral geese and up to 200 feral waterfowl nests (and eggs) could be destroyed annually under the proposed action. Since feral waterfowl often compete with native wildlife species for resources, any take of feral waterfowl could be viewed as benefitting the natural environment. The number of feral waterfowl inhabiting Massachusetts is currently unknown. However, based on the limited take proposed and the likely benefit to the natural environment that could occur, the lethal removal of up to 300 feral ducks or feral geese would not adversely affect populations of those feral species.

Double-Crested Cormorant Biology and Population Impacts

MA population estimate: 11,926*	WS proposed removal: 75 +25 nests (and eggs)
New England/Mid-Atlantic BBS, 1966-2013: 11.43%	MA BBS, 1966-2013: 5.67%
New England/Mid-Atlantic BBS, 2003-2013: 19.66%	MA BBS, 2003-2013: 6.07%
WS take as % of state population: 0.63%	MA CBC Trend 1966-2013: Increasing
Cumulative removal as % of state population: 0.6%	

*Estimates from 2006 to 2008 and based on estimated number of nesting pairs (Melvin 2010)

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 impacts 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 very real management need to address those concerns (USFWS 2003, USFWS 2009a).

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). The population (breeding and non-breeding birds) in the United States was estimated to be greater than one million birds in the 1990's (Tyson et al. 1999). The USFWS estimated the global population at approximately 2.2 million cormorants, 90% of this population in North America (WCA 2007). The Mid-Atlantic/New England/Maritimes population was estimated at over 173,000 breeding pairs, 16,860 of these in the Southern New England area which includes Massachusetts. Most of Massachusetts is included in Bird Conservation Region (BCR) 30 and the remainder, in North Central and Western Massachusetts, is in BCR 14. BCR 30 has approximately 29,700 nesting pairs while BCR 14 has approximately 143,400 nesting pairs (WCA 2007). 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).

The double-crested cormorant was extirpated from Massachusetts in the nineteenth century. Double-crested cormorants returned to breed in Massachusetts around 1944 (Petersen and Meservey 2003).

In 1977, 1,760 pairs nested at eleven sites, in 1984 nearly 5,000 pairs nested at fifteen sites, and by the 1990s approximately 8,000 pairs nested at twenty-five sites (Petersen and Meservey 2003). During 2006 to 2008, Melvin (2010) reported 5,693 nesting pairs at 31 sites, a decline of 19.5% from 6,375 pairs at 35 sites estimated during 1994 to 1995.
Along with the increase in breeding birds, in the 1980s the species became regular in winter along the coast and inland during migration (Sibley 1994; Zeranski and Baptist 1990). CBC data from surveys conducted from 2009 through 2013 shows an average of over 105 cormorants have been observed in areas surveyed ranging from a low of 33 cormorant in 2013 to a high of 270 cormorants in 2011 (NAS 2002). The double-crested cormorant is ranked as a species of lowest concern by the Mid-Atlantic/New England/Maritimes Regional Waterbird Conservation Plan (WCA 2007) and as a species of least concern by the IUCN (2011).

From FY 2010 through FY 2014, WS has lethally taken eight cormorants and non-WS entities lethally took 24 cormorants in the Commonwealth to alleviate damage or threats (see Table 4.6). The two years of lethal removal represented 0.06% and 0.07% of the estimated 11,926 cormorants breeding in Massachusetts in 2006 to 2008. All take occurred under depredation permits issued by the USFWS. More than 99.40% of the cormorants addressed by WS from FY 2010 through FY 2014 were addressed using non-lethal methods.

Table 4.6 – Double-crested cormorants addressed in Massachusetts from FY 2010 to FY 2014

Year	Dispersed by WS[1]	Total Lethal Take Authorized by USFWS[2]	Take Under Depredation Permit		
			WS' Lethal Take[1]	Non-WS' Lethal Take[3]	Total Lethal Take by All Entities
2010	44	60	1	7	8
2011	0	60	7	8	15
2012	0	55	0	5	5
2013	1,200	40	0	4	4
2014	80	40	0	0	0
AVERAGE	**221**	**42.5**	**1.6**	**4.8**	**6.4**

[1]Data reported by federal fiscal year
[2]Does not include WS authorized take
[3]Data reported by calendar year

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).

Direct, Indirect, and Cumulative Effects:
Although only limited cormorant damage management activities have been conducted by WS in Masachusetts, WS anticipates the number of requests for assistance to manage damage caused by cormorants will increase based on the increasing number of cormorants observed during the breeding season and overwintering within the Commonwealth. Based on the best scientific data, WS proposed removal level will have no adverse direct effects on cormorant populations. The potential authorized

removal from all non-WS entities combined with WS proposed removal is also not expected to create adverse cumulative impacts. All removal of cormorants would occur within the levels permitted by the USFWS and MDFW pursuant to the MBTA.

Eastern Wild Turkey Biology and Population Impacts

MA population estimate: 18,000*
WS proposed removal: 150 +15 nests (and eggs)
New England/Mid-Atlantic BBS, 1966-2013: 17.86%
MA BBS, 1966-2013: 13.19%
New England/Mid-Atlantic BBS, 2003-2013: 18.51%
MA BBS, 2003-2013: 20.76%
WS removal as % of state population: 0.83%
MA CBC Trend 1966-2013: Increasing
Cumulative removal as % of state population: 15.6%
*Estimates from Living with Wildlife, Wild Turkey in Massachusetts (MDFW 2012)

The Eastern wild turkey can be found in 38 states and four Canadian provinces, ranging from southern Canada and New England to northern Florida and west to Texas, Missouri, Iowa, and Minnesota (Kennamer 2010). In the Eastern United States, wild turkeys inhabit hardwood, mixed, and pine forests foraging on a variety of acorns, fruit, seeds, and insects. Turkeys are considered permanent, non-migratory residence in states where they are present. There are an estimated 5.1 million to 5.3 million wild turkeys in the Eastern subspecies in the United States and Canada (National Wild Turkey Federation 2010).

The stocking releases and subsequent population expansion have resulted in the successful restoration of wild turkeys to all Massachusetts counties with the exception of Nantucket. The Eastern wild turkey is ranked as a species of least concern by IUCN (2011). Populations of turkeys are sufficient to allow for annual hunting seasons. The numbers of turkeys harvested in the Commonwealth from 2010 through 2014 during the annual turkey hunting seasons are shown in Table 4.7.

Requests for assistance received by the WS program in Massachusetts to manage damage or threats of damage associated with wild turkeys occur primarily at airports where turkeys can pose strike risks to aircraft. Turkeys are also known to attack people and cause damage to windows, siding, and vehicles when turkeys, primarily males during the breeding season, see humans as rivals or mistake their reflection as another turkey and attempt to attack the image which can scratch paint on vehicles and siding on houses. Between FY 2010 through FY 2014, WS has dispersed a total of 244 turkeys to manage damage or threats of damage occurring within the Commonwealth when requested. In addition, WS has also employed lethal methods to take a total of 151 wild turkeys between FY 2010 and FY 2014. All turkeys lethally taken were at airports where those turkeys posed an immediate threat of aircraft strikes by feeding or loafing on or moving across active runways and/or taxiways.

Table 4.7 – Number of Eastern wild turkeys addressed and turkey harvest from 2010-2014 in Massachusetts

		Depredation take and Harvest			
Year	**Dispersed by WS[1]**	**WS' Lethal Take[1]**	**Fall Harvest[2]**	**Spring Harvest[2]**	**Total**
2010	20	20	n/a†	2,757	**2,777**
2011	51	57	n/a†	2,857	**2,914**
2012	22	18	179	2,723	**2,920**
2013	59	32	n/a†	2,778	**2,810**
2014	92	24	n/a†	2,550	**2,574**
Average	**41**	**30**	**36**	**2,733**	**2,799**

[1]Data reported by federal fiscal year

[2]Data reported by previous years fall seasons and current years spring seasons and correlates to the federal fiscal year, for example 2006 refers to the 2005 fall season and the spring 2006 season.
[†]Data not available at the time this EA was prepared.

Direct, Indirect, and Cumulative Effects:
Based on the best scientific data, WS' proposed removal level will have no adverse direct or indirect effects on turkey populations. Additionally, the potential authorized removal from all non-WS entities combined with WS proposed removal and the annual harvest is not expected to create adverse cumulative impacts. Like other game species, the removal of turkeys by WS to alleviate damage will only occur when permitted by the MDFW, which ensures WS' removal and removal by all entities, including hunter harvest, would be considered to achieve the desired population management levels of turkeys in Massachusetts. WS' proposed removal is only a small percentage of the annual harvest, and therefore is not expected to hinder the ability of those interested persons in harvesting turkeys during the hunting season.

Bald Eagle Population Impact Analysis

MA population estimate: 129*
New England/Mid-Atlantic BBS, 1966-2013: 9. 91%
New England/Mid-Atlantic BBS, 2003-2013: 11.30%
*Oberved during the 2014 CBC (NAS 2010)

WS proposed removal: 1 nest (0 eggs)
MA CBC Trend 1966-2013: Increasing

The bald eagle is a large raptor often associated with aquatic habitats across North America with breeding populations occurring primarily in Alaska and Canada; however, eagles have been documented nesting in all 48 contiguous States (Buehler 2000). During the migration period, eagles can be found throughout the United States and parts of Mexico (Buehler 2000). The migration of eagles has been labeled as "complex" which can make determining migration movement difficult to ascertain. Migration is dependent on many factors, including the age of the eagle, location of the breeding site, severity of the climate at the breeding site, and availability of food (Buehler 2000). Generally, the fall migration period begins in mid-August and extends through mid-November with peak periods occurring from September through October. The spring migration period generally begins in March and extends through May with peak periods occurring from mid-March through mid-May (Buehler 2000).

Eagles are thought to form life-long pair bonds but information on the relationship between pairs is not well documented (Buehler 2000). Nesting normally occurs from late-March through September with eggs present in nests from late-May through the end of May. Eaglets can be found in nests generally from late-May through mid-September (Buehler 2000).

Populations of bald eagles showed periods of steep declines in the lower United States during the early 1900s. Population declines have been attributed to the loss of nesting habitat, hunting, poisoning, and pesticide contamination. To curtail steep declining trends in bald eagles, the Bald Eagle Protection Act was passed in 1940 which prohibited the taking or possession of bald eagles or any parts of eagles. The Bald Eagle Protection Act was amended in 1962 to include the golden eagle and is now referred to as the Bald and Golden Eagle Protection Act (see Section 1.7). Certain populations of bald eagles were listed as "endangered" under the Endangered Species Preservation Act of 1966 which was extended when the modern ESA of 1973 was passed. The bald eagle was officially de-listed from the ESA on June 28, 2007 except for the Sonora Desert bald eagle population which remained classified as a threatened species. Although officially removed from the protection of the ESA across most of the range of the eagle, the bald eagle now is afforded protection under the Bald and Golden Eagle Protection Act in addition to the Migratory Bird Treaty Act.

The Bald and Golden Eagle Protection Act allows the USFWS to permit the take of eagles when "necessary for the protection of...other interests in any particular locality" after determining the take is "...compatible with the preservation of the bald eagle" (16 U.S.C. 668a). The USFWS developed an EA that evaluated alternatives and issues associated with regulations establishing new permits for the take of eagles pursuant to the Act (USFWS 2009b). Based on the evaluations in the EA and a FONSI, the selected alternative in the EA established new permit regulations for the "take" of eagles (see 50 CFR 22.26) and a provision to authorize the removal of eagle nests (see 50 CFR 22.27).

WS has previously received requests for assistance associated with bald eagles posing threats at or near airports. The large body size and soaring behavior of eagles can pose threats of aircraft strikes when eagles occur in close proximity to airports. Given the definition of "molest" and "disturb" under the Act as described above, the use of harassment methods to disperse eagles posing threats at or near airports could constitute "take" as defined under the Act which would require a permit from the USFWS to conduct those types of activities.

Under 50 CFR 22.23, WS and/or an airport authority could apply for a permit allowing for the harassment of bald eagles that pose threats of aircraft strikes at airports. Under this proposed action alternative, WS could employ harassment methods to disperse eagles from airports or surrounding areas when authorized and permitted by the USFWS pursuant to the Act. Therefore, if no permit is issued by the USFWS to harass eagles that are posing a threat of aircraft strikes, no activities would be conducted by WS. Activities will only be conducted by WS when a permit allowing for the harassment of eagles has been issued to WS or to an airport authority where WS is working as a subpermittee under the permit issued to the airport.

Direct, Indirect, and Cumulative Effects:
Similarly, if a bald eagle nest is built in close proximity to an airport or in an area where the nest or the activities of the adult eagles pose a threat to human health and safety, the nest may be removed under a depredation permit. Under this proposed action alternative, WS could remove an active or inactive eagle nest when authorized and permitted by the USFWS pursuant to the Act. Therefore, if no permit is issued by the USFWS to remove an eagle nest creating a threat of aircraft strikes or other threat to human health and safety, no activities would be conducted by WS. Activities will only be conducted by WS when a permit allowing for eagle nest removal and destruction has been issued to WS or to an airport or property owner where WS is working as a subpermittee under the permit. Eggs or chicks would be turned over to a licensed rehabilitator or other agent authorized by the USFWS and the MDFW for rearing or hacking. No lethal take of eagles would occur under this proposed action alternative.

WS will abide by all measures and stipulations provided by the USFWS in permits issued for the harassment of eagles at airports to reduce aircraft strikes. The USFWS determined that the issuance of permits allowing the "take" of eagles as defined by the Act would not significantly impact the human environment when permits are issued for "take" of eagles under the guidelines allowed within the Act (USFWS 2009b). Therefore, the issuance of permits to allow for the "take" of eagles, including permits issued to WS or other entities has been fully evaluated in a separate analysis (USFWS 2009b).

Snowy Owl Biology and Population Impacts

MA population estimate: 54*
WS proposed removal: 5
Cumulative removal as % of state population: 9.3%
WS proposed relocations: 150
MA CBC Trend 1966-2013: Increasing
*Oberved during the 2014 CBC (NAS 2010)

Snowy owls breed in open terrain of the artic barrens from the Aleutian Islands along the northern edge of Alaska, throughout the Canadian Arctic Islands and from northern Yukon, northeastern Manitoba, northern Quebec, and northern Labrador (Parmelee 1992). They can be found in similar open habitats during their winter migrations. During the winter migrations, snowy owls can be found across Canada, Alaska, and the northern edge of the United States (Parmelee 1992). The open habitats of airports provide ideal wintering areas for snowy owls. Their low-flying behavior, along with their large size and body mass, (Parmelee 1992) makes them a significant hazard for a damaging strike (Dolbeer et al. 2013). The number of snowy owls observed during the CBC across all areas surveyed in the United States has shown a variable trend over the past 20 years (NAS 2010). There are no breeding or year-round populations of snowy owls within Massachusetts, and population trend data is limited and long-term data is lacking (Parmelee 1992).

WS dispersed 14 snowy owls from FY 2010 to FY 2014. Unfortunately, snowy owls generally become easily habituated to harassment measures and quickly become non-responsive, moving only a short distance or not at all. Thus, additional methods for wildlife hazard management may be necessary. As part of an integrated approach to reducing threats, WS would first employ non-lethal harassment methods (e.g., pyrotechnics, aversive noise, vehicle chasing) to disperse or move snowy owls when appropriate and safe. If snowy owls are deemed an immediate threat to aviation safety (e.g., flying along an active runway) or if repeated non-lethal harassment methods have failed, WS may need to implement non-lethal removal options. From FY 2010 to FY 2014, WS live captured and relocated 175 snowy owls, 120 of these during FY 2014. WS may lethally remove up to five snowy owls that are non-responsive to non-lethal methods, including owls that may be translocated but return to the airport and are deemed immediate threats to aviation safety. The WS Eastern Regional Director would be contacted prior to any lethal removal of snowy owls.

Direct, Indirect, and Cumulative Effects:
The live-capture and translocation of owls to appropriate habitat would not adversely affect populations since the owls would be unharmed. The limited lethal removal would not reach a magnitude that would cause adverse effects to the snowy owl population based on the following information. 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". Therefore, WS does not expect the use of appropriately sized leg bands to adversely affect snowy owl populations. All removal of snowy owls would occur within the levels permitted by the USFWS and the MDFW pursuant to the MBTA to ensure cumulative impacts are monitored and considered.

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. 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).

The USFWS completed PBR models for great black-backed gulls, herring gulls, ring-billed gulls, and laughing gulls that nest in BCR 14 and BCR 30. The majority of Massachusetts lies within BCR 30. BCR 14 and BCR 30 cover most of the coastal and inland areas of the upper northeastern United States. Since population estimates and trends for gulls in Massachusetts are limited, the PBR models developed

by the USFWS for BCR 14 and BCR 30 will be used to analyze potential population impacts under the proposed action alternative.

Allowable harvest models for bird species have had a long history of use in the United States, primarily with waterfowl species, to determine allowable harvest during annual hunting seasons. Although no hunting season exists for gulls, the take of gulls under depredation permits issued by the USFWS and the MDFW can occur in Massachusetts. The USFWS prepared PBR models using population parameters for each gull species to estimate the allowable take level for gulls in BCR 14 and BCR 30. Population parameter estimates were taken from available literature for each gull species (see Table 4.9), or in cases where estimates were not available, surrogate estimates from closely-related species were used (Seamans et al. 2007). 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).

To use the PBR method to determine levels of allowable take, or cumulative impacts over a large geographic area, the information required includes 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 PBR is:

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

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).

Table 4.9 - Demographic parameter estimates (θ) used for estimating R_{max} and Potential Biological Removal of gulls in BCR 14 and BCR 30 (Seamans et al. 2007).

		Great black-backed gull[1]		Herring gull[2]		Ring-billed gull [3]		Laughing 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
$l\alpha$	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		54,000		270,000	
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] Ryder 1993, Seamans et al. 2007

[4] Burger 1996, Dinsmore and Schreiber 1974

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

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

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 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 (Waterbird Conservation for the Americas 2007), and adjusted using a conservative estimate of 0.75 non-breeding gull per breeder 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 4.10.

The PBR models were developed by the USFWS for BCR 14 and BCR 30 to evaluate harvest levels for gulls in the northeastern United States to ensure take occurred within levels to achieve desired population objectives for those species. The four gull species addressed in this assessment are known to breed along coastal areas and inland sites that are contained within BCR 14 and BCR 30. Some concerns arise regarding the use of regional gull population estimates for assessing allowable take in BCR 14 and BCR 30 as opposed to the more specific breeding population estimates in Massachusetts. To address those concerns, the analyses for each species will include the evaluation of proposed take levels as they relate to the statewide breeding population, and how the proposed take relates to the PBR model for gulls in BCR 14 and BCR 30.

Table 4.10 - Potential Biological Removal (± 95% CI) of gulls in BCR 14 and BCR 30 under three recovery factors (Seamans et al. 2007).

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

Most states in the northeastern United States 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 is only representative of the number of gulls present in a state during a short period of time (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 that includes non-breeding populations of gulls allows for a more systemic analysis of allowable take on gull populations.

The level of annual take evaluated for each gull species under the proposed action was based on the number of gulls lethally taken during requests received by WS in Massachusetts from FY 2007 through FY 2012. As the number of requests for assistance received by WS increases, the number of gulls that are addressed to alleviate damage is also likely to increase. Based on prior requests for assistance, WS anticipates requests to alleviate damage associated with gulls to increase at airports, military installations, landfills, transfer stations, and building rooftops. WS also anticipates an increase in requests to alleviate predation and nest site competition with other colonial nesting waterbirds.

Great Black-backed Gull Biology and Population Impacts

S. New England (SNE) pop. Est.: 25,528*
New England/Mid-Atlantic BBS, 1966-2013: 2.31%
New England/Mid-Atlantic BBS, 2003-2013: 7.51%
WS removal as % of SNE population: 0.78%
WS removal: 200 +100 nests (and eggs)
MA BBS, 1966-2013: -0.71%
MA BBS, 2003-2013: 0.05%
MA CBC Trend 1966-2013: Decreasing
*Waterbird Conservation for the Americas 2007

In BCR 14, the breeding population of great black-backed gulls has been estimated at 115,546 birds and in BCR 30, the breeding population of great black-backed gulls has been estimated at 37,372 birds (Waterbird Conservation for the Americas 2007). Great black-backed gulls have increased about 39% across the entire 13 northeast states in the region from the 1970s through the 1990s (Waterbird Conservation for the Americas 2007). In the United States, great black-backed gull breeding populations have increased 109% from the 1970s to 1990s (Waterbird Conservation for the Americas 2007).

Table 4.11 shows the authorized take of great black-backed gulls in Massachusetts permitted by the USFWS and the MDFW, and the reported take for all entities receiving depredation permits.

To maintain the current population levels in BCR 14 and BCR 30, the PBR model developed by the USFWS predicts take of 11,234 great black-backed gulls would not cause a decline in gull populations in BCR 14 or BCR 30. With $F_R = 0.5$ (recovery factor), the PBR predicted 5,614 great black-backed gulls could be harvested annually in BCR 14 and BCR 30 and still allow those populations to increase.

Table 4.11 – Number of great black-backed gulls addressed in Massachusetts from FY 2010 through FY 2014

Year	Dispersed by WS[1]	Take under Depredation Permits							
		Non-WS Authorized Nests[2]	WS Nests[1]	Non-WS Nests[2]	Total Nests	Authorized Lethal Take[2]	WS' Lethal Take[1]	Non-WS Lethal Take[2]	Total Lethal Take by All Entities
2010	5,935	3	0	0	0	2,335	98	57	155
2011	3,766	520	0	2	2	3,760	86	163	249
2012	1,147	858	3	223	226	3,390	26	131	157
2013	456	1,028	3	209	212	2,753	46	98	144
2014	387	1,002	0	0	0	2,425	75	1	76
AVERAGE	**1,949**	**683**	**2**	**87**	**88**	**2,933**	**67**	**90**	**157**

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

Direct, Indirect, and Cumulative Effects:
From 2010 through 2013, the latest year with complete take report data, the number of great black-backed gulls taken annually by all entities in the northeastern United States (USFWS Region 5) has ranged from

307 to 691 gulls with an average of 483 gulls (J. Ratcliffe, USFWS, pers. comm. 2015). This average annual take of 483 gulls is below the level of annual take required to maintain current population levels predicted by the PBR model. To cause a population decline, the PBR model estimates that nearly 17,000 great black-backed gulls would have to be taken annually in the region. If WS annual take reaches 200 great black-backed gulls and the take of great black-backed gulls remains similar to the average annual take that occurred from 2010 through 2014 in the northeastern United States, the combined total (n= ~1,184 gulls) would not reach a magnitude that the PBR model predicts would result in a decline in the population of black-backed gulls in BCR 14 and BCR 30.

The destruction of up to 100 great black-backed gull nests (and eggs) annually by WS would occur in localized areas 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 MDFW. Therefore, the number of nests taken by WS annually would occur at the discretion of the USFWS and the MDFW.

Herring Gull Biology and Population Impacts

S. New England (SNE) pop. Est.: 36,256*
New England/Mid-Atlantic BBS, 1966-2013: -4.69%
New England/Mid-Atlantic BBS, 2003-2013: -2.79%
WS removal as % of SNE population: 2.07%
*Waterbird Conservation for the Americas 2007

WS proposed removal: 750+1,000 nests (and eggs)
MA BBS, 1966-2013: -8.66%
MA BBS, 2003-2013: -8.58%
MA CBC Trend 1966-2013: Decreasing

Herring gulls nest along the Atlantic coast using natural or man-made sites, such as rooftops and breakwalls. Herring gulls are increasingly nesting on man-made structures, particularly on rooftops or in areas with complete perimeter fencing such as electrical substations.

Almost 91,000 herring gulls are believed to breed in BCR 30. In addition, over 196,000 herring gulls are believed to breed in the neighboring BCR 14 (Waterbird Conservation for the Americas 2007). Herring gulls have decreased approximately 38% in the same area between 1970 and into the 1990s (Waterbird Conservation for the Americas 2007). According to the Waterbird Conservation for the Americas (2007), herring gulls are considered a species of low concern in North America.

Herring gulls are protected under the MBTA, but can be taken pursuant to the issuance of a depredation permit by the USFWS and the MDFW when gulls are causing or about to cause damage (see Table 4.12). Based on the PBR 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 take of herring gulls also occurs by other entities (e.g., airports, landfills) through depredation permits issued by the USFWS and the MDFW.

Table 4.12 – Number of herring gulls addressed in Massachusetts from FY 2010 through FY 2014

Year	Dispersed by WS[1]	Take under Depredation Permits							
		Non-WS Authorized Nests[2]	WS Nests[1]	Non-WS Nests[2]	Total Nests	Authorized Lethal Take[2]	WS' Lethal Take[1]	Non-WS Lethal Take[2]	Total Lethal Take by All Entities
2010	30,372	55	146	14	160	3,205	477	90	567
2011	32,716	550	176	0	176	3,800	474	479	953
2012	40,543	1,162	311	502	813	3,505	440	284	724
2013	28,918	2,932	579	457	1,036	2,935	339	235	574
2014	16,588	815	471	0	471	2,624	473	0	473
AVERAGE	**24,857**	**1,103**	**337**	**195**	**532**	**3,214**	**441**	**218**	**659**

[1]Data reported by federal fiscal year

[2]Data reported by calendar year

The highest level of herring gull take occurred in 2011 when 953 gulls were taken by all entities in Massachusetts. Based on a stable population of herring gulls, take in 2012 represented 2.63% of the breeding population estimated in Southern New England, without accounting for the non-breeding and wintering populations.

From 2010 through 2013, the number of herring gulls taken annually by all entities in the northeastern United States (USFWS Region 5) has ranged from 2,633 to 5,556 gulls with an average of 4,445 gulls (J. Ratcliffe, USFWS, pers. comm. 2015). This average annual take of 4,445 gulls is below the level of annual take required to maintain current population levels predicted by the PBR model. To cause a population decline, the PBR model estimates that nearly 16,725 herring gulls would have to be taken annually in the region. If WS annual take reaches 1,750 herring gulls and the take of herring gulls remains similar to the take that occurred from 2010 through 2013 in the northeastern United States, the combined total would not reach a magnitude that the PBR model predicts would result in a decline in the population of herring gulls in BCR 14 and BCR 30.

Direct, Indirect, and Cumulative Effects:

WS' proposed take of up to 750 herring gulls and 1,000 nests (and eggs) annually, along with take by other entities, is expected to continue to be insignificant to the overall viability and reproductive success of herring gull populations on a local, regional, and nationwide scale. Known take of herring gulls is below the level that the PBR model predicts will cause a decline in the population in the northeastern United States from take permitted by the USFWS and the MDFW.

Based on the best available information described above, WS' potential impacts to populations of herring gulls has been, and is expected to continue to be, insignificant to the overall viability and reproductive success of herring gull populations on a local, regional, and nationwide scale. The permitting of take by the USFWS and the MDFW provides outside evaluation to ensure WS' take occurs within the allowed limits to achieve desired population management objectives for herring gulls in Massachusetts and the northeastern United States.

Ring-billed Gull Biology and Population Impacts

MA population estimate: 40,844*	WS proposed removal: 150
New England/Mid-Atlantic BBS, 1966-2013: 1.89%	MA BBS, 1966-2013: -1.10%
New England/Mid-Atlantic BBS, 2003-2013: 3.10%	MA BBS, 2003-2013: -1.18%
WS removal as % of BCR 14 population: 0.89%	MA CBC Trend 1966-2013: Increasing

*Waterbird Conservation for the Americas 2007

New England/Mid-Atlantic populations of ring-billed gulls have increased at a rate of 3.10% from 2003 to 2013, with a regional breeding population estimated at 40,844 gulls (Waterbird Conservation for the Americas 2007). No breeding populations are currently known to occur in Massachusetts or anywhere else in BCR 30. However, ring-billed gulls can be found throughout the year and can be observed throughout most, if not all, of the Commonwealth. Ring-billed gulls are considered a species of lowest concern in BCR 14 and BCR 30 (Waterbird Conservation for the Americas 2007).

The USFWS-authorized take of ring-billed gulls in Massachusetts issued to all entities is shown in Table 4.13. In 2014, the USFWS authorized take of up to 2,430 ring-billed gulls for damage management purposes to all entities, which would comprise 5.95% of the population estimated at 40,844 gulls in BCR 14 if take had occurred at the authorized levels.

From 2010 through 2013, the number of ring-billed gulls taken annually in the northeastern United States (USFWS Region 5) has ranged from 2,224 to 3,001 ring-billed gulls with an average annual take of 2,573 ring-billed gulls (J. Ratcliffe, USFWS, pers. comm. 2015). The PBR model developed by the USFWS currently predicts that 3,065 ring-billed gulls could be taken annually to maintain the current breeding population levels in BCR 14 and BCR 30 (Waterbird Conservation for the Americas 2007). Non-breeding ring-billed gulls are also known to occur throughout BCR 14 and BCR 30 during the breeding season. Based on the known take of ring-billed gulls occurring annually in BCR 14 and BCR 30, the take level from all known sources has been below the estimated level that would result in a breeding population decline.

Table 4.13 – Number of ring-billed gulls addressed in Massachusetts from FY 2010 through FY 2014

Year	Dispersed by WS[1]	Take under Depredation Permits			
		Authorized Take[2]	WS' Take[1]	Non-WS Take[2]	Total Take by All Entities
2010	456	3,375	44	214	258
2011	184	3,425	29	132	161
2012	370	3,530	20	110	130
2013	60	2,975	9	20	29
2014	36	2,430	1	0	1
AVERAGE	**185**	**3,147**	**21**	**96**	**116**

[1]Data reported by federal fiscal year

[2]Data reported by calendar year

Direct, Indirect, and Cumulative Effects:

Based on the best available information described above, WS' potential impacts to populations of ring-billed gulls has been, and is expected to continue to be, insignificant to the overall viability and reproductive success of ring-billed gull populations on a local, regional, and nationwide scale. With management authority over migratory birds in Massachusetts, the USFWS and the MDFW could impose stricter take limits if warranted based on population data. This should assure that cumulative impacts on ring-billed gull populations would have no significant adverse impact on the quality of the human environment.

Laughing Gull Biology and Population Impacts

S. New England (SNE) pop. Est.: 13,524*
New England/Mid-Atlantic BBS, 1966-2013: 5.46%
New England/Mid-Atlantic BBS, 2003-2013: 4.91%
WS proposed removal: 100 +500 nests (and eggs)
MA CBC Trend 1966-2013: Decreasing
WS removal as % of SNE population: 0.74%
*Estimated Population of BCR 30

Laughing gulls can be found nesting along the coastal areas of BCR 14 and BCR 30 with most breeding colonies occurring in BCR 30 (Waterbird Conservation for the Americas 2007). Over 200,000 laughing gulls nest along the coastal areas in BCR 30 and have been given a conservation rank of lowest concern (Waterbird Conservation for the Americas 2007). In BCR 14, nesting laughing gulls are estimated at 2,704 birds and have also been given a conservation rank of lowest concern (Waterbird Conservation for the Americas 2007). The breeding population of laughing gulls in the 1970s was estimated at 129,768 birds in 63 colonies. In the 1990s, the breeding population had increased to 205,348 laughing gulls in 275 colonies which represented a 58% increase in regional abundance (Waterbird Conservation for the

Americas 2007). The take of laughing gulls in Massachusetts authorized by the USFWS is shown in Table 4.14.

Although WS has only taken a very low number of laughing gulls lethally taken from FY 2010 through FY 2014, the increasing regional population and need to protect nesting T&E birds such as roseate terns and piping plovers make it reasonable to anticipate an increase in the number of requests for assistance. Based on this, WS could lethally take up to 100 laughing gulls. However, the need to manage nesting colonies, especially in situations where nest site competition with common and roseate terns may require that up to 500 laughing gull nests (and eggs) be removed or destroyed as part of an integrated damage management program. WS also anticipates an increase in the need to address damage and threats associated with laughing gulls at airports and waste management facilities, and from gulls nesting on rooftops.

Table 4.14 – Number of laughing gulls addressed in Massachusetts from FY 2010 through FY 2014

Year	Dispersed by WS[1]	Take under Depredation Permits		
		WS' Take[1]	Non-WS Authorized Nests[2]	Non-WS Total Nest Take [2]
2010	0	1	0	9
2011	0	0	500	0
2012	0	0	500	0
2013	0	0	500	10
2014	0	0	50	0
AVERAGE	**0**	**1**	**310**	**4**

[1]Data reported by federal fiscal year

[2]Data reported by calendar year

From 2010 through 2013, the lethal annual take of laughing gulls by all entities in the northeastern United States (USFWS Region 5) has ranged from 1,882 to 4,385 gulls with an average annual take of 3,028 laughing gulls (J. Ratcliffe, USFWS, pers. comm. 2015). The PBR model for laughing gulls in BCR 14 and BCR 30 estimates that nearly 15,000 laughing gulls can be taken annually with no adverse effect on the current population. Current take levels from all known entities in the breeding range of laughing gulls has not exceeded the level of annual take that would cause a decline in the breeding laughing gull population based on the PBR model. Based on the increasing populations observed during summer and winter surveys and the cumulative take of laughing gulls in the northeastern United States being below the level where a decline would occur in the population, WS' take of laughing gulls since 2010, with the oversight of cumulative take by the USFWS, has not adversely affected laughing gull populations.

Direct, Indirect, and Cumulative Effects:

If WS lethally takes 100 laughing gulls and 500 laughing gull nests annually, and if the take of laughing gulls under depredation permits from 2010 through 2014 is indicative of future lethal take in the northeastern United States, the total take of gulls in BCR 14 and BCR 30 would range from 3,640 to 7,532 gulls with an average annual take of 6,418 laughing gulls. As stated previously, based on the PBR model developed for laughing gulls by the USFWS, up to 15,000 laughing gulls could be taken in BCR 14 and BCR 30 annually to maintain current population levels. The proposed total take of laughing gulls by WS evaluated in this assessment when included with take by all other entities would not exceed the level necessary to cause a decline in laughing gull populations based on the PBR model.

Based on the best available information described above, WS' potential impacts to populations of laughing gulls has been, and is expected to continue to be, insignificant to the overall viability and reproductive success of laughing gull populations on a local, regional, and nationwide scale. With management authority over migratory birds in the Massachusetts, the USFWS and the MDFW could impose stricter take limits if warranted based on population data. This should assure that cumulative impacts on laughing gull populations would have no significant adverse impact on the quality of the human environment.

Rock Pigeon Biology and Population Impacts

MA population estimate: 23,259*
New England/Mid-Atlantic BBS, 1966-2013: -2.89%
New England/Mid-Atlantic BBS, 2003-2013: -1.83%
WS removal as % of state population: 2.15%
WS removal take: 500 +100 nests (and eggs)
MA BBS, 1966-2013: -3.32%
MA BBS, 2003-2013: -2.84%
MA CBC Trend 1966-2013: Decreasing
* Estimate from PFSC 2013

Pigeons are an introduced rather than native species and, thereforethey are not protected by federal law. Pigeons are closely associated with humans as human structures and activities provide them with food and sites for roosting, loafing, and nesting (Williams and Corrigan 1994). Thus, they are commonly found around city buildings, bridges, parks, farm yards, grain elevators, feed mills, and other man-made 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).

Since pigeons are a non-native species and are, therefore, afforded no protection under the MBTA, the take of pigeons to alleviate damage or to reduce threats can occur without the need for a depredation permit from the USFWS or the MDFW. WS' take of pigeons from FY 2010 through FY 2014 to alleviate damage and threats of damage when requested is shown in Table 4.15.

Table 4.15 – Number of rock pigeons addressed by WS on airports from FY 2010 through FY 2014

Year	Dispersed by WS[1]	WS' Take[1]
2010	94	18
2011	299	231
2012	125	25
2013	0	0
2014	0	49
AVERAGE	**104**	**65**

[1]Data reported by federal fiscal year

Direct, Indirect, and Cumulative Effects:

Based on the gregarious behavior of pigeons (i.e., forming large flocks) and in anticipation of the number of requests for assistance by WS to alleviate damage and threats to increase, WS could annually take up to 500 pigeons and 100 nests (and eggs). Based on a population estimated at 23,259 pigeons, take of up to 500 pigeons by WS would represent 2.15% of the estimated statewide population. WS' proposed pigeon damage management activities would be conducted pursuant to Executive Order 13112. The Executive Order states that each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law; 1) reduce invasion of exotic species and associated damages, 2) monitor invasive species populations, provide for restoration of native species and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control and promote public education on invasive species. WS' proposed take

is of a low magnitude compared with the statewide population; however, any take of invasive species can be considered a positive impact to the environment.

Mourning Dove Biology and Population Impacts

MA population estimate: 174,457*
New England/Mid-Atlantic BBS, 1966-2013: 0.10%
New England/Mid-Atlantic BBS, 2003-2013: -0.58%
WS removal as % of state population: 0.06%
WS proposed removal: 100 +10 nests (and eggs)
MA BBS, 1966-2013: 0.80%
MA BBS, 2003-2013: -2.15%
MA CBC Trend 1966-2013: Decreasing
* Estimate from PFSC 2013

Mourning doves are migratory birds with substantial populations throughout much of North America and can be found in Massachusetts year-round. Mourning doves are considered migratory game birds and many states have regulated annual hunting seasons for doves, although Massachusetts does not. Across the United States, the preliminary mourning dove harvest in 2012 was estimated at 14,490,900 million doves and in 2013 at 14,529,800 doves (Raftovich et al. 2014).

The number of mourning doves addressed in Massachusetts by WS and other entities is shown in Table 4.16. Requests for assistance often arise from airports where the gregarious flocking behavior of doves can pose risks to aircraft at or near airports. Based on the number of requests to manage damage associated with doves received previously and based on the increasing need to address damage and threats associated with doves in Massachusetts, up to 100 mourning doves and 10 nests (and eggs) could be taken by WS annually to address damage or threats.

Table 4.16 – Number of mourning doves addressed in Massachusetts from FY 2010 through FY 2014

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[2]
2010	439	270	21	25
2011	1,196	270	39	0
2012	305	270	9	0
2013	126	296	2	0
2014	267	70	5	0
AVERAGE	**388.83**	**236**	**16**	**5**

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

Direct, Indirect, and Cumulative Effects:
An annual take by WS of up to 100 mourning doves would represent 0.06% of the estimated statewide breeding population. This potential limited take of doves, in comparison to the overall population and the permitting take by the USFWS and MDFW through the issuance of depredation permits, should not adversely affect dove populations in Massachusetts. Local populations of mourning doves in the Massachusetts are likely augmented by migrating birds during during the winter months. Like other native bird species, the take of mourning doves by WS to alleviate damage will only occur when permitted by the USFWS and the MDFW pursuant to the MBTA through the issuance of depredation permits. Therefore, the take of mourning doves by WS will only occur at levels authorized by the USFWS which ensures WS' take and take by all entities are considered to achieve the desired population management levels of doves in the Massachusetts.

European Starling Biology and Population Impacts

MA population estimate: 104,714*
New England/Mid-Atlantic BBS, 1966-2013: -2.68%
New England/Mid-Atlantic BBS, 2003-2013: -2.14%
WS removal as % of state population: 23.87%
WS proposed removal: 25,000 +250 nests (and eggs)
MA BBS, 1966-2013: -5.29%
MA BBS, 2003-2013: -5.21%
MA CBC Trend 1966-2013: Decreasing
* Estimate from PFSC 2013

The European starling is an Old World passerine species introduced in the eastern U.S. in the late 1800's. Starlings are considered an agricultural pest thoughout North America. Additionally, they form large winter roosts in urban and suburban areas causing conflicts with society. In Massachusetts, starlings are probably the second most abundant bird behind only the American robin (Homan et al. 2012).

The starling is found in virtually all Massachusetts habitats. Starlings nest in cavities and will readily evict most native hole-nesting species. In the absence of natural cavities, they will nest in almost any enclosed area such as a street light, a mail box, or an attic (Brauning 1992).

European starlings are considered a non-native species in Massachusetts and are afforded no protection under the MBTA. Therefore, no depredation permits, from either the USFWS or the MDFW, are needed for the take of starlings. The number of starlings lethally removed to alleviate damage or threats in the Massachusetts is unknown since the reporting of starling take is not required. Executive Order 13112 states that each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law; 1) reduce invasion of exotic species and associated damages, 2) monitor invasive species populations, provide for restoration of native species and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control and promote public education on invasive species.

To alleviate damage and threats of damage, the WS program in Massachusetts has lethally taken a total of 46,705 starlings from FY 2010 through FY 2014, with an average annual take of 9,341 starlings (see Table 4.17). Based on previous requests for assistance received and in anticipation of receiving additional requests for assistance, up to 25,000 starlings and 250 nests (and eggs) could be taken by WS annually to alleviate damage and threats. Damage and threats are primarily associated with aviation safety at and near airports and military installations, as well as in agricultural settings.

Table 4.17 – Number of European starling addressed by WS from FY 2010 through FY 2014

Year	Dispersed by WS[1]	WS' Take[1]	WS' Nest Take
2010	110,505	9,868	7
2011	380,199	10,459	67
2012	233,656	18,246	36
2013	121,221	3,096	46
2014	410,780	5,036	11
AVERAGE	**251,273**	**9,341**	**34**

[1]Data reported by federal fiscal year

Direct, Indirect, and Cumulative Effects:
Based on the best scientific data, WS' proposed removal level of up to 25,000 starlings annually will have no adverse direct or indirect effects on European starling populations. While non-WS removal is unknown, starling populations have remained relatively stable and have historically expanded their range throughout North America. Additionally, starling populations have remained abundant enough that the USFWS has maintained the Federal Blackbird Depredation Order. Therefore, WS does not anticipate any significant cumulative impacts to starling populations.

Blackbird Status

The blackbird group in North America includes ten species of birds (Dolbeer 1994) including some of the most prolific and abundant birds in North America (Dolbeer and Stehn 1983). Of those ten species, red-winged blackbirds, common grackles brown-headed cowbirds, American crows, and fish crows are the species most commonly involved with causing damage or posing threats of damage in Massachusetts. The USFWS has established a Federal Depredation Order (50 CFR 21.43) for blackbirds (Sobeck 2010). Therefore, no federal permit is required to remove blackbirds, cowbirds, grackles, crows and magpies if they are committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance. The USFWS could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of crow populations, which should also assure that cumulative impacts on crow populations would have no significant impact on the quality of the human environment.

Red-winged Blackbird Biology and Population Impacts

MA population estimate: 113,527*	WS proposed removal: 1,000 +25 nests (and eggs)
New England/Mid-Atlantic BBS, 1966-2013: -1.88%	MA BBS, 1966-2013: -1.32%
New England/Mid-Atlantic BBS, 2003-2013: -1.36%	MA BBS, 2003-2013: -1.27%
WS removal as % of state population: 0.88%	MA CBC Trend 1966-2013: Increasing

* Estimate from PFSC 2013

Perhaps the most abundant bird in North America, the red-winged blackbird is highly adaptable to habitat change caused by humans and can be found in Massachusetts throughout the year (Yasukawa and Searcy 1995). The breeding habitat of red-winged blackbirds includes marshes and upland habitats from southern Alaska and Canada southward to Costa Rica extending from the Pacific to the Atlantic Coast along with the Caribbean Islands (Yasukawa and Searcy 1995). Primarily associated with emergent vegetation in freshwater wetlands and upland habitats during the breeding season, red-winged blackbirds also nest in marsh vegetation in roadside ditches, saltwater marshes, rice paddies, hay fields, pasture land, fallow fields, suburban habitats, and urban parks (Yasukawa and Searcy 1995).

From FY 2010 to FY 2014, to alleviate threats at airports, the WS program in Massachusetts dispersed 30 red-winged blackbirds using non-lethal methods during FY 2010 and lethally removed two red-winged blackbirds during FY 2011. Based on previous requests for assistance received and in anticipation of receiving additional requests for assistance, up to 1,000 red-winged blackbirds and 25 nests (and eggs) could be taken by WS annually. Damage and threats are primarily associated with human safety at airports and military installations, as well as in agricultural settings.

Direct, Indirect, and Cumulative Effects:

Based on the limited take by WS when compared to the estimated breeding population, WS' proposed annual take of red-winged blackbirds would be a low magnitude when compared to the estimated breeding populations, especially given the the USFWS maintains a Federal Blackbird Depredation Order for this species. WS doesn't anticipate any significant impacts to the statewide red-wing blackbird population.

Common Grackle Biology and Population Impacts

MA population estimate: 147,011*	WS proposed removal: 1,000 +100 nests (and eggs)
New England/Mid-Atlantic BBS, 1966-2013: -2.28%	MA BBS, 1966-2013: -3.15%

New England/Mid-Atlantic BBS, 2003-2013: -2.53% MA BBS, 2003-2013: -3.11%
WS removal as % of state population: 0.68% MA CBC Trend 1966-2013: Decreasing
* Estimate from PFSC 2013

Another blackbird species commonly found in mixed species flocks is the common grackle. Common grackles are a semi-colonial nesting species often associated with human activities (Peer and Bollinger 1997). Common grackles have likely benefited from human activities, such as the clearing of forests in the eastern United States which provides suitable nesting habitat and the planting of trees in residential areas which has led to an expansion of the species' range into the western United States (Peer and Bollinger 1997).

Like other blackbird species, the take of common grackles can occur under the previously referenced Federal 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. Therefore, the number of common grackles taken annually by other entities is currently unknown. To alleviate damage and threats of damage, the WS program in Massachusetts has dispersed 1,080 common grackles using non-lethal methods, primarily to alleviate damage occurring at and near airports from FY 2010 through FY 2014. A total of 57 common grackles were lethally removed during this time period (see Table 4.18). Damage and threats are primarily associated with human safety at and near airports and military installations, to protect T&E species, as well as in agricultural settings.

Table 4.18 – Number of common grackle addressed by WS from FY 2010 through FY 2014

Year	Dispersed by WS[1]	WS' Take[1]
2010	1,030	0
2011	0	0
2012	0	0
2013	44	25
2014	6	32
AVERAGE	**216**	**12**

[1]Data reported by federal fiscal year

Direct, Indirect, and Cumulative Effects:
The take of common grackles by WS is expected to be of low magnitude when compared to the statewide estimated population. Based on the above information and WS anticipated lethal take of common grackles in Massachusetts, WS should have minimal effects on local, statewide, regional or continental populations. WS doesn't anticipate any significant impacts to the statewide grackle population.

Brown-headed Cowbird Biology and Population Impacts

MA population estimate: 122,693* WS proposed removal: 1,000 +100 nests (and eggs)
New England/Mid-Atlantic BBS, 1966-2013: 0.38% MA BBS, 1966-2013: -0.65%
New England/Mid-Atlantic BBS, 2003-2013: 1.06% MA BBS, 2003-2013: -0.55%
WS removal as % of state population: 0.82% MA CBC Trend 1966-2013: Decreasing
* Estimate from PFSC 2013

Brown-headed cowbirds are another species of the blackbird family commonly found in mixed species flocks during migration periods. Brown-headed cowbirds can be found during all seasons in Massachusetts and are a common summer resident (Lowther 1993). Somewhat unique in their breeding habits, cowbirds are known as brood parasites meaning they lay their eggs in the nests of other bird

species (Lowther 1993). Female cowbirds can lay up to 40 eggs per season with eggs reportedly being laid in the nests of over 220 species of birds, of which, 144 species have actually raised cowbird young (Lowther 1993). No parental care is provided by cowbirds with the raising of cowbird young occurring by the host species (Peterson 1980).

The take of brown-headed cowbirds can occur under the Federal Blackbird Depredation Order which allows blackbirds, including cowbirds, to be taken when committing damage or about to commit damage without the need for a depredation permit. Therefore, the number of cowbirds taken annually by other entities is currently unknown. To alleviate damage and threats of damage, the WS program in Massachusetts has dispersed 2,075 brown-headed cowbirds using non-lethal methods, primarily to alleviate damage occurring at and near airports from FY 2010 through FY 2014. A total of 61 cowbirds have been lethally removed during this time period (see Table 4.19). Based on previous requests for assistance received, and in anticipation of receiving additional requests for assistance, up to 1,000 brown-headed cowbirds and 25 nests (eggs) could be lethally taken in the Massachusetts by WS annually. Damage threats are primarily associated with human health and safety requests on airports, as well as nest parasitism of native migratory birds and agricultural damage.

Table 4.19 – Number of brown-headed cowbirds addressed by WS from FY 2010 through FY 2014

Year	Dispersed by WS[1]	WS' Take[1]
2010	2,059	61
2011	0	0
2012	0	0
2013	0	0
2014	16	0
AVERAGE	**415**	**13**

[1]Data reported by federal fiscal year

Direct, Indirect, and Cumulative Effects:
Although cowbirds can cause damage or pose threats of damage, some take of cowbirds by WS would be the result of addressing flocks of mixed species of starlings and blackbirds. Given the relative abundance of brown-headed cowbirds, long-term increasing population trends, and that WS' starling/blackbird damage management activities would only be conducted at a limited number of sites involving a very small portion of the area in the state, WS concludes that the proposed action will not significantly impact the state, regional or national brown-headed cowbird population.

American Crow Biology and Population Impacts

MA population estimate: 73,092*
New England/Mid-Atlantic BBS, 1966-2013: 0.67%
New England/Mid-Atlantic BBS, 2003-2013: 0.01%
WS removal as % of state population: 2.05%
WS proposed removal: 1,500 +250 nests (and eggs)
MA BBS, 1966-2013: 0.61%
MA BBS, 2003-2013: -0.78%
MA CBC Trend 1966-2013: Increasing
* Estimate from PFSC 2013

American crows are highly adaptable and will live in any open place that offers a few trees to perch in and a reliable source of food. Crows regularly use both natural and human-created habitats, including farmlands, pastures, landfills, city parks, golf courses, cemeteries, yards, vacant lots, highway turnarounds, feedlots, and the shores of rivers, streams, and marshes. Crows tend to avoid unbroken expanses of forest, but do show up at forest campgrounds and travel into forests along roads and rivers (Verbeek and Caffrey 2002).

Large flocks of crows tend to concentrate in some areas where abundant food and roosting sites are available. In the fall and winter, crows often form large roosting flocks in urban areas. These large flocks disperse to different feeding areas during the day. Crows will fly up to 6-12 miles from the roost to a feeding site each day (Johnson 1994). Large fall and winter crow roosts may cause serious problems in some areas, particularly when located in towns or other sites near people. Such roosts are objectionable because of the odor of the bird droppings, health concerns, noise, and damage to trees in the roost.

Between FY 2010 and FY 2014, WS has dispersed 97,340 American crows and lethally removed a total of 1,525 crows and two nests (containing four eggs) in Massachusetts (See Table 4.20). In anticipation of increased requests for assistance, primarily to alleviate damage and threats of damage associated with aviation safety and urban crow roosts, take of up to 1,500 American crows and 25 nests (including eggs) annually could occur by WS in Massachusetts.

Table 4.20 – Number of American crows addressed by WS from FY 2010 through FY 2014

Year	Dispersed by WS[1]	WS' Take[1]
2010	19,762	302
2011	32,228	374
2012	10,923	273
2013	15,306	297
2014	19,121	279
AVERAGE	**19,468**	**305**

[1]Data reported by federal fiscal year

Direct, Indirect, and Cumulative Effects:

WS proposed removal is not expected to create adverse direct or indirect effects on the American crow population in Massachusetts. Although non-WS removal is unknown, crows have maintained a historically increasing population that has remained viable enough to support an annual hunting season and a Federal Blackbird Depredation Order. Therefore, WS does not expect there to be significant adverse cumulative impacts to crow populations. Additionally, the USFWS could impose restrictions on depredation harvest as needed to assure cumulative removal does not adversely affect the continued viability of crow populations, which should also assure that cumulative impacts on crow populations would have no significant impact on the quality of the human environment. WS also does not expect crow populations to be impacted enough to limit the ability of those persons interested in harvesting crows during the regulated hunting season.

Fish Crow Biology and Population Impacts

MA population estimate: 400*
New England/Mid-Atlantic BBS, 1966-2013: 3.16%
New England/Mid-Atlantic BBS, 2003-2013: 4.04%
WS removal as % of state population: 25%
WS proposed removal: 100 +10 nests (and eggs)
MA BBS, 1966-2013: 17.68%
MA BBS, 2003-2013: 18.24%
MA CBC Trend 1966-2013: Increasing

* Estimate from PFSC 2013

Fish crows are similar to the American crow in coloration, body weight and length. The diet of fish crows is also similar but with a higher intake of aquatic organisms. This is due to their preferred feeding habitat of tidal flats, beaches, rookeries, and brackish waterways. The major differences between the two species are their range and calls. Fish crows tend to be a coastal species that spends much of its time along the Atlantic and Gulf coast from southern New England to Florida. However, it is not unlikely for them to be observed inland feeding and roosting alongside flocks of American crows.

The breeding and wintering habitat of fish crows consists of wooded marine shorelines, coastal marshes and inland wetlands along tidal rivers. Nesting behavior of fish crows are also similar to American crows, however, they do nest higher at approximately 20 to 80 feet above the ground and build slightly smaller nests (RIDEM 2012). Inland from the coast, fish crows are generally found in large river drainages, although they may feed in woods or fields a few miles from water (Kaufman 1996). Hamel (1992) specifies viable inland habitats as lake shores, pinewoods, and occasionally in towns, residential, or other urban areas.

Given the similar physical appearance of the two species, estimating the number of individual fish crows or American crows in a roost or flock of crows based on visual cues can be difficult. Isolating and distinguishing the vocalizations of an individual crow for species identification in a mixed species flock of crows can also be difficult.

Between FY 2010 and FY 2014, no fish crows were lethally taken by WS to alleviate damage nor were any fish crows known to have been dispersed using non-lethal methods by WS. Like American crows, fish crows can be taken without a depredation permit issued by the USFWS when committing or about to commit damage or posing a threat to human safety under a blackbird depredation order (see 50 CFR 21.43). In addition, fish crows can be harvested during a regulated season that allows an unlimited number of crows to be harvested. As with American crowns, the number of fish crows taken under the depredation order to alleviate damage or reduce threats is currently unknown because the reporting requirement was not implemented until 2011. Additionally, hunters harvesting crows during the regulated hunting season are not required to report their take to the USFWS or the MDFW.

Although fish crows and American crows form mixed species flocks, most flocks of crows or crow roosts encountered is the Commonwealth consists primarily of American crows. Based on previous requests for assistance with American crows and in anticipation of requests to disperse urban crow roosts, up to 100 fish crows could be taken by WS annually under the proposed action. Although not as abundant, fish crows could be present in flocks of crows addressed by WS. The IUCN (2011) ranks the fish crow as a species of least concern.

Direct, Indirect, and Cumulative Effects:
Based on take of up to 100 fish crows annually by WS would represent 25.0% of the estimated statewide population of fish crows. However, fish crows have experienced over an 18% population increase from 2003 to 2013 and are a known predator of nesting T&E bird species. Although non-WS removal is unknown, crows have maintained a historically increasing population that has remained viable enough to support an annual hunting season and a Federal Blackbird Depredation Order. Therefore, WS does not expect there to be significant adverse cumulative impacts to crow populations. Additionally, the USFWS could impose restrictions on depredation harvest as needed to assure cumulative removal does not adversely affect the continued viability of crow populations, which should also assure that cumulative impacts on crow populations would have no significant impact on the quality of the human environment. WS also does not expect crow populations to be impacted enough to limit the ability of those persons interested in harvesting crows during the regulated hunting season.

Bank Swallow Biology and Population Impacts

MA population estimate: 2,000*
New England/Mid-Atlantic BBS, 1966-2013: -4.09%
New England/Mid-Atlantic BBS, 2003-2013: -2.58%
WS removal as % of state population: 2.5%
WS proposed removal: 50 +50 nests (and eggs)
MA BBS, 1966-2013: -5.52%
MA BBS, 2003-2013: -5.17%
MA CBC Trend 1966-2013: Increasing
* Estimate from PFSC 2013

Bank swallows nest in colonies in steeply cut dirt or sand banks, usually along a streamside or coastal area, but also in quarries, sand lots, construction zones, or even sand or dirt piles (Garrison 1999). The IUCN (2011) ranks the bank swallow as a species of least concern.

As seen in Table 4.21, WS has lethally taken 72 bank swallows, non-lethally dispersed 1,485 bank swallows, and destroyed 40 nests with eggs in Massachusetts from 2010 to 2014. Annual take of up to 150 bank swallows has been authorized by the USFWS from 2010 to 2014 but no non-WS take occurred during this period. To address anticipated requests for assistance to manage damage associated with bank swallows in the future up to 100 bank swallows could be lethally taken and up to 50 active bank swallow nests with eggs could be destroyed annually by WS to alleviate damage and threats. The increased level of take analyzed when compared to the take occurring by WS from FY 2010 through FY 2014 is in anticipation of requests to address threats of aircraft strikes at airports and to reduce damages or monetary losses caused when property owners or managers cannot access or move soil or sand due to active nesting of a migratory bird, which would result in the violation of the MBTA.

Table 4.21 – Number of bank swallows addressed in Massachusetts from FY 2010 through FY 2014

Year	Dispersed by WS[1]	Take under Depredation Permits				
		Authorized Take[2]	**WS' Take[1]**	**WS Nests Take**	**Non-WS Take[2]**	**Total Take by All Entities[2]**
2010	0	25	0	0	0	0
2011	500	125	36	40	0	36
2012	70	150	0	0	0	0
2013	0	50	0	0	0	0
2014	915	25	36	0	0	36
AVERAGE	**248**	**75**	**15**	**8**	**0**	**15**

[1]Data reported by federal fiscal year

[2]Data reported by calendar year

Direct, Indirect, and Cumulative Effects:

Although BBS data indicates a decreasing population trend for bank swallows in the New England/Mid-Atlantic Region and Massachusetts, the limited take proposed by WS when compared to the estimated breeding population in BCR 30 and the Commonwealth could be considered low. The permitting of the take by the USFWS and the MDFW would ensure the cumulative take of bank swallows would not reach a magnitude where significant adverse effects occur. The take of bank swallows by WS would occur within allowed levels of take permitted by the USFWS and the MDFW.

House Sparrow Biology and Population Impacts

MA population estimate: 175,627*
New England/Mid-Atlantic BBS, 1966-2013: -2.34%
New England/Mid-Atlantic BBS, 2003-2013: -2.09%
WS removal as % of state population: 0.14%
WS proposed removal: 250 +50 nests (and eggs)
MA BBS, 1966-2013: -1.76%
MA BBS, 2003-2013: -1.84%
MA CBC Trend 1966-2013: Decreasing

* Estimate from PFSC 2013

House sparrows were introduced to North America from England in 1850 and have spread throughout the continent (Fitzwater 1994). Nesting locations often occur in areas of human activities and are considered "*...fairly gregarious at all times of year*" with nesting occurring in small colonies or clumped distribution (Lowther and Cink 2006). Large flocks of sparrows can also be found in the winter as birds forage and roost together. Like European starlings, because of their negative effects on and competition with native bird species, house sparrows are considered by many wildlife biologists, orinthologists, and naturalists to

be an undesirable component of North American ecosystems. Since house sparrows are an introduced, rather than native species, they are not protected by the MBTA, and take of house sparrows does not require depredation permits issued by either the USFWS or the MDFW. Executive Order 13112 states that each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law; 1) reduce invasion of exotic species and associated damages, 2) monitor invasive species populations, provide for restoration of native species and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control and promote public education on invasive species.

From FY 2010 through FY 2014, WS lethally removed an average of twenty house sparrows per year (see Table 4.22) to alleviate damage and threats of damage, primarily associated with aviation safety and agriculture. The number of sparrows lethally removed by other entities is unknown. Based on the gregarious behavior of sparrows and in anticipation of receiving additional requests for assistance to alleviate damage and threats, WS could take up to 250 house sparrows and 50 nests (and eggs) annually.

Table 4.22 – Number of house sparrows addressed by WS from FY 2010 through FY 2014

Year	Dispersed by WS[1]	WS' Take[1]	WS' Nest Take
2010	605	51	29
2011	1,462	23	7
2012	75	52	24
2013	20	4	6
2014	335	67	14
AVERAGE	**500**	**40**	**16**

[1]Data reported by federal fiscal year

Direct, Indirect, and Cumulative Effects:
WS' removal of house sparrows to reduce damage and threats would be in compliance with Executive Order 13112. WS' proposed removal is only a fraction of a percent of the statewide population and therefore will have no adverse direct or indirect effects on sparrow populations. Although non-WS removal is unknown, house sparrow populations have remained relatively stable and have historically expanded their range throughout North America. Therefore, WS does not anticipate any significant cumulative impacts to sparrow populations.

Woodpecker Population Impact Analysis
Several species of woodpeckers are found in Massachusetts, including downy woodpeckers, hairy woodpeckers, Northern flickers, pileated woodpeckers, red-headed woodpeckers, red-bellied woodpeckers, and yellow-bellied sapsuckers. All of these species have the potential to cause significant damage to buildings, particulary residential homes, but also to non-residential wooden or stucco buildings, wooden utility poles and other wooden structures. Most requests for assistance from WS are received from private homeowners. From FY 2010 to FY 2014 WS provided technical assistance on 51 occassions and requests have been increasing annually. WS would address those requests for assistance primarily with technical assistance. However, if non-lethal methods fail or are not appropriate for the circumstance, WS proposes up to 20 each of downy woodpeckers, hairy woodpeckers, Northern flickers, pileated woodpeckers, red-bellied woodpeckers, and yellow-bellied sapsuckers could be taken annually under the proposed action. This minimal level of lethal removal is not expected to have any significant direct, indirect, or cumulative impacts to woodpecker populations.

Live-capture and Translocation Species

Several species within Massachusetts, including red-tailed hawks, Cooper's hawks, sharp-shinned hawks, broad-wing hawks, red-shouldered hawks, rough-legged hawks, Northern harriers, snowy owls, barred owls, great horned owls, short-eared owls, peregrine falcons, merlins, and American kestrels, have the potential to pose threats to aviation safety and T&E bird species. WS would address those requests for assistance primarily with non-lethal dispersal methods and through live-capture and translocation of individuals. Based on the requests for assistance received previously and in anticipation of receiving additional requests for assistance, WS proposes up to 20 each of red-tailed hawks, Cooper's hawks, sharp-shinned hawks, broad-wing hawks, Northern harriers, barred owls, great horned owls, short-eared owls, peregrine falcons, merlins, rough-legged hawks, and American kestrels could be live-captured and translocated annually under the proposed action. From FY 2010 to FY 2014, WS captured and relocated one red-tailed hawk, one Cooper's hawk, one peregrine falcon, two Northern harriers, one sharp-shinned hawk, two barred owls, and four short-eared owls. One great horned owl was live captured and turned over to a licensed rehabilitator because it was a predator of T&E birds. Additionally, four red-tailed hawks, three American kestrels, and one barred owl were live captured and transported to licensed rehabilitators at the request of cooperators. These birds were found injured or as juveniles primarily at airports and landfills.

Lethal removal would only be conducted on these species when immediate threats to human safety occur, such as when banded individuals have returned to the same airport twice after translocation, when habituation to non-lethal methods occurs, or when human injury has occurred due to nest aggression. In addition, WS could also be requested to employ lethal methods under the proposed action alternative to address damage or threats of damage associated with those species, including damage to property, agricultural resources, and livestock. From FY 2010 to FY 2014, WS has dispersed red-tailed hawks, Cooper's hawks, rough-legged hawks, Northern harriers, peregrine falcons, American kestrels, barred owls, great horned owls, and lethally removed one red-tailed hawk in Massachusetts. Based on previous requests for assistance received by WS, as well as anticipated requests, no more than 10 individuals and 10 nests (with eggs) each of the following species could be removed annually by WS: red-tailed hawks, Cooper's hawks, broad-wing hawks, red-shouldered hawks, merlins, American kestrels, barred owls, and great horned owls. No lethal take of peregrine falcons, sharp-shinned hawks, Northern harriers, or short-eared owls would occur by WS because these species are state listed as endangered, threatened, or of special concern.

Direct, Indirect, and Cumulative Effects:

Red-tailed hawks, Cooper's hawks, broad-wing hawks, red-shouldered hawks, rough-legged hawks, snowy owls, barred owls, great horned owls, merlins, and American kestrels, are not expected to be removed by WS at any level that would cause adverse direct effects on the population of those species. These species listed are afforded protection under the MBTA and removal is only allowed through the issuance of a depredation permit and only at those levels stipulated in the permit. Therefore, those birds would be removed in accordance with applicable state and federal laws and regulations authorizing removal of migratory birds and their nests and eggs, including the USFWS and the MDFW permitting processes.

Although the live-capture and translocation of these species would be a non-lethal method of reducing damage or threats of damage, these species could be translocated during their nesting season which could lower nesting success. Reduced nesting success could occur by removing one of the adult pairs of any of these species. However, available information indicates that the successful raising of young could occur if only one adult was left to tend to the young. Provided most of WS' relocation will occur outside of the nesting season, and there is the ability to successfully raise young with only one parent, significant adverse indirect effects are not expected to occur to the population of red-tailed hawks, Cooper's hawks, broad-wing hawks, red-shouldered hawks, rough-legged hawks, snowy owls, barred owls, great horned owls, merlins, and American kestrels in Massachusetts.

The USFWS, as the agency with management responsibility for migratory birds, could impose restrictions on depredation removal as needed to assure cumulative removal does not adversely affect the continued viability of populations. Since removal of these species, including live-capture and translocation, can only occur when permitted by the USFWS and MDFW pursuant to the MBTA through the issuance of depredation permits, all removal, including removal by WS, would only occur at levels authorized by the USFWS and the MDFW which ensures there are no adverse cumulative impacts on the population of these species in Massachusetts. This would assure that cumulative impacts on these bird populations would have no significant adverse impact on the quality of the human environment.

Additional Target Species

Target species, in addition to those species analyzed previously, that have been or could be lethally removed in the future include the following: American wigeon, Atlantic brant, buffleheads, common eiders, gadwalls, green-winged teals, long-tailed ducks, ring-necked ducks, white-winged scoters, wood ducks, common mergansers, hooded mergansers, red-breasted mergansers, black-crowned night herons, cattle egrets, great blue herons, great egrets, green herons, snowy egret, black-bellied plovers, killdeers, semi-palmated plovers, American woodcocks, glossy ibises, lesser yellowlegs, short-billed dowitchers, ring-necked pheasants, ruffed grouse, ospreys, black vultures, turkey vultures, monk parakeets, belted kingfishers, American robins, blue jays, common ravens, Eastern meadowlarks, gray catbirds, horned larks, Northern mockingbirds, snow buntings, barn swallows, tree swallows, Northern rough-winged swallows, purple martins, and chimney swifts. These species typically do not cause significant damage to resources and are not considered nuisance species, but individual birds have the potential to cause damage in some situations, especially when encountered on airports. Some of these target species have been lethally removed in small numbers by WS and have included no more than 20 individuals and/or no more than 20 nests annually. Based on previous requests for assistance, anticipation of future requests for assistance, and the removal levels necessary to alleviate those requests for assistance, no more than 20 individuals and 20 nests (and eggs) of each of those additional target species listed could be removed annually by WS.

None of those bird species are expected to be taken by WS at any level that would adversely affect populations of those species. Most of those birds listed are afforded protection under the MBTA and take is only allowed through the issuance of a depredation permit and only at those levels stipulated in the permit. The USFWS, as the agency with management responsibility for migratory birds, could impose restrictions on depredation take as needed to assure cumulative take does not adversely affect the continued viability of populations. This would assure that cumulative impacts on these bird populations would have no significant adverse impact on the quality of the human environment

Gadwall, ring-necked ducks, green-winged teal, common eiders, white-winged scoters, buffleheads, hooded mergansers, common mergansers, red-breasted mergansers, ring-necked pheasants, ruffed grouse, and American woodcock maintain sufficient population densities to allow for annual harvest seasons. The proposed take of those species, including nests, under the proposed action would be a minor component of the annual take of those species during the regulated hunting seasons.

All of the birds addressed in this EA are species that could be or have been found at or near airports where those species represent strike hazards to aircraft. Previously, WS has addressed those species using non-lethal harassment methods to disperse those species from areas where they have posed strike risks to aircraft at or near airports and reinforced this harassment with lethal control when necessary. WS anticipates continuing to use non-lethal harassment methods reinforced with lethal control to address those species at or near airports to reduce the risks of aircraft striking those species. The take of those species would only occur by WS when permitted by the USFWS and/or the MDFW and only at take levels allowed under those depredation permits. The permitting of the take by the USFWS and the

MDFW ensures the take of those species occurs within population management objectives for those species and is conducted pursuant to federal and state laws and regulations.

WS will analyze the removal of Eastern meadowlarks as an indicator of no significant direct or cumulative adverse impacts to these additional species. Eastern meadowlarks are a sensitive species included in this group because they are experiencing a population decline in Massachusetts. Therefore, if Eastern meadowlarks are not adversely impacted by WS' removal, then no other species in this group should suffer negative impacts to their statewide populations.

Eastern Meadowlark Biology and Population Impacts

MA population estimate: 1,626*	WS proposed removal: 20 +20 nests (and eggs)
New England/Mid-Atlantic BBS, 1966-2013: -6.90%	MA BBS, 1966-2013: -9.66%
New England/Mid-Atlantic BBS, 2003-2013: -7.03%	MA BBS, 2003-2013: -9.67%
WS removal as % of state population: 1.23%	MA CBC Trend 1966-2014: Decreasing

* Estimate from PFSC 2013

Eastern meadowlarks can be found throughout the eastern United States in suitable habitat such as pastures, hayfields, agricultural fields, airports, and other grassy areas where it can be found year-round in many parts of their range which can be highly dependent on weather. The open areas found at airports makes the habitat ideal for meadowlarks to forage and nest while providing ample perching areas. Most requests for assistance to reduce threats associated with Eastern meadowlarks would occur at airports. Eastern meadowlarks found on and adjacent to airport property can pose a hazard to aircraft from being struck causing damage to the aircraft and potentially threatening passenger safety. Since 1990, there have been 11 strikes reported at Massachusetts airports (Embry Riddle Aeronautical University 2015). Based on request for assistance, up to 20 Eastern meadowlarks could be lethal taken annually, primarily to alleviate damage and threats at airports.

Direct, Indirect, and Cumulative Effects:

WS' proposed removal is less than one and a quarter percent of the statewide population and therefore will have no adverse direct or indirect effects on Eastern meadowlark populations. Although non-WS removal is unknown and meadowlark populations have steadily decreased in Massachusetts and the New England/Mid-Atlantic Region, WS does not anticipate any significant cumulative impacts to Eastern meadowlark populations in Massachusetts due to the low level of anticipated take.

Summary

Evaluation of WS' activities relative to wildlife populations indicated that program activities will likely have no cumulative adverse effects on populations in Massachusetts. WS' actions would be occurring simultaneously, over time, with other natural processes and human-generated changes that are currently taking place. Those activities include, but are not limited to:

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

All those factors play a role in the dynamics of wildlife 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. WS' actions 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 evaluates damage occurring, including other affected elements and the

dynamics of the damaging species; determines 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.

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.[8] 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 (USDA 2005). 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 (USDA 2005), or birds that may be in contact with species from areas with reported outbreaks would be targeted. Where possible, this sampling effort would be coordinated with local projects that already plan on capturing and handling the desired bird species. Coordinating sampling with ongoing projects currently being conducted by state and federal agencies, universities, and others maximizes use of resources and minimizes the need for additional bird capture and handling.

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

Sentinel Species: Waterfowl, 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.

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

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

Direct, Indirect, and Cumulative Effects:
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 create adverse direct or indirect effects on avian populations in the state. Sampling strategies that could be employed involve sampling live-captured birds that could be released on site after sampling occurs. The sampling (e.g., drawing blooding, feather sample, fecal sample) and the subsequent release of live-captured birds would not result in adverse effects since those birds are released unharmed on site. In addition, sampling of sick, dying, or hunter harvested birds would not result in the additive lethal take of birds that would not have already occurred in the absence of a disease sampling program. Therefore, the sampling of birds for diseases would not adversely affect the populations of any of the birds addressed in this EA nor would result in any take of birds that would not have already occurred in the absence of disease sampling (e.g., hunter harvest).

Alternative 2 - Bird Damage Management by WS using only Non-lethal Methods

Under this alternative, WS would not use lethal methods to resolve bird damage problems. Although some unintentional mortality might result from the use of bird capture devices like mist nets, these incidents are likely to be rare and would have negligible impacts on target species populations. Individuals, agencies and organizations would still be able to obtain permits for lethal bird removal from the MDFW and USFWS. Efforts to reduce or prevent damage and risks to livestock and/or human health and safety risks would likely be higher than with Alternative 1. If BDM is conducted by individuals with limited training or experience, it is possible that additional birds may be taken in the course of attempts to resolve damage problems.

Direct, Indirect, and Cumulative Effects:
Depending upon the experience, training and methods available to the individuals conducting the BDM, potential adverse direct and indirect impacts on target bird populations would likely be the same or greater than with Alternative 1. However, for the same reasons shown under Alternative 1, it is unlikely that significant adverse direct or indirect effects would occur to target species' by implementation of this alternative. Direct and indirect impacts and potential risks of illegal toxicant use would be greater under this alternative than Alternative 1. DRC-1339 and alpha-chloralose are currently only available for use by WS employees and would not be available under this alternative. It is possible that frustration caused by the inability to reduce damage by the public would lead to illegal use of toxicants which could increase adverse direct, indirect, or cumulative effects, however to an unknown degree. Because WS would be able to provide assistance with non-lethal BDM, risks of adverse cumulative impacts from actions by non-WS entities are lower than with Alternative 3.

Alternative 3 – No Bird Damage Management Conducted by WS

Under this alternative, WS would not conduct bird damage management activities. 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. Birds could continue to be lethally taken to resolve

damage and/or threats occurring either through depredation permits issued by the USFWS, under the blackbird and cormorant depredation orders, 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*.

Direct, Indirect, and Cumulative Effects:
Local bird populations could decline, stay the same, or increase depending on actions taken by those persons experiencing bird damage. The direct and indirect effects on bird populations would be variable and unknown. 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 direct or indirect impacts similar to the proposed action.

Since birds would still be removed under this alternative, the potential direct, indirect, and cumulative effects on the populations of those bird species would be similar among all the alternatives for this issue. WS' involvement would not be additive to removal that could occur since the cooperator requesting WS' assistance could conduct bird damage management activities without WS' direct involvement. Therefore, any actions to resolve damage or reduce threats associated with birds could occur by other entities despite WS' lack of involvement under this alternative, and therefore the cumulative impact on those bird species could be similar to Alternative 1.

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

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

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

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

WS personnel are experienced and trained in wildlife identification and to select the most appropriate methods for taking targeted animals and excluding non-target species. To reduce the likelihood of capturing non-target wildlife, WS would employ the most selective methods for the target species, would employ the use of attractants that are as specific to target species as possible, and determine placement of methods to avoid exposure to non-targets. SOPs to prevent and reduce any potential adverse impacts on non-targets are discussed in Chapter 3 of this EA. Despite the best efforts to minimize non-target removal during program activities, the potential for adverse impacts to non-targets exists when applying both non-lethal and lethal methods to manage damage or reduce threats to safety. From FY 2010 through FY 2014, the WS program in Massachusetts unintentionally killed a hooded merganser in a conibear trap while conducting beaver management. In addition, one Cooper's hawk was unintentionally live-captured in a starling decoy trap and released unharmed.

Direct, Indirect, and Cumulative Effects:

While every precaution is taken to safeguard against taking non-targets during operational use of methods and techniques for resolving damage and reducing threats caused by birds, the use of such methods can result in the incidental removal of unintended species. Those occurrences are rare and should not affect the overall populations of any species under the proposed action. WS' removal of non-target species during activities to reduce damage or threats to human safety associated with birds is expected to be extremely low to non-existent. WS would monitor the removal of non-target species to ensure program activities or methodologies used in bird damage management do not create direct effects on non-target populations. Methods available to resolve and prevent bird damage or threats when employed by trained, knowledgeable personnel are selective for target species. WS would annually report to the USFWS and/or the MDFW any non-target removal to ensure removal by WS is considered as part of management objectives established. The potential impacts to non-targets are similar to the other alternatives and are considered to be minimal to non-existent.

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 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 restrain wildlife once captured and are considered live-capture methods. Live traps have the potential to capture non-target species. Trap and net placement in areas where target species are active and the use of target-specific attractants would likely minimize the capture of non-targets. If traps and nets are attended to appropriately, most non-targets captured can be released on site unharmed.

Only those repellents registered with the EPA pursuant to the FIFRA and registered for use in the state would be recommended and used by WS under this alternative. Therefore, the use and recommendation of repellents would not have negative effects on non-target species when used according to label requirements. Most repellents for birds are derived from natural ingredients that pose a very low risk to non-targets when exposed to or when ingested. Two chemicals commonly registered with the EPA as bird repellents are methyl anthranilate and anthraquinone. Methyl anthranilate naturally occurs in grapes. Methyl anthranilate has been used to flavor food, candy, and soft drinks. Anthraquinone naturally occurs in plants like aloe. Anthraquinone can be 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. Mesurol is applied directly inside eggs that are of a similar appearance to those being predated on by crows. Therefore, risks to non-target would be restricted to those wildlife species that would select for the egg baits. However, adherence to the label requirements of mesurol would ensure threats to non-targets would be minimal. Similarly, when used in accordance with the label

requirements, the use of Avitrol would also not adversely affect non-targets based on restrictions on baiting locations.

Immobilizing drugs are applied through hand-baiting that targets specific individuals or groups of target species. Therefore, immobilizing drugs are only applied after identification of the target occurs prior to application. Pre-baiting and acclimation of the target waterfowl occurs prior to the application of alpha chloralose which allows for the identification of non-targets that may visit the site prior to application of the bait. All unconsumed bait is retrieved after the application session has been completed. Since sedation occurs after consumption of the bait, personnel are 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 are 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.

Analysis of the non-target species risks from nicarbazin are analyzed here so that WS may have access to this method in the event that this product becomes available at a future date. Nicarbazin baits for geese and rock pigeons are to be used at sites, office complexes, golf courses, residential communities, and municipalities. Although it is possible that other egg-laying species such as birds, reptiles, amphibians, fish, and invertebrates, could feed on the baits, which could reduce their egg-laying potential, the sites where the bait would be used are not as conducive to attracting many species of egg-laying animals. These areas are also places where T&E species are typically not found. Birds in urban and suburban habitats are typically common species that have adapted to the presence of man. Only a few other species are expected to consume the baits, primarily mallards, domestic waterfowl, and possibly gulls, and crows. In an Oregon field study, the primary non-target avian species to consume the bait were American crows, ravens and mallards. However, because most bait consumption by non-target species is expected to be occasional or intermittent and the bait must be consumed regularly throughout the breeding season to inhibit reproduction, nicarbazin is not expected to have any significant impact on these species. Additionally, the size of the baits will prevent small birds and songbirds from eating the baits; small pieces of bait will be removed during the manufacturing process by sifting through screens. Studies on waterfowl in the Fort Collins, Colorado area have shown that most mallards will not eat the bait; they pick up the bait, manipulate it with their bill and then spit it out. However, mallards that are used to being fed by people could eventually eat the bait after the Canada geese on site began eating the bait. Since Canada geese will typically aggressively protect their food sources, they are expected to chase away any other birds attempting to eat the bait offered. WS will also monitor the site prior to and during bait application to ensure that non-target species access to the site is limited to nonexistent and that there is no state or federally listed species that could consume the bait present at the site. Unconsumed bait will be picked up after the bait application period.

Canada geese typically nest earlier in the year than most other waterfowl species that would consume the bait and before many songbirds. Nicarbazin bait will be offered as early as February and will end in early April. Nicarbazin bait must be consumed for several days to achieve blood levels that affect the hatchability of eggs that are forming. Since most waterfowl do not begin to nest until at least May, no effects on the hatchability of eggs of non-target waterfowl that do consume bait are expected as bait exposure will stop before their nesting season is beginning.

Risk of non-target species access to nicarbazin when used for rock pigeons is likely to be lower due to differences in the application strategy. As with the goose formulation, nicarbazin for pigeons in only registered for use in urban areas, applicators must ensure that children and pets do not come into contact with the product, the product cannot be used within 20 feet of any body of water, and the product may only be applied on rooftops or other flat paved or concrete surfaces. Applicators must confirm by visual observation that rock pigeons are eating the bait and non-targets are not feeding on the bait. The label stipulates that the bait application must be discontinued at sites if non-targets are observed feeding on the

bait. As with the goose formulation, no excess bait may remain after feeding. The chemistry of the active ingredient assures that there is a low risk of any effect on a raptor. To have an effect, the bird must consume the bait. Once Nicarbazin is digested and absorbed, it is no longer biologically available to another bird. There is effectively no risk of secondary toxicity (http://www.innolyticsllc.com/new%20pigeon%20pages/pigeon_FAQ.html).

Studies of the effects of nicarbazin on animals other than birds that lay eggs have been limited to snakes. When brown tree snakes were treated with nicarbazin, the number of eggs laid, the hatchability of the eggs, and the health of the offspring were not affected by treatment. It is possible, but not probable, that other egg-laying species could feed on the bait such as turtles. However, WS will monitor the site prior to and during bait application and will remove the bait and/or change the bait application system to avoid exposure to non-target species.

Toxicity studies in birds and mammals given short and long-term doses of nicarbazin show minimal effects. The volume of Nicarbazin bait that would have to be consumed by non-target birds and mammals precludes them from being killed by exposure to the bait. For example, a rat would have to consume over 2.2 pounds of the Nicarbazin bait in a single feeding to reach the lethal dose required to kill 50% of the rats to consume that level of bait (LD_{50}). Extrapolations from data on chickens indicate that crows would have to eat 1.4 lbs. of bait each day for 84 days before they would reach the LD_{50} (Bynam et al. 2005). Mammalian predators of geese that have eaten bait could also be exposed to the bait. However, calculations of a worst case scenario by Bynam et al. (2005) indicate that a coyote would have to eat over 40 geese in a single day in order to reach the acute (one dose) LD_{50} for Nicarbazin determined for dogs weighing 25 lbs., or over 13 geese per day for 163 days to reach the chronic (repeated dose) LD_{50}.

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 and DRC-1339. In addition, birds could be euthanized once live-captured by other methods.

The use of firearms is essentially selective for target species since animals are 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 have been live-captured. Since live-capture of birds using other methods occurs prior to the administering of euthanasia chemicals, no adverse effects to non-targets would occur under this alternative. WS' recommendation that birds be harvested during the regulated season by private entities to alleviate damage would not increase risks to non-targets.

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

By acclimating target bird species to a feeding schedule, baiting can occur at specific times to ensure bait placed is quickly consumed by target bird species, especially when large flocks of target species are present. The acclimation period allows treated bait to be present only when birds are conditioned to be present at the site and provides a higher likelihood that treated bait would be consumed by the target

species, which makes it unavailable to non-targets. In addition, many bird species when present in large numbers tend to exclude non-targets from a feeding area due to their aggressive behavior and by the large number of conspecifics present at the location. Any treated bait remaining at the location after target birds had finished feeding would be removed to avoid attracting non-targets. WS would retrieve all dead birds to the extent possible following treatment with DRC-1339.

Summary

WS does not anticipate any adverse cumulative impacts on non-target species from the implementation of the proposed bird damage management methods. Based on the methods available to resolve bird damage and/or threats, WS does not anticipate the number of non-targets removed to reach a magnitude where declines in those species' populations would occur. Therefore, removal under the proposed action of non-targets will not create adverse cumulative effects on non-target species. DRC-1339, alpha chloralose, and mesurol are currently only available for use by WS employees; therefore, no adverse cumulative impacts are expected from the use of these chemical due to no additional contribution of these chemical into the environment from non-WS entities.

The proposed bird damage management could benefit many other wildlife species that are impacted by predation or competition for resources. For example, crows are generally very aggressive nesting area colonizers and will force other species from prime nesting areas. American crows and fish crows often feed on the eggs, nestlings, and fledglings of other bird species. Fish crows are known to feed heavily on colonial waterbird eggs (McGowan 2001). This alternative has the greatest possibility of successfully reducing bird damage and conflicts to wildlife species since all available methods could possibly be implemented or recommended by WS.

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 minimization 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 Massachusetts as determined by the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Services was obtained and reviewed during the development of this EA. Appendix D contains the list of species currently listed in the state along with common and scientific names.

Because of the statewide scope and number of species and activities covered under this EA, WS will consult with and follow the procedures and guidelines provided by the NEFO to assist in determining whether a Section 7 consultation is needed on a project by project basis. These procedures are provided on the USFWS NEFO Endangered Species Consultation Project Review for Projects with Federal Involvement website as well as information on how to avoid or minimize adverse effects for specific projects. The website is located at http://www.fws.gov/newengland/EndangeredSpec-Consultation_Project_Review.htm.

For each project, WS personnel will access the website and review the list for the project location to determine if federally listed species are where the project is to be conducted, and if so, could they be located at the project site during the period when the project will be conducted. If the proposed project occurs in a city or town with no known federally listed, proposed, or candidate species present, no further coordination with the USFWS is needed. A "No Species Present" letter stating "no species are known to occur in the project area" will be included with the project file.

If one or more federally listed, proposed, or candidate species occurs in the city or town where the project will be conducted, WS will determine whether these species are likely to occur within the proposed project area by comparing the habitat present within the proposed project action area with habitat that is suitable for the species. This will be done through a review the information provided in species profiles and fact sheets on the USFWS NEFO website, from the MDFW Natural Heritage and Endangered Species Program (NHESP), or any other sources of information available to WS to determine types of habitat the species use. This will be used by WS personnel to determine whether the proposed project area has any potential for listed species habitat. If the project site is in appropriate habitat for federally listed species, additional investigation will be made.

If the MDFW NHESP does not identify any listed species for the proposed project and there is no potential habitat for any listed species within the project area, no further coordination with the USFWS NEFO is required and a "no species present" letter stating "no species are known to occur in the project area" will be entered into the project file.

If potential listed species habitat is present although the species has not been documented from that specific location or if federally listed species are known to occur at the project site, WS personnel will consult with the USFWS NEFO, and if necessary obtain the appropriate formal or informal Section 7 Consultation as required under the ESA. By utilizing the established procedures from the USFWS, it ensures that WS' operations comply with all USFWS regulations and mitigating measures. This will also ensure that significant direct, indirect, and cumulative impacts are avoided on T&E species.

State Listed Species – The current list of state listed species as determined by the MDFW NHESP was obtained and reviewed during the development of the EA (see Appendix E). Based on the review of species listed, WS has determined that the proposed activities would not adversely affect those species currently listed by the state. Any activity involving state-listed birds being analyzed in this EA would require prior authorization by the MDFW through permitting or specific authorization. The MDFW has concurred with WS' determination for listed species.

Alternative 2 - Bird Damage Management by WS using only Non-lethal Methods

Under this alternative, risks to non-target species from WS actions would likely be limited to the use of frightening devices, exclusionary devices, and the risks of unintentional capture of a bird in a live-capture device as outlined under Alternative 1. Although the availability of WS assistance with non-lethal BDM methods could decrease incentives for non-WS entities to use lethal BDM methods, non-WS efforts to reduce or prevent damage could result in less experienced persons implementing bird damage management methods and lead to a greater take of non-target wildlife.

Direct, Indirect, and Cumulative Effects:
Similar to Alternative 3, it is possible that frustration from the resource owner due to the inability to reduce losses could lead to illegal use of toxicants, or other non-specific damage management methods by others could lead to unknown direct or indirect effects to non-target species populations, including T&E species (Appendix D and Appendix E). Hazards to T&E species could be more variable under this alternative than Alternative 1. Potential direct or indirect effects to non-target species could therefore be greater under this alternative if methods that are less selective or toxicants that cause secondary poisoning are used by non-WS entities. Direct effects on non-targets from non-lethal methods of bird damage management conducted by WS would be similar to Alternative 1. Since WS would be able to employ non-lethal methods under this alternative, indirect effects on non-target species could occur when implementing exclusionary devices if the area is large enough, but these indirect effects are expected to be minimal. The ability to reduce negative effects 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

BDM programs. It is possible that frustration caused by the inability to reduce losses would lead to non-specific damage management methods or illegal use of toxicants by others which could increase adverse cumulative impacts, however to unknown degree. While cumulative impacts would be variable, WS does not anticipate any significant cumulative impacts from this alternative.

Alternative 3 – No Bird Damage Management Conducted by WS

Under this alternative, WS would not be directly involved with damage management activities. 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 MDFW, take would continue to occur during the regulated harvest season, non-native bird species could continue to be taken without the need for a permit, blackbirds and cormorants could still be taken under the depredation orders, and Muscovy ducks could be lethally taken under the control order. Risks to non-targets and T&E species would continue to occur from those who implement bird damage management activities on their own or through recommendations by the other federal, state, and private entities. Although some risks occur from those people that implement bird damage management in the absence of any involvement by WS, those risks are likely low and are similar to those under the other alternatives.

Direct, Indirect, and Cumulative Effects:
Under this alternative, WS would not be directly involved with damage management activities. Therefore, no direct or indirect impacts to non-targets or T&E species would occur by WS under this alternative. The ability to reduce damage and threats of damage caused by birds to other wildlife species and their habitats, including T&E species, would be variable based upon the skills and abilities of the person implementing damage management actions under this alternative. 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, direct, indirect, and cumulative effects 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 causes those persons experiencing bird damage to use methods that were not legally available for use, direct, indirect, and cumulative effects on non-targets would be higher under this alternative. People have resorted to the use of illegal methods to resolve wildlife damage that have resulted in the lethal removal of non-target wildlife (e.g., White et al. 1989, USFWS 2001, FDA 2003). Therefore, adverse direct, indirect, or cumulative impacts to non-targets, including T&E species, could occur under this alternative; however WS does not anticipate any significant cumulative impacts.

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

WS would use the Decision Model to determine the appropriate method or methods that would effectively resolve the request for assistance. Those methods would be continually evaluated for effectiveness and if necessary, additional methods could be employed. Risks to human safety from technical assistance conducted by WS would be similar to those risks addressed under the other alternatives. The use of non-lethal methods as part of an integrated approach to managing damage that would be employed as part of direct operational assistance by WS would be similar to those risks addressed by the other alternatives.

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 lethal 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 are 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 occur on private property in rural areas where access to the property is controlled and monitored, the risks to human safety from the use of methods would likely be less. If damage management activities occur at parks or near other public use areas, then risks of the public encountering damage management methods and the corresponding risk to human safety increases. Activities would generally be conducted when human activity is minimal (e.g., early mornings, at night) or in areas where human activities are minimal (e.g., in areas closed to the public).

The use of live-capture traps has also been identified as a potential issue. Live-capture traps are typically set in situations where human activity is minimal to ensure public safety. Traps rarely cause serious injury and are triggered through direct activation of the device. Live-capture traps available for birds are typically walk-in style traps where birds enter, but are unable to exit. Therefore, human safety concerns associated with live traps used to capture birds require direct contact to cause bodily harm.

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

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 taken using chemical methods would be disposed of in accordance with WS Directive 2.515 and applicable federal and state permits. All euthanasia would occur in the absence of the public to further minimize risks. SOPs are further described in Chapter 3 of this EA.

The recommendation of repellents or the use of those repellents registered for use to disperse birds 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 be 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. 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.

Mesurol contains the active ingredient methiocarb and is registered by the EPA for use to condition crows not to feed on the eggs of T&E species. Mesurol is currently in the registration process for use in Massachusetts, and will be evaluated in this assessment as a repellent that could be employed under the proposed action if the product becomes available. Human safety risks associated with the use of mesurol occur primarily to the mixer and handler during preparation. WS' personnel would follow all label requirements, including the personal protective equipment required to handle and mix bait. When used according to label requirements, the risks to human safety from the use of mesurol would be minimal.

Risks to human safety from the use of avicides could occur either through direct exposure of the chemical or exposure to the chemical from birds that have been lethally taken. The only avicide currently registered for use in Massachusetts is DRC-1339 (3-chloro-p-toluidine hydrochloride) that could be used for bird damage management. The mixing, drying, and storage of DRC-1339 treated bait occurs in controlled areas that are not accessible by the public. 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.

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 pre-baiting and an acclimation period), on non-target use of the area (areas with non-target activity are not used or abandoned), and based on human safety (e.g., in areas restricted or inaccessible by the public or where warning signs have been placed). Once appropriate locations 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. 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 target species or was removed by WS, then treated bait would no longer be available and human exposure to the bait could not occur.

Factors that minimize any risk of public health problems from the use of DRC-1339 are: 1) its use is prohibited within 50 feet of standing water and cannot be applied directly to food or feed crops (contrary to some misconceptions, DRC-1339 is not applied to feed materials that livestock can feed upon), 2) DRC-1339 is highly unstable and degrades rapidly when exposed to sunlight, heat, or ultraviolet radiation. The half-life is about 25 hours; in general, DRC-1339 on treated bait material is almost completely broken down within a week if not consumed or retrieved, 3) the chemical is more than 90% metabolized in target birds within the first few hours after they consume the bait. Therefore, little

material is left in bird carcasses that may be found or retrieved by people, 4) application rates are extremely low (EPA 1995), 5) a human would need to ingest the internal organs of birds found dead from DRC-1339 to be exposed, and 6) the EPA has concluded that, based on mutagenicity (the tendency to cause gene mutations in cells) studies, this chemical is not a mutagen or a carcinogen (i.e., cancer-causing agent) (EPA 1995).

Under the proposed action, the controlled and limited circumstances in which DRC-1339 would be used would prevent any exposure of the public to this chemical. Based on current information, the human health risks from the use of DRC-1339 would be virtually nonexistent under this alternative.

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

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

Alpha-chloralose is an immobilizing agent available only for use by WS. The FDA has approved the use of alpha chloralose as an INAD (INAD #6602) to be used for the immobilization and capture of certain species of birds by trained WS' personnel. Alpha-chloralose is administered to target individuals, either as a tablet or liquid solution contained within a bread ball or as a powder formulated on whole kernel corn. All unconsumed baits are retrieved. Since applicators are present at all times during application of alpha chloralose, the risks to human safety are low. All WS' employees using alpha chloralose are required to successfully complete a training course on the proper use and handling of alpha chloralose. All WS' employees who use alpha chloralose would wear the appropriate personal protective equipment required to ensure the safety of employees.

Of additional concern with the use of immobilizing drugs and reproductive inhibitors is the potential for human consumption of meat from waterfowl that have been immobilized using alpha chloralose or have consumed nicarbazin. Since waterfowl are harvested during a regulated harvest season and consumed, the use of immobilizing drugs and potentially reproductive inhibitors is of concern. 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. In compliance with FDA use restrictions, the use of alpha chloralose is prohibited for 30 days prior to and during the hunting season on waterfowl and other game birds that could be hunted. In the event that WS were requested to immobilize waterfowl or use nicarbazin during a period of time 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 either immobilizing drugs or nicarbazin. In those cases, other methods would be employed.

Direct, Indirect, and Cumulative Effects:
No adverse direct or indirect effects to human safety have occurred from WS' use of methods to alleviate bird damage from FY 2010 through FY 2014. The risks to human safety from the use of non-lethal and lethal methods, when used appropriately and by trained personnel, is considered low. No adverse direct effects to human health and safety are expected through the use of live-capture traps and devices or other non-lethal methods. Since WS personnel are required to complete and maintain firearms safety training, no adverse direct effects to human health and safety are expected as a result of the misuse of firearms by WS personnel. Additionally, all WS personnel are properly trained on all chemicals handled and administered in the field, ensuring their safety as well as the safety of the public. Therefore, adverse direct effects to human health and safety from chemicals used by WS are anticipated to be insignificant. The amount of chemicals used or stored by WS and cooperating agencies would be minimal to ensure human safety. No adverse indirect effects are anticipated from the application of any of the chemicals available for WS. According to the hazard profile for DCR-1339, it is not likely to cause contaminant of the water supply, especially when used in accordance to label requirements. Based on potential use patterns, the chemical and physical characteristics of the above mentioned toxicants and repellents, and factors related to the environmental fate, no cumulative impacts are expected from the chemical components used or recommended by the WS program in Massachusetts. Since DCR-1339 is only available to WS and alpha chloralose is not currently available, WS does not anticipate any adverse cumulative impacts to human health and safety from the use of these chemicals.

Alternative 2 - Bird Damage Management by WS using only Non-lethal Methods

Under this alternative, WS would not use lethal BDM methods. Concerns about human health risks from WS' use of lethal bird damage management methods would be alleviated because no such use would occur. However, Avitrol would be available to licensed pesticide applicators. Private efforts to reduce or prevent damage would be expected to increase, and would likely result in less experienced persons implementing chemical or other damage management methods which may have a greater risks to human and pet health and safety than under Alternative 1. Ignorance and/or frustration caused by the inability to reduce losses could lead to illegal use of toxicants by others which could lead to unknown impacts to humans and pets.

Benefits to the public from WS BDM activities will depend on the ability of WS to resolve problems using non-lethal methods and the effectiveness of non-WS BDM efforts. In situations where risks to human health and safety from birds cannot be resolved using nonlethal methods, benefits to the public will depend on the efficacy of non-WS use of lethal BDM methods. If lethal BDM programs are implemented by individuals with less experience than WS, they may not be able to effectively resolve the problem or it may take longer to resolve the problem than with a WS program.

Direct, Indirect, and Cumulative Effects:
Since most methods available to resolve or prevent bird damage or threats are available to anyone, the direct, indirect, and cumulative effects to human safety from the use of those methods are similar between the alternatives. Private efforts to reduce or prevent damage would be expected to increase, and would likely result in less experienced persons implementing chemical or other damage management methods which may have variable adverse direct, indirect, and/or cumulative effects to human and pet health and safety than under Alternative 1. Ignorance and/or frustration caused by the inability to reduce losses could lead to illegal use of toxicants by others which could lead to unknown direct, indirect, and/or cumulative impacts to humans and pets. DRC-1339 would not be available under this alternative to non-WS entities experiencing damage or threats from birds and WS would not use DCR-1339 under this alternative since it is lethal, therefore no cumulative impacts to human health and safety should occur from these chemicals.

Alternative 3 – No Bird Damage Management Conducted by WS

Under the no bird damage management alternative, WS would not be involved with any aspect of managing damage associated with birds, 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 MDFW. The direct burden of implementing permitted methods would be placed on those experiencing damage.

Direct, Indirect, and Cumulative Effects:
Since most methods available to resolve or prevent bird damage or threats are available to anyone, the adverse direct, indirect, and cumulative effects to human safety from the use of those methods are similar between the alternatives. Although some risks to safety are likely to occur with the use of pyrotechnics, propane cannons, and exclusion devices, those risks are minimal when those methods are used appropriately and in consideration of human safety. DRC-1339 and alpha chloralose would not be available under this alternative to those experiencing damage or threats from birds; therefore no adverse direct, indirect, or cumulative impacts to human health and safety should occur from these chemicals. The only methods that would be available under this alternative that would involve the direct lethal taking of birds are shooting, publicly available pesticides and repellents, and nest destruction. Under this alternative, shooting and nest destruction would be available to those persons experiencing damage or threats of damage when permitted by the USFWS and the MDFW. Firearms, when handled appropriately and with consideration for safety, pose minimal risks to human safety. However, methods employed by those persons not experienced in the use of methods or are not trained in their proper use, could increase the adverse direct, indirect, and/or cumulative impacts to human safety. Overall, the methods available to the public, when applied correctly and appropriately, pose minimal risks to human safety.

Issue 4 - Effects on the Aesthetic Values of Birds

People often enjoy viewing, watching, and knowing birds exist as part of the natural environment and gain aesthetic enjoyment in such activities. Those methods available to alleviate damage are intended to disperse and/or remove birds. Non-lethal methods are intended to exclude or make an area less attractive, which disperses birds to other areas. Similarly, lethal methods are intended to remove those birds identified as causing damage or posing a threat of damage. The effects on the aesthetic value of birds as it relates to the alternatives are discussed below.

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

Under the proposed action, methods would be employed that would result in the dispersal, exclusion, or removal of individuals or small groups of birds to resolve damage and threats. In some instances where birds are dispersed or removed, the ability of interested persons to observe and enjoy those birds would likely temporarily decline. Even the use of exclusionary devices can lead to the dispersal of wildlife if the resource being damaged was acting as an attractant. Thus, once the attractant has been removed or made unavailable, the wildlife would likely disperse to other areas where resources are more available.

The use of lethal methods would result in temporary declines in local populations resulting from the removal of birds to address or prevent damage and threats. The goal under the proposed action is to respond to requests for assistance and to manage those birds responsible for the resulting damage. Therefore, the ability to view and enjoy birds would remain if a reasonable effort is made to locate birds

outside the area in which damage management activities occurred. Those birds removed by WS are those that could be removed by the person experiencing damage.

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

Direct, Indirect, and Cumulative Effects:
Since those birds removed by WS under this alternative could be removed with a depredation permit issued by the USFWS, under depredation orders, under control orders, without the need for a permit (non-native species), or the regulated hunting seasons, WS' involvement in taking those birds would not likely be additive to the number of birds that could be removed in the absence of WS' involvement. WS' removal of birds from FY 2010 through FY 2014 has been of low magnitude compared to the total mortality and populations of those species. WS' activities are not likely additive to the birds that would be taken in the absence of WS' involvement. Given the limited take proposed by WS under this alternative when compared to the known sources of mortality of birds, WS' bird damage management activities conducted pursuant to the proposed action is not expected to cause adverse direct or indirect effects on the aesthetic value of birds. The impact on the aesthetic value of birds and the ability of the public to view and enjoy birds under the proposed action would be similar to the other alternatives and is likely insignificant.

When damage caused by birds has occurred, any removal of birds by the property or resource owner would likely occur whether WS was involved with taking the birds or not. Therefore, the activities of WS are not expected to have any adverse cumulative impacts on this element of the human environment if occurring at the request of a property owner and/or manager. No significant cumulative impact is expected because the bird populations are a renewable resource and therefore will be replaced with new birds in the following years. The purpose of WS involvement is to alleviate the damage caused by the bird, not to eradicate the species.

Alternative 2 - Bird Damage Management by WS using only Non-lethal Methods

Under this alternative, WS would not conduct any lethal BDM, but may conduct harassment of birds that are causing damage. Other non-lethal methods may be conducted as well under this alternative to help alleviate damage caused by birds. Non-lethal methods would not be employed over large geographical areas or applied at such intensity that or over such a wide geographical scope that long-term adverse effects would occur to a species' population. Relocation may be appropriate in some situations. However, relocations would not occur at a magnitude to significantly impact the aesthetic value of birds.

Direct, Indirect, and Cumulative Effects:
Although WS would not perform any lethal activities under this alternative, other private entities would likely conduct BDM activities similar to those that would no longer be conducted by WS, which means the direct and indirect effects would then be similar to the Proposed Action Alternative. Cumulative impacts are expected to be similar to Alternative 1 as well.

Assuming property owners would choose to allow and pay for the implementation of non-lethal methods only by WS, this alternative could result in birds relocating to other sites where they would likely cause or aggravate similar problems for other property owners. Thus, this alternative would likely result in more property owners experiencing adverse direct and/or indirect effects on the aesthetic values of their properties than the Proposed Action Alternative. If WS is providing direct operational assistance in

relocating such birds, coordination with local authorities may be conducted to assure they do not re-establish in other undesirable locations.

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. Those persons experiencing damage or threats from birds would be responsible for researching, obtaining, and using all methods as permitted by federal, state, and local laws and regulations. The degree to which damage management activities would occur in the absence of assistance by any agency is unknown but likely lower compared to damage management activities that would occur where some level of assistance was provided. Birds could still be dispersed or removed under this alternative by those persons experiencing damage or threats of damage. Removal could also occur during the regulated harvest season, pursuant to the blackbird and cormorant depredation orders, pursuant to the Muscovy duck control order, and in the case of non-native species, removal could occur any time without the need for a depredation permit.

Direct, Indirect, and Cumulative Effects:
The potential direct and indirect effects on the aesthetic values of birds could be similar to the proposed action if similar levels of damage management activities are conducted by those persons experiencing damage or threats or is provided by other entities. If no action is taken or if activities are not permitted by the USFWS and the MDFW, then no direct or indirect effect on the aesthetic value of birds would occur under this alternative.

Since birds could continue to be removed 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 removed since WS' has no authority to regulate removal or the harassment of birds. The USFWS and the MDFW with management authority over birds would continue to adjust all removal levels based on population objectives for those bird species. Therefore, the number of birds lethally removed annually through hunting, under the depredation/control orders, and pursuant to depredation permits are regulated and adjusted by the USFWS and the MDFW. The cumulative impacts to the aesthetic value of birds would be similar to the other alternatives.

Summary
No significant cumulative environmental impacts are expected from any of the proposed actions analyzed in this supplement. Under the Current/Proposed Action, the lethal removal of birds by WS has not and would not have a significant impact on overall bird populations in Massachusetts or nationwide, but some local reductions may occur. No risk to public safety is expected when WS' services are provided and accepted by continuing the BDM program with the included supplemental actions since only trained and experienced wildlife biologists/specialists would conduct and recommend bird damage management activities. Although some persons will likely be opposed to WS' participation in bird damage management activities on public and private lands, the analysis in this EA indicates that WS integrated bird damage management program would not result in significant adverse cumulative impacts on the quality of the human environment.

CHAPTER 5 - LIST OF PREPARERS AND PERSONS CONSULTED

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APPENDIX A

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APPENDIX B

BIRD DAMAGE MANAGEMENT METHODS AVAILABLE FOR USE

NON-LETHAL METHODS - NONCHEMICAL

Agricultural producer and property owner practices. These consist primarily of non-lethal preventive methods such as cultural methods and habitat modification. Cultural methods and other management techniques are implemented by the agricultural producer or property owners/managers. Resource owners/managers may be encouraged to use these methods, based on the level of risk, need, and professional judgment on their effectiveness and practicality. These methods include:

Cultural methods. These may include altering planting dates so that crops are not young and more vulnerable to damage when the damage-causing species is present, or the planting of crops that are less attractive or less vulnerable to such species. At feedlots or dairies, cultural methods generally involve modifications to the level of care or attention given to livestock which may vary depending on the age and size of the livestock. Animal husbandry practices include, but are not limited to, techniques such as night feeding, indoor feeding, closed barns or corrals, removal of spilled grain or standing water, and use of bird proof feeders (Johnson and Glahn 1994).

Environmental/Habitat modification can be an integral part of bird damage management. Wildlife production and/or presence are directly related to the type, quality, and quantity of suitable habitat. Therefore, habitat can be managed to reduce or eliminate the production or attraction of certain bird species or to repel certain birds. In most cases, the resource or property owner is responsible for implementing habitat modifications, and WS only provides advice on the type of modifications that have the best chance of achieving the desired effect. Habitat management is most often a primary component of bird damage management strategies at or near airports to reduce bird aircraft strike problems by eliminating bird nesting, roosting, loafing, or feeding sites. Generally, many bird problems on airport properties can be minimized through management of vegetation and water from areas adjacent to aircraft runways. Habitat management is often necessary to minimize damage caused by crows and blackbirds that form large roosts during late autumn and winter. Bird activity can be greatly reduced at roost sites by removing all the trees or selectively thinning the stand.

Animal behavior modification. This refers to tactics that alter the behavior of wildlife to reduce damage. Animal behavior modification may involve use of scare tactics or fencing to deter or repel animals that cause loss or damage (Twedt and Glahn 1982). Some but not all methods that are included by this category are bird-proof barriers, electronic guards, propane exploders, pyrotechnics, distress calls and sound producing devices, chemical frightening agents, repellents, scarecrows, mylar tape, lasers, and eye-spot balloons.

These techniques are generally only practical for small areas. Scaring devices such as distress calls, helium-filled eyespot balloons, raptor effigies and silhouettes, mirrors, and moving disks can be effective, but usually for only a short time before birds become accustomed and learn to ignore them (Arhart 1972, Rossbach 1975, Conover 1982, Shirota and Masake 1983, Schmidt and Johnson 1984, Mott 1985, Graves and Andelt 1987, Bomford 1990). Mylar tape has produced mixed results in its effectiveness to frighten birds (Dolbeer et al. 1986, Tobin et al. 1988).

Paintball guns are used as a non-lethal harassment method to disperse birds from areas using physical harassment. Paintballs are most often used to harass waterfowl. Paintballs can be used to produce physically and visually negative-reinforcing stimuli that can aid in the dispersement of birds from areas where damages or threats of damages are occurring.

Bird proof barriers can be effective, but are often cost-prohibitive, particularly because of the aerial mobility of birds which requires overhead barriers as well as peripheral fencing or netting. Exclusion adequate to stop bird movements can also restrict movements of livestock, people and other wildlife (Fuller-Perrine and Tobin 1993).

Overhead wire grids can deter crow use of specific areas where they are causing a nuisance (Johnson 1994). The birds apparently fear colliding with the wires and thus avoid flying into areas where the method has been employed. Netting can be used to exclude birds from a specific area by the placement of bird proof netting over and around the specific resource to be protected. Exclusion may be impractical in most settings (e.g., commercial agriculture), however it can be practical in small areas (e.g., personal gardens) or for high-value crops (e.g., grapes) (Johnson 1994). Although this alternative would provide short-term relief from damage, it may not completely deter birds from feeding, loafing, staging, or roosting at that site. A few people would find exclusionary devices such as netting unsightly, trashy, and cause a decreased aesthetic value of the neighborhood when used over personal gardens.

Auditory scaring devices such as propane exploders, pyrotechnics, electronic guards, scare crows, and audio distress/predator vocalizations are effective in many situations for dispersing damage-causing bird species. These devices are sometimes effective, but usually only for a short period of time before birds become accustomed and learn to ignore them (Arhart 1972, Rossbach 1975, Shirota and Masake 1983, Schmidt and Johnson 1984, Mott 1985, Bomford 1990). Williams (1983) reported an approximate 50% reduction in blackbirds at two south Texas feedlots as a result of pyrotechnics and propane cannon use. However, they are often not practical in dairy or feedlot situations because of the disturbance to livestock, although livestock can generally be expected to habituate to the noise. Birds, too, quickly learn to ignore scaring devices if the birds' fear of the methods is not reinforced with shooting or other tactics.

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

Lasers are a non-lethal technique recently evaluated by the NWRC (Glahn et al. 2000, Blackwell et al. 2002). For best results and to disperse numerous birds from a roost, the laser is most effectively used in periods of low light, such as after sunset and before sunrise. In the daytime, the laser can also be used during overcast conditions or in shaded areas to move individual and small numbers of birds, although the effective range of the laser is much diminished. Blackwell et al. (2002) tested lasers on several bird species and observed varied results among species. Lasers were ineffective at dispersing mallards with birds habituating in approximately 5 minutes and 20 minutes, respectively (Blackwell et al. 2002). As with other bird damage management tools lasers are most effective when used as part of an integrated management program.

Live traps (although live traps are non-lethal, birds may be euthanized upon capture). In most situations, live trapped birds are subsequently euthanized. Relocation to other areas following live capture would not generally be effective because problem bird species are highly mobile and can easily return to damage sites from long distances; habitats in other areas are generally already occupied; and relocation would most likely result in bird damage problems at the new location. Translocation of wildlife is also discouraged by WS' policy (WS Directive 2.501) because of stress to the relocated animal, poor survival rates, and difficulties in adapting to new locations or habitats. Live traps include:

Decoy traps are used by WS for preventive and corrective damage management. Decoy traps are similar in design to the Australian Crow Trap as reported by McCracken (1972) and Johnson and Glahn (1994). Live decoy birds of the same species that are being targeted are usually placed in the trap with sufficient food and water to assure their survival. Perches are configured in the trap to allow birds to roost above the ground and in a more natural position. Feeding behavior and calls of the decoy birds attract other birds which enter and become trapped themselves. Active decoy traps are monitored daily to remove and euthanize excess birds and to replenish bait and water. Decoy traps and other cage/live traps, as applied and used by WS, pose no danger to pets or the public and if a pet is accidentally captured in such traps, it can be released unharmed.

Nest box traps may be used by WS for corrective damage management and are effective in capturing cavity nesting birds (DeHaven and Guarino 1969, Knittle and Guarino 1976).

Mist nets are more commonly used for capturing small-sized birds, but can be used to capture larger birds such as ducks and ring-neck pheasants or even smaller nuisance hawks and owls. It was introduced 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 which birds can be caught and overlapping pockets in the net cause birds to entangle themselves when they fly into the net.

Cannon nets are normally used for larger birds and use mortar projectiles to propel a net up and over birds which have been baited to a particular 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 Canada geese during the annual molt when birds are unable to fly. Each year for a few weeks in the summer, geese are flightless as they are growing new flight feathers. Therefore, geese 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.

Nest/egg destruction is the removal of nesting materials during the construction phase of the nesting cycle. Nest destruction is generally only applied when dealing with a single bird or very few birds. This method is used to discourage birds from constructing nests in areas, which may create nuisances or safety issues for home and business owners. Removal of nests is intended to deter birds from nesting in the same area again. Birds generally attempt to re-nest, so the method may need to be conducted repeatedly throughout the nesting season, and over several years. Heusmann and Bellville (1978) reported that nest removal was an effective, but time-consuming, method because problem bird species are highly mobile and can easily return to damage sites from long distances, or because of high populations. This method poses no imminent danger to pets or the public.

Egg Treatment (addling/shaking, puncturing, or oiling) is a method of suppressing reproduction in local nuisance bird populations by destroying egg embryos to arrest their development and eliminate hatching. Treated eggs are returned to the nest and the adult bird remains attached to the nest site. Treatment of eggs is typically done where the current number of birds is tolerable, but additional birds would not be.

Treatment of eggs will not reduce the overall problem bird population, but may slow its growth and make adult birds more responsive to harassment (also see *Egg oiling* below).

Lure crops/alternate foods. When damage cannot be avoided by careful crop selection or modified planting schedules, lure crops can sometimes be used to mitigate the loss potential. Lure crops are planted or left for consumption by wildlife as an alternative food source. This approach provides relief for critical crops by sacrificing less important or specifically planted fields. Establishing lure crops is sometimes expensive, requires considerable time and planning to implement, and may attract other unwanted species to the area.

NON-LETHAL METHODS - CHEMICAL

Avitrol is a chemical frightening agent (repellent) that is effective in a single dose when mixed with untreated baits, normally in a 1:9 ratio. Avitrol, however, is not completely non-lethal in that a small portion of the birds are generally killed (Johnson and Glahn 1994). Prebaiting is usually necessary to achieve effective bait acceptance by the target species. This chemical is registered for use on pigeons, crows, blackbirds, starlings, and house sparrows in various situations. Avitrol treated bait is placed in an area where the targeted birds are feeding. When a treated particle is consumed, affected birds begin to broadcast distress vocalizations and display abnormal flying behavior, thereby frightening the remaining flock away.

Avitrol is a restricted-use pesticide that can only be sold to certified applicators and is available in several bait formulations where only a small portion of the individual grains carry the chemical. It can be used during anytime of the year, but is used most often during winter and spring. Any granivorous bird associated with the target species could be affected by Avitrol. Avitrol is water soluble, but laboratory studies demonstrated that Avitrol is strongly absorbed onto soil colloids and has moderately low mobility. Biodegradation is expected to be slow in soil and water, with a half-life ranging from three to 22 months. However, Avitrol may form covalent bonds with humic materials, which may serve to reduce its availability for intake by organisms from water, is non-accumulative in tissues and rapidly metabolized by many species (Schafer, Jr. 1991).

Avitrol is acutely toxic to avian and mammalian species, however, blackbirds are more sensitive to the chemical and there is little evidence of chronic toxicity. Laboratory studies with predator and scavenger species have shown minimal potential for secondary poisoning and during field use only magpies and crows appear to have been affected (Schafer, Jr. 1991). However, a laboratory study by Schafer, Jr. et al. (1974) showed that magpies exposed to two to 3.2 times the published LD_{50} in contaminated prey for 20 days were not adversely affected and three American kestrels that were fed contaminated blackbirds for seven to 45 days were not adversely affected. Some hazards may occur to predatory species consuming unabsorbed chemical in the GI tract of affected or dead birds (Schafer, Jr. 1981, Holler and Shafer 1982).

Methyl anthranilate (artificial grape flavoring used in foods and soft drinks for human consumption) could be used or recommended by WS as a bird repellent. Methyl anthranilate (MA) (artificial grape flavoring food additive) has been shown to be a promising repellent for many bird species, including waterfowl (Dolbeer et al. 1993). Cummings et al. (1995) found effectiveness of MA declined significantly after 7 days. Belant et al. (1996) found MA ineffective as a bird grazing repellent, even when applied at triple the recommended label rate. MA is also under investigation as a potential bird taste repellent. MA may become available for use as a livestock feed additive (Mason et al. 1984, Mason et al. 1989). It is registered for applications to turf or to surface water areas used by unwanted birds. Recently, a special local needs registration was approved for its use as a seed treatment to protect planted corn seed against consumption by various blackbird species and crows. The material has been shown to

be nontoxic to bees (LD_{50} > 25 micrograms/bee[9]), nontoxic to rats in an inhalation study (LC_{50} > 2.8 mg/L[10]), and of relatively low toxicity to fish and other invertebrates. Methyl anthranilate is naturally occurring in concord grapes and in the blossoms of several species of flowers and is used as a food additive and perfume ingredient (Dolbeer et al. 1992). It has been listed as "*Generally Recognized as Safe*" by the U.S. Food and Drug Administration (Dolbeer et al. 1992).

Water surface and turf applications of MA are generally considered expensive. For example, the least intensive application rate required by label directions is 20 lbs. of product (8 lbs. active ingredient) per acre of surface water at a cost of about $64/lb. with retreating required every 3-4 weeks. Cost of treating turf areas would be similar on a per acre basis. In addition, MA completely degrades in about 3 days when applied to water, which indicates the repellent effect is short-lived.

Another potentially more cost effective method of MA application is by use of a fog-producing machine (Vogt 1997). The fog drifts over the area to be treated and is irritating to the birds, while being non-irritating to any humans that might be exposed. Fogging applications must generally be repeated 3-5 times after the initial treatment before the birds abandon a treatment site. Applied at a rate of about 0.25 lb/acre of water surface, the cost is considerably less than when using the turf or water treatment methods.

MA is also being investigated as a livestock feed additive to reduce or prevent feed consumption by birds. Such chemicals undergo rigorous testing and research to prove safety, effectiveness, and low environmental risks before they would be registered by EPA or the FDA.

Mesurol was recently registered by WS to repel crows and ravens from bird nests of T&E species. It could be used by WS only as a bird repellent to deter predation by crows on eggs of threatened or endangered species. Dimmick and Nicolaus (1990) showed breeding pairs of crows could be conditioned with aversive chemicals to avoid eggs. However, Avery and Decker (1994) observed increased consumption of eggs treated with higher doses of Mesurol by fish crows. Sullivan and Dinsmore (1990) reported bird nests greater than 700 meters from crow nests were relatively safe from crow predation, thus nests beyond 700 meters from active crow nests may not need to be treated.

WS would treat eggs similar in appearance as those eggs of the species needing protection. The active ingredient is injected into eggs, which are placed in artificial nests or upon elevated platforms. Upon ingestion, crows develop post-ingestional malaise (Mason 1989) and subsequently develop an aversion to consuming similar-looking eggs (Dimmick and Nicolaus 1990). Repeated exposures may be necessary to develop and maintain aversion to eggs of T&E species as the learning curve for crows can take from 23 days to 3 months (Dimmick and Nicolaus 1990, Avery and Decker 1994).

Treated areas will be posted with warning signs at access points to exclude people from T&E species nesting areas. Treated eggs are not placed in locations where T&Especies may eat the treated eggs. Mesurol is highly toxic to birds and mammals and toxic to fish. It is also highly toxic to honey bees.

Other chemical repellents. A number of other chemicals have shown bird repellent capabilities. Anthraquinone, a naturally occurring chemical found in many plant species and in some invertebrates as a natural predator defense mechanism, has shown effectiveness in protecting rice seed from red-winged blackbirds and boat-tailed grackles (Avery et al. 1997). It has also shown effectiveness as a foraging

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

repellent against Canada goose grazing on turf and as a seed repellent against brown-headed cowbirds (Dolbeer et al. 1998).

Tactile repellents. A number of tactile repellent products are on the market which reportedly deters birds from roosting on certain structural surfaces by presenting a tacky or sticky surface that the birds avoid. However, experimental data in support of this claim are sparse (Mason and Clark 1992). The repellency of tactile products is generally short-lived because of dust, and they sometimes cause aesthetic problems and expensive clean-up costs by running down the sides of buildings in hot weather.

Alpha-chloralose is a central nervous system depressant used as an immobilizing agent to capture and remove pigeons, waterfowl and other birds. It is labor intensive and in some cases, may not be cost effective (Wright 1973, Feare et al. 1981). Alpha-chloralose is typically delivered in a well contained bait in small quantities with minimal hazards to pets and humans; single bread or corn baits are fed directly to the target birds. WS' personnel are present at the site of application during baiting to retrieve the immobilized birds. Unconsumed baits are removed from the site following each treatment. Alpha-chloralose was eliminated from more detailed analysis based on critical element screening; therefore, environmental fate properties of this compound were not rigorously assessed. However, the solubility and mobility are believed to be moderate and environmental persistence is believed to be low. Bioaccumulation in plants and animal tissue is believed to be low. Alpha-chloralose is used in other countries as an avian and mammalian toxicant. The compound is slowly metabolized, with recovery occurring a few hours after administration (Schafer, Jr. 1991). The dose used for immobilization is designed to be about two to 30 times lower than the LD_{50}. Mammalian data indicate higher LD_{50} values than birds. Toxicity to aquatic organisms is unknown (Woronecki et al. 1990), but the compound is not generally soluble in water and therefore should remain unavailable to aquatic organisms. Factors supporting the determination of this low potential included the lack of exposure to pets, non-target species and the public, and the low toxicity of the active ingredient. Other supporting rationale for this determination included relatively low total annual use and a limited number of potential exposure pathways. The agent is currently approved for use by WS as an Investigative New Animal Drug by the FDA rather than a pesticide.

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.

Contraception. Inhibiting reproduction is one way of reducing some bird populations. However, in long-lived species like geese (Cramp and Simmons 1977) exclusive use of contraceptive methods may take a period of years to reduce local bird populations. Contraceptive methods are likely to be most valuable as a means of maintaining waterfowl populations at desired levels.

The NWRC has been instrumental in the development and registration of a new product, nicarbazin (OvoControl-GTM; CAS 330-95-0/4, 4-dinitrocarbanilide (DNC, CAS 587-90-6)/ 2-hydroxy-4,6-dimethylpyrimidine (HDP, CAS 108-79-2) (1:1)), which is an infertility agent for Rock Pigeons in urban areas. 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 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 mallards and chickens by 4-6 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 best impact on reproduction.

In a field study conducted in Oregon (Yoder et al. 2005), use of nicarbazin reduced hatchability of eggs 35.6% ($P = 0.062$). When considering the success of individual nests at sites rather than flocks as a whole, percent hatchability was significantly reduced 50.7% ($P < 0.001$). Under current label guidelines, the cost for nicarbazin (Ovocontrol®) applications exceeds the cost of other control methods (Cooper and Keefe 1997) until the bird population reaches a critical threshold of approximately > 80 birds (Caudell and Shwiff 2006).

Resource Management. Resource management includes a variety of practices that may be used by resource owners to reduce the potential for wildlife damage. Implementation of these practices is appropriate when the potential for damage can be reduced without significantly increasing a resource owner's costs or diminishing his/her ability to manage resources pursuant to goals. Resource management recommendations are made through WS technical assistance efforts.

LETHAL METHODS - MECHANICAL

Shooting is more effective as a dispersal technique than as a way to reduce bird densities when large numbers of birds are present. Normally shooting is conducted with shotguns, rifles or air rifles. Shooting is a very individual specific method and is normally used to remove a single offending bird. However, at times, a few birds could be shot from a flock to make the remainder of the birds more wary and to help reinforce non-lethal methods. It is selective for target species and may be used in conjunction with the use of spotlights, decoys, and calling. Shooting with shotguns, air rifles, or rim and center fire rifles is sometimes used to manage bird damage problems when lethal methods are determined to be appropriate. The birds are killed as quickly and humanely as possible. All firearm safety precautions are followed by WS when conducting bird damage management activities and all laws and regulations governing the lawful use of firearms are strictly complied with.

Firearm use is very sensitive and a public concern because of safety issues relating to the public and misuse. To ensure safe use and awareness, WS' employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 2 years afterwards (WS Directive 2.615). WS' employees, who carry firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

Sport hunting is sometimes recommended by WS as a viable damage management method when the target species can be legally hunted. A valid hunting license and other licenses or permits may be required by the MDFW 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 for crow damage management around crops or other resources.

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

Snap traps are modified rat snap traps used to remove individual birds, 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.

LETHAL METHODS - CHEMICAL

All chemicals used by WS are registered as required by the FIFRA (administered by the EPA and the Clemson University Department of Pesticide Regulation). WS' personnel that use restricted-use chemical methods are certified as pesticide applicators by the Commonwealth of Massachusetts and are required to adhere to all certification requirements set forth in FIFRA and Massachusetts pesticide control laws and regulations. Chemicals are only used on private, public, or tribal property sites with authorization from the property owner/manager.

CO_2 is sometimes used to euthanize birds which are captured in live traps. Live birds are placed in a container such as a plastic 5-gallon bucket or chamber and sealed shut. CO_2 gas is released into the bucket or chamber and birds quickly die after inhaling the gas. This method is approved as a euthanizing agent by the AVMA (Beaver et al. 2001). CO_2 gas is a byproduct of animal respiration, is common in the atmosphere, and is required by plants for photosynthesis. It is used to carbonate beverages for human consumption and is also the gas released by dry ice. The use of CO_2 by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society.

DRC-1339. For more than 30 years, DRC-1339 has proven to be an effective method of starling, blackbird, gull, and pigeon control at feedlots, dairies, airports, and in urban areas (DeCino et al. 1966, Besser et al. 1967, West et al. 1967). Studies continue to document the effectiveness of DRC-1339 in resolving blackbird/starling problems at feedlots (West and Besser 1976, Glahn 1982, Glahn et al. 1987), and dispersing crow roosts in urban/suburban areas (Boyd and Hall 1987). Glahn and Wilson (1992) noted that baiting with DRC-1339 is a cost-effective method of reducing damage by blackbirds to sprouting rice.

DRC-1339 is a slow acting avicide that is registered with the EPA for reducing damage from several species of birds, including blackbirds, starlings, pigeons, crows, ravens, magpies, and gulls. DRC-1339 was developed as an avicide because of its differential toxicity to mammals. DRC-1339 is highly toxic to sensitive species but only slightly toxic to non-sensitive birds, predatory birds, and mammals (Schafer, Jr. 1981, Schafer, Jr. 1991, Johnston et al. 1999). For example, starlings, a highly sensitive species, require a dose of only 0.3 mg/bird to cause death (Royall et al. 1967). Most bird species that are responsible for damage, including starlings, blackbirds, pigeons, crows, magpies, and ravens are highly sensitive to DRC-

1339. Many other bird species such as raptors (Schafer, Jr. 1981), sparrows, and eagles are classified as non-sensitive. Numerous studies show that DRC-1339 poses minimal risk of primary poisoning to non-target and T&E species (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 which died from DRC-1339 were fed to raptors and scavenger mammals for 30 to 200 days with no symptoms of secondary poisoning observed (Cunningham et al. 1981). This can be attributed to relatively low toxicity to species that might scavenge on blackbirds and starlings killed by DRC-1339 and its tendency to be almost completely metabolized in the target birds which leaves little residue to be ingested by scavengers. Secondary hazards of DRC-1339 are almost nonexistent (Schafer, Jr. 1984, Schafer, Jr. 1991, Johnston et al. 1999). DRC-1339 acts in a humane manner producing a quiet and apparently painless death.

DRC-1339 is unstable in the environment and degrades rapidly when exposed to sunlight, heat, or ultra violet radiation. DRC-1339 is highly soluble in water but does not hydrolyze and degradation occurs rapidly in water. DRC-1339 tightly binds to soil and has low mobility. The half-life is about 25 hours, which means it is nearly 100% broken down within a week, and identified metabolites (*i.e.*, degradation chemicals) have low toxicity. Although DRC-1339 is highly toxic to aquatic invertebrates (EPA 1995), following labeling requirements eliminates the risks to non-target mussel species. These label requirements include application more than 50 feet from a body of water, observation and pre-baiting to ensure the rapid uptake of treated bait by the target bird species.

APPENDIX C

Bird Species Evaluated in the Environmental Assessment for Massachusetts

Common Name	Scientifcic Name	Common Name	Scientifcic Name
American black ducks	*Anas rubripes*	horned larks	*Eremophila alpestris*
American crows	*Corvus brachyrhynchos*	house sparrows	*Passer domesticus*
American kestrels	*Falco sparverius*	killdeer	*Charadrius vociferous*
American robins	*Turdus migratorius*	laughing gulls	*Larus atricilla*
American wigeons	*Anas americana*	lesser yellowlegs	*Tringa flavipes*
American woodcocks	*Scolopax minor*	long-tailed ducks	*Clangula hyemalis*
Atlantic brant	*Branta bernicla hrota*	mallards (domestic/wild)	*Anas platyrhynchos*
bald eagles	*Haliaeetus leucocephalus*	merlins	*Falco columbarius*
bank swallows	*Riparia riparia*	monk parakeets	*Myiopsitta monachus*
barn swallows	*Hirundo rustica*	mourning doves	*Zenaida macroura*
barred owls	*Strix varia*	mute swans	*Cygnus olor*
belted kingfishers	*Megaceryle alcyon*	Northern cardinals	*Cardinalis cardinalis*
black vultures	*Coragyps atratus*	Northern flickers	*Colaptes auratus*
black-bellied plovers	*Pluvialis squatarola*	Northern harriers	*Circus cyaneus*
black-crowned night herons	*Nycticorax nycticorax*	Northern mockingbirds	*Mimus polyglottos*
blue jays	*Cyanocitta cristata*	ospreys	*Pandion haliaetus*
broad-winged hawks	*Buteo platypterus*	peregrine falcons	*Falco peregrinus*
brown-headed cowbirds	*Molothrus ater*	pileated woodpeckers	*Dryocopus pileatus*
Canada geese	*Branta canadensis*	red-bellied woodpeckers	*Melanerpes carolinus*
cattle egrets	*Bubulcus ibis*	red-breasted merganser	*Mergus serrator*
chimney swifts	*Chaetura pelagica*	red-headed woodpeckers	*Melanerpes erythrocephalus*
common eiders	*Somateria mollissima*	red-shouldered hawks	*Buteo lineatus*
common grackles	*Quiscalus quiscula*	red-tailed hawks	*Buteo jamaicensis*
common mergansers	*Mergus merganser*	red-winged blackbirds	*Agelaius phoeniceus*
common ravens	*Corvus corax*	ring-billed gulls	*Larus delawarensis*
Cooper's hawks	*Accipiter cooperii*	ring-necked ducks	*Aythya collaris*
double-crested cormorants	*Phalacrocorax auritus*	ring-necked pheasants	*Phasianus colchicus*
downy woodpeckers	*Picoides pubescens*	rock pigeons	*Columba livia*
Eastern meadowlarks	*Sturnella magna*	rough-legged hawks	*Buteo lagopus*
European starling	*Sturnus vulgaris*	ruffed grouse	*Bonasa umbellus*
feral/free ranging ducks	*n/a*	semi-palmated plovers	*Charadrius semipalmatus*
feral/free ranging geese	*n/a*	sharp-shinned hawks	*Accipiter striatus*
fish crows	*Corvus ossifragus*	short-billed dowitchers	*Limnodromus griseus*
gadwalls	*Anas strepera*	short-eared owls	*Asio flammeus*
glossy ibises	*Plegadis falcinellus*	snow buntings	*Plectrophenax nivalis*
gray catbirds	*Durnetella carolinensis*	snow geese	*Chen caerulescens*
great black-backed gulls	*Larus marinus*	snowy egrets	*Egretta thula*
great blue herons	*Ardea herodias*	snowy owls	*Bubo scandiacus*
great egrets	*Ardea alba*	tree swallows	*Tachycineta bicolor*
great horned owls	*Bubo virginianus*	turkey vultures	*Cathartes aura*
green herons	*Butorides virescens*	white-winged scoters	*Melanitta fusca*
green-winged teals	*Anas crecca*	wild turkeys	*Meleagris gallopavo*
hairy woodpeckers	*Picoides villosus*	wood ducks	*Aix sponsa*
herring gulls	*Larus argentatus*	yellow-bellied sapsuckers	*Sphyrapicus varius*
hooded mergansers	*Lophodytes cucullatus*		

APPENDIX D

USFWS Listing of Threatened and Endanged Species

Animal species listed in this state and that occur in this state

Status	Species
E	Beetle, American burying (*Nicrophorus americanus*)
T	Plover, piping except Great Lakes watershed (*Charadrius melodus*)
E	Plymouth Red-Bellied Turtle (*Pseudemys rubriventris bangsi*)
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	Sturgeon, shortnose (*Acipenser brevirostrum*)
E	Tern, roseate northeast U.S. nesting pop. (*Sterna dougallii dougallii*)
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, blue (*Balaenoptera musculus*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Whale, right (*Balaena glacialis (incl. australis)*)
E	Whale, Sei (*Balaenoptera borealis*)

Animal species listed in this state that do not occur in this state

Status	Species
E	Butterfly, Karner blue (*Lycaeides melissa samuelis*)
E	Curlew, Eskimo (*Numenius borealis*)
E	Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
E	Wolf, gray Lower 48 States, except where delisted and where EXPN. Mexico. (*Canis lupus*)

Animal listed species occurring in this state that are not listed in this state

Status	Species
T	Sea turtle, green except where endangered (*Chelonia mydas*)

Plant species listed in this state and that occur in this state

Status	Species
E	Bulrush, Northeastern (*Scirpus ancistrochaetus*)
E	Gerardia, sandplain (*Agalinis acuta*)
T	Pogonia, small whorled (*Isotria medeoloides*)

Plant species listed in this state that do not occur in this state

Status	Species
T	Amaranth, seabeach (*Amaranthus pumilus*)
E	Chaffseed, American (*Schwalbea americana*)

APPENDIX E

MDFW Listing of Endangered and Threatened Wildlife Species in Massachusetts

Common Name	Scientific Name	MA Status	Fed Status	Notes
VERTEBRATES:				
Fish				
American Brook Lamprey	*Lampetra appendix*	T		
Shortnose Sturgeon	*Acipenser brevirostrum*	E	E	
Atlantic Sturgeon	*Acipenser oxyrinchus*	E		
Lake Chub	*Couesius plumbeus*	E		
Eastern Silvery Minnow	*Hybognathus regius*	SC		
Bridle Shiner	*Notropis bifrenatus*	SC		
Northern Redbelly Dace	*Phoxinus eos*	E		
Longnose Sucker	*Catostomus catostomus*	SC		
Burbot	*Lota lota*	SC		
Threespine Stickleback	*Gasterosteus aculeatus*	T		1
Amphibians				
Jefferson Salamander	*Ambystoma jeffersonianum*	SC		2
Blue-Spotted Salamander	*Ambystoma laterale*	SC		3
Marbled Salamander	*Ambystoma opacum*	T		
Eastern Spadefoot	*Scaphiopus holbrookii*	T		
Reptiles				
Loggerhead Seaturtle	*Caretta caretta*	T	T	
Green Seaturtle	*Chelonia mydas*	T	T	
Hawksbill Seaturtle	*Eretmochelys imbricata*	E	E	
Kemp's Ridley Seaturtle	*Lepidochelys kempii*	E	E	
Leatherback Seaturtle	*Dermochelys coriacea*	E	E	
Wood Turtle	*Glyptemys insculpta*	SC		
Bog Turtle	*Glyptemys muhlenbergii*	E	T	
Blanding's Turtle	*Emydoidea blandingii*	T		
Diamond-backed Terrapin	*Malaclemys terrapin*	T		
Northern Red-bellied Cooter	*Pseudemys rubriventris*	E	E	4
Eastern Box Turtle	*Terrapene carolina*	SC		
Eastern Wormsnake	*Carphophis amoenus*	T		
Eastern Ratsnake	*Pantherophis alleghaniensis*	E		
Copperhead	*Agkistrodon contortrix*	E		
Timber Rattlesnake	*Crotalus horridus*	E		
Birds				
Common Loon	*Gavia immer*	SC		
Pied-Billed Grebe	*Podilymbus podiceps*	E		
Leach's Storm-Petrel	*Oceanodroma leucorhoa*	E		
American Bittern	*Botaurus lentiginosus*	E		
Least Bittern	*Ixobrychus exilis*	E		
Bald Eagle	*Haliaeetus leucocephalus*	E		
Northern Harrier	*Circus cyaneus*	T		
Sharp-Shinned Hawk	*Accipiter striatus*	SC		
Peregrine Falcon	*Falco peregrinus*	E		

Common Name	Scientific Name	MA Status	Fed Status	Notes
King Rail	*Rallus elegans*	T		
Common Moorhen	*Gallinula chloropus*	SC		
Piping Plover	*Charadrius melodus*	T	T	
Upland Sandpiper	*Bartramia longicauda*	E		
Roseate Tern	*Sterna dougallii*	E	E	
Common Tern	*Sterna hirundo*	SC		
Arctic Tern	*Sterna paradisaea*	SC		
Least Tern	*Sternula antillarum*	SC		
Barn Owl	*Tyto alba*	SC		
Long-Eared Owl	*Asio otus*	SC		
Short-Eared Owl	*Asio flammeus*	E		
Sedge Wren	*Cistothorus platensis*	E		
Golden-Winged Warbler	*Vermivora chrysoptera*	E		
Northern Parula	*Parula americana*	T		
Blackpoll Warbler	*Dendroica striata*	SC		
Mourning Warbler	*Oporornis philadelphia*	SC		
Vesper Sparrow	*Pooecetes gramineus*	T		
Grasshopper Sparrow	*Ammodramus savannarum*	T		
Henslow's Sparrow	*Ammodramus henslowii*	E		
Mammals				
Water Shrew	*Sorex palustris*	SC		
Rock Shrew	*Sorex dispar*	SC		
Indiana Myotis	*Myotis sodalis*	E	E	
Small-Footed Myotis	*Myotis leibii*	SC		
Southern Bog Lemming	*Synaptomys cooperi*	SC		
Sperm Whale	*Physeter catodon*	E	E	
Fin Whale	*Balaenoptera physalus*	E	E	
Sei Whale	*Balaenoptera borealis*	E	E	
Blue Whale	*Balaenoptera musculus*	E	E	
Humpback Whale	*Megaptera novaeangliae*	E	E	
Northern Right Whale	Eubalaena glacialis	E	E	
INVERTEBRATES:				
Sponges				
Smooth Branched Sponge	*Spongilla aspinosa*	SC		
Flatworms				
Sunderland Spring Planarian	*Polycelis remota*	E		
Segmented Worms				
New England Medicinal Leech	*Macrobdella sestertia*	SC		
Snails				
New England Siltsnail	*Floridobia winkleyi*	SC		
Walker's Limpet	*Ferrissia walkeri*	SC		
Coastal Marsh Snail	*Littoridinops tenuipes*	SC		
Slender Walker	*Pomatiopsis lapidaria*	E		
Boreal Marstonia	*Marstonia lustrica*	E		
Boreal Turret Snail	*Valvata sincera*	E		

Common Name	Scientific Name	MA Status	Fed Status	Notes
Mussels				
Dwarf Wedgemussel	*Alasmidonta heterodon*	E	E	
Triangle Floater	*Alasmidonta undulata*	SC		
Swollen Wedgemussel	*Alasmidonta varicosa*	E		
Yellow Lampmussel	*Lampsilis cariosa*	E		
Tidewater Mucket	*Leptodea ochracea*	SC		
Eastern Pondmussel	*Ligumia nasuta*	SC		
Creeper	*Strophitus undulatus*	SC		
Crustaceans				
Intricate Fairy Shrimp	*Eubranchipus intricatus*	SC		
Agassiz's Clam Shrimp	*Eulimnadia agassizii*	E		
Northern Spring Amphipod	*Gammarus pseudolimnaeus*	SC		
American Clam Shrimp	*Limnadia lenticularis*	SC		
Taconic Cave Amphipod	*Stygobromus borealis*	E		
Piedmont Groundwater Amphipod	*Stygobromus tenuis tenuis*	SC		
Coastal Swamp Amphipod	*Synurella chamberlaini*	SC		
Insects				
Dragonflies				
Spatterdock Darner	*Rhionaeschna mutata*	SC		
Subarctic Darner	*Aeshna subarctica*	T		
Comet Darner	*Anax longipes*	SC		
Ocellated Darner	*Boyeria grafiana*	SC		
Spine-Crowned Clubtail	*Gomphus abbreviatus*	E		
Harpoon Clubtail	*Gomphus descriptus*	E		
Midland Clubtail	*Gomphus fraternus*	E		
Rapids Clubtail	*Gomphus quadricolor*	T		
Cobra Clubtail	*Gomphus vastus*	SC		
Skillet Clubtail	*Gomphus ventricosus*	SC		
Umber Shadowdragon	*Neurocordulia obsoleta*	SC		
Stygian Shadowdragon	*Neurocordulia yamaskanensis*	SC		
Brook Snaketail	*Ophiogomphus aspersus*	SC		
Riffle Snaketail	*Ophiogomphus carolus*	T		
Ski-tipped Emerald	*Somatochlora elongata*	SC		
Forcipate Emerald	*Somatochlora forcipata*	SC		
Coppery Emerald	*Somatochlora georgiana*	E		
Incurvate Emerald	*Somatochlora incurvata*	T		
Kennedy's Emerald	*Somatochlora kennedyi*	E		
Mocha Emerald	*Somatochlora linearis*	SC		
Riverine Clubtail	*Stylurus amnicola*	E		
Zebra Clubtail	*Stylurus scudderi*	SC		
Arrow Clubtail	*Stylurus spiniceps*	T		
Ebony Boghaunter	*Williamsonia fletcheri*	E		
Ringed Boghaunter	*Williamsonia lintneri*	E		
Damselflies				
Tule Bluet	*Enallagma carunculatum*	SC		
Attenuated Bluet	*Enallagma daeckii*	SC		

Common Name	Scientific Name	MA Status	Fed Status	Notes
New England Bluet	*Enallagma laterale*	SC		
Scarlet Bluet	*Enallagma pictum*	T		
Pine Barrens Bluet	*Enallagma recurvatum*	T		
Beetles				
Twelve-Spotted Tiger Beetle	*Cicindela duodecimguttata*	SC		
Hentz's Redbelly Tiger Beetle	*Cicindela rufiventris hentzii*	T		
Northeastern Beach Tiger Beetle	*Cicindela dorsalis dorsalis*	E	T	
Bank Tiger Beetle	*Cicindela limbalis*	SC		
Cobblestone Tiger Beetle	*Cicindela marginipennis*	E		
Barrens Tiger Beetle	*Cicindela patruela*	E		
Puritan Tiger Beetle	*Cicindela puritana*	E	T	
Purple Tiger Beetle	*Cicindela purpurea*	SC		
American Burying Beetle	*Nicrophorus americanus*	E	E	
Butterflies and Moths				
Coastal Heathland Cutworm	*Abagrotis nefascia*	SC		
Barrens Daggermoth	*Acronicta albarufa*	T		
Drunk Apamea Moth	*Apamea inebriata*	SC		
New Jersey Tea Inchworm	*Apodrepanulatrix liberaria*	E		
Straight Lined Mallow Moth	*Bagisara rectifascia*	SC		
Hessel's Hairstreak	*Callophrys hesseli*	SC		
Frosted Elfin	*Callophrys irus*	SC		
Bog Elfin	*Callophrys lanoraieensis*	T		
Gerhard's Underwing	*Catocala herodias gerhardi*	SC		
Precious Underwing Moth	*Catocala pretiosa pretiosa*	E		
Waxed Sallow Moth	*Chaetaglaea cerata*	SC		
Melsheimer's Sack Bearer	*Cicinnus melsheimeri*	T		
Chain Dot Geometer	*Cingilia catenaria*	SC		
Unexpected Cycnia	*Cycnia inopinatus*	T		
Three-Lined Angle Moth	*Digrammia eremiata*	T		
Imperial Moth	*Eacles imperialis*	T		
Early Hairstreak	*Erora laeta*	T		
Persius Duskywing	*Erynnis persius persius*	E		
Sandplain Euchlaena	*Euchlaena madusaria*	SC		
Dion Skipper	*Euphyes dion*	T		
The Pink Streak	*Faronta rubripennis*	T		
Phyllira Tiger Moth	*Grammia phyllira*	E		
Slender Clearwing Sphinx Moth	*Hemaris gracilis*	SC		
Barrens Buckmoth	*Hemileuca maia*	SC		
Buchholz's Gray	*Hypomecis buchholzaria*	E		
Pine Barrens Itame	*Itame* sp. 1	SC		5
Pale Green Pinion Moth	*Lithophane viridipallens*	SC		
Twilight Moth	*Lycia rachelae*	E		
Pine Barrens Lycia	*Lycia ypsilon*	T		
Barrens Metarranthis	*Metarranthis apiciaria*	E		
Coastal Swamp Metarranthis	*Metarranthis pilosaria*	SC		
Northern Brocade Moth	*Neoligia semicana*	SC		

Common Name	Scientific Name	MA Status	Fed Status	Notes
Dune Noctuid Moth	*Oncocnemis riparia*	SC		
Pitcher Plant Borer	*Papaipema appassionata*	T		
Ostrich Fern Borer	*Papaipema* sp. 2	.SC		6
Chain Fern Borer	*Papaipema stenocelis*	T		
Water-willow Stem Borer	*Papaipema sulphurata*	T		
Mustard White	*Pieris oleracea*	T		
Pink Sallow Moth	*Psectraglaea carnosa*	SC		
Southern Ptichodis	*Ptichodis bistrigata*	T		
Orange Sallow Moth	*Rhodoecia aurantiago*	T		
Oak Hairstreak	*Satyrium favonius*	SC		
Spartina Borer	*Spartiniphaga inops*	SC		
Faded Gray Geometer	*Stenoporpia polygrammaria*	T		
Pine Barrens Zale	*Zale* sp. 1	SC		7
Pine Barrens Zanclognatha	*Zanclognatha martha*	T		

PLANTS:

Aceraceae (Maples)				
Black Maple	*Acer nigrum*	SC		
Adiantaceae (Cliff Ferns)				
Fragile Rock-Brake	*Cryptogramma stelleri*	E		
Alismataceae (Arrowheads)				
Estuary Arrowhead	*Sagittaria montevidensis* ssp. *spongiosa*	E		
Wapato	*Sagittaria cuneata*	T		
River Arrowhead	*Sagittaria subulata*	E		
Terete Arrowhead	*Sagittaria teres*	SC		
Apiaceae (Parsleys, Angelicas)				
Hemlock Parsley	*Conioselinum chinense*	SC		
Saltpond Pennywort	*Hydrocotyle verticillata*	T		
Canadian Sanicle	*Sanicula canadensis*	T		
Long-Styled Sanicle	*Sanicula odorata*	T		
Aquifoliaceae (Hollies)				
Mountain Winterberry	*Ilex montana*	E		
Araceae (Arums)				
Green Dragon	*Arisaema dracontium*	T		
Golden Club	*Orontium aquaticum*	E		
Araliaceae (Ginsengs)				
Ginseng	*Panax quinquefolius*	SC		
Asclepiadaceae (Milkweeds)				
Purple Milkweed	*Asclepias purpurascens*	E		
Linear-Leaved Milkweed	*Asclepias verticillata*	T		
Aspleniaceae (Spleenworts)				
Mountain Spleenwort	*Asplenium montanum*	E		
Wall-Rue Spleenwort	*Asplenium ruta-muraria*	T		
Asteraceae (Asters, Composites)				
Lesser Snakeroot	*Ageratina aromatica*	E		

Common Name	Scientific Name	MA Status	Fed Status	Notes
Eaton's Beggar-ticks	*Bidens eatonii*	E		
Estuary Beggar-ticks	*Bidens hyperborea*	E		
Cornel-leaved Aster	*Doellingeria infirma*	E		
New England Boneset	*Eupatorium novae-angliae*	E		
Purple Cudweed	*Gamochaeta purpurea*	E		
New England Blazing Star	*Liatris scariosa* var. *novae-angliae*	SC		
Lion's Foot	*Nabalus serpentarius*	E		
Sweet Coltsfoot	*Petasites frigidus* var. *palmatus*	E		
Sclerolepis	*Sclerolepis uniflora*	E		
Large-Leaved Goldenrod	*Solidago macrophylla*	T		
Upland White Aster	*Solidago ptarmicoides*	E		
Rand's Goldenrod	*Solidago simplex* ssp. *randii* v. *monticola*	E		
Eastern Silvery Aster	*Symphyotrichum concolor*	E		
Crooked-Stem Aster	*Symphyotrichum prenanthoides*	T		
Tradescant's Aster	*Symphyotrichum tradescantii*	T		
Betulaceae (Birches, Alders)				
Mountain Alder	*Alnus viridis* ssp. *crispa*	T		
Swamp Birch	*Betula pumila*	E		
Boraginaceae (Borages)				
Oysterleaf	*Mertensia maritima*	E		
Brassicaceae (Mustards)				
Lyre-Leaved Rock-cress	*Arabidopsis lyrata*	E		
Smooth Rock-cress	*Boechera laevigata*	T		
Green Rock-cress	*Boechera missouriensis*	T		
Purple Cress	*Cardamine douglassii*	E		
Long's Bitter-cress	*Cardamine longii*	E		
Fen Cuckoo Flower	*Cardamine pratensis* var. *palustris*	T		
Cactaceae (Cacti)				
Prickly Pear	*Opuntia humifusa*	E		
Campanulaceae (Bluebells, Lobelias)				
Great Blue Lobelia	*Lobelia siphilitica*	E		
Caprifoliaceae (Honeysuckles)				
Hairy Honeysuckle	*Lonicera hirsuta*	E		
Snowberry	*Symphoricarpos albus* var. *albus*	E		
Broad Tinker's-weed	*Triosteum perfoliatum*	E		
Downy Arrowwood	*Viburnum rafinesquianum*	E		
Caryophyllaceae (Pinks, Sandworts)				
Nodding Chickweed	*Cerastium nutans*	E		
Michaux's Sandwort	*Minuartia michauxii*	T		
Large-leaved Sandwort	*Moehringia macrophylla*	E		
Silverling	*Paronychia argyrocoma*	E		
Chenopodiaceae (Saltworts)				
Fogg's Goosefoot	*Chenopodium foggii*	E		
American Sea-blite	*Suaeda calceoliformis*	SC		

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Cistaceae (Rockroses, Pinweeds)				
Bushy Rockrose	*Crocanthemum dumosum*	SC		
Beaded Pinweed	*Lechea pulchella* var. *moniliformis*	E		
Clusiaceae (St. John's-worts)				
Creeping St. John's-wort	*Hypericum adpressum*	T		
Giant St. John's-wort	*Hypericum ascyron*	E		
St. Andrew's Cross	*Hypericum hypericoides* ssp. *multicaule*	E		
Convolvulaceae (Morning Glories)				
Low Bindweed	*Calystegia spithamaea*	E		
Crassulaceae (Sedums)				
Pygmyweed	*Tillaea aquatica*	T		
Cupressaceae (Cedars, Junipers)				
Arborvitae	*Thuja occidentalis*	E		
Cyperaceae (Sedges)				
River Bulrush	*Bolboschoenus fluviatilis*	SC		
Foxtail Sedge	*Carex alopecoidea*	T		
Back's Sedge	*Carex backii*	E		
Bailey's Sedge	*Carex baileyi*	T		
Bush's Sedge	*Carex bushii*	E		
Chestnut-colored Sedge	*Carex castanea*	E		
Creeping Sedge	*Carex chordorrhiza*	E		
Davis's Sedge	*Carex davisii*	E		
Glaucescent Sedge	*Carex glaucodea*	E		
Handsome Sedge	*Carex formosa*	T		
Slender Woodland Sedge	*Carex gracilescens*	E		
Gray's Sedge	*Carex grayi*	T		
Hitchcock's Sedge	*Carex hitchcockiana*	SC		
Shore Sedge	*Carex lenticularis*	T		
Glaucous Sedge	*Carex livida*	E		
False Hop Sedge	*Carex lupuliformis*	E		
Midland Sedge	*Carex mesochorea*	E		
Michaux's Sedge	*Carex michauxiana*	E		
Mitchell's Sedge	*Carex mitchelliana*	T		
Few-fruited Sedge	*Carex oligosperma*	E		
Few-flowered Sedge	*Carex pauciflora*	E		
Variable Sedge	*Carex polymorpha*	E		
Schweinitz's Sedge	*Carex schweinitzii*	E		
Dioecious Sedge	*Carex sterilis*	T		
Walter's Sedge	*Carex striata*	E		
Fen Sedge	*Carex tetanica*	SC		
Hairy-fruited Sedge	*Carex trichocarpa*	T		
Tuckerman's Sedge	*Carex tuckermanii*	E		
Cat-tail Sedge	*Carex typhina*	T		
Wiegand's Sedge	*Carex wiegandii*	E		
Engelmann's Umbrella-sedge	*Cyperus engelmannii*	T		

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Houghton's Flatsedge	*Cyperus houghtonii*	E		
Wright's Spike-rush	*Eleocharis diandra*	E		
Intermediate Spike-sedge	*Eleocharis intermedia*	T		
Tiny-fruited Spike-rush/Spike-sedge	*Eleocharis microcarpa* var. *filiculmis*	E		
Ovate Spike-rush or Spike-sedge	*Eleocharis ovata*	E		
Few-flowered Spike-sedge	*Eleocharis quinqueflora*	E		
Three-angled Spike-sedge	*Eleocharis tricostata*	E		
Slender Cottongrass	*Eriophorum gracile*	T		
Dwarf Bulrush	*Lipocarpha micrantha*	T		
Capillary Beak-rush or Beak-sedge	*Rhynchospora capillacea*	E		
Inundated Horned-sedge	*Rhynchospora inundata*	T		
Short-beaked Bald-sedge	*Rhynchospora nitens*	T		
Long-beaked Bald-sedge	*Rhynchospora scirpoides*	SC		
Torrey's Beak-sedge	*Rhynchospora torreyana*	E		
Northeastern Bulrush	*Scirpus ancistrochaetus*	E	E	
Long's Bulrush	*Scirpus longii*	T		
Papillose Nut-sedge	*Scleria pauciflora*	E		8
Tall Nut-sedge	*Scleria triglomerata*	E		
Dryopteridaceae (Wood Ferns)				
Braun's Holly-fern	*Polystichum braunii*	E		
Smooth Woodsia	*Woodsia glabella*	E		
Elatinaceae (Waterworts)				
American Waterwort	*Elatine americana*	E		
Empetraceae (Crowberries)				
Broom Crowberry	*Corema conradii*	SC		
Equisetaceae (Horsetails)				
Dwarf Scouring-rush	*Equisetum scirpoides*	SC		
Ericaceae (Laurels, Blueberries)				
Great Laurel	*Rhododendron maximum*	T		
Mountain Cranberry	*Vaccinium vitis-idaea* ssp. *minus*	E		
Eriocaulaceae (Pipeworts)				
Parker's Pipewort	*Eriocaulon parkeri*	E		
Fabaceae (Beans, Peas, Clovers)				
Large-bracted Tick-trefoil	*Desmodium cuspidatum*	T		
Wild Senna	*Senna hebecarpa*	E		
Fagaceae (Oaks, Beeches)				
Bur Oak	*Quercus macrocarpa*	SC		
Yellow Oak	*Quercus muehlenbergii*	T		
Fumariaceae (Fumitories)				
Climbing Fumitory	*Adlumia fungosa*	SC		
Gentianaceae (Gentians)				
Andrew's Bottle Gentian	*Gentiana andrewsii*	E		
Spurred Gentian	*Halenia deflexa*	E		

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Slender Marsh Pink	*Sabatia campanulata*	E		
Plymouth Gentian	*Sabatia kennedyana*	SC		
Sea Pink	*Sabatia stellaris*	E		
Grossulariaceae (Currants)				
Bristly Black Currant	*Ribes lacustre*	SC		
Haemodoraceae (Redroots)				
Redroot	*Lachnanthes caroliana*	SC		
Haloragaceae (Water-milfoils)				
Alternate-flowered Water-milfoil	*Myriophyllum alterniflorum*	E		
Farwell's Water-milfoil	*Myriophyllum farwellii*	E		
Pinnate Water-milfoil	*Myriophyllum pinnatum*	SC		
Comb Water-milfoil	*Myriophyllum verticillatum*	E		
Hydrophyllaceae (Waterleaves)				
Broad Waterleaf	*Hydrophyllum canadense*	E		
Hymenophyllaceae (Filmy-ferns)				
Weft Bristle-fern	*Trichomanes intricatum*	E		
Iridaceae (Irises)				
Sandplain Blue-eyed Grass	*Sisyrinchium fuscatum*	SC		
Slender Blue-eyed Grass	*Sisyrinchium mucronatum*	E		
Isoetaceae (Quillworts)				
Acadian Quillwort	*Isoetes acadiensis*	E		
Lake Quillwort	*Isoetes lacustris*	E		
Juncaceae (Rushes)				
Weak Rush	*Juncus debilis*	E		
Thread Rush	*Juncus filiformis*	E		
Black-fruited Woodrush	*Luzula parviflora* ssp. *melanocarpa*	E		
Lamiaceae (Mints)				
Purple Giant-hyssop	*Agastache scrophulariifolia*	E		
Downy Wood-mint	*Blephilia ciliata*	E		
Hairy Wood-mint	*Blephilia hirsuta*	E		
Gypsywort	*Lycopus rubellus*	E		
False Pennyroyal	*Trichostema brachiatum*	E		
Lentibulariaceae (Bladderworts)				
Resupinate Bladderwort	*Utricularia resupinata*	T		
Subulate Bladderwort	*Utricularia subulata*	SC		
Liliaceae (Lilies)				
Devil's-bit	*Chamaelirium luteum*	E		
Linaceae (Flaxes)				
Sandplain Flax	*Linum intercursum*	SC		
Rigid Flax	*Linum medium* var. *texanum*	T		
Lycopodiaceae (Clubmosses)				
Foxtail Clubmoss	*Lycopodiella alopecuroides*	E		
Mountain Firmoss	*Huperzia selago*	E		
Lythraceae (Loosestrifes)				

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Toothcup	*Rotala ramosior*	E		
Magnoliaceae (Magnolias)				
Sweetbay Magnolia	*Magnolia virginiana*	E		
Melastomataceae (Meadow Beauties)				
Maryland Meadow Beauty	*Rhexia mariana*	E		
Moraceae (Mulberries)				
Red Mulberry	*Morus rubra*	E		
Nymphaeaceae (Water Lilies)				
Tiny Cow-lily	*Nuphar microphylla*	E		
Onagraceae (Evening Primroses)				
Many-fruited False-loosestrife	*Ludwigia polycarpa*	E		
Round-fruited False-loosestrife	*Ludwigia sphaerocarpa*	E		
Ophioglossaceae (Grape Ferns)				
Adder's-tongue Fern	*Ophioglossum pusillum*	T		
Orchidaceae (Orchids)				
Putty-root	*Aplectrum hyemale*	E		
Arethusa	*Arethusa bulbosa*	T		
Autumn Coralroot	*Corallorhiza odontorhiza*	SC		
Ram's-head Lady's-slipper	*Cypripedium arietinum*	E		
Small Yellow Lady's-slipper	*Cypripedium parviflorum* var. *makasin*	E		
Showy Lady's-slipper	*Cypripedium reginae*	SC		
Dwarf Rattlesnake-plantain	*Goodyera repens*	E		
Small Whorled Pogonia	*Isotria medeoloides*	E	T	
Lily-leaf Twayblade	*Liparis liliifolia*	T		
Heartleaf Twayblade	*Listera cordata*	E		
Bayard's Green Adder's-mouth	*Malaxis bayardii*	E		
White Adder's-mouth	*Malaxis monophyllos* var. *brachypoda*	E		
Crested Fringed Orchis	*Platanthera cristata*	E		
Leafy White Orchis	*Platanthera dilatata*	T		
Pale Green Orchis	*Platanthera flava* var. *herbiola*	T		
Hooded Ladies'-tresses	*Spiranthes romanzoffiana*	E		
Grass-leaved Ladies'-tresses	*Spiranthes vernalis*	T		
Cranefly Orchid	*Tipularia discolor*	E		
Three Bird Orchid (Nodding Pogonia)	*Triphora trianthophora*	E		
Oxalidaceae (Wood-sorrels)				
Violet Wood-sorrel	*Oxalis violacea*	E		
Poaceae (Grasses)				
Annual Peanutgrass	*Amphicarpum amphicarpon*	E		
Purple Needlegrass	*Aristida purpurascens*	T		
Seabeach Needlegrass	*Aristida tuberculosa*	T		
Reed Bentgrass	*Calamagrostis pickeringii*	E		
New England Northern Reedgrass	*Calamagrostis stricta* ssp. *inexpansa*	E		

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Tufted Hairgrass	*Deschampsia cespitosa* ssp. *glauca*	E		
Commons's Panic-grass	*Dichanthelium ovale* ssp. *pseudopubescens*	SC		
Mattamuskeet Panic-grass	*Dichanthelium dichotomum ssp. mattamuskeetense*	E		
Rough Panic-grass	*Dichanthelium scabriusculum*	T		
Wright's Panic-grass	*Dichanthelium wrightianum*	SC		
Hairy Wild Rye	*Elymus villosus*	E		
Frank's Lovegrass	*Eragrostis frankii*	SC		
Saltpond Grass	*Leptochloa fusca* ssp. *fascicularis*	T		
Sea Lyme-grass	*Leymus mollis*	E		
Woodland Millet	*Milium effusum*	T		
Gattinger's Panic-grass	*Panicum philadelphicum* ssp. *gattingeri*	SC		
Long-Leaved Panic-grass	*Panicum rigidulum* ssp. *pubescens*	T		
Philadelphia Panic-grass	*Panicum philadelphicum ssp. philadelphicum*	SC		
Drooping Speargrass	*Poa saltuensis* ssp. *languida*	E		
Bristly Foxtail	*Setaria parviflora*	SC		
Salt Reedgrass	*Spartina cynosuroides*	T		
Shining Wedgegrass	*Sphenopholis nitida*	T		
Swamp Oats	*Sphenopholis pensylvanica*	T		
Small Dropseed	*Sporobolus neglectus*	E		
Northern Gama-grass	*Tripsacum dactyloides*	E		
Spiked False-oats	*Trisetum spicatum*	E		
Podostemaceae (Threadfeet)				
Threadfoot	*Podostemum ceratophyllum*	SC		
Polygonaceae (Docks, Knotweeds)				
Strigose Knotweed	*Persicaria setacea*	T		
Sea-beach Knotweed	*Polygonum glaucum*	SC		
Pondshore Knotweed	*Polygonum puritanorum*	SC		
Seabeach Dock	*Rumex pallidus*	T		
Swamp Dock	*Rumex verticillatus*	T		
Portulacaceae (Spring Beauties)				
Narrow-leaved Spring Beauty	*Claytonia virginica*	E		
Potamogetonaceae (Pondweeds)				
Algae-like Pondweed	*Potamogeton confervoides*	T		
Frie's Pondweed	*Potamogeton friesii*	E		
Hill's Pondweed	*Potamogeton hillii*	SC		
Ogden's Pondweed	*Potamogeton ogdenii*	E		
Straight-leaved Pondweed	*Potamogeton strictifolius*	E		
Vasey's Pondweed	*Potamogeton vaseyi*	E		
Pyrolaceae (Shinleaf)				
Pink Pyrola	*Pyrola asarifolia* ssp. *asarifolia*	E		
Ranunculaceae (Buttercups)				

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Black Cohosh	*Actaea racemosa*	E		
Purple Clematis	*Clematis occidentalis*	SC		
Golden Seal	*Hydrastis canadensis*	E		
Tiny-flowered Buttercup	*Ranunculus micranthus*	E		
Bristly Buttercup	*Ranunculus pensylvanicus*	SC		
Rosaceae (Roses, Shadbushes)				
Small-flowered Agrimony	*Agrimonia parviflora*	E		
Hairy Agrimony	*Agrimonia pubescens*	T		
Bartram's Shadbush	*Amelanchier bartramiana*	T		
Nantucket Shadbush	*Amelanchier nantucketensis*	SC		
Roundleaf Shadbush	*Amelanchier sanguinea*	SC		
Bicknell's Hawthorn	*Crataegus bicknellii*	E		
Sandbar Cherry	*Prunus pumila* var. *depressa*	T		
Northern Prickly Rose	*Rosa acicularis* ssp. *sayi*	E		
Northern Mountain-ash	*Sorbus decora*	E		
Barren Strawberry	*Waldsteinia fragarioides*	SC		
Rubiaceae (Bedstraws, Bluets)				
Northern Bedstraw	*Galium boreale*	E		
Labrador Bedstraw	*Galium labradoricum*	T		
Long-leaved Bluet	*Houstonia longifolia*	E		
Salicaceae (Willows)				
Swamp Cottonwood	*Populus heterophylla*	E		
Sandbar Willow	*Salix exigua ssp. interior*	T		
Scheuchzeriaceae (Pod-grasses)				
Pod-grass	*Scheuchzeria palustris*	E		
Schizaeaceae (Climbing Ferns)				
Climbing Fern	*Lygodium palmatum*	SC		
Scrophulariaceae (Figworts)				
Sandplain Gerardia	*Agalinis acuta*	E	E	
Winged Monkey-flower	*Mimulus alatus*	E		
Muskflower	*Mimulus moschatus*	E		
Swamp Lousewort	*Pedicularis lanceolata*	E		
Hairy Beardtongue	*Penstemon hirsutus*	E		
Sessile Water-speedwell	*Veronica catenata*	E		
Culver's-root	*Veronicastrum virginicum*	T		
Sparganiaceae (Bur-reeds)				
Small Bur-reed	*Sparganium natans*	E		
Verbenaceae (Vervains)				
Narrow-leaved Vervain	*Verbena simplex*	E		
Violaceae (Violets)				
Sand Violet	*Viola adunca*	SC		
Britton's Violet	*Viola brittoniana*	T		
Viscaceae (Christmas-mistletoes)				
Dwarf Mistletoe	*Arceuthobium pusillum*	SC		

1. Trimorphic freshwater population only.
2. Including triploid and other polyploid forms within the Ambystoma jeffersonianum/Ambystoma laterale complex.
3. Ditto
4. This species is listed by the U. S. Fish and Wildlife Service as P. r. bangsi (Plymouth Redbelly Turtle) in 50 CFR 17.11.
5. Undescribed species near I. inextricata
6. Undescribed species near P. pterisii
7. Undescribed species near Z. lunifera
8. Includes the two varieties of this species that occur in Massachusetts: s.p. var. pauciflora and s.p. var. caroliniana.